

## CONFERENCE PARTNERS

General Partner:



Official Partners:



Main Media Partners:







## **5<sup>th</sup> International Conference on Emerging e-Learning Technologies and Applications**

Editors: František Jakab, Viliam Fedák  
Graphical Layout: Jozef Velk  
Publishers: elfa, s.r.o., Letná 9, 042 00 Košice, Slovakia  
Printed by: elfa, s.r.o.  
Copyright: © 2007 elfa, s.r.o.

All rights reserved. No part of this publications may be reproduced, stored in retrieval system or transmitted in any form or by any means, electronic, mechanical, magnetic tape, photocopying, recording of otherwise, without the written permission from the publisher. The reponsibility for the contents and the English language of each paper in the proceedings rests solely with its author(s).

The proceedings are also available in electronic form on CD ROM. The porceedings are available form elfa, s.r.o., Letná 9, 042 00 Košice, Slovakia

ISBN 978-80-8086-061-5

## CONFERENCE IS HELD UNDER THE AUSPICES OF

**Ján Figel',**

Member of the European Commission,  
responsible for Education, Training, Culture and Youth

**Ján Mikolaj,**

Minister of Education, Slovakia

and

**Anton Čižmár,**

Rector of Technical University of Košice, Slovakia

### **The Conference is organized in co-operation with:**

1. Ministry of Education of Slovak Republic
2. Communication Technology Forum, Slovakia
3. Slovak Academic Network Association, Bratislava, Slovakia
4. Slovak Academic Organization for International Co-operation, Slovakia
5. IT Association of Slovakia, Slovakia
6. Kosice IT Valley Asociation
7. Faculty of Electrical Eng. and Informatics, Technical University of Košice, Slovakia
8. Faculty of Informatics and Information Technologies, Slovak University of Technology, Bratislava, Slovakia
9. Faculty of Mathematics and Physics, Charles University in Prague, Czech Republic
10. Cisco Networking Academy Program in Slovakia
11. EuroPACE, a trans-European network of universities, enterprises and organizations

#### **Hosted by:**

Congres centre of the Hotel Academia,  
Stará Lesná, The High Tatras,  
Slovakia

#### **Organised by:**

*elfa*, s.r.o., Košice  
Slovakia



## **Message from the Organising and Programme Committees**

On behalf of the Organizing and Program Committees we are pleased to welcome all participants to the **"5<sup>th</sup> International Conference on Emerging e-Learning Technologies and Applications", ICETA 2007** in Stará Lesná, The High Tatras, Slovak Republic.

Meetings of the specialists of any branch of science, especially for these in scientific and technical fields are not longer exceptional. They are becoming common and a natural part of our scientific and teaching life.

The recent rapid development of the information and communication technology basically influences and supports substantial public services. Tele-education belongs to the most important services. The offered program collects contributions on theoretical, practical and methodological aspects of the ICT supported services. The main stress is on practice and that is why we will arrange several online international videoconferencing sessions with participated partners utilising the most modern and heterogeneous infrastructure.

More than 120 papers were sent to the Organizing Committee. We would like to express our thanks to members of the International Program Committee for their praiseworthy work done for the success of the Conference.

The social program will involve Welcome Party enabling informal gatherings in order to renew previous contacts and establish new ones. The optional program will consist of interesting trip into the region to see the beauties of the countryside.

We shall try to create a friendly and creative environment for the Conference and we believe that you will enjoy your stay in our wonderful country.

We are looking forward to meeting you at the ICETA 2007 Conference.

Sincerely yours,

František Jakab  
Organizing Committee Chairman

Viliam Fedák  
Programme Committee Chairman



# CONFERENCE COMMITTEES

## Honorary committee

**Čižmár Anton**

Baumann Olaf  
Figel' Ján  
Fonodová Irena  
Gajdoš Marián  
Gruntorad Jan  
Hruška Ivan  
Jurkovič Jozef  
Kaderali Firoz  
Kukura Pavol  
Levický Dušan  
Lichardus Branislav  
Martel Nicolas  
Mikolaj Ján  
Mikulecká Jaroslava  
Molnár Stanislav  
Návrat Pavol  
Newman B. Harvey  
Ondáš Jozef  
Plander Ivan  
Rebroš Marcel  
Rudas Imre  
Sabaka Juraj  
Sinay Juraj  
Slegers Jake C.  
Súkeník Ján  
Šimončíč Robert  
Tóth Attila

### Chairman:

Rector of the Technical University of Košice, Slovakia

### Members:

VSE IT služby, s.r.o., SK  
Member of the European Commission, Brussels, B  
SAAIC, SK  
Gamo, Banská Bystrica, SK  
CESNET Prague, CZ  
NESS Europe, BB Centrum, Prague, CZ  
Oracle Slovensko, spol. s r.o. Bratislava, SK  
FernUniversität Hagen, D  
T-com, Bratislava, SK  
Technical University of Košice, SK  
Vysoká škola manažmentu, Bratislava, SK  
NM Management, Bratislava, SK  
Minister of Education of Slovak Republic, SK  
University of Hradec Králové, CZ  
Slovak University of Technology, Bratislava, SK  
Slovak University of Technology, Bratislava, SK  
California Institute of Technology, Pasadena, USA  
T-Systems Slovakia, Košice, SK  
University of Trencin, SK  
Cisco Slovakia, Bratislava, SK  
Budapest Tech, H  
IT Association Slovakia (ITAS), SK  
Technical University of Košice, SK  
American Chamber of Commerce, Bratislava, SK  
GiTy, Martin SK  
Microsoft Slovakia, Bratislava, SK  
Novitech Plc., SK

## Programme Committee

**Fedák Viliam**

Bača Ivan  
Baroňák Ivan  
Bauerová Danuše  
Bieliková Mária  
Brestenská Beáta  
Čičák Pavol  
Dado Milan  
Drobný Martin

### Chairman:

Technical University of Košice, SK

### Members:

Technical University of Košice, SK  
Slovak University of Technology, SK  
Technical University, Ostrava, CZ  
Slovak University of Technology, Bratislava, SK  
Comenius University Bratislava, SK  
Slovak University of Technology, Bratislava, SK  
University of Žilina, SK  
PC REVUE, Bratislava, SK

|                          |  |
|--------------------------|--|
| Drozdová Matilda         | University of Žilina, SK                                 |
| Ehlers Ulf-Daniel        | University of Duisburg-Essen, D                          |
| Genči Ján                | Technical University of Košice, SK                       |
| Gierl Juraj              | Technical University of Košice, SK                       |
| Furminger Michael        | Cisco Networking Academy Program, UK                     |
| Gerber-Pišútová Katarína | OSF Bratislava, SK                                       |
| Grabowska Anna S.        | Association of Academic E-learning, PL                   |
| Hán Jan                  | West-Bohemia University, Pilsen, CZ                      |
| Hämäläinen               | Timo University of Jyväskylä, FI                         |
| Hiroshi Nakano           | Kumamoto University, Kumamoto, JPN                       |
| Hluchý Ladislav          | Slovak Academy of Sciences, SK                           |
| Horváth Pavol            | SANET - Slovak Academic Network, Bratislava, SK          |
| Huba Mikuláš             | Slovak University of Technology, Bratislava, SK          |
| Hvorecký Jozef           | Vysoka škola manažmentu, Bratislava, SK                  |
| Ištván Milan             | Partnerships for Prosperity, SK                          |
| Jakab František          | Technical University of Košice/Cisco Systems, SK         |
| Kimmo Salmenjoki         | University of Vaasa, FI                                  |
| Klimo Martin             | University of Žilina, SK                                 |
| Kocur Dušan T.           | Technical University of Košice, SK                       |
| Kollár Jan               | Technical University of Košice, SK                       |
| Kommers Piet             | University of Twente, NL                                 |
| Kulchytskyy Ivan         | Lviv Centre for Sc., Technical and Econ. Information, UA |
| Lavrin Anton             | Technical University of Košice, SK                       |
| Lustigová Zdena          | Charles University in Prague, CZ                         |
| Makarenko Alexander      | National Technical University of Ukraine, Kiev, UA       |
| Mechlová Erika           | University of Ostrava, CZ                                |
| Meško Dušan              | Ministry of Education of Slovak Republic, SK             |
| Murín Pavol              | P.J.Safarik University, Košice, SK                       |
| Pekka Kess               | University of Oulu, FI                                   |
| Popov Oliver B.          | Mid Sweden University, Holmgatan, S                      |
| Poulová Petra            | University of Hradec Kralové, CZ                         |
| Rocchetti Marco          | University of Bologna, I                                 |
| Salem Abdel-Badeeh M.    | Ain Shams University of Cairo, EG                        |
| Samuelis Ladislav        | Technical University of Košice, SK                       |
| Schindler Frank          | Slovak University of Technology, Bratislava, SK          |
| Schwertel Markus         | Cisco Systems Germany, D                                 |
| Sinčák Peter             | Technical University of Košice, SK                       |
| Sivý Igor                | Technical University of Košice/elfa, Košice, SK          |
| Šebo Ján                 | Communication Technology Forum, SK                       |
| Štechovič Aurel          | Research Inst. of Posts and Telecomm., B. Bystrica, SK   |
| Šimák Boris              | Czech Technical University in Prague, CZ                 |
| Šimšík Dušan             | Technical University of Košice, SK                       |
| Šperka Martin            | Slovak University of Technology, Bratislava, SK          |
| Taylor Jim               | University of Southern Queensland, Toowoomba, A          |
| Tseytlin G. E.           | International Solomon University, Kiev, UA               |
| Virgl Luděk              | IBM SK, Bratislava, SK                                   |
| Vokorokos Liberios       | Technical University of Košice, SK                       |
| Vrana Ivan               | The Czech University of Agriculture, Prague, CZ          |
| Zelenda Stanislav        | Charles University in Prague, CZ                         |
| Zvacek Susan M.          | University of Kansas, Lawrence, USA                      |

## **Organising Committee**

**Jakab František**

### **Chairman:**

elfa, Košice, SK

### **Members:**

Bučko Marián  
Fedák Viliam  
Fejedelem Štefan  
Puškášová Gabriela  
Szabóová Zuzana  
Štika Jaroslav  
Zámečnicková Iveta

elfa, Košice SK  
Technical University of Košice, SK  
elfa, Košice, SK  
elfa, Košice, SK  
elfa, Košice, SK  
elfa, Košice, SK  
elfa, Košice, SK

# CONTENTS

## INVITED PAPERS

---

|  |            |
|--|------------|
| <b>The Role of Artificial Intelligence Technology in Education .....</b>   | <b>3</b>   |
| Abdel-Badeeh M. Salem, Ain Shams University, Cairo, Egypt  |            |
| <b>Learning 2.0 and Paradigm of Education .....</b>  | <b>11</b>  |
| D. Bauerová, VŠB – Technical University, Ostrava, Czech Republic   |            |
| <b>From Homo Sapiens to Homo Mobilis – or How the Schools and Teachers Change .....</b>                              | <b>19</b>  |
| B. Brestenská, Comenius University, Bratislava, Slovakia   |            |
| <b>Re-framing Education for the 21st Century .....</b>   | <b>23</b>  |
| J. Connell, Cisco Systems, United Kingdom  |            |
| <b>Developing Instructors to Actively Teach in an eLearning Curriculum .....</b>                                     | <b>27</b>  |
| Kristen E. DiCerbo & Helen M. Parke, Cisco Learning Institute, Phoenix, USA  |            |
| <b>The Importance of ICT for Education in the European Union .....</b>   | <b>35</b>  |
| J. Figel', EU Commissioner for Education, Training, Culture and Youth, EC  |            |
| <b>SANET Network – New Development .....</b>   | <b>37</b>  |
| P. Horváth, Slovak University of Technology, Bratislava, Slovakia  |            |
| <b>Strategic Lessons Learned – The Finnish Virtual University .....</b>  | <b>41</b>  |
| P. Kess, University of Oulu, Finland   |            |
| <b>Recommendations for Institutional Implementation of e-Learning Technologies.....</b>                              | <b>47</b>  |
| D. Kocur, P. Košč, Technical University of Košice, Slovakia  |            |
| <b>ICT – Challenger for Education in Slovakia .....</b>  | <b>53</b>  |
| D. Meško, Ministry of Education of Slovakia  |            |
| <b>The Virtual Mobility and The Inter-University Study .....</b>   | <b>59</b>  |
| P. Poulová, University of Hradec Králové, Czech Republic   |            |
| <b>HP Managed Learning Environment.....</b>  | <b>65</b>  |
| B. Tvaroška, Hewlett-Packard Slovakia s.r.o.   |            |
| <b>Social Learning – How Web is Changing the Way we Process Information and Knowledge.....</b>                       | <b>67</b>  |
| K. Salmenjoki, A. Vainio, University of Vaasa, Finland, F. Paulsson, Umeå University, Sweden                         |            |
| <b>Importance of Communication in on-line Distance Education Over the Internet .....</b>                             | <b>73</b>  |
| F. Schindler, Slovak Technical University, Bratislava, Slovakia  |            |
| <b>Ambient Intelligence in Elderlies and disabled Life in Europe.....</b>  | <b>77</b>  |
| D. Šimšík, Alena Galajdová, Technical University of Košice, Slovakia   |            |
| <b>Flexible Learning Futures .....</b>   | <b>87</b>  |
| J. C. Taylor University of Southern Queensland, Queensland, Australia  |            |
| <b>e-Learning – Revolution in Education .....</b>  | <b>89</b>  |
| P. Tomčák, Oracle Slovensko spol. s r.o., Bratislava, Slovakia   |            |
| <b>IT Literacy Acquisiton Courses Designed for University and Community Supported by Good-Practice Program .....</b> | <b>95</b>  |
| T. Usagawa, H. Nakano, N. Iriguchi, K. Sugitani, Kumamoto University, Japan  |            |
| <b>Changing Roles for Teachers and Learners in Online Courses: Evolution, not Revolution .....</b>                   | <b>101</b> |
| S. M. Zvacek, University of Kansas, Lawrence, USA  |            |

## **INFRASTRUCTURE**

---

|   |            |
|---|------------|
| <b>Packet Loss Concealment by Shifted Basis .....</b>   | <b>109</b> |
| K. Bachratá, J. Boroň, B. Rosival, University of Žilina, Slovakia   |            |
| <b>Utilization of Videoconferences in Educational Environment.....</b>  | <b>115</b> |
| M. Biňas, I. Adamuščíňová, F. Jakab, M. Michalko, Technical University of Košice, Slovakia  |            |
| <b>Process Visualization System Design Based on co-Design Methodology .....</b>   | <b>121</b> |
| E. Csókás, P. Čičák, Slovak university of Technology, Bratislava, Slovakia  |            |
| <b>Centralized Systems in the Area of Network Monitoring and Management .....</b>   | <b>127</b> |
| P. Fecíľak, K. Kleinová, F. Jakab, Technical University of Košice, Slovakia   |            |
| <b>Methodical Instrument for the Study and Proper Analysis<br/>of Distributed Algorithms off ICEE 802.1D and IEEE 802.1W Standards.....</b> | <b>131</b> |
| I. Grellneth, M. Kvasnička, Slovak university of Technology, Bratislava, Slovakia   |            |
| <b>Factors Influencing Voice Quality in VoIP Technology .....</b>   | <b>137</b> |
| M. Halás, B. Kyrbashov, Slovak University of Technology,<br>M. Vozňák, Technical University of Ostrava, Czech Republic                      |            |
| <b>Communication Challenges in eLearning solutions .....</b>  | <b>141</b> |
| F. Jakab, M. Jakab, J. Janitor, K. Kleinová, M. Biňas,<br>M. Révész, Technical University in Košice, Slovakia                               |            |
| <b>Practical use of Traffic Control Simulatons for Education Purposes .....</b>   | <b>147</b> |
| M. Kavacký, I. Baroňák, Slovak university of technology, Slovakia   |            |
| <b>Assessment of Voice Quality Under the Conditions of Educational Institutions .....</b>   | <b>153</b> |
| K. Kleinová, P. Fecíľak, F. Jakab, J. Bača, Technical University of Košice, Slovakia  |            |
| <b>NGN For a New Integrated e-Learning.....</b>   | <b>159</b> |
| T. Kováčiková, P. Segeč, M. Kubina, University of Žilina, Slovakia  |            |

## **TOOLS & CONTENT-ORIENTED APPLICATIONS**

---

|   |            |
|---|------------|
| <b>Flash and Mobile Solutions for Video Streaming Platform .....</b>  | <b>163</b> |
| M. Michalko, F. Jakab, M. Biňas, J. Bača, Technical University of Košice, Slovakia  |            |
| <b>Current Status of EVO and the Plan of the Plan of the Future Development .....</b>   | <b>171</b> |
| R. Adamek, P. Farkaš, M. Harčár, V. Michalčín, P. Murín,<br>M. Paulíny, Pavol Jozef Šafárik University in Košice, Slovakia                      |            |
| <b>Learner's Support in Intelligent Tutoring Systems .....</b>  | <b>177</b> |
| A. Anohina, Riga Technical University, Latvia   |            |
| <b>Triological Learning – New Approach to Education .....</b>   | <b>183</b> |
| F. Babič, J. Wagner, Technical University of Košice, Slovakia   |            |
| <b>Implementation of e-Learning Platform<br/>for Distance Practical Education in Electrical Engineering .....</b>                               | <b>189</b> |
| P. Bauer, Delft University of Technology, The Netherlands<br>V. Fedák, Technical University of Košice, Slovakia                                 |            |
| <b>Complex Adaptive on-line Learning System “Theory of Automatic Control” .....</b>   | <b>195</b> |
| Y. Bezgachnyuk, L. Zamikhovskyy, R. Matviyenko, L. Savyuk.<br>Ivano-Frankovsk Institute of Economy and Management “Galitskaya Academy”, Ukraine |            |

|  |            |
|--|------------|
| <b>Is Linux Enough Accessible?.....</b>  | <b>201</b> |
| M. Biñas, F. Jakab, M. Michalko, A. Galajdová, Technical University of Košice, Slovakia  |            |
| <b>Why is it so Difficult to Prepare a Project Proposal<br/>for EU FP7 Collaborative Research Programme? .....</b>   | <b>207</b> |
| <b>Can e-Learning Help?</b><br>Z. Brož, Private Consultant, Dobřichovice, Czech Republic   |            |
| <b>Remote Communication with Measurement Workplace .....</b>   | <b>213</b> |
| O. Čičáková, I. Ondrášová, Slovak University of Technology, Bratislava, Slovakia,<br>M. Kubik, Honeywell comp., Brno, Czech Republic                         |            |
| <b>The Concept of Developing e-Learning Repository – Metadata and Group Work.....</b>  | <b>217</b> |
| D. Dobrowolski, Maria Curie Skłodowska University, Lublin,<br>A. Grabowska, PRO-MED Co Ltd., Gdańsk, Poland P. Lafourcade, ETH Zurich, Switzerland           |            |
| <b>Designing and Complete Special Tasks<br/>with Automatic Evaluation and Video Presentation in e-Learning.....</b>  | <b>221</b> |
| R. Fasuga, L. Holub, VŠB Technical University of Ostrava, Czech Republic   |            |
| <b>Greenstone Digital Library Implementation with Fedora Directory Server .....</b>  | <b>227</b> |
| A. Frolová, National University of Kyiv, Ukraine   |            |
| <b>Flash in Teaching.....</b>  | <b>241</b> |
| J. Hrbáček, Pedf MU Brno, Czech Republic   |            |
| <b>Building Quality in e-Learning.....</b>   | <b>235</b> |
| M. Huba, L. Rovánová, Slovak University of Technology, Bratislava, Slovakia  |            |
| <b>Intelligent e-Learning Systems .....</b>  | <b>231</b> |
| P. Kažík, I. Sivý, Technical University of Košice, Slovakia  |            |
| <b>Remote Access to Sensors on Basis of Distributed Information Measurement<br/>and Control System for Support of Research and Educational Process.....</b>  | <b>247</b> |
| S. A. Kiprushkin, S.Y. Kurskov, E.S. Sukharev, Petrozavodsk State University, Russia   |            |
| <b>Systemic e-Learning Solution of AC Machine Explanation Based on Phasor Theory .....</b>   | <b>251</b> |
| M. Kostelný, V. Fedák, Technical University of Košice, Slovakia  |            |
| <b>IcPoint – Interactive Night Sky Observation .....</b>   | <b>255</b> |
| A. Kovárová, M. Dobiš, V. Hlaváček, L. X. Hoang, M. Jajcaj,<br>D.Lamoš, Slovak University of Technology, Bratislava, Slovakia                                |            |
| <b>Distance Course “Tutors Practice” .....</b>   | <b>261</b> |
| V. N. Kukhareno, N. Syrotenko, National Technical University<br>“Kharkiv Polytechnic Institute”, Ukraine   |            |
| <b>Eduklik.com.....</b>  | <b>265</b> |
| N. Martel, NM Management s.r.o., Bratislava, Slovakia  |            |
| <b>E-learning in the Education of Optical Communication Systems.....</b>   | <b>269</b> |
| M. Mazálková, University of Defense, Brno, Czech Republic  |            |
| <b>The Learning Portal for Improving the e-Learning Environment .....</b>  | <b>273</b> |
| H. Nakano, T. Kita, K. Sugitani, J. Nemoto, S. Kitamura, K. Suzuki,<br>R. Matsuba, M. Migta, Y. Musashi, N. Iriguchi, T. Usagawa, Kumamoto University, Japan |            |
| <b>On-line Support for Assessment of Student Knowledge .....</b>   | <b>277</b> |
| Ľ. Odráška, K. Žáková, Slovak University of Technology, Bratislava, Slovakia   |            |



|   |            |
|---|------------|
| <b>Programming in OS Windows – Interactive e-Learning System .....</b>  | <b>283</b> |
| V. Krajnyík, I. Sivý, Technical university of Košice, Slovakia  |            |
| <b>Learning Management System “AGAPA”<br/>as an Instrument for Building of Information-Educational Area .....</b> | <b>287</b> |
| A. Striuk, Kryvyi Rih Technical University, Ukraine   |            |
| <b>System of Distance Education at Sumy State University .....</b>  | <b>291</b> |
| T. Lavrik, A. Vasylyev, V. Lyubchak, Sumy State University (SSU), Ukraine   |            |
| <b>Web Based Authoring/Teaching Tool for e-Learning with Use of 3D User Interface.....</b>                        | <b>295</b> |
| L. Vokorokos, B. Madoš, Technical University of Košice, Slovakia  |            |

---

## **NEW ROLES OF INSTRUCTOR AND LEARNER**

---

|  |            |
|--|------------|
| <b>Pedagogical Diagnostic with use of Computer Technologies .....</b>  | <b>301</b> |
| L. Bilousova, O. Kolgatin, L. Kolgatina,<br>The Kharkiv National Pedagogical University named after G.S.Skovoroda, Ukraine   |            |
| <b>ELU Project Approach to IDTV Pedagogy .....</b>   | <b>307</b> |
| P. Čech, D. Ponce, V. Bureš, K. Olševičová, University of Hradec Králové, Czech Republic   |            |
| <b>Finding a Balance in Blended Learning with Extra Large Student Groups.....</b>  | <b>311</b> |
| P. Fabian, University of Zilina, Slovakia, A. Muhren, W. Ween, Technical university Delft, The Netherland  |            |
| <b>Preserving the Experts Knowledge for the New Learners Generation: A Web-based Knowledge Map .....</b>   | <b>317</b> |
| P. Fabian, S. Sattari, W. Backhaus, K. Henning, E. Sjoer, E. McQuade, P. Pimenta, J. Carlos Nascimento,<br>University of Zilina, SK, Aachen University, DE, TU Delft, NL, University of Limerick, IE,<br>University of Minho, Guimares, PT |            |
| <b>Construction of the System of Distance Learning with Variable Kernel Technology Using.....</b>  | <b>323</b> |
| P. Fedoruk, Precarpathian National Vasyl Stefanyk University, Ivano-Frankivsk, Ukraine   |            |
| <b>Advanced Knowledge Assessment System (Functional Specification).....</b>  | <b>327</b> |
| J. Genči, F. Jakab, Technical University of Košice, Slovakia   |            |
| <b>Learning Object Repositories as a Technology for Virtual Community of Teachers? .....</b>   | <b>331</b> |
| Z. Lustigová, Charles University Prague, Czech Republic  |            |
| <b>Ontology – Based Models for Personalized e-Learning Environment.....</b>  | <b>335</b> |
| M. Šimún, A. Andrejko, M. Bielíková, Slovak University of Technology, Bratislava, Slovakia   |            |
| <b>Digital Media Engineering and Design: Proposals for Interdisciplinary Study Program .....</b>   | <b>341</b> |
| M. Šperka, A. Kovárová, Slovak University of Technology, Bratislava, Slovakia  |            |

---

## **CASES & PROJECTS**

---

|  |            |
|--|------------|
| <b>E-Learning Environments with Remote Configuration, Control and Verification of Digital Systems .....</b>                  | <b>349</b> |
| J. Bača, S. Šuba, M. Hauliš, Technical University of Košice, Slovakia  |            |
| <b>Knowledge Mining from Adaptive Course .....</b>   | <b>355</b> |
| M. Bober, Z. Velart, VŠB Technical University of Ostrava. Czech Republic<br>P. Šaloun, University of Ostrava, Czech Republic |            |
| <b>Satellite and Mobile Communication as Means of Modern Distance Education Technology .....</b>                             | <b>361</b> |
| V. Bondarenko, Kiev National Economic University, Ukraine  |            |

|  |            |
|--|------------|
| <b>Semantically Enhanced Adaptive e-Learning System .....</b>  | <b>367</b> |
| S. N. Boytcheva, M. Nisheva, Sofia University, Bulgaria  |            |
| <b>Innovation in Education Involve Quality Systems Implementation at the Universities .....</b>                                  | <b>375</b> |
| M. Drozdová, M. Dado, University of Zilina, Slovakia   |            |
| <b>On-line School Book of Applied Economics .....</b>  | <b>383</b> |
| J. Glasnák, G. Balátová, Junior Achievement Slovensko – Mládež pre Budúcnosť,<br>Bratislava, Slovakia                            |            |
| <b>The Fully Distributed Architecture of Virtual Network Laboratory .....</b>  | <b>387</b> |
| P. Grygárek, M. Milata, J. Vavříček, Technical University of Ostrava, Czech Republic   |            |
| <b>On the Possibilities of the e-Learning Development at Smaller Universities .....</b>  | <b>393</b> |
| M. Hruby, Jiří Dvorský, University of Defence in Brno, Czech Republic  |            |
| <b>E-course and e-Tool for Safety on Machinery .....</b>   | <b>399</b> |
| M. Huba, V. Saly, Slovak University of Technology, Bratislava, Slovakia  |            |
| <b>The Use of Podcasting in Foreign Language Teaching.....</b>   | <b>405</b> |
| Š. Hubáčková, University of Hradec Králové, Czech Republic<br>P. Hubáček, ČSOB a.s., Hradec Králové, Czech Republic              |            |
| <b>European Structural Funds in 2007-2013 Programing Period in Slovakia and e-Learning .....</b>                                 | <b>409</b> |
| M. Ištván, Partnerships for Prosperity (PPP), Slovakia   |            |
| <b>Virtual Laboratory .....</b>  | <b>411</b> |
| F. Jakab, V. Andoga, M. Nagy, M. Kapa, Technical University of Košice, Slovakia  |            |
| <b>E-Learning and IPTV Network.....</b>  | <b>417</b> |
| C. Francisci, M. Kovacik, Research Institute of Telecommunications,<br>Banská Bystrica, Slovakia                                 |            |
| <b>Recent Trends in informatical Technologies,high Education and some Prospects .....</b>  | <b>423</b> |
| <b>and research Tasks in eLearning</b><br>A. Makarenko, National Technical Unievrstiy of Ukraine, Ukraine                        |            |
| <b>Motivating Primary Schoolchildrens Using Latest Multimedia Technologies in Education .....</b>                                | <b>429</b> |
| M. Michalko, F. Jakab, M. Biñas, Technical University of Košice, Slovakia  |            |
| <b>Experience with Teaching Accounting via e-Learning form at the Faculty of Management .....</b>                                | <b>435</b> |
| <b>and Economics, Tomas Bata Univerzity in Zlin</b><br>M. Otrusínová, M. Paseková, Tomas Bata University in Zlin, Czech Republic |            |
| <b>Get to Know Your Money – e-Learning Educational Program.....</b>  | <b>439</b> |
| T. Piovarčiová, E. Galanská, Nadácia pre deti Slovenska, Bratislava, Slovakia  |            |
| <b>Didactical Internet Broadcasting.....</b>   | <b>445</b> |
| V. Plasek, M. Šedivý, M. Danišovič, Comenius University, Bratislava, Slovakia  |            |
| <b>E-learning as a Tool for Training Innovative SMEs to Effectively Use ICT in their Business Activities .....</b>               | <b>449</b> |
| J. Poledna, National Agency for Development of Small and Medium Enterprises, Slovakia  |            |
| <b>Open Learning Problems and Solutions in Latvija RSEBAA.....</b>   | <b>455</b> |
| O. Remez, Riga International School of Economics and Business Administration, Latvija  |            |
| <b>E-Learning Enhancement Using Voice Enabled Applications Management For Blind People .....</b>                                 | <b>459</b> |
| Safaa S. Mahmoud, Ain Shams University, Egypt  |            |

|   |            |
|---|------------|
| <b>Organising Virtual European Seminars:</b>  |            |
| <b>Case-study the Venus Summer School on Social Software in Education and Business .....</b>                    | <b>469</b> |
| S. Bieke, EuroPACE, Belgium   |            |
| <b>Didactic Principles Applied in Teaching Listening and Reading Comprehension in Professional English.....</b> | <b>475</b> |
| I. Šimonová, University of Hradec Kralové, Czech Republic   |            |
| <b>Implementation of Study Information System at TU in Zvolen.....</b>  | <b>479</b> |
| M. Šorm, Mendel University of Agriculture and Forestry in Brno, Czech Republic                                  |            |
| M. Gecovič, Technical University in Zvolen, Slovakia  |            |
| <b>Modeling of Multilingual e-Learning and Virtual Learning Space for R&amp;D Staff.....</b>                    | <b>483</b> |
| Š. Svetský, Faculty of Material Sciences and Technology in Trnava, Slovakia                                     |            |
| <b>„Learning by Doing“ in the e-Learning Course on Constrained PID Control.....</b>                             | <b>489</b> |
| P. Ľapak, M. Huba, Slovak University of Technology, Bratislava, Slovakia  |            |
| <b>eFarmer – The Farmer’s Gateway to EU Rural Aid Schemes.....</b>  | <b>495</b> |
| M. Varga, Novitech, Košice, Slovakia  |            |
| <b>Differences and Similarities: Czech and US Online Learning.....</b>  | <b>501</b> |
| J. Vejvodová, University of West Bohemia Pilsen, Czech Republic   |            |
| S. M. Zvacek, The University of Kansas, Lawrence, USA   |            |

## **NEW ROLE OF UNIVERSITY**

---

|   |            |
|---|------------|
| <b>Experience with International Interuniversity Studies at the University of Hradec Kralove.....</b> | <b>509</b> |
| L. Bažantová, University of Hradec Králové, Czech Republic  |            |
| <b>Management of e-Learning Development at a Large University .....</b>                               | <b>513</b> |
| J. Brandejsová, M. Brandejš, Masaryk University, Brno, Czech Republic                                 |            |
| <b>Initiation of the Interuniversity Study in the CR.....</b>   | <b>519</b> |
| J. Hán, University of West Bohemia, Czech Republic  |            |
| P. Poulová, University of Hradec Králové, Czech Republic  |            |
| B. Zimola, University of Thomas Bata, Zlín, Czech Republic  |            |
| <b>MBA in Marketing via a World-wide Virtual University.....</b>                                      | <b>523</b> |
| J. Hvorecký, Vysoká škola manažmentu v Trenčíne, Slovakia   |            |
| V. Burcik, Comenius University in Bratislava, Slovakia  |            |
| I. Zary, Vysoká škola manažmentu v Trenčíne, Slovakia   |            |
| <b>e-Learning Usage for Purposes of the Bachelor Studies at Technical University in Liberec.....</b>  | <b>529</b> |
| H. Pařilová, K. Petroszki, Technická univerzita v Liberci, Czech Republic                             |            |
| <b>Computer Literacy and New University Students.....</b>   | <b>533</b> |
| P. Poulová, M. Černá, University of Hradec Králové, Czech Republic                                    |            |
| <b>University Collaboration and Virtual Mobility towards Internationalization at Home .....</b>       | <b>537</b> |
| B. Zimola, Tomas Bata University in Zlín, Czech Republic  |            |
| J. Hán, University of West Bohemia Plzeň, Czech Republic  |            |
| P. Poulová, University of Hradec Králové, Czech Republic  |            |

## **CISCO NETWORKING ACADEMY PROGRAM**

---

|  |            |
|--|------------|
| <b>NetAcad – Success in Preparing Network Professionals Using E-Learning Technologies.....</b>               | <b>543</b> |
| J. Baráth, L. Dederá, The Academy of the Armed Forces of Gen. M. R. Štefánik,<br>Liptovský Mikuláš, Slovakia |            |

|   |            |
|---|------------|
| <b>Local Cisco Networking Academy High School Rokycany:<br/>Implementation, History, Experiences and Future Plans .....</b> | <b>547</b> |
|---|------------|

J. Burda, Gymnázium a střední odborná škola Rokycany, Czech Republic

|  |            |
|--|------------|
| <b>Automatic WAN Topology Interconnection and it's Usage in NetAcad Networking Laboratories .....</b>        | <b>551</b> |
| P. Grygárek, D. Seidl, Regional Cisco Networking Academy,<br>Technical University of Ostrava, Czech Republic |            |

|  |            |
|--|------------|
| <b>The System of Career Promotion of Professionals<br/>in the Field of Computer Networks Based on Industrial Certificates.....</b> | <b>557</b> |
| F. Jakab, M. Bučko, Cisco Systems Slovakia & Technical University of Košice, Slovakia  |            |

|   |            |
|---|------------|
| <b>NetAcad Curricula Translation Tool.....</b>  | <b>563</b> |
| J. Janitor, J. Genčí, V. Sidimák, Technnical univesity of Košice, Slovakia<br>F. Jakab, K. Kniewald, Cisco Systems Slovakia, Cisco Systems Czech Republic |            |

|  |            |
|--|------------|
| <b>Implementation Cisco Networking Academy Program into Study Program for Grammar Schools.....</b> | <b>571</b> |
| I. Kovacová, Grammar school M. Galandu, Turčianske Teplice, Slovakia                               |            |

|   |            |
|---|------------|
| <b>NetAcad Program:How we Implement it at the Faculty<br/>of Management Science and Informatics, University of Žilina .....</b> | <b>575</b> |
| P. Segeč, T. Kováčiková, M. Kubina, University of Žilina, Slovakia  |            |

## **POWERPOINT PRESENTATIONS**

---

|   |            |
|---|------------|
| <b>Networked ICT Transforming Education .....</b> | <b>581</b> |
| František Baranec, Cicso Systems Slovakia         |            |

|  |            |
|--|------------|
| <b>Motivating Learners with Skills-based e-learning.....</b> | <b>593</b> |
| Michael Furminger, Cisco Networking Academy, United Kingdom  |            |

|                              |            |
|------------------------------|------------|
| <b>Wind of Change.....</b>   | <b>603</b> |
| Pavol Kukura, Slovak Telecom |            |

|  |            |
|--|------------|
| <b>HP Managed Learning Environment.....</b>  | <b>609</b> |
| B. Tvaroška, Hewlett-Packard Slovakia s.r.o. |            |



**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**Invited Papers**





## THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGY IN EDUCATION

Abdel-Badeeh M. Salem  
Faculty of Computer & Information Sciences  
Ain Shams University, Abbassia, Cairo, Egypt  
E-mail: absalem@asunet.shams.edu.eg

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract:** The field of Artificial Intelligence (AI) in education has become the most challenging topic of research in the last years. It includes different disciplines; eg. computer science, social psychology, biology, mathematics, linguistics, pedagogical aspects, and cognitive sciences. The main goal of AI in Education is to deliver intelligent educational software can be used in real teaching, learning, and training situations. In addition AI can also provide an excellent methodology for learning and reasoning from the human experiences. This paper presents the potential role of AI in the various aspects of education, where three AI fields are discussed. The first presents the knowledge representation techniques for intelligent learning and educational systems. The second is related to the use of one of the important reasoning methodology namely Case-Based Reasoning (CBR) which is used in developing interactive intelligent educational software. The third is concerned with the Intelligent Tutoring Systems (ITSs), which are capable of adaptive instruction by means of multiple representations of domain knowledge. Moreover, the paper will present a proposal for an international master's degree in artificial intelligence in education.

**Keywords:** Intelligent Tutoring, Learning Technology, Emerging Technology, Artificial Intelligence, Educational Technology.

### 1. INTRODUCTION

AI technology offers intelligent computer programs which are mimic the behavior of the user in a specific domain. AI software is not based on an algorithmic process. Instead, it is based on symbolic representation and manipulation. By using symbols, it is possible to create a knowledge base, not database that states facts, concepts, and the relationships between them. Then various processes are used to manipulate the symbols to solve a problem. The process is qualitative rather than quantitative as it is in algorithmic computing. With algorithmic software, the problem is guaranteed to be solved; with AI, there can be partial solutions or even no solution. As a result, AI often fits the disorganized, imperfect real world better than conventional software because it can deal with shades of gray.

On the other hand, using AI methods, new forms of computer-based training (CBT) software can be created that allow the computer to act as an intelligent tutor. AI technology offers students more sophisticated tools that can act as "intelligent" collaborator allowing student to develop richer inquiry skills, which may be transferable across learning situations [9]. In conventional CBT applications, "canned" sequences of instructional material are presented. Interaction with the program helps the student learn, but the main disadvantage of such CBT is that it presents a fixed content and sequence to all students regardless of their background or capability. AI-based CBT software can adjust its tutorial to the student's knowledge, experience, strengths, and weaknesses. It may even be able to carry on a natural language dialogue.

Applications of AI technology include; general problem solving, expert systems, natural language processing, computer vision, robotics, and education. All of these applications employ knowledge base and inferencing techniques to solve problems or help make decisions in specific domains. Recently, AI researches have begun to use CBR in building new generation of knowledge-based systems [7, 8, and 11]. CBR is an analogical reasoning method provides both a methodology for problem solving and a cognitive model of people. CBR means reasoning from experiences or "old cases" in an effort to solve problems, critique solutions, and explain anomalous situations [5 and 23]. CBR has been used in building a new generation of intelligent training and tutoring systems. These systems acted primarily as browsing systems and information providers. Lessons learned about the content that needs to be in cases informed the content of cases in these systems. Schank's ASK systems [3] take on the role of expert and guide a user dialog in which the system tells stories to make its points. Archie-2 [2], is used in several architecture studios at Georgia Tech to help student designers with their projects. Its associated authoring tool, DesingMuse [1], is used in classes as well, both to build useful case libraries for several of engineering classes and to give students the opportunity to learn more about some area by preparing and indexing well-articulated cases.

The paper is structured as follows; section 2 gives a brief overview of the areas of AI in education. Sections 3 and 4 dedicated to the knowledge representation techniques and the reasoning methodologies for developing the intelligent educational and learning software respectively. Section 5

presents a brief overview of authoring shells and intelligent tutoring systems. Section 6 discusses different intelligent learning applications of Medical Informatics Research Group at Ain Shames University, Egypt. Section 7 gives a proposal for master degree in “Artificial Intelligence in Education”. The final section contains the summary and conclusion.

## 2. THE AREAS OF AI IN EDUCATION

AI is science and technology and is based on many disciplines such as: computer science, psychology, mathematics, biology, linguistics and engineering. The goal of AI is to develop intelligent software models the human behaviour, i.e. : think, see, hear, walk, talk, and also feel. The field covers the areas : Action and Perception (Vision, Robotics, Auditory Scene Analysis), automated reasoning, case based reasoning, cognitive modeling, connectionist models, constraint satisfaction, distributed AI, genetic algorithms, knowledge base technology, knowledge representation, learning, natural language, non monotonic reasoning, planning, qualitative reasoning and diagnosis, reasoning under uncertainty and temporal reasoning.

Based on the analysis of the topics of the World Conferences on “Artificial Intelligence in Education (AI-ED)” which held during the period 1993 – 1999, one can summarize the main topics of the field AI in education in the following areas.

- Intelligent tutoring systems.
- Learning environment & microworlds.
- Visual and graphical interfaces.
- Human factor and interface design.
- Intelligent multimedia systems.
- Authoring system and tutoring shells.
- Collaboration tools.
- Training job skills.
- Principles/tools for instructional design.
- Natural language interfaces.
- Knowledge representation.
- Knowledge and skill acquisition.
- Conceptual change.
- Metacognition.
- Social and cultural aspect of learning.
- Cognitive development and errors.
- Student modelling.
- Teaching higher-order thinking skill.
- Theories of teaching.
- Motivation.
- Reading and writing.
- Computer-assisted language learning.
- Evaluation of computer system.
- Assessment of learning outcomes.

## 3. KNOWLEDGE REPRESENTATION FOR INTELLIGENT EDUCATIONAL SOFTWARE

The first step in constructing AI software is to build a knowledge base. In order to act intelligently, a computer

must have knowledge about the domain of interest. The knowledge of the domain must be collected and codified. It must be organized, outlined, or otherwise arranged in a systematic order. This process of collecting and organizing the knowledge is called knowledge engineering. It is the most difficult and time-consuming stage of any AI software development process. Although a variety of knowledge representation schemes have been developed over the years, these representation schemes share two common characteristics. First, they can be programmed with computer languages and stored in memory. Second, they are designed so that the facts and other knowledge contained within them can be manipulated by an inference system, the other major part of an AI program. The inference system uses search and pattern matching techniques on the knowledge base to answer questions, draw conclusions, or otherwise perform an intelligent function. A brief overview of each of these schemes is presented in the following subsections.

### 1. Logic

Logic is the oldest form of knowledge representation technique. In any logical process first, information is given, statements are made, or observations are noted. These form the inputs to the logical process and are called premises. The premises are used by the logical process to create the output which consists of conclusions called inferences. With this process, facts that are known to be true can be used to derive new facts that also must be true. There are two basic types of reasoning: deductive and inductive. Both types are used in logic to make inferences from premises. Almost any problem or argument can be put into this form for deductive reasoning purpose. In inductive reasoning a number of established facts or premises is used to draw some general conclusion.

For a computer to perform reasoning using logic, some method must be used to convert the deductive or inductive reasoning process into a form suitable for manipulation by a computer. The result is what is known as symbolic logic or mathematical logic. It is a system of rules and procedures that permit the drawing of inferences from various premises using a variety of logical techniques. These methods are generally known as computational logic. There are two basic forms of computational logic, propositional logic and predicate logic. Since propositional logic deals primarily with complete statements and whether they are true or false, its ability to represent real world knowledge is limited. Consequently, intelligent tutoring training technology uses predicate logic instead. Predicate logic gives added ability to represent knowledge in finer detail.

### 2. Lists and Trees

Lists and trees are simple structures used for representing hierarchical knowledge. A list is a series of related items. Objects are divided into groups or classes of similar items. Their relationships are shown by linking them together. The simplest form is one list, but a hierarchy is created when two or more related lists are combined. On the other hand, a tree is a graphical structure of hierarchy, it is simply a way of illustrating lists and other hierarchical knowledge.



### 3. Semantic Networks

Semantic networks are basically graphical depictions of knowledge that show hierarchical relationships between objects. A semantic network is made up of a number of nodes, which represent objects and descriptive information about those objects. Objects can be any physical items such as a book, car, desk, or even a person. Nodes can also be concepts, events, or actions. The nodes in a semantic network are also interconnected by link or arcs. The arcs show the relationships between the various objects and descriptive factors. Some of the most common arcs are of the is-a or has-a type.

### 4. Frames

A frame is a relatively large block or chunk of knowledge about a particular object, event, location, situation, or other element. The frame describes that object in great detail. The detail is given in the form of slots which describe the various attributes and characteristics of the object or situation. Frames are normally used to represent stereotyped or knowledge based on well-known characteristics and experiences. With frames, it is easy to make inferences about new objects, events, or situations because they provide a base of knowledge drawn from previous experience. For example, the items of the components of any automobile or the animal kingdom can be represented in frames format.

### 5. Scripts

A script is a knowledge representation scheme similar to a frame, but instead of describing an object, the script describes a sequence of events. Like the frame, the script portrays a stereotyped situation. Unlike the frame, it is usually presented in a particular context. To describe a sequence of events, the script uses a series of slots containing information about the people, objects, and actions that are involved in the events. Some of the elements of a typical script include *entry conditions*, *props*, *roles*, *tracks* and *senes*.

### 6. Production Rules

Production rules, sometimes just referred to as rules or productions, are two part statements that embody small pieces of knowledge. The first part of the rule, called the antecedent, expresses a situation or premise while the second part, called the consequent, states a particular action or conclusion that applies if the situation or premise is true. The first or left-hand part of the rule is a statement with the prefix IF. The second or right-hand part of the rule is a statement with the prefix THEN.

### 7. Cases

The case is a list of features that lead to a particular outcome. (e.g. *The information on a patient history and the associated diagnosis*). The complex case is a connected set of sub cases that form the problem solving task's structure (e.g. *the design of an airplane*). Determining the appropriate case features is the main knowledge engineering task in case-based AI software. This task involves defining the terminology of the domain and gathering representative cases of problem solving by the expert Representation of

cased can be in any of several forms (*predicate*, *frames*, *scribes*).

### 8. Ontologies

The word "ontology" came from philosophy. From a philosophical viewpoint, "Ontology" is the branch of philosophy which deals with the nature and the organization of reality. At the computer science domain, ontologies aim at capturing domain knowledge in a generic way and provide a commonly agreed understanding of a domain, which may be reused and shared across applications and groups [14]. Ontologies provide a common vocabulary of an area and define -with different levels of formality- the meaning of the terms and the relations between them.

Ontologies emerged as an alternative to represent knowledge. However, they have been used to support a great variety of tasks. Although ontologies emerged in artificial intelligence they have been used in different research areas. At present, there are applications of ontologies with commercial, industrial, medical, academics and research focuses [15, 16 and 17]. Ontology design, approaches and methodologies are very important aspect of building ontologies in different domains and tasks. In addition the reusability is a key issue that is determined by the level of compatibility among ontology concepts and among the theories of the different domains they convey.

Ontologies may be categorized according to the domain they represent or the level of detail they provide. General ontologies represent knowledge at an intermediate level of detail independently of a specific task. In such ontologies, upper levels reflect theories of time and space, for example, and provide notions to which all concepts in existing ontologies are necessarily related. Domain ontologies represent knowledge about a particular part of the world, such as medicine, and should reflect the underlying reality through a theory of the domain represented. Finally, ontologies designed for specific tasks are called application ontologies. Conversely, reference ontologies are developed independently of any particular purpose and serve as modules sharable across domains.

Combining logic with ontology establishes a domain specific language that not only describes the items of the domain, but also the relationships between entities within the domain. The current trend in knowledge representation language is to use XML as the basic syntax, simplifying machine parsing KR languages. Unfortunately, this greatly reduces human readability. Salem and Alfonse [17] discusses in more details about methodologies, languages and tools for building ontologies and the different ontologies in medical domain.

## **4. REASONING ETHODOLOGIES FOR INTELLIGENT EDUCATIONAL SOFTWARE**

The field of reasoning is very important for the development of AI-based educational software. The research area in this field covers a variety of topics, e.g.; automated reasoning, case-based reasoning, commonsense reasoning, fuzzy reasoning, geometric reasoning, nonmonotonic reasoning, model-based reasoning, probabilistic reasoning, causal reasoning, qualitative reasoning, spatial reasoning and Temporal reasoning. This

section is dealing with reasoning with rules, fuzzy-rules, and cases. In fact these methodologies receive increasing attention within the AI in education community.

### 1. Reasoning with Rules

Rules are easily manipulated by reasoning systems. Forward chaining can be used to produce new facts (hence the term “production” rules), and backward chaining can deduce whether statements are true or not. Rule-based systems were one of the first large-scale commercial successes of artificial intelligence research. An *expert system* or *knowledge-based system* is the common term used to describe a rule-based processing system. It consists of three major elements, a *knowledge base* (the set of if-then rules and known facts), a *working memory* or database of derived facts and data, and an *inference engine*, which contains the reasoning logic used to process the rules and data.

Rule-based systems solve problems by taking an input specification and then “chaining” together the appropriate set of rules from the rule base to arrive at a solution. Given the same exact problem situation, the system will go through exactly the same amount of work to come up with the solution. In other words rule-based ITSs don’t inherently learn. In addition, given a problem that is outside the system’s original scope, the system often can’t render any assistance. Finally, rule-based ITSs are very time-consuming to build and maintain because rule extraction from experts is labor-intensive and rules are inherently dependent on other rules, making the addition of new knowledge to the system a complex debugging task.

Forward chaining is a data-driven reasoning process where a set of rules is used to drive new facts from an initial set of data. It does not use the resolution algorithm used in predicate logic. The forward-chaining algorithm generates new data by the simple and straightforward application or firing of the rules. As an inferencing procedure, forward chaining is very fast. Forward chaining is also used in real-time monitoring and diagnostic systems where quick identification and response to problems are required.

Backward chaining is often called goal-directed inferencing, because a particular consequence or goal clause is evaluated first, and then we go backward through the rules. Unlike forward chaining, which uses-rules to produce new information, backward chaining uses rules to answer questions about whether a goal clause is true or not. Backward chaining is more focused than forward chaining, because it only processes rules that are relevant to the question. It is similar to how resolution is used in predicate logic. However, it does not use contradiction. It simply traverses the rule base trying to prove that clauses are true in a systematic manner. Backward chaining is used for advisory systems, where users ask questions and get asked leading questions to find an answer. A famous early expert system, Mycin, used backward chaining to perform diagnoses of bacterial infections in medical patients.

One advantage of backward chaining is that, because the inferencing is directed, information can be requested from the user when it is needed. Some reasoning systems also

provide a trace capability which allows the user to ask the inference engine why it asking for some piece of information, or why it came to some conclusion.

### 2. Reasoning with Fuzzy Rules

In the rich history of rule-based reasoning in AI, the inference engines almost without exception were based on Boolean or binary logic. However, in the same way that neural networks have enriched the AI landscape by providing an alternative to symbol processing techniques, fuzzy logic has provided an alternative to Boolean logic-based systems.

Unlike Boolean logic, which has only two states, true or false, fuzzy logic deals with truth values which range continuously from 0 to 1. Thus something could be *half true* 0.5 or *very likely true* 0.9 or *probably not true* 0.1. The use of fuzzy logic in reasoning systems impacts not only the inference engine but the knowledge representation itself. For, instead of making arbitrary distinctions between variables and states, as is required with Boolean logic systems, fuzzy logic allows one to express knowledge in a rule format that is close to a natural language expression. For example, we could say:

If temperature is hot and humidity is sticky then fan\_speed is high

The difference between this fuzzy rule and the Boolean-logic rules we used in our forward- and backward-chaining examples is that the clauses “temperature is hot” and “humidity is sticky” are not strictly true or false. Clauses in fuzzy rules are real-valued functions called membership functions that map the fuzzy set “hot” onto the domain of the fuzzy variable “temperature” and produce a truth-value that ranges from 0.0 to 1.0 (a continuous output value, much like neural networks).

Reasoning with fuzzy rule systems is a forward-chaining procedure. The initial numeric data values are *fuzzified*, that is, turned into fuzzy values using the membership functions. Instead of a match and conflict resolution phase where we select a triggered rule to fire, in fuzzy systems, all rules are evaluated, because all fuzzy rules can be true to some degree (ranging from 0.0 to 1.0). The antecedent clause truth values are combined using fuzzy logic operators (a fuzzy conjunction or and operation takes the minimum value of the two fuzzy clauses). Next, the fuzzy sets specified in the consequent clauses of all rules are combined, using the rule truth values as scaling factors. The result is a single fuzzy set, which is then *defuzzified* to return a crisp output value.

### 3. Reasoning with Cases

The idea of case-based reasoning is becoming popular in developing ITSs because it automates applications that are based on precedent or that contain incomplete causal models. In rule-based ITSs an incomplete mode or an environment which does not take into account all variables could result in either an answer built on incomplete data or simply no answer at all. Case-based methodology attempt to get around this shortcoming by inputting and analyzing problem data.

The methodology of case-based ITS can be summarized in the following steps:

- 1 - The system will search its Case-Memory for an existing case that matches the input problem specification.
- 2 - If we are lucky (our luck increases as we add new cases to the system), we will find a case that exactly matches the input problem and goes directly to a solution.
- 3 - If we are not lucky, we will retrieve a case that is similar to our input situation but not entirely appropriate to provide as a completed solution.
- 4 - The system must find and modify small portions of the retrieved case that do not meet the input specification. This process is called "case-adaptation".
- 5 - The result of case - adaptation process is : a completed solution, and also, generates a new case that can be automatically added to the system's case-memory for future use.

Research reveals that students learn best when they are presented with examples of problem-solving knowledge and are then required to apply the knowledge to real situations. The case-base of examples and exercises capture realistic problem-solving situations and presents them to the students as virtual simulations, each example/exercise includes:

- A multi-media description of the problem, which may evolve over time,
- A description of the correct actions to take including order-independent, optional, and alternative steps;
- A multi-media explanation of why these steps are correct;
- The list of methods to determine whether students correctly executed the steps;
- The list of principles that must be learned to take the correct action.

3.1. Benefits of the Educational CBR-Based Systems. There are several areas where students should be able to perform better using CBR:

1. With more cases available, students will be able to recognize more situations and the solutions that go with these cases include failure cases, students will be able to benefit from the failures of others
2. Retrieval cases will allow students to better recognize what is important in a new situation. Cases indexed by experts would recall and will show the student ways of looking at a problem that he might not have the expertise for without the system
3. Student will have access to obscure cases that they otherwise would not be able to make use of. These obscure cases can help with any of the tasks previously listed
4. During a training period CBR system provides the student with a model of the way decision making ought to be done, for example, what things ought to be considered and provides them with concrete examples on which to hang their more abstract knowledge
5. For tasks where there is much to remember, CBR systems can augment the memories of even educators. Also, both educators and students tend to focus on too few possibilities when reasoning analogically or to focus on the wrong cases.

## 5. AUTHORING SHELLS AND INTELLIGENT TUTORING SYSTEMS

### 5.1. Authoring shells

Authoring shells allow a course instructor to easily enter domain and other knowledge without requiring computer programming skills [12]. The authoring shell automatically generates an ITS focusing on the specified knowledge. It also facilitates the entry of examples/exercises, including problem descriptions, solutions steps, and explanations. The examples may be in the form of scenarios or simulations. It allows organized entry of the course principles and the integration of multi-media courseware (developed with well-known authoring tools) which includes descriptions of the principles or motivational passages. In addition to course knowledge, the instructor specifies pedagogical knowledge (how best to teach a particular student), and student modeling knowledge (how to assess actions and determine mastery).

The most recent authoring shells are DIAG, RIDES-VIVIDS, XAIDA, REDEEM, EON, INTELLIGENT TUTOR, D3 TRAINER, CALAT, INTERBOOK, and PERSUADE (Redfield, 1998). Some tools were meant for select authors or students and others were designed for a wide set of authors. Some tools were designed to work with a limited area of domain expertise, and some were designed for a wide range of domains. Some tools had one main instructional strategy, but others had many. Each tool had their own way of representing the student's knowledge and understanding of the material being taught. Some tools generated instruction directly from domain knowledge. Some relied on pedagogical knowledge about the domain to create instruction. Some provided simulation environments for practice and exploration. For example, KONGZI is an automatic generation tool and composed of two main systems: knowledge acquisition system and ITS generation system [6]. Using KONGZI, Lu et al. [6] developed three systems of domains: mineralogy, medicine and botany. The first system for detecting and processing faults of drills; the second one is for teaching diagnosis of heart diseases; and the third is a system of teaching botanical classification.

### 5.2. Intelligent Tutoring Systems

Intelligent tutoring systems (ITS's) are a product of the combination of AI and education. ITS technology have several difficulties:

- 1- ITS face the knowledge-acquisition difficulty, productivity of ITS development is determined by the efficiency of their knowledge methods/facilities.
- 2- ITS must organize their knowledge in a lesson-oriented manner. This organization must be dynamically adjusted by ITS themselves according to student models.
- 3- Student modeling is one of the integral components in ITS. Student models are the keys to individual instruction.
- 4- Automatic generation of exercises and tests is an important feature of ITS.

Koedinger [4] has made the point that AI systems, and ITSs in particular, may have their greatest impact in complex or "enigmatic" domains. These are learning domains which

typically use notation or other means of representation that do not promote problem solutions and which typically are not transparent in their use (e.g., geometric proofs). As computer programs are able to offer students alternative mental models for representing mathematical concepts, power and flexibility will be afforded the student in problem solving. Two examples of existing systems which provide alternative methods of representation are ANGLE [4] and OPERA [10]. ANGLE is a geometric proof tutor, which emphasizes student use of schemas in addition to knowledge of rules. Students are encouraged to parse geometric diagrams into meaningful chunks, or Diagram configuration schemas, which can assist them in planning their proofs. OPERA is an environment in which students can investigate the properties of algebraic operators. Through the use of various schematic representations, students are able to form mental models or concepts such as mappings, functions, and structures of algebraic expressions. Both of these systems avoid dependence on the use of mathematical symbols, which is typical of the CAI programs presently available for classroom use.

## 6. DIFFERENT INTELLIGENT LEARNING APPLICATIONS

This section discusses the different intelligent learning applications of Medical Informatics Research Group (MIRG) at Ain Shames University, Egypt [22].

### 1- Seatutor identification system

Seatutor is a prototype applies the rule-based reasoning approach to identify sea creatures. The system can identify 11 different creatures, namely: whale, porpoise, dolphin, shark, flounder, salmon, crab, shrimp, scallop, oyster, and clam. All of knowledge came from a set of encyclopedias and two books on sea animals. The system is implemented in prolog (Salem, 1999).

### 2- Upper Respiratory Infection (URI) system

Is a medical diagnoses case-based intelligent learning system for diagnoses of upper respiratory infections. The system can assists young physicians in their diagnoses. The system ables to query the user about symptoms then reach any of eight actions (Eight diseases). The knowledge of the following diseases are included in the knowledge base: common measles, German measles, mumps, chicken pox, meningitis, whooping cough, flu diseases and common cold. URI is implemented by using case point tool which is a runtime version of CBR-Express Shell [13].

### 3- CANCER learning system

CANCER is an intelligent learning system for pain control in cancer disease in the research stage [21]. The system can improve the quality of life for these people by helping to control the pain. The functions of the system are:

- (One) Confirmation of the current diagnosis.
- (Two) Description of symptoms that may appear later.
- (Three) Treatments proven successful in similar or related cases, and
- (Four) Possible alternative causes of the pain.

Two versions of CANCER are developed: CANCER-R and CANCER-C. The first system uses the rule-based approach and is written in Prolog Language (is very good for rapid prototyping). CANCER-C uses a case-based reasoning strategy to record and retrieve its knowledge and is implemented by using the CBR-Work tool. All the technical and computational aspects are discussed in more details in other publications [19 and 21].

### 4- Heart learning system

Heart is a cased-based learning system for diagnoses of the cardiac diseases. The system is a prototype for supporting diagnoses of heart diseases: 110 cases were collected for 4 heart diseases namely; mitral stenosis, left-sided heart failure, stable angina pectoris and essential hypertension. Each case contains 207 attributes concerning both demographic and clinical data. After removing the duplicated cases, the system has trained set of 42 cases for Egyptian cardiac patients. All the technical and computational aspects are discussed in more details in other publications [18, 20, and 21].

## 7. A PROPOSAL FOR INTERNATIONAL MASTER OF ARTIFICIAL INTELLIGENCE IN EDUCATION

The objective of this degree is to prepare professional persons on the international level specialized in developing an intelligent educational software. The master consists of two main parts; core courses and specialization tracks. In addition to practical training and graduate project. In what follows we propose the following structure:

- Core courses (9 credits, 3courses to be selected)
  1. Knowledge representation and knowledge-based technology
  2. Natural language processing
  3. Reasoning methodologies
  4. Learning and planning
- Specialization track  
(18 credits, 2 courses from each track and 1 additional course in a track of specialization plus graduate seminar)
  - Intelligent tutoring systems and tools track
    1. Principle/tools for intrusion design
    2. Collaboration tools and techniques
    3. Evaluation of instruction systems
    4. Authoring systems and tutoring shells
  - Intelligent interfaces track
    1. Visual and graphical interfaces
    2. Human factors and interface design
    3. Non-standard and innovative interfaces
    4. Natural language interfaces
  - Teaching strategies and student modeling track
    1. Theories of teaching and motivation
    2. Student modeling and cognitive diagnoses
    3. Social and culture aspects of learning
    4. Cognitive issues in knowledge acquisition and evaluation

- Practical training
- Graduate project
- Course schedule
  1. The total duration of study is about 6 months
  2. The total number of courses is 9 courses, 40 hrs each
  3. The course will be completed in 8 working days / 5 hours a day

## 8. SUMMARY AND CONCLUSIONS

1. Knowledge representation techniques offer potentially powerful tools for the development of intelligent learning software. The variety of such techniques enabling the design of a robust intelligent tutoring and training systems. The key to the success of such systems is the selection of the knowledge representation scheme that best fits the domain knowledge and the problem to be solved. That choice is depends on the experience of the knowledge engineer.
2. The combination of AI and education results in different products of intelligent educational software for all tasks and domains. With AI methods new generation of intelligent tutoring systems and intelligent authoring tools can be created. AI provides a variety of methodologies and theories about reasoning and inference. Hypotheses derived from these theories can inform curriculum, pedagogy, and potential roles for computers in education.
3. CBR technology leads to an educational knowledge based systems able to perform each of the following tasks: Solve problems, Generate problems, Generate teaching materials, Compose lessons at various levels of knowledge by following the curriculum, Critique solutions, Explain anomalous situations, and Dealing with dynamically changing situations and other situations where solutions are not clear cut.
4. Intelligent authoring shells allow easy development and maintenance of intelligent learning systems which are based on pedagogically sound instructional strategies. The software is domain-independent and thus useful for creating a wide array of intelligent tutoring and training systems for a variety of domains.
5. The convergence of AI and web technologies is enabling the creation and implementation of the intelligent internet-based training technology. Such technology will provide a unique opportunity to distribute training across multiple sites while dramatically reducing travel-related training costs. Not only do students receive training at their own sites, but instructors monitor students progress from a distance, and course authors maintain and update training material across the internet.

## 9. REFERENCES

- [1] Domeshek, E., Kolodner, J. L., & Zimring, C., "*The Design of a Tool Kit for Case-Based Design Aids*". Gero, J. S. & Sudweeks, F. (Eds.), Artificial Intelligence in Design 94, Kluwer Academic Publishers, Netherlands, 1994, pp. 109-126.
- [2] Domeshek, E. and Kolodner, J. L., "*Using the Points of Large Cases*". Artificial Intelligence for Engineering Design, Analysis and Manufacturing (AIEDAM), Vol. 7. No. 2, 1993, pp. 87-96.
- [3] Ferguson, W., Bareiss, R., Birnbaum, L., & Osgood, R., "*ASK Systems.: An Approach to the Realization of Story-based Teachers*". Journal of the Learning Sciences 2, 1992, pp 95-134.
- [4] Koedinger, K., "*On the Design of novel Notations and Actions to Facilitate Thinking and Learning*". In L. Birnbaum (Ed.), Proceedings of the International Conference on the Learning Science, 1991, pp. 266-273.
- [5] Kolodner, J. (1993). Case-Based Reasoning, Morgan Kaufmann, San Mateo.
- [6] Lu, R., Cao, C. Chen, Y., and Han, Z., "*On Automatic Generation of Intelligent Tutoring Systems*", Proceeding of the Int. Conf. Of Artificial Intelligence in Education, Washington D.C., USA, 1995, pp 67-74.
- [7] Salde, S., "*Case-Based Reasoning: A Research Paradigm*", AI Magazine, Vol. 12, No. 1, 1991, pp 42-55.
- [8] Salem, A. M., "*Educational Knowledge-Bases on the Web*", Proceedings of the Sixth EDEN Annual Conference on Open and Distance Learning, Budapest, Hungary. 1997, pp 382 - 386
- [9] Salomon, G., Perkins, D., and Golberson, T. (1991). Partners in Cognition: Extending Human Intelligence with Intelligent Technologies, Educational Researcher, 20 (4), 2-9.
- [10] Schwarz, B. B., "*Advantages in the use of causal models for the learning of mathematical concepts*", ITS'92 Montreal, Canada, 1992.
- [11] Voss, A. (1996). Towards a Methodology for Case Adaptation, Proceedings of the 12th European Conference on Artificial Intelligence, 147, Budapest, Hungary.
- [12] Redfield, C. L., "*Intelligent Tutoring System Authoring Tools*", AI Magazine, Vol. 19, No. 2, 1998, p. 126.
- [13] Salem, A. M. and Roushdy, M., "*Developing a Case-Based Expert System for Diagnoses of Upper Respiratory Infections*", Proceedings of the Fourth International Conference on Artificial Intelligence Applications, Cairo, Egypt, 1996, pp 46-55.
- [14] Chandra R, B.; Johnson, T. R.; Benjamins, V. R., "Ontologies: what are they? why do we need them?". *IEEE Intelligent Systems and Their Applications*. 14(1). Special Issue on Ontologies. 1999, pp 20-26.

- [15] Kitamura Y, Koji Y and Mizoguchi R. “*An Ontological Model of Device Function and Its Deployment for Engineering Knowledge Sharing*”, *Proc. Of 1st workshop on formal ontologies meet industry (FOMI), Castelnovo del Garda, Italy, 2005*.
- [16] Kitamura Y. and Mizoguchi R., “An Ontological Schema for Sharing Conceptual Engineering Knowledge” *Proc. Of the International Workshop on Semantic Web Foundations and Application Technologies, 2003*, pp25-28.
- [17] Salem A. M. and Alfonse M., “Ontological Engineering in Medicine” *Proc. of Medical Informatics Workshop, the Third International Conference on Intelligent Computing and Information Systems ICICIS07, Cairo, Egypt, 2007*, pp 59-74.
- [18] Salem A. M., Roushdy M. and Hodhod R. A, “A Case Based Expert System for Supporting Diagnoses of Heart Diseases”, *ICGST International Journal on Artificial Intekkgience and Machine Learning (AIML), 2004*.
- [19] Salem A. M. and El Bagoury B. M., “A Case Based Adaptation Model for Thyroid Cancer Diagnoses Using Neural Networks” *proc. of the Sixteenth International Florida Artificial Intelligence Research Society (FLAIRS) Conference, California, USA, 2003*, pp. 155 -159.
- [20] Salem A. M. and Hodhod R. A., “A Hybrid Expert System Supporting Diagnoses of Heart Diseases”, *IFIP 17<sup>th</sup> World Computer Congress – TC12 Stream on Intelligent Information Processing, Montreal, Quebec, Canada. 2002*, pp. 301-305.
- [21] Salem A. M., Roushdy M. and El Bagoury B. M., “An Expert System for Diagnosing of Cancer Diseases”, *proc. of 7<sup>th</sup> International Conference on Soft Computing MENDEL 2001, Brno, Czech Republic, 2001*, pp. 300-305.
- [22] Salem A. M. “Intelligent Technologies for Medical e-Learning”, *Proc. of the Third International Conference on Intelligent Computing and Information Systems ICICIS07, Cairo, Egypt, 2007*, pp 46-54.
- [23] AI@work. “*Intelligent Tutoring System on the Internet: A Case-Based Approach*”, PC IA, July / August 1999.

#### THE AUTHOR



**Abdel-Badeeh M. Salem:** Vice Dean of the Faculty of Computers & Information Sciences, Ain Shames University. Professor of Computer Science since June 1989. Member of Several International Societies in Artificial Intelligence, Information Technology and Medical Informatics. Over 130 Academic and Professional Publications in the fields of Knowledge Based Systems, Medical Informatics, Machine Learning and Intelligent e-Learning Technologies.



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## LEARNING 2.0 AND THE PARADIGM OF EDUCATION

Danuše Bauerová

Education Innovation Institute

VŠB – Technical University, Faculty of Economics, Sokolská 33, 701 21 Ostrava, Czech Republic  
+420 59 699 2012, [danuse.bauerova@vsb.cz](mailto:danuse.bauerova@vsb.cz), <http://vsb.cz>, <http://iiv.vsb.cz>

**Abstract.** The Web 2.0 technology is here – it has been created and offered to all branches of science. But has 'Learning 2.0' automatically arrived as well? We would not have made any progress beyond medieval medicine if we had not abandoned its paradigm that assumed that all diseases are based on imbalances in our blood. Improvement in the quality of medicine would be limited to searching for superior methods and forms of blood-letting. Is there any parallel to education?

**Keywords:** Blended learning, Blog, Computer based Learning, Collaborative Learning, Communication Technologies, Course, Digital Literacy, Digitalisation, Distance education, Education, Education quality criteria, Education quality system, ELearning, Human resource, Human network, Information and Communication Technology, Interactive Learning, Internet access, Knowledge, Learner, Life long learning, Management, Methodology, Metalearning, Modelling, Network, Open global dialog, Open learning, Paradigm, Pedagogy, School, Skills, Society, Student, System, Teacher, Teaching, Tools, Training network, Tutoring, Virtual classroom, Web-based courses, World Wide Web.

### 1. INTRODUCTION

Each model, as a picture of reality, is formed in a *certain way*, which *corresponds to a certain period of time*, and it is natural that the model develops gradually. Most of the time it happens in an evolutionary way; nevertheless, from time to time revolutionary changes happen. These, in turn, bring changes in qualitative structure. A correct evaluation of the degree of exhaustion of the system of basic assumptions and conditions, on which the current degree of scientific discipline is based, is a starting point for each realization of qualitative change.

Changes, which information and communication technologies (ICT) bring, are so revolutionary that a so called 'new model' is sought in many scientific disciplines. Also in the field of education there are calls for a diversion from an authoritative education model controlled by the teacher to processes of *metalearning* and to a model based on an ability to learn. [2].

With the appearance of a new educational model, the search for possibilities of how to *evaluate the quality* of its realization inherently gains in importance. It is no longer enough to evaluate within the frame of the current scale. Quality is changing along with revolutionary changes, and new measures and criteria have to appear.

Tabulation of a new *system of criteria* for evaluating education is mandated by *overstepping the borders* of current principles. With the domination of new technologies, these principles are becoming restrictive and they prevent further development in accordance with possibilities.

### 2. PARADIGM AND REVOLUTIONARY CHANGES

According to T. S. Kuhn, a paradigm is a sum of basic assumptions, prerequisites and concepts of given scientific discipline in a certain time period. A paradigm creates a platform for creating a view of reality and for construction of its model, a platform, on whose basis we perceive reality in a *certain way*.

In science, a turning point comes after a certain period of time when the *current paradigm* becomes exhausted.

#### "Thinking outside of the box"

To understand the principle of a paradigm we can use the common saying "thinking outside of the box". Thinking inside a given space is an analogy for the so called normal science according to Kuhn. If there is an accumulation of many abnormalities in a respective science, that is, unsatisfactory answers to questions of the science, an impulse to abandon the current space appears – a need to find a new paradigm surfaces. A period of normal science resumes after this process is completed.

#### Time to change the current paradigm

The accumulation of qualitative contradictions in the form of unacceptable answers brings about discussions on what shall newly be observed and scientifically researched, which questions shall be asked, in what structure, and how should the acquired results of scientific research be interpreted. Kuhn in 'The Structure of Scientific Revolutions' presents his definition of a paradigm: "...how an experiment shall be lead and which equipment is available for a realization of the experiment..."

As previously stated, the effort to compare changes in F2F on one hand and online education on the other hand just confirms the misunderstanding of the role of information and communication technologies. The point is to evaluate education *before and newly after* the emergence of ICT, in other words education without and with the services (and dominance!) of ICT. There is a qualitative change in both – in F2F as well as in online education, and even in their combination, labelled as blended learning! Education – as all society – was influenced by a *new quality*, which is certainly accompanied by a new criteria system for its evaluation.

#### Why chalk and a blackboard are not enough?

It is not about whether we teach electronically or do not. It is simply the way we teach today. The point is *what* and by which methodology students learn. It does not matter if it is presentational, distance or a combined form of study.

If we misunderstood what was said previously, it could appear that we could make do with just chalk and a blackboard – writing and reading is actually more comfortable without an electronic presence. Searching for information however, is much more difficult. Even this could be comparable, if we presume that we are in the middle of the renowned 'stone' library with a perfect retrieval system. Nevertheless, inevitably this old system begins to fall behind. Why? The core of understanding the revolutionary changes, which ICT has brought along, lies in finding the answer. So – why? Apparently, because, with chalk and a blackboard, and in an enclosed library, it is impossible to sufficiently *communicate, interact* and have an *open global dialog* (in virtual world wide net), receive or just consider knowledge of others, and react to it.

#### New criteria system needs new starting points

The correct identification of the subject of interest, i. e. the correct identification of what is new, what we want to compare with old, is the basis of progress. To find new criteria, it is useful to note what changes have occurred in terminology – there was 'teaching' before ICT, and now we have 'eLearning'! The new term consists of the two parts – 'e' and 'learning'. It can be perceived that the 'e' represents the heart of the shift to a new quality. But that is not the case. 'E' just represents a technological instrument, which facilitates qualitative changes, even dictates them, but does not create them. The divergence from 'teaching' towards 'learning' influences the structure of the system and actually affects the evaluation of its quality! That is why we do not hear 'eTeaching', but rather 'eLearning'! That is what we implement as well! Let's not evaluate how educators teach, but how students *learn*! *The sign of the quality of the new process is no longer to be able to teach well, but to create conditions for quality learning.* Teacher-centred education is being replaced with student-centred education! The subject of the evaluation is diametrically opposite, so the criteria system has to be different as well!

## 5. NEW PARADIGM IN EDUCATION

Newly, it is not as important to consider the quality of what teacher should do to teach but, on the contrary what the student should do to learn!

With the introduction of ICT, it has been necessary to leave the standard model of the theory of the education. The current paradigm in education, represented by a 'wise man on a podium', is beginning, with the emergence of ICT, to be exhausted and it is failing. The teacher ceases to be the centre of activity (teacher-centred model) and the *student as a unique individual (learner-centred model)* replaces him.

At the centre of the educational process is an individual who is *motivated* by outside influences to learn. At the same time, education is being made more accessible and available to him through out his life by outside circumstances, mainly those associated with development of ICT. The student is in the centre of an activity, whose goal is intense *sharing of thoughts*. ICT is simply an instrument for the high-quality sharing of thoughts, to make possible the consideration of many views, to allow immediate reaction, to bring inputs from various cultural environments, etc.

#### Human resources

There is a need to find answers to questions about how to provide the best conditions for this new educational process, how to provide not just technological support, but with 'human resources' as well. Technologies start the process, currently by means of Web 2.0 development, but people expand the possibilities of the technologies. The role of participants in the new education model differs from past ones. The activities of all focus farther on *raising the individual's life long motivation to learn*. The new technologies only give him the possibility.

#### Dialogue

Without ICT, a high-quality dialogue held by a multicultural community was subject to world exclusivity of educational institution. The more prestigious the university, the higher the quality of the global dialogue held inside the community, there by becoming a catalyst for exceptionality and quality of education.

What does the ICT generation of Web 2.0 allow? *Dialogue – open and global* – it descends from heights of select, exclusive universities to anybody who is *motivated* enough to participate in the dialog! And learn! Continuously through out one's live!

#### Network structure of links

In principle, the emergence of an open global dialogue *negates the linear structure* of activities and tiebacks applied in the educational process until now. Individuals are interconnected more and more and the former unique position of authority loses its importance. Others become the new authority at particular stages of the process – a *network* structure of linkage is emerging. However, the educator is not being forced out! Not only is he even now a



In 1900, Lord Kelvin famously announced, 'There is nothing to discover in physics any more. What is left allows only for perfecting of that already existing.' Five years later, Albert Einstein published the Theory of Relativity and presented new rules, which reduced Newton mechanics to just a special case of this new theory.

### 3. IS ICT A REVOLUTIONARY POWER, WHICH DEMANDS PARADIGM SHIFTS?

Let this posed question be one of the impulses for crossing outlived limitations, even in education. Yes, education is also assured by new revolutionary tools in the form of a new generation of ICT. However, are we able to take and use these tools to step over deep-rooted standards and to pursue activities in a different way than before? It is possible only if we step out of the box represented by a model of 'a classroom and textbook'. Without understanding limitations of this box's walls, we will only search for electronic analogies of current principles in the sense of never-ending improvement of the model that has already been superseded. The current model obstructs progress because it does not allow leaving the space of old way of thinking, which belonged to an era without ICT. But be aware, this does not mean that F2F (i. e. 'face to face', meaning presentational) education with personal contact has become a thing of the past! On the contrary, it points out the fact that the methodology of education – in both its attendance and distance form – has to take the ICT presence into consideration and use it to create new methods and forms of the learning process!

#### The principle of sharing

It seems that a global criteria for an evaluation of new quality, superior and involving many partial criteria, derives from the ability to *share*. The question, however, is to share WHAT! The old criteria system evaluates educational quality on the basis of its ability to share *space and time*. ICT manage to solve this in a Solomonic manner – in the case of ICT, space and time are shared, yet are not shared. We are not in the same place, and yet we are. It seems we do not communicate at the same time, but in fact we do! The sharing of space and time is no longer decisive to the evaluation of the quality of education, i. e. it is leaving the criteria system. What is rapidly coming in to take its place?

#### Sharing of space and time is being replaced by *sharing of thoughts*

The teacher relinquishes his place at the centre to his students. This by itself would lead to collapse of the educational process. Here we find the main reason why many teachers reject the idea of abandoning the traditional role of a teacher – it's not possible to deny the role of the academic! But collapse would happen only during an implementation of 'one without the other'. What, however, is the other?

It is impossible to remove the teacher from his role and go on expecting that the sharing of space and time, which is

the basis of the old model of 'the classroom and textbook', will be sufficient in the education process. The educator newly creates (with ever-present ICT) an environment, which allows SHARING OF THOUGHTS ! Thoughts sharing among all involved, i. e. not just linearly from teacher to students and eventually back to the centre, but more or less equally among all, i. e. in NETWORK LAYOUT OF ROLES. Such chaos is unmanageable!? Yes, certainly with the old tools. However, ICT copes with it easily! Though, in the presence of teacher – in his new role! And what about the argument that the role – after the teacher has stepped-down from the podium - is undignified? On the contrary, human destiny has relied upon which thought have been accepted at many times in history. The new role of educators is critically important for its motivational mission, alongside an atmosphere of life long learning.

### 4. EDUCATION QUALITY CRITERIA

The general uncertainty concerning the evaluation of the quality of eLearning and web-based education confirms that the assigned space in the field of education is inadequate. Doubts are appearing about the current existing system. Gradually, it is becoming obvious that evaluation according to the established criteria system 'is not suitable' and the effort to simply improve it is just a wasted endeavour. What can be a better indicator of the emergence of a change in quality, and that the impulse to change the paradigm is here?

What has the most relevance to the evaluation of the quality of the new educational model? Which categories of quality characterize it? It is possible to be misled by accepting ideas that before F2F ('face to face', that is presentational) education had been evaluated, whereas now we want to evaluate an online education. Not so, the emergence of ICT has and will change education in all its forms. The statement that 'the criteria systems for evaluating the quality of F2F and online education do not differ radically' is an indication of the effort to evaluate still the same education model – the model of classroom, textbook and teacher. In this case, 'new evaluation' is absolutely wrongly *reduced to only an evaluation of transmission of information* – before personal, today with the internet use.

#### New quality entrance relates to all educational forms without exception

The Internet and technologies connected with it are here, they are a part of our existence. Information and communication technologies affect all our being, some places more, elsewhere less, some persons more, others less, sometimes to a greater extent, other times to a lesser, but they affect everybody, everywhere and all the time. These technologies influence man's quality of life through their use, but also in an opposite way by their absence. There is an increasing danger of a deepening chasm. The question is not whether to accept eLearning or not, but by which means, with which consequences and with what quality.

As previously stated, the effort to compare changes in F2F on one hand and online education on the other hand just confirms the misunderstanding of the role of information and communication technologies. The point is to evaluate education *before and newly after* the emergence of ICT, in other words education without and with the services (and dominance!) of ICT. There is a qualitative change in both – in F2F as well as in online education, and even in their combination, labelled as blended learning! Education – as all society – was influenced by a *new quality*, which is certainly accompanied by a new criteria system for its evaluation.

#### Why chalk and a blackboard are not enough?

It is not about whether we teach electronically or do not. It is simply the way we teach today. The point is *what* and by which methodology students learn. It does not matter if it is presentational, distance or a combined form of study.

If we misunderstood what was said previously, it could appear that we could make do with just chalk and a blackboard – writing and reading is actually more comfortable without an electronic presence. Searching for information however, is much more difficult. Even this could be comparable, if we presume that we are in the middle of the renowned 'stone' library with a perfect retrieval system. Nevertheless, inevitably this old system begins to fall behind. Why? The core of understanding the revolutionary changes, which ICT has brought along, lies in finding the answer. So – why? Apparently, because, with chalk and a blackboard, and in an enclosed library, it is impossible to sufficiently *communicate, interact* and have an *open global dialog* (in virtual world wide net), receive or just consider knowledge of others, and react to it.

#### New criteria system needs new starting points

The correct identification of the subject of interest, i. e. the correct identification of what is new, what we want to compare with old, is the basis of progress. To find new criteria, it is useful to note what changes have occurred in terminology – there was 'teaching' before ICT, and now we have 'eLearning'! The new term consists of the two parts – 'e' and 'learning'. It can be perceived that the 'e' represents the heart of the shift to a new quality. But that is not the case. 'E' just represents a technological instrument, which facilitates qualitative changes, even dictates them, but does not create them. The divergence from 'teaching' towards 'learning' influences the structure of the system and actually affects the evaluation of its quality! That is why we do not hear 'eTeaching', but rather 'eLearning'! That is what we implement as well! Let's not evaluate how educators teach, but how students *learn*! *The sign of the quality of the new process is no longer to be able to teach well, but to create conditions for quality learning.* Teacher-centred education is being replaced with student-centred education! The subject of the evaluation is diametrically opposite, so the criteria system has to be different as well!

## 5. NEW PARADIGM IN EDUCATION

Newly, it is not as important to consider the quality of what teacher should do to teach but, on the contrary what the student should do to learn!

With the introduction of ICT, it has been necessary to leave the standard model of the theory of the education. The current paradigm in education, represented by a 'wise man on a podium', is beginning, with the emergence of ICT, to be exhausted and it is failing. The teacher ceases to be the centre of activity (teacher-centred model) and the *student as a unique individual (learner-centred model)* replaces him.

At the centre of the educational process is an individual who is *motivated* by outside influences to learn. At the same time, education is being made more accessible and available to him through out his life by outside circumstances, mainly those associated with development of ICT. The student is in the centre of an activity, whose goal is intense *sharing of thoughts*. ICT is simply an instrument for the high-quality sharing of thoughts, to make possible the consideration of many views, to allow immediate reaction, to bring inputs from various cultural environments, etc.

#### Human resources

There is a need to find answers to questions about how to provide the best conditions for this new educational process, how to provide not just technological support, but with 'human resources' as well. Technologies start the process, currently by means of Web 2.0 development, but people expand the possibilities of the technologies. The role of participants in the new education model differs from past ones. The activities of all focus farther on *raising the individual's life long motivation to learn*. The new technologies only give him the possibility.

#### Dialogue

Without ICT, a high-quality dialogue held by a multicultural community was subject to world exclusivity of educational institution. The more prestigious the university, the higher the quality of the global dialogue held inside the community, thereby becoming a catalyst for exceptionality and quality of education.

What does the ICT generation of Web 2.0 allow? *Dialogue – open and global* – it descends from heights of select, exclusive universities to anybody who is *motivated* enough to participate in the dialog! And learn! Continuously through out one's live!

#### Network structure of links

In principle, the emergence of an open global dialogue *negates the linear structure* of activities and tiebacks applied in the educational process until now. Individuals are interconnected more and more and the former unique position of authority loses its importance. Others become the new authority at particular stages of the process – a *network* structure of linkage is emerging. However, the educator is not being forced out! Not only is he even now a

part of the interconnections of the network, but, in addition, he has the role more demanding and indispensable than before – the role of directing the paths of knowledge of particular individual.

#### Inner motivation versus unreasonable directing of students' work

The technological capabilities of ICT are often used for perfecting control of students' work in the sense of programmed teaching. However, this is rather a case of its misuse. It is imperative to resign oneself to the fact that we cannot have the network structure under our strict control. In addition, it would be mistake to consider control over students' work as the priority.

However, without control it is easy to loose our way. Here in lays the responsibility of the institution and society – to find early enough, a new adequate criteria of quality, which respects the importance and role of inner *motivation* in the new educational model.

From the old model, excessive control over students' work is still practiced. Much energy is expended counter-productively – partly to exert *control* over students' work and also to *evaluate* their knowledge of facts (rather than of their 'know how' and skills) by means of testing. Newly, in the life long learning (LLL) model, the first and second words relate to the students' inner *motivation* – this supplements, even replaces, strict control of their activities on the one hand, and evaluation of their work on the other. Classic testing is not a decisive factor in the evaluation of outputs any more, but rather it is an evaluation of *meeting* of students' *expectations*, as it relates to their future success in the labour market.

The teacher becomes more and more a manager of the process of education; therefore, we must not forget the managerial truism: obsession with control renders progress impossible. One of main experts in the field of human resource development, Pepper de Callier [13], points out: 'The Pygmalion syndrome in leadership means short-sighted faith that we create perfect working environment by micro-managing activities, by directing activities of subordinates in the smallest detail. Instead of us establishing guidelines, defining expectations. And then letting people use their own creativity to achieve the required results.' In addition, it seems that the academic environment, along with its deep-rooted principles of education, even intensifies the following danger: 'Just like puberty, the Pygmalion syndrome is a natural stage, which all experienced managers and leaders have to go through. Unfortunately, not all of them will grow out of this stage'.

What is the distance between development of human resource and education? Is this not the same thing as asking to change the deep-rooted principles of education that see the teacher's role as that of the 'wise man on podium'? Acceptance of change means creating a new paradigm in education in the form of a student-centred educational process.

#### Just-in-time education

If we overcome the Pygmalion syndrome, students will obtain a broad space for performing the activities during which they will be learning. Such learning will happen under the systematic direction of authority and by accepting (and using) influences of a wide spectrum of net participants.

One practical indication of acceptance of new paradigm is overcoming of deep-rooted *conditions of commensment* of education process in the form of a detailed working plan, study materials, and individual steps, including their alternatives. The road forward to the new model of education is the liberation from strict givens and the allowance to *further shape the course through its duration by the students themselves in the role of active participants in the education process*.

#### Knowledge and skills

The ability to transform information into knowledge is indispensable. And where are the abilities? There have been calls for a close interconnection between a university education and the working experience for many generations. As answer, which does not solve anything, we often see artificial addition of chapters to the old text, which rather than connect in real sense, only adds paragraphs, which artificially use terminology of chosen practical discipline.

In the new education model, the development of abilities is supported quite naturally. There is the inner motivation of an individual at the beginning – he identifies (on his own and eventually with support of authority) what he needs to know to be able to solve a given assignment. If I need to understand or solve the problem in dynamics in a technical discipline, I will become more proficient in the area of difference and differential equations. If I am given an assignment to lead a workshop on communication skills, I will, in principle, use the same approach, but in a different scientific field. The understanding of those ideas leads to education as a *repetition of practical creative work* in a new situation, i. e. in the presence and domination of information and communication technologies.

The centre of education in its new model is *the ability to learn and to educate yourself*.

#### Metalearning versus inadequate concentration on content

What one knows ceases to be a competitive advantage. What is decisive is to *know how and what i have to do, so i will know*. From the long run point of view, it ceases to be important what I have learned, but HOW I have achieved the learning.

In society where there is ever-present access to information, educational activities have to concentrate on *the process of getting and constructing* individual's knowledge from existing information and knowledge given explicitly. Individuals' effort focuses on '*tacit understanding*' [10] of people with desired knowledge and abilities. Is that 'tacit' a parallel from teaching to learning?

Application of the principle 'show me, assist me, let me work on my own' is the first success in overcoming the linearly assigned steps in the education process. It seems to be necessary, however, to go even further. An individual in the life-long learning education system is left alone to rely on his inner motivation, not only in the process of performing a particular activity, but also in *the selection of an authority* (whether real or virtual), which will 'show him' and 'assist him'. Perhaps, here is the root of danger in the conservation of academic givens.

## 6. PRACTICAL EXPERIENCES FROM EDUCATION BASED ON THE PRINCIPLE OF REPEATING TODAY'S COMMON CREATIVE WORK

Which activities are the basis of scientific research and of professional paper writing? The achievement of the goal is built on an individual's basic knowledge and skills. The individual further searches, evaluates, puts into a new context, and creates his new ideas. That is, however, not an end in itself. That, which was a luxury before, today is present everywhere – communication, interaction. New findings are submitted for discussion to others; new points of view are accepted and worked in. The quality of result often parallels the quality of dialogue reached. [10].

The scientist proceeds on this path automatically. Let's teach students the same and they will have the knowledge and abilities needed by society where ability and skills for life-long learning give him a competitive advantage! The measurement for an success of educator will be his ability to make accessible the principles of metalearning from the sphere of its natural uses – in research workplaces – to the lowest levels of the educational system.

### Case studies

One's own web space on the LMS Moodle is assigned to student teams in suitable courses at the Faculty of Economics at Technical University of Ostrava. The important thing is that students also assume the teacher's role within this eLearning team course, i. e. they have the right to post their own materials. The educational environment, which they until now only knew from the students' perspective, allows them collectively the opportunity to expose the strength of the Web 2.0 technology. They can experience the possibility to participate through the web communication interface and create the work as a team, with all the consequences ensuing from it.

Analogical principles are implemented into the educational process much more comprehensively at the Technical University of Košice, under the name of Trialogical Learning [1].

## 7. CONCLUSION

The transition to the educational model based on the notion of LLL (Life Long Learning) is conditional on the acceptance of a new system of basic assumptions and rules of scientific discipline. The heart of the changes includes divergence from a linearly coordinated system with teacher in the middle, i. e. from all the participants only the teacher leads the process, towards a network structure of roles. Activities are newly developed (by all participants) according to students' needs, and with the goal of supporting their work, their learning.

*The creation of a space, a framework for sharing* of what the student is learning, for an equal sharing of thoughts by all participants, becomes the new mission for the teacher and the educational institution. The shared space is organized on the principles of a network structure of inputs and outputs, of a whole network system and everybody's role in it.

*Criteria system* for the evaluation of the quality of education is diametrically different from the previous one. Individual criteria can be formulated exactly by copying changes indicated above, summarized under the veil of a change of paradigm of education.

## 8. REFERENCES

- [1] Babič F., Wagner, J.; Trialogical learning – new approach to education. ICETA 2007, 5<sup>th</sup> Int. Conference on Emerging e-learning Technologies and Applications, The High Tatras, Slovakia, September 6-8, 2007 (in appear)
- [2] Bauerová, D.: Větší pozornost než „e“ zasluhuje „learning“. Sborník příspěvků ELearn 2007, Žilinská univerzita v Žilině, ISBN 978-80-8070-645-6 (2007) 263-266
- [3] Bauerova, D. and Sein-Echaluce, M.L. Herramientas y metodologías para el trabajo cooperativo en red en la Universidad. Revista Interuniversitaria de Formación del Profesorado. N° 58, Volume 21(1), Pag 69-83. ISSN: 0213-8464. 2007
- [4] Bauerova, D. and Sein-Echaluce, M.L. Open dialog as a tool for university education, In: ITI 2007 Proceedings of the 29th International Conference on Information Technology Interfaces, Cavtat, Croatia, June 25-28, 2007, IEEE Catalog Numer 07EX1589, ISBN 978-953-7138-09-7. ISSN 1330-1012, *University of Zagreb*, pp. 33-38/792.
- [5] Collis, B., & Moonen, J.: Flexible learning in a digital world: Experiences and expectations. London: Kogan Page. ISBN Hardback: 07494 33728, Softback 07494 3371X (2001)
- [6] Dirckinck-Holmfeld, L., Sorensen, E.K., Ryberg, T., Buus, L.: A Theoretical Framework for Designing Online Master Communities of Practice. In Proceedings of the Forth International Networked Learning Conference (NLC2004) held April 5-7, at Lancaster University, UK. ISBN: 1-86220-150-1 (2004) 267-273

- [7] Dotson, T.: Why Johnny Won't Post.  
[http://www.timdotson.com/instructor\\_files/collaboration.htm](http://www.timdotson.com/instructor_files/collaboration.htm) [2007/03/10]
- [8] Downes, Stephen. E-learning 2.0.  
<Http://www.elearnmag.org/subpage.cfm?section=articles&article=29-1>, National Research Council of Canada [20/4/2006]
- [9] Gil, J.J., Fidalgo A. & Sein-Echaluce, M.L.: The knowledge Networks as an Innovation to Improve the Quality of University Teaching. In: Proceedings of ED MEDIA 2004 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Lugano, Suiza (2004)
- [10] Jackson Norman, Exploring the Concept of Metalearning, Paper from seminar on MetaLearning, Middlesex University, Jan 2004, Downloaded from [www.iclml.com](http://www.iclml.com), University of Surrey and UK Learning and Teaching Support Network Generic Centre [2007/05/20]
- [11] Oliver, R., Herrington, J.: Teaching and Learning Online. Centre for Research in Information technology and Communications Edit Cowan University, Western Australia, ISBN 0-7298-0513-1 paper, O-7298-0514-X pdf; 1 (2001)
- [12] O'Reilly, T. What is Web 2.0. Design Patterns and Business Models for the Next Generation of Software. <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html> [2006/11/09]
- [13] Pepper de Callier J., Cesta nahoru LII, Posedlost kontrolou znemožňuje vývoj; Hospodářské noviny, Kariéra. 30.4.2007
- [14] Zvacek, S.: Beyond Button Pushing. Integrating Technology Literacy into Our Teaching. What Makes an Online Course "Excellent?" University of Kansas, Lawrence. Online seminar VSB-TU Ostrava. <http://was.vsb.cz/mediasite/viewer/> [2007/03/10]

## THE AUTHOR



**Danuše Bauerová** has been working as a director of the Education Innovation Institute of VSB – Technical University, Ostrava since 2005. She graduated in mathematics and fine art from Palacky University in Olomouc and received her Ph.D. degree in System Engineering and informatics from VSB-TU, Ostrava. Her research interests focus on fuzzy control of processes and methodology of education as well, in order to make complex systems more users accessible for a wider part of the population. Her activities aim to the potential of ICT as a catalyst of social and educational innovation and change, and she is an expert in eLearning quality control. She has been a keynote speaker and an author of nearly fifty research papers. She is a program committee member for national and international conferences. Presently, she is leading several national and international research projects.



# FROM HOMO SAPIENS TO HOMO MOBILIS – OR HOW THE SCHOOLS AND TEACHERS CHANGE



Beáta Brestenská,  
Comenius University, The Faculty of Natural Sciences, Mlynská dolina Ch-2, 842 15 Bratislava, Slovakia  
Phone: +421 911 653 343, <http://www.fns.uniba.sk>, [brestenska@fns.uniba.sk](mailto:brestenska@fns.uniba.sk)

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract:** Information technologies change our life, our hundreds year old habit. Today is not enough be Homo Sapiens. The changing life in the Earth needs more and more communication, mobility and learning during whole the life. We are changing to the Homo Mobilis. The new vision of education process is necessary, because only graduate people will be able change the Industrial Society into the Knowledge Society. It is need a new partneship among Schools, Government, IT sector etc. We would like to present some wiew into process of changing in education.

**Keywords:** Homo Sapiens, Homo Mobilis, Traditional School, Modern School, Knowledge Society, School reform, IT skills, New competence for students and teachers,

## 1. INTRODUCTION

Internet, Informatization, Globalization etc. are the new phenomena witch very quickly change quality of our life. Is school system be able to prepare the students for life in the new Knowledge Society? We want to put the new technologies into the New School or we put the new technologies into the Old School? What need the employers form they employees? We do not present the answers for this questions in the article, but we present the ideas and encouragement for new strategy of education.

It is simply a reality of the human evolution and technical revolution.

## 3. THE SOCIETY AND THE HUMAN CHANGES

The world around us change very quickly. In the every day life we can not able to recognize such big changes they are. In order to understand global changes we need to put correct questions and look for answers and solution.

## 2. THE CHANGING AT THE TIME

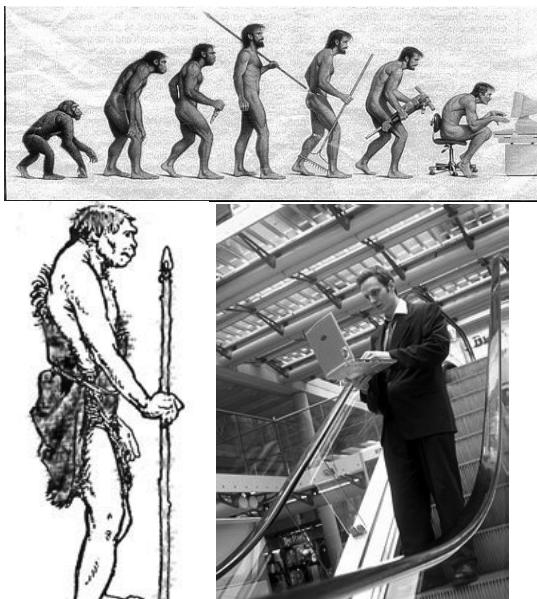


Fig. 1. Homo Sapiens - Homo Mobilis

How does change the World ?  
How does change our work ?  
How does change the technology ?  
How does change education ?  
How changes does need the education system ?... [6].

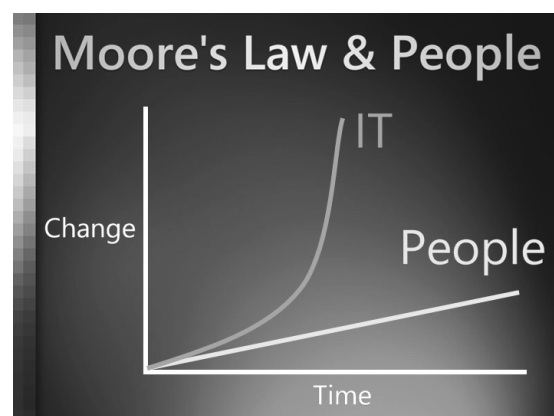


Fig. 2. Digital paradoxes

We start with the short view into history.

#### 4. COMMUNICATION AT THE TIME

554 year from discovery of book printing - J.Gutenberg  
 141 year- radiotelegraphy and voice communication (J.Murgaš)  
 121 year exchange central in Bratislava – The President Palace  
 36 year –starting of the first net of 4 computers – ARPANET  
 21 year celebrate internet – million people communicate every day  
 15 year from the first SMS

#### 5. COMMUNICATION IN THE GENERATION

In the last fifty-sixty years we can see the significant changes in the communication the people at work and at home.

| People                      | Communication technologies  |
|-----------------------------|---|
| <b>My Grand Mother 1898</b> | <b>Book,, radio, telegraph</b>  |
| <b>My Mother 1925</b>       | <b>Book,, radio , telephone, television</b>   |
| <b>Me - 1955</b>            | <b>Book,, radio , telephone, television , PC, ,e-mail, web-cam, iPAQ, internet, ,3G-mobile phone, IPT, ....</b> |

#### 6. EDUCATION AT THE TIME

Mainly a few hundred years ago who know to read and write was educated persons  
 Fifty years ago who had a Levels had a good job and position  
 Today the high education is the necessity to get a good job.  
 The personal success and economical prosperity of the state needs Life Long Learning.  
 For example:

| People                      | Education          | Position   |
|-----------------------------|--------------------|--|
| <b>My Grand Mother 1898</b> | <b>High School</b> | <b>The high social position</b>  |
| <b>My Mother 1925</b>       | <b>High School</b> | <b>The good social position</b>  |
| <b>Me - 1955</b>            | <b>University</b>  | <b>Is not enough for good position at the labour market in the 21st. Century - LLL</b> |

The Industrial Society was characteristic with local and national level- national economy, and culture, local labour market, long term plans, education for life etc.

The Digital Society or Information Society is characteristic with globalization – global labour market, economy, lifelong education, mobility for „all“, change – open plans etc.

The education has a new function in the 21.st Century. All the spheres – state, technical, economic, civil, policy have a influence in education and education has a very significant influence into the all Society spheres. (Fig.2.)

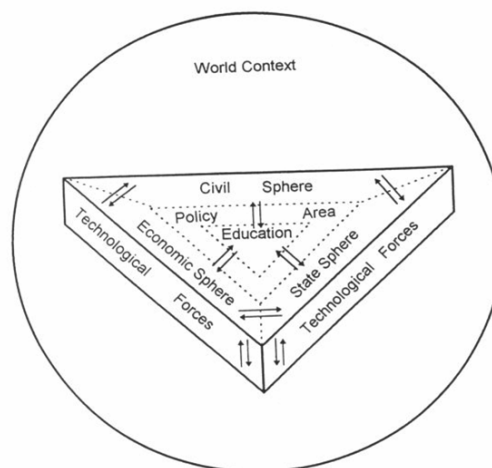


Fig. 3. Education in the Knowledge Society

The Delor's Report [1] analyses the process of education in many states and show how to change the process of education from teaching to learning. It defines 4 basic education type:

- Learn to learn
- Learn to work
- Learn to collaborate with others
- Learn to know myself

The education in the goals, methods and forms start to be more and more divergent and it must cover all activities and all life time.

#### 7. WHAT DO EXPECT THE EMPLOYERS FROM GRADUATES ?

The graduate from schools needs a new knowledge, competence and skills in all levels:

- Communication and cooperation
- Creativity, critical and system thinking,
- Self-activity and productivity
- Responsibility
- To Think and all time to learn
- Argumentation and assessment

The European Committee defines the key competence for the students in EU [3] ,[4]:

- Communication in the native language
- Communication in the foreign languages



- Information literacy
- Mathematic literacy and scientific thinking
- Ability to learn
- The general cultural knowledge
- Enterprise skills
- Interpersonal and civil competence

In the end of the 20th Century and in beginning of the 21st Century many countries have realized the new school reform which reflect the knowledge, skills and technology necessary for life in the Information Society.

## 8. COURAGE AND CHALLENGE FOR A SCHOOL REFORM

Information and communication technologies significantly change the world of education.

Prof. Richard Noss's from London Knowledge Lab asks very important question for present time:

**„We would like support with new ICT the old school conception, or we would like support with new ICT the new school conception [1],[2] ?“**

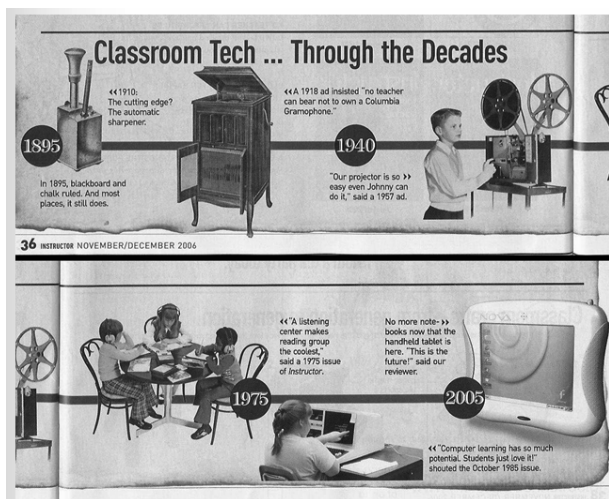


Fig.4. School technologies through the Decades

It is the main question for present school reform in Slovakia and whole world.

We can see a new trends at the school reform in many countries. The main importance is put into the Scientific

knowledge, IT and Math. For example: Russia – project Archimedes– increases the scientific knowledge at schools. Korea – 5-years plan to create the scientific laboratory and invest to the high-tech at schools. Great Britain – scientific work in practise compulsory subject at schools. USA – the Parliament approved the new Federal Act NCLB (No Child Left Behind) - PC/child 1/1 this year. Israel – the High-Tech Laboratories at school [5].

Slovak's school reform is starting very slowly, and has not clearly answered the main question. Which quality of graduates we need to prepare in all school levels. How to increase the quality of our schools to be comparable with quality at EU ? It needs the complex education reform of educational content, new methods and form with using

a new technology in teaching, new competence of teachers and students and new benchmarking quality of education process.

The Project InfoAge Slovakia (1999-2006) was a creator and motivator for starting the transformation process from the Traditional schools to the Modern schools in Slovakia. All the schools (3600) have had an IT infrastructure, the 56 thousand teachers was retrained for basic IT skills and for implementation ICT into the content of education. The Schools start to use the digital educational portal and multimedia CD for different subjects. The Summer school of InfoAge and the National Conference InfoAge in the last six years have showed increasing motivation of teachers to creatively use the ICT in education. Many of the teachers are the innovative teachers now and collaborate with teachers at home and in the whole world. They participate with the IT company (Microsoft, HP, LegoDacta) in the process of creation of the modern digital content too [7], [8], [9], [10].

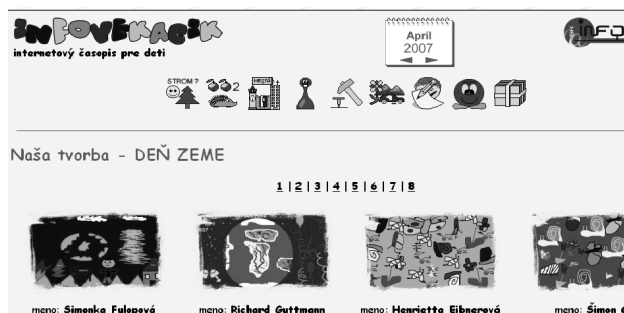


Fig. 5. Children's creative work with IT

The project InfoAge at the beginning was realized as a „bottom up“ activity (NGO) and „waked up“ the schools, teachers, the Ministry of Education, the National Council of Slovakia, local Governments and many simple people. The project InfoAge is the first very important step to transformation of educational system in Slovakia. The main benefit of project is the higher motivation of teachers and student to participate in the transformation process. The next step must be realized „top down“ from the Government and the Ministry of Education with new vision and the complex strategy for Modern school for the 21st Century.

## 9. REFERENCES

- [1] Kalaš, I.: Digitálne technológie a vízie moderného vzdelávania, Proceeding from Conference Didinfo 2006
- [2] Becta: *Secondary Schools – ICT and Standards*, An analysis of national data from Ofsted and QCA by Becta, 2003, ISBN 1 85379 456 2
- [3] UNESCO: *Information and Communication Technologies in Teacher Education*, Planning Guide, Division of Higher Education, UNESCO 2002
- [4] Belz, H., Siegrist, M.: *Kľúčové kompetence a jejich rozvíjení. Východiska, metody, cvičení a hry*, Portál 2001, ISBN 80-7178-497-6

[5] TopSoft, BSP s.r.o. *NOVA 5000*, Presentation, 2007

[6] Muehlfeid J.: *Economical Impact of Innovation*. Presentation from Conference, Innovation day in Slovakia, 2007

[7] <http://www.infovek.sk>

[8] Brestenská B. and coll: The Annual Report InfoAge. API, Bratislava, 2006, pp. 68

[9] Coll: The Final Report of Project of training the teachers for using the ICT in education. API, 2007, Bratislava, pp.57

[10] <http://www.moderniucitel.cz>

### THE AUTHOR



Name: **Beáta Brestenská**

Birth Day: 16.8.1955

Address: Líščie údolie 140, 841 04  
Bratislava, Slovakia

Position: Vice-Dean at The Faculty of  
Natural Sciences, Comenius  
University

### Employment:

- University Comenius Faculty of Natural Sciences – asistent 1980 – 1997
- PhD degree - 1987
- Assoc. Prof. since 1998
- Head of The Department of Didactic of Sciences 1998 – 2001
- Head of The Research and Education IT Center Comenius University . – since 2002

- Member of National Council of the Slovak Republic - 2002-2006:

- Member of Committee for Education, Science, Sport and Youth, Culture and Media - National Council of the Slovak Republic
- Member of Economy Committee
- Head of Work SubCommittee of Information Society - National Council of the Slovak Republic

- The Head of Slovak Delegation of The Council of Europe – 2004-2006

- Vice-dean at University Comenius of Faculty of Natural Sciences – since 2007

**Scientific work** – Implementation of IT in Education  
Co-ordinator of international Project:

- I\*EARN
- Comenius I, II
- ECDL

National Project Leader:

- InfoAge Slovakia
- ESF Projects
- State Research Project
- Developing Research Projects

**Research stay:** Belgium , Israel, Canada, USA, Poland

E-mail: [beata.brestenska@fns.uniba.sk](mailto:beata.brestenska@fns.uniba.sk)

URL: <http://www.fns.uniba.sk>  
<http://www.vecit.sk>

### ACKNOWLEDGEMENTS

*The project InfoAge has had a big influence on my life. It is increasing my knowledge on many spheres, it helps me to know many excellent and wise persons at home and at abroad.*

*For all of it I would like to thank Peter Sýkora, Katka Mandíková and my dear colleagues and realizators of project InfoAge.*

## RE-FRAMING EDUCATION FOR THE 21st CENTURY



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

John Connell  
Education Strategist  
Cisco Systems

**Abstract:** Education is a universal. It is a truism to say that, in every age throughout human history, in every society, every nation, every tribe, every empire, every culture, we have sought to pass to each succeeding generation the skills, the knowledge and the ideology deemed necessary for survival and progress. However, while education has been a universal, its particular application has not been. The practice of education has differed from one context to another so that, in any one place at any one time, its purpose has been to meet the specific needs of that society and culture. With the increasing power and permeation of digital technologies in our lives, the opportunity now exists for countries across the world to seek to build a new kind of education, an education based on values pertinent to the world of today and, more importantly, the world of tomorrow. Education is a mainspring of transformation, and genuine and lasting transformation cannot happen without education.

*Please note that some parts of this paper have appeared before in various sections of John Connell's blog at: [www.johnconnell.co.uk/blog/](http://www.johnconnell.co.uk/blog/)*

### 1. EDUCATION IS A UNIVERSAL

It is a truism to say that, in every age throughout human history, in every society, every nation, every tribe, every empire, every culture, we have sought to pass to each succeeding generation the skills, the knowledge and the ideology deemed necessary for survival and progress. However, while education has been a universal, its particular application has not been. The practice of education has differed from one historical and geographical context to another so that, in any one place at any one time, its purpose has been to meet the specific needs of each society and culture.

I would contend that, today, we are in a situation where the particular practice of education in most parts of the world does not reflect the current realities facing the global village. In this situation, education must either change or become, in its current form, irrelevant. Schools, especially, across the world are stuck in a paradigm that reflects, not the massive connectedness of the digital age, but the mass-production values of the industrial age. As Greg Whitby, CEO of the Parramatta Schools District in Sydney, Australia, and from whom I borrow the title of this paper, has written:

*"Technology is changing the way we live, communicate and learn. It also enables educators to re-frame schooling in order to meet the needs of twenty-first century learners."* (Whitby, website reference)

In an earlier age, Woodrow Wilson, when he was Principal of Princeton University, was able to say:

*"We want one class of persons to have a liberal education. We want another class of persons, a very much larger class of necessity, to forego the privileges of a liberal education and fit themselves to perform specific difficult manual tasks."* (Wilson, website reference)

He said this to a group of trainee teachers in 1909. Wilson, of course, was a child of his time and such views did nothing to detract from his enlightened internationalism when, as US President, he played a major role in the foundation of the League of Nations in 1919. But the values underlying Wilson's words are precisely the values of the industrial age of schooling, precisely the values so derided, each for their own reasons, by radical educationists such as RF Mackenzie, Ivan Illich, AS Neill, Paulo Freire and so many others. And they are the values that render so much of educational practice today obsolete and no longer fit-for-purpose.

Unfortunately, whether we like it or not, they are still, essentially, the values that underpin the systems of schooling surviving in most parts of the world today. Thankfully, they are not always the values of the teachers and other key players in the system, but the fundamental pedagogies, the mass-production methodologies that still predominate in so many schools the world over mean that such enlightened people are having to struggle daily against a prevailing regime that has its feet planted firmly in the anachronistic rhetoric of Wilson from almost a century ago.

But the world is changing. The difference today is that, with the world flattening around us, the pressures on education systems are very similar wherever you look around the globe. There will always be a need to meet the particular needs of the society being served, but there is also now a

growing international dimension to education, a globally common dimension that seeks to deploy education as an instrument whose purpose is to create a key part of the conditions needed to ensure growing competitiveness and prosperity for countries and regions.

Of course, there has always been an instrumental view of education – but it is arguable that the instrumentality evident in education is different in kind today. A key factor in its current manifestation is, of course, the expanding role for technology in teaching and learning as well as in the administration and management of education. However, education and technology are rarely the precise instruments that many country leaders would like them to be. The reason for this is simple: that whatever the intention behind educational planning, whatever specified reasons a country might have for taking its education system down one particular route or another, there will always be a strong current of unintended consequences flowing from education. It is in the intrinsic nature of education, that those doing the learning – the students, the teachers (the best teachers are always learning as they teach) – change as they learn. That is the point of education, of course – but the nature of that change in the individual simply cannot be pre-defined in any precise way, so that the multiplier effect across a whole society or a whole nation is unpredictable at best.

In this vein, Amartya Sen, Nobel-Prize-winning economist, makes an interesting distinction between ‘Human Capital’ and ‘Human Capability’ in his book *Development as Freedom* (Sen, 2001). The first is the target of the educational instrumentalist – the latter is the set of characteristics of the learning person that grow and are enhanced naturally by education. An effective education will develop new skills across a population – and will therefore increase, it is hoped, the economic capacity of the country – its Human Capital. However, while the individual might be developing new skills, he or she is also learning about himself or herself, is being given the intellectual tools to be able to analyse their social, political, economic, emotional situation, is able to read more widely, is able to learn from history – and so on. The result is likely to be a nation of better educated people – their Human Capability is extended.

So, while education is a primary driver for economic prosperity, it is also the route to freedom, to knowledge as a public good, and to a fairer society. The latter, of course, require some agreement - or at least a continuing debate - on the range of basic values that education should both reflect and reproduce.

The other key pressure on education to change to meet the needs of the modern age comes, of course, from learners themselves, from those who are education’s ‘clients’. Young learners in particular are no longer so willing to accept the values of a bygone age. Young people across the world today are probably less bound by received wisdom than any previous generation in history. That seemingly uncomplicated acceptance by the young of the great forces for change occurring right now is the aspect that, above all

others, will change education whether it wants to change or not. The young simply accept as given trends that some in the older generations are wont to typify as disruptive in some sense or other, even where they recognize and acknowledge the long-term benefits to be derived. Perspective is all, of course.

While many working in education systems around the world blithely soldier on against the rising tide of modernity and ‘disruptive’ technology, others recognize the changing reality and are struggling to prise themselves out of the factory-schooling straitjacket. Such people understand that the values they seek to reflect in teaching and learning are critical to their success in creating radical change in education. They know it is not enough to consider just pedagogy and curriculum, not enough to pin a simplistic faith on technology-as-a-good-thing-in-itself, and certainly not enough to reduce education to an instrument of economic advancement.

Conversations criss-crossing the globe - conversations that are exciting, disputatious, energizing, ironic, deadly serious, thought-provoking, contradictory, eloquent, heartfelt – raise the optimistic expectation that education will increasingly outgrow the school in its current manifestation, that monument to the industrial revolution. Education is likely to happen more and more in the interstices between the complex strands of social relations that people build and colonize and disassemble and re-build throughout their lives, whether face-to-face or in the expanding panoply of virtual spaces that we now inhabit. Something akin to a school might well survive this process - it has already proved itself to be a long-lived and enduring concept – but many educationists, the world over, are now working to ensure that schools (and colleges and universities and ‘learning centres’) become, not monuments to past glories, but merely the physical traces of a new kind of education that is truly social, global and pervasive.

What might this new kind of education look like? Ivan Illich, in *De-Schooling Society*, wrote:

*“A good education system should have three purposes: it should provide all who want to learn with access to available resources at any time in their lives; it should empower all who want to share what they know to find those who want to learn it from them; and it should furnish all who want to present an issue to the public with the opportunity to make their challenge known.” (Illich, 1971)*

Illich’s words resonate in the current debate on educational transformation. Of course, the expert knowledge held by individuals, and the ability of those individuals to help others to acquire that knowledge, will always be a critical component of any educational provision. What will be different, however, will be seen in the nature of the relationship between the teacher and the learner. Illich’s second point, in particular, indicates the possible changes in that relationship between the learner and the learned. According to Illich, it is just as important that those with knowledge can find those who seek their knowledge as it is

for those who seek knowledge to find those who might teach them. The paradigm here is closer to the marketplace than the compulsory state education system; nonetheless, the education system in the future, I believe, will have to be able to facilitate the process by which each side of the relationship finds the other. At the moment, and for some time now, it has been the role of the school to do that, but the school has really only facilitated the first of Illich's points, bringing learners together in one physical space to be taught by the accredited experts known as teachers. It is in this changing relationship that the developing nature of the school will be most profoundly asserted over the next few years, in which the concept of the school will outgrow the physical walls that have contained it until now, and in which the mutual definitions of teacher and learner will become increasingly blurred.

A strong argument for this has come from Alexander Yu Uvarov, who has written about the concept of a 'closed educational architecture' – a fixed framework that set minimum standards of general education, that created 'barriers against low-quality teaching' and that ensured 'the relatively effective introduction of global modifications to the educational process' (in other words, a regulated framework that permitted changes to the curriculum or to the structures of schooling to be put in place relatively easily and quickly). This is the concept of education that we all understand because it is the framework within which, as we have seen, we were all educated and in which we are largely still educating our young people. But in the digital age, in which we now have open and, to all intents and purposes, unlimited access to information, that closed educational architecture is starting to creak. We now have to define and move towards a more open educational architecture, a framework in which learners take more and more responsibility for their own learning and in which teachers establish a new definition of what it is to teach. This means freeing up teachers to work with students in an open, collaborative way, with the teaching and learning that goes on the result of a continual process of negotiation. Teachers freed to do what they do best – to teach, to work with young people to help them get the best out of their own efforts, to advise, to counsel, to cajole, to persuade, and, yes, to impart knowledge where required – will go a long way towards enabling that 'open architecture' that will better reflect the needs of the digital age and the global village.

Of course, it is not to education alone that we must look for the transformative agent needed today – we must instead look to the necessary conjunction of education and the digital technologies for the means to create an educational experience for learners that will reflect the realities of the 21<sup>st</sup> Century. The rapidly flattening (and rapidly warming) world in which we live means that the belief in the transformative powers of some optimum conjunction of education and technology is a global phenomenon. Just as technology is making it possible for the so-called emerging nations, increasingly, to compete economically with their already-developed neighbours, so these same countries are realizing that they can exploit technology to help them take a decisive leap in educational terms. Where so many

industrialized countries are still firmly wedded, given their economic dominance over decades and centuries, to the model of schooling that helped get them there, the emerging nations, some of them at least, have no such baggage to hold them back. Such countries are more than capable, over the next few years, of leapfrogging the industrialized nations by recognizing the potential of the new learning and by finding ways to implement a form of education or schooling based on the new reality described here.

This will not be a straightforward process. The relationship between education and technology is a complex one and certain traits that they share can, when brought together, lead as readily to our advantage as to our disadvantage. Both can be used to enhance life or to blight life. They are, neither of them, neutral instruments in the hands of Man. Perhaps Richard Feynman's insightful words about Man's use of science, based on a Buddhist proverb, can be applied just as effectively to this powerful confluence of education and technology:

*"To every man is given the key to the gates of heaven. The same key opens the gates of hell."* (Feynman, 2001)

Feynman himself, indeed, made exactly this connection when he said:

*"It was once thought that the possibilities people had were not developed because most of the people were ignorant. With universal education, could all men be Voltaires? Bad can be taught at least as efficiently as good. Education is a strong force, but for either good or evil."* (Feynman, 2001)

If neither education nor technology is a neutral instrument, how they are used is a then matter of choice, and that choice will always have a moral and ethical as well as a merely instrumental dimension. The nature of digital technologies means, however, that should schools or regions or countries continue to make the wrong choices, should they continue to depend on an industrial model of education that has had its day, learners across the world will begin to make the right choice for themselves and will eventually render the industrial-age schools and industrial-age schooling irrelevant despite those choices of those in authority.

## 2. REFERENCES

- [1] Feynman, Richard P, 2001. *The Pleasure of Finding Things Out*. London, Penguin Books.
- [2] Freire, Paulo, 2001. *Pedagogy of Freedom*. London, Rowman & Littlefield.
- [3] Illich, I, 1971. *Deschooling Society*. Harmondsworth, Penguin Books
- [4] Mackenzie, RF, 1970. *State School*. Harmondsworth, Penguin Books.

[5] Neill, AS, 1970. *Summerhill – a Radical Approach to Education*. Harmondsworth, Penguin Books

[6] Sen, Amartya, 2001. *Development as Freedom*. Oxford, Oxford University Press.

[7] Uvarov, AY, 2004. Article in *Connected Schools* (ed. Michele Selinger) – published by Cisco Systems – available for download from:

<http://www.cisco.com/web/about/ac79/wp/ctd/>

[8] Whitby, G - reference taken from a presentation on his website at:

<http://gbwhitby.parra.catholic.edu.au/>

Presentation entitled: A Time to be Bold

[9] Wilson, Woodrow – quoted in Wikipedia at:  
[http://en.wikiquote.org/wiki/Woodrow\\_Wilson](http://en.wikiquote.org/wiki/Woodrow_Wilson)



**John Connell** is an Education Strategist and Business Development Manager working for Cisco across the Emerging Markets. He worked for 25 years in the public sector in Scotland, at all levels of education from teacher and headteacher to national policy adviser and national programme director. For 6 years he led the world-class Scottish Schools Digital Network project (see <http://www.glowscotland.org.uk>). He has spoken at many events and conferences across the world on the conjunction of education and technology. His blog can be found at: [www.johnconnell.co.uk/blog/](http://www.johnconnell.co.uk/blog/)



## DEVELOPING INSTRUCTORS TO ACTIVELY TEACH IN AN E-LEARNING CURRICULUM

Kristen E. DiCerbo & Helen M. Parke

Cisco Learning Institute, 1661 E. Camelback Rd., Phoenix, AZ, USA 85037

(602)343-1500, [Kristen.DiCerbo@ciscolearning.org](mailto:Kristen.DiCerbo@ciscolearning.org), [Helen.Parke@ciscolearning.org](mailto:Helen.Parke@ciscolearning.org)

<http://www.ciscolearning.org>

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Creating a program to allow instructors of an elearning curriculum to continue developing their teaching skills can be a complex task. Such a program must not only be usable and appreciated by instructors, but change their classroom practices and ultimately improve student learning. In order to approach these goals, it is necessary to use a research-based process from the beginning of the creation of the program through its completion. We will describe Cisco Learning Institute's development of an e-learning approach for instructors already teaching an e-learning curriculum in the Cisco Networking Academy Program. The presentation of e-learning tools for instructors that resulted from this process will complete the session.

**Keywords:** Teaching, Instructor, Research, Professional Development

### 1. INTRODUCTION

#### Teaching in an e-learning Curriculum

Teaching with an e-learning curriculum in an in-person environment is a challenging task. The management of the combination of online, e-learning content with in-person instruction requires a delicate balance. Research literature suggests instructors should become facilitators who serve to guide students as they construct their understanding of material. In reality, many instructors continue with instructional practices they are most comfortable with and have seen modelled as students themselves. These practices usually involve transmission of information through lecture, with the instructors serving as the expert disseminating all the knowledge.

#### Cisco Networking Academy Program

An example of these tensions can be seen in the Cisco Networking Academy Program, a global program in which information technology is taught via a blended program with face-to-face classroom instruction, an online curriculum, and online assessments. Instructors in the program have a variety of backgrounds, ranging from those with extensive technical experience and little teaching experience to those who have spent decades teaching but have little technical expertise. The size and global nature of the program is interesting, but presents challenges when creating instructional materials that will be relevant across cultures. Since being launched in 1997, the program has been taught in more than 10,000 academies in 50 U.S. states and over 145 countries with curriculum in nine different languages.

The Cisco Learning Institute (CLI) partners with Cisco Systems, Inc. to provide support for the Networking Academy Program in a variety of areas. Recently, CLI undertook the task of creating a professional development program for Networking Academy instructors. The project

has specific goals of improving classroom instruction and eventually influencing student outcomes. This multi-year project is in the first phase, the development of instructor materials designed to provide teaching strategies and ideas for a new curriculum being released. In order to maximize the likelihood that the materials produced would impact classroom instruction, a research process was instituted from the beginning of the project. This research process parallels the product development process and serves as a checkpoint along the way to ensure that the materials are on track with the intended goal. The instructional materials included components designed to influence instructional practices implemented with the new e-learning curriculum. This paper details the research process, the resulting requirements, and the eventual e-learning solution developed for instructors.

### 2. THE RESEARCH

Prior to beginning to design a development solution, we engaged in a period of analysis to understand the needs and requirements of instructors. This research involved: review of the literature, an interview project to determine how successful instructors and struggling instructors differed in instructional practices, and a series of surveys to determine instructor desires and needs.

#### Literature Review: Professional Development of Teachers

The literature base on teacher professional development is vast. There have been hundreds of articles published in scholarly journals over the past five years, and thousands more in the years before that. In addition, there are thousands of observations and anecdotes published on the Internet. Unfortunately, surprisingly few of these measure two important outcomes of professional development: 1) change in teaching practices and 2) student achievement or attitudes. However, with the standards movement that began

in the U.S. in the 1990s, student learning outcomes became a key focus. Success of professional development began to be measured based on increased student learning rather than on whether teacher participants were satisfied [1].

We conducted a review focused on studies that demonstrated the effectiveness of professional development techniques based on change in teacher practices and/or student achievement. In addition, a standard of quality was applied such that the focus of the review was on quantitative research conducted using experimental or quasi-experimental techniques and qualitative research conducted using rigorous analysis procedures. As a result of this review the following aspects of professional development were found to influence instructor practice and/or student achievement:

- Results-driven goals: Programs with clearly articulated goals are more likely to produce desired change. [2,3]
- Content that provides:
  - In-depth, rigorous subject-area content instruction [4,5]
  - Information on how students learn subject area content [5]
  - Information on teaching strategies specific to the subject area and content [4,5]
- Learning strategies that:
  - Teach teachers with the same strategies they should use with their students (modelling) [6]
  - Incorporate active learning- providing teachers with the means to explore, reflect on, practice and problem-solve using the ideas presented [4,7]
- Explicitly designing for transfer/ application of learning into the classroom [3]
- Coherence: Creating a larger professional development program rather than single isolated sessions [7]

#### Literature Review: Learning principles

The second piece of the literature review focused on defining the learning principles instructors should ideally use in their classrooms. There is extensive existing research that culminates in general learning practices we wanted to ensure were encouraged by the instructor materials.

Critical Ideas. Understanding the critical ideas to be taught helps improve instruction in a variety of ways. First, it allows instructors to set instructional goals. Research has shown that setting specific, measurable instructional goals increases student achievement [8]. The goals focus students' attention on the important areas and this focus makes it more likely that important concepts will be learned.

Second, understanding the critical ideas allows instructors to help students construct knowledge. If students understand what the big concepts are, they can better organize those and understand how they relate to one another. We know that experts draw on both their deep knowledge base and their understanding of how all the knowledge fits together. Since novices typically don't grasp the fundamental principles in a field, they don't see how the concepts relate to each other. They tend therefore to adopt an idiosyncratic organizational scheme for what they are learning [9]. Understanding the

critical ideas helps instructors ensure the major ideas are part of the knowledge students construct.

Relevance. Students often do not see how they will use information in "the real world" [10] and their engagement with the topic is affected by this perceived lack of applicability. Providing real world scenarios demonstrating the use of knowledge increases motivation, which is likely to lead to an increase in learning [11].

The second benefit of real world scenarios is the direct effect on learning. The development and retention of new knowledge depends in large part on the relationship between what one is learning and what one already knows (12, 13, 14, 15). Research shows that as new information is presented, it is essential for it to be linked with information already known by the student. Cognitive psychology tells us that it is these connections that will allow learners to access the new information later [16]. Because novices in a field by definition don't know the content in that field, they have little to which they can relate the things they're attempting to learn. In addition, students frequently don't make logical connections between new ideas and prior knowledge [17]. Presenting real-world scenarios provides guidance to students on how to make the appropriate connections between new information and familiar knowledge.

Diverse active experiences. Learning research clearly shows that students who are actively engaged in material are likely to learn it better. Active learning, initially promoted by Dewey as far back as 1924, requires students to do meaningful activities and think about what they are doing. Introducing even a two minute reflective activity three times during a lecture has been shown to improve student memory of the material [18]. Numerous other studies have demonstrated the efficacy of active engagement in improving learning outcomes [19, 20, 21]. In addition, nearly all students benefit from having material presented in multiple ways, and a struggling student may see it presented in a new way and understand it. Therefore, having a variety of strategies available for instructors on a given topic is likely to increase student learning.

Progress Monitoring. Instructors should actively and frequently determine if students understand the material that has been presented. This can be done informally through questioning and discussion or more formally with assessments. Whatever the technique, the goal of progress monitoring is to determine systematically and explicitly whether students understand what was being presented. This then allows for the adjustment of instructional strategies, the introduction of other means of explanation, and/or other means to ensure students are learning the content.

#### Determining what successful instructors do

After reviewing the literature we sought to better define the teaching strategies of successful Networking Academy instructors. In order to do this, we had to define instructor success, which can be done in many ways. However, one of the most important measures may be student outcomes. For our analysis, instructor success was defined based on two



student outcomes: students' self-rated confidence with networking skills at the end of a class and students' final exam scores. In addition, students' ratings of the instructor were used as a third measure. The confidence and instructor ratings were obtained from a course feedback form completed by each student following each course they take. On the form, students rate their instructors on a series of items related to their instructor's teaching, including: whether the instructor is prepared, is easy to approach, and whether they would take another class from that instructor. Factor analyses indicate students' responses on these questions tend to be related to each other, so we can take an average of their ratings on all of the questions to form an instructor rating score. Similarly, there is a group of questions that asks students to rate their confidence performing a series of course-related tasks. These questions are averaged to form a confidence score. Finally, all students complete a final exam at the end of the course, and their scores are recorded in a centralized database.

The sample for our research was defined as instructors whose students fell in the top 5% or bottom 5% on at least two out of three of the following: instructor rating, confidence rating, and final exam score. Individuals in these groups were invited to participate in an individual phone interview about teaching in the Networking Academy Program. A total of 37 instructors were interviewed, with a nearly even split of instructors from secondary/ high schools, 2-3 year technical/ community colleges, and 4 year colleges and universities. The regional breakdown of interviewees was:

- 5 from Asia Pacific
- 3 from Central & Eastern Europe
- 8 from Western Europe
- 1 from Japan
- 5 from Middle East & Africa
- 15 from US & Canada

Each participant was interviewed individually by phone. Interviews were conducted without interviewer knowledge as to which group the instructor belonged. Interviews lasted between 30 and 60 minutes depending on the verbosity of the interviewee and the number of follow-up questions needed. Extensive notes were taken during the interview with direct quotations when possible.

Instructors were asked to describe both their general approach to teaching networking and a typical class session. The most common teaching method is a combination of lecture and lab activities. However, the interviews revealed significant variation in the emphasis instructors placed on various classroom activities. The largest differentiator between the top and bottom groups was the difference in emphasis on hands-on activities. A majority of those in the top group put great emphasis on the hands-on activities. The following comments are representative descriptions of their approach.

*"I would describe my approach as hands-on in the extreme"*

*"Hands-on is where I try to get them to understand. I give them routers they can put their hands on; some have no*

*idea how a network works, it's so abstract they need to see live networks and have to actually get involved."*

In contrast, some instructors in the bottom group did not describe labs or hands-on activities at all, for example, *"I let the modules drive it; each does it at their pace, each student has their own computer and the curriculum is on a local server. I present the study guide and slides off community college sites; I show things on the board, 2-3 weeks into the module I turn on the test, they have a notebook where they get credit for taking notes."*

Others do talk about labs, but as part of a list of other activities. For these instructors, hands-on activities are clearly not the central part of their philosophy. For example, *"We start with a PPT presentation, then they read the curriculum and ask questions, we do labs if there are any in the module, then they take the test."*

In addition to a lack of emphasis on hands-on activities, a common practice that emerged in the bottom group was reading the curriculum in class. This was far less common in the top group. One possible explanation for reading in class is that students do not have access to the online curriculum at home, so the instructors have no choice. However, even the top instructors in Africa, where access is a known problem, did not have students reading in class.

When asked about what their students found engaging, there was agreement among a large majority of instructors in both the top and bottom groups. Hands-on activities were most engaging. There were also no education level or geographic differences on this question. Students particularly like configuring routers even, as one interviewee noted, if they don't know what they're doing.

There is a discrepancy within the bottom group between what they recognize engages students and what they do in their classrooms. There appear to be multiple, somewhat related explanations that may account for this. First, the current CCNA1 curriculum does not have many hands-on labs. As one instructor noted, *"Because they're not in the routers first, it turns some off right away."* Second, many instructors in the bottom group indicated they do not have time to develop activities beyond those in the curriculum. The top instructors are more likely to make up their own activities to supplement what is in the curriculum. For instance, one instructor in the top group described how he has his students create a mini-communication device with electronic equipment in the first couple of weeks of class. They then try to get messages from one group on one side of the room to the other. Other instructors in the top group described creating their own challenge labs. Third, those in the bottom group are less likely to have professional networking experience and more likely to feel deficient in their technical skills. Therefore, they are less likely to have the background and ability to go beyond what is offered in the curriculum.

A final difference between the top and bottom groups was that the instructors in the top group described their approach

in more detail, and more often described their reasoning. In general, their answers were longer and they often described trying different things. So, even the instructors in the high group who did not focus their strategy around hands-on experiences were able to articulate a strategy and reason for implementing it.

#### What instructors want

Following the definition of what successful instructors are doing, we turned our attention to what instructors wanted in a development solution. For this process we used online surveys sent to the instructor community. In nearly every survey completed, instructors indicated they were more interested in receiving training on advanced technical topics than training on teaching. However, across surveys 70-75% of instructors indicate they are interested in training on teaching strategies specific to the curriculum.

The question of the format in which to present development options often arises in the Networking Academy. On one hand, instructors like in-person training both for the opportunity to engage in more hands-on work and the ability to meet other instructors. On the other hand, the logistics of in-person training including taking time off from teaching and the cost of travel are often prohibitive. In addition, training topics may not be relevant to what the instructors' current needs are, and so will be less likely to be implemented in the classroom.

Instructors were also asked what additional instructional materials would be most beneficial to them. They indicated that extended labs, which allow students to challenge themselves or extend their learning beyond the curriculum, are the most useful additional materials. In addition, these extended labs can be used by instructors to extend their own knowledge.

#### Summary of instructional requirements

Based on the research and analysis, the following is a list of requirements developed for the instructor materials so that they would likely change instructor classroom practices and improve student outcomes.

- Instructors must be able to access teaching strategies at the time they need them in the classroom. The strategies are therefore more likely to be implemented.
- Provide teaching strategies specific to the content
- Encourage focus on hands-on and/or interactive activities.
- Provide multiple ways to teach topics
- Provide all resources necessary for implementation rather than requiring instructors to spend more time to develop materials to implement.
- Provide instructors opportunities to build their own technical skills, including case studies and/or extended labs.

### **3. THE SOLUTION**

Based on all of the requirements above, we developed an e-learning resource called Interactive Course Guides (ICG).

These ICGs are a series of web-based modules that provide teaching strategies and materials at the chapter- or section-level for a course. Instructors can access the ICG for particular content they are teaching at the time they are covering it.

Fig. 1 displays a screen shot of the entry page and the various sections included in the ICG. Each of the sections along the bottom of the screen provides teaching information and strategies that encourage teachers to use one or more of the learning principles likely to improve student achievement.



Fig. 1. Screen shot of first page of Interactive Course Guide

The Key Ideas, Teaching Goals, and Critical Concepts sections all help instructors maintain focus on the major ideas in the content. The Key Ideas identify the areas instructors need to emphasize for the students' understanding. The Teaching Goals section specifically outlines the goals for instructors. By making these explicit, it is more likely that they will be achieved. Finally the critical concepts section identifies both the concepts students must understand to master the chapter and common misconceptions students have.

The How to Teach section provides specific teaching suggestions particularly aimed at making the content relevant and identifying real world examples of the concepts in the chapter. It also provides suggestions for activities that create multiple ways to address the content.

The Discussion section provides interesting topics and scenarios for classroom discussion, providing opportunities for instructors to monitor student understanding, and provide necessary feedback and correction to their thinking.

The Reflection section provides suggestions for ways to allow students to consolidate and deepen their understanding by considering additional examples and scenarios.

Across the top of the ICG are links to additional materials. These include case studies, activities including extended labs, videos of instructors discussing the content or showing

how to use the equipment, and additional tools. These can be used by instructors to expand their own technical knowledge and used in the classroom to challenge students.

#### 4. PRELIMINARY RESULTS

During the creation of the Interactive Course Guides, a prototype was developed and used to gather feedback on the ICGs. A group of global instructors previously formed to provide feedback on curriculum and instructional tools reviewed the prototype and provided feedback about its various components. Tab. 1 displays a summary of their quantitative ratings. Instructors overwhelmingly indicated that each section would be helpful to them.

| Section           | % Rated Helpful or Very Helpful |
|-------------------|---------------------------------|
| Key Ideas         | 100%                            |
| Critical Concepts | 89%                             |
| How To Teach      | 84%                             |
| Discussion        | 88%                             |
| Reflection        | 84%                             |

Tab. 1. Ratings of Prototype Sections

Interestingly, when asked to indicate which section they were most likely to use, responses were divided across the sections. This seems to indicate that different instructors have different needs and the provision of a variety of resources is needed to meet those diverse needs.

Based on the results of this prototype test, a complete set of ICGs were developed for the new curricula. The development process involved instructors in both the creation of ICGs and their review prior to publication. An additional feature was added to allow instructors to further influence their continued evolution; instructors are able to make suggestions online about each IGC in a comments box associated with each IGC. These comments will be collected and analyzed to identify what instructors say work for them or does not work for them [22].

The ICGs will be evaluated in the coming year to determine if they are used, if instructors like them, if using them influences instructors' classroom practice, and if those practices influence student outcomes. Results will be parsed by geographic regions to determine whether certain teaching practices are more acceptable in certain areas and whether different pieces impact instructor and student outcomes differently in different cultures [23].

#### 5. CONCLUSIONS

CLI recognizes the complexity of unpacking instructor beliefs about teaching and learning. What it means instructionally to teach for successful student outcomes is influenced when the instructor is less than confident in the content of networking or merely believes the instructional role is to transmit knowledge rather than to actively engage

students in learning. We believe there are several factors, discussed below, that are essential when creating a professional development program that will influence how teachers teach and student learn.

#### Research and Evaluation Process

We believe it is essential to engage in research and evaluation throughout the development process. Initial reviews of current research literature allow for an understanding of what has worked in the past and can be built on. Second, gaining an initial understanding of what successful instructors in the environment do allowed us to form a picture of the types of things we want more instructors to do. Third, gathering information about instructor wishes allowed us to make a product that was more likely to be used. Finally, gathering feedback on the product prototype allowed us to modify and change directions before the ICGs had been fully developed, which would have required much greater effort. Each of these research activities allowed for a greater likelihood that the final product will indeed influence teaching and learning.

#### From the Community

In order for instructors to accept and use a professional development product, they generally want to feel as though they or someone like them has been involved in its development [24]. For this reason, instructors were involved in both the writing of the ICGs and the review process they went through prior to release. This is particularly important in the Networking Academy Program because we must have on one hand a global view of what will be successful and on the other hand, a specific view of what will work in a given region, country, or school. The balance between these two needs can begin to be addressed by allowing content and ideas to emerge from the community itself. We have begun this process through both the surveys and development. We plan to continue it through the comments feature and added community spaces.

#### Take Advantage of Technology

The project at this phase did not use all of the latest web technology (e.g., Wikis, blogs, etc.). However, even just using basic e-learning tools allowed for certain benefits over solutions that do not employ technology. First, using the Web allows us to get information to people in a consistent way. Training in the Networking Academy Program has traditionally been accomplished through a tiered train-the-trainer model in which Cisco passed information to training centers, who trained regional academies, who trained local academies, who then taught student classes. While this design has many advantages, one of the primary disadvantages is that the main messages intended to be distributed can be diluted or lost. Use of the e-learning solutions ensures that a consistent message about teaching reaches all instructors in the academy.

Second, use of technology allows us to be nimble with our message. Changes can be made to the ICGs quickly and new pieces added as they become available. For example, many instructors request videos of other instructors and many instructors have expertise to share. Videos of these

instructors can be added to the appropriate ICGs as they are developed, and easily removed if they fall out of date due to technology changes. In addition, as instructor needs change, we can develop other new materials we may not have considered at this point.

In summary, by using a research and evaluation process, allowing development to come from the instructor community, and taking advantage of technology, the Cisco Learning Institute has endeavoured to create instructor development materials to improve teaching and learning in the Cisco Networking Academy Program. In the coming years, we look forward to evaluating and improving these materials and developing a complete professional development program that will serve instructors throughout their careers in the academy. In the process, we will continue to expand our understanding of what it takes to change instructors' beliefs about teaching, for that is surely what is needed to change classroom practices.

## 6. REFERENCES

- [1] Guskey, T.: Evaluating Professional Development. Corwin Press, 2000.
- [2] Speck, M. & Knipe, C.: Why Can't We Get it Right? Professional Development in the Schools, Corwin Press, 2001.
- [3] Wick, C., Pollock, R., Jefferson, A., & Flanagan, R.: The Six Disciplines of Breakthrough Learning: How to turn training and development into business results, John Wiley & Sons, 2006.
- [4] Snow-Renner, R. & Lauer, P.: Professional Development Analysis, McRel, 2005.
- [5] American Educational Research Association: Teaching Teachers: Professional Development to Improve Student Achievement, American Educational Research Association, 2005.
- [6] Jeanpierre, B., Oberhauser, K., & Freeman, C.: Characteristics of professional development that effect change in secondary science teachers' classroom practices. *Journal of Research in Science Teaching*, Vol. 42, 2005, pp. 668-690.
- [7] Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S.: What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, Vol. 38, 2001, pp. 915-945.
- [8] Gaa, J. P.: The Effect of Individual Goal-Setting Conferences on Academic Achievement and Modification of Locus of Control Orientation. *Psychology in the Schools*. Vol. 16, 1979, 4, pp. 591-596.
- [9] Bransford, J. D., Brown, A. L., & Cocking, R.: How People Learn: Brain, Mind, Experience, and School. National Academies Press. 2000.
- [10] Perdue, D. S.: A Descriptive Study of Developmental Mathematics Students' Beliefs and Affects. *Dissertation Abstracts International*, Vol. 58, 1997, pp. 2122.
- [11] Lepper, M., & Hodell, M. Intrinsic Motivation in the Classroom. In C. Ames and R. Ames (Ed.), *Research on Motivation in Education*, Vol. 3, 1988, pp. 75-105.
- [12] Anderson, R. C.: Role of reader's schema in comprehension, learning, and memory. In R. C. Anderson, J. Osborn, & R.J. Tierney (Eds.), *Learning to Read in American Schools: Basal readers and content texts*. Erlbaum. 1984.
- [13] Chandran, S., Treagust, D., & Tobin, K.: The role of cognitive factors in chemistry achievement. *Journal of Research in Science Teaching*. Vol. 24, 1987, pp. 145-160.
- [14] Kuhn, D., Garcia-Mila, M., Zohar, A., and Anderson, C.: Strategies of Knowledge Acquisition. *Monographs of the Society for Research in Child Development*. Vol. 60, 1995.
- [15] Recht, D., & Leslie, L.: Effect of prior knowledge on good and poor readers' memory of text. *Journal of Educational Psychology*. Vol. 80, 1988, pp. 16-20.
- [16] Anderson, J. R.: *Cognitive psychology and its implications*. Freeman. 1995.
- [17] Hayes-Roth, B. & Thorndike, P. W.: Integration of Knowledge from Text. *Journal of Verbal Learning and Verbal Behavior*. Vol. 18, 1979, pp. 91-108.
- [18] Ruhl, K., Hughes, C., & Schloss, P.: Using the pause procedure to enhance lecture recall. *Teacher Education and Special Education*. Vol. 10, 1987, pp. 14-18.
- [19] Hake, R.: Interactive-engagement vs. traditional methods: A six thousand student survey of mechanics test data for introductory physics courses. *American Journal of Physics*. Vol. 66, 1998, pp. 64.
- [20] Laws, P., Sokiloff, D., & Thornton, R. Promoting active learning using the results of physics education research. *UniServe Science News*, 1999.
- [21] Redish, E., Saul, J., & Steinberg, R.: On the effectiveness of active-engagement microcomputer-based laboratories. *American Journal of Physics*. Vol. 65, 1997, pp. 45.
- [22] Dede, C.: *Online Professional Development for Teachers. Emerging Models and Methods*, Harvard Education Press, 2006.
- [23] Lam, W. S.: *Culture and Learning in the Context of Globalization: Research Directions. Rethinking Learning: What Counts as Learning and What Learning Counts*. American Educational Research Association, 2006.
- [24] Dede, C., Honan, J. P., & Peters, L. C.: Scaling up success: Lessons from technology-based educational improvement. *Jossey-Bass*, 2005.

## THE AUTHORS



### **Kristen E. DiCerbo, Ph.D.**

Dr. DiCerbo is the Teaching and Learning Research Lead at the Cisco Learning Institute. Her research interests include understanding how students learn computer networking, researching instructional practice around the world, and using new and different techniques to explore teaching and learning. She received her Ph.D. in Educational Psychology from Arizona State University and continues to teach there as a faculty associate.



### **Helen M. Parke, Ph.D., PMP, Sigma Xi**

Dr. Parke is Executive Director of the Cisco Learning Institute and holds Emeritus Faculty status with the University of North Carolina System, US, where she was a member of the graduate faculty for 28 years. Her research focuses on transformational teaching. She continues to design and coordinate professional development opportunities for teachers of mathematics and science.

## ACKNOWLEDGEMENT

*The authors wish to thank the Networking Academy instructors who take the time to participate in research activities and also those who worked with CLI on the creation of the ICGs. In addition, we wish to acknowledge the efforts of the entire CLI team involved in the creation of the instructor materials.*





*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

## **THE IMPORTANCE OF ICT FOR EDUCATION IN THE EUROPEAN UNION**

Jan Figel'

The European Commissioner for Education, Training, Culture and Youth

Abstract: Presentation is devoted to the great contribution that information and communication technologies give to the development of education in the European Union, including fostering equal opportunities and intercultural dialogue.

(Power Point Presentation)





## SANET NETWORK - NEW DEVELOPMENT



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

Pavol Horvath  
Slovak University of Technology Bratislava, University Computing Centre  
Vazovova 5, 812 43 Bratislava, Slovakia  
pavol.horvath@stuba.sk

**Abstract.** The further development was focused on international dark fiber connection to neighbour countries. These fiber lines are used not only for fast cross-border connection - 10 Gbps. In addition, SANET has 1Gbps Ethernet link to the GEANT PoP in Bratislava and other international connections to the Internet 800 Mbps. In the second stage it will be upgraded all backbone nodes environments to the 10 Gbps. The third stage in the very next step will be establishing 54 new nodes in the regional centres, which enables provide fibre to schools. In the next 5 years will be connected using this technology more than 600 secondary a primary schools.

**Keywords.** Fiber network, cross-border interconnection, fiber into the schools.

### 1. INTRODUCTION

Data networks for science, research and education provide suitable conditions for the technical innovation enable research projects such possibilities, which are unavailable in commercial networks. At the same time these networks represent sources of high-qualified experts, who enter the commercial field every year. We may say that the national networks for science, research and education are capital for every country for the growth of the economy and prosperity. They are sources of innovation and provide rapid transfer of technologies to the industry and society in general. Introduction of these new technologies into praxis should have been explicitly one of the main goals of the NREN.

By realization of Project SANET II the new network infrastructure was established based on DF technology used switched Ethernet (end-to-end). The backbone speed is 1 Gbps, access to the backbone up to 1Gbps. Length of optical cables is app. 1220 km country wide (IRU contracted), and in MANs 8 regional centres is installed app. 45 km optical cables owned by SANET. International connection to GEANT is established with the speed 2,5 Gbps – SANET utilizes 200 Mbps from this capacity.

Quality of services is established by monitoring of network 24x365 hours, and all network nodes administrators have input into network statistics. Errors rate measured at the ports of switches – 0%, exception of case of mechanical interruption cables or interruption of connection.

SANET built its own optical lines, in the frame of the university centres, in range up to 100 km. In order to cover longer distances, there are implemented regenerators of the optical signal.

The SANET optical network was built in frame of SANET II project and now the network covers all Slovak Universities and scientifically institutions in 26 towns. The

whole network infrastructure is based on leased dark fibers, which are terminated in gigabit Ethernet switches and the dark fibres routes in the university Centres. SANET Network is configured as two rings providing full redundancy with maximum delay 5ms. The national connectivity is realized through the Ethernet link in to Slovak Peering Centre SIX placed in Computer Centre of the Slovak University of Technology (CVT STU) in Bratislava.

### 2. CURRENT TOPOLOGY

The current SANET network topology, lines speed is shown on the Fig.1.



Fig. 1: SANET network Topology (February 2007)

The whole network infrastructure is based on leased dark fibers, which are terminated in Cisco Catalyst 6500 gigabit Ethernet switches. Building of SANET network went through two phases. The first one started in July 2001 and was finished in February 2002 when the south path (Kosice

-Bratislava) was done. Second phase started in March 2002 and was finished in January 2003. SANET II project has been officially finished in January 2004. Now all nodes of SANET network topology are fully functional.

In addition, SANET has 1Gbps Ethernet link to the GEANT PoP in Bratislava and other international connections to the Internet 800 Mbps.

### 3. THE DEVELOPMENT OF THE OPTICAL INFRASTRUCTURE

A very significant development had been done within the new type of connection between the Slovakia, Austria and Poland. In more European countries NREN, taking into account the situation on the market, have created their own optical connection cross border CBDF. The basic approach is to connect geographically neighbouring universities by fibres.

The further development was focused at the first stage on international dark fiber connection to neighbour countries. These fiber lines are used not only for fast cross-border connection - 10 Gbps with very small delay approx. 3ms but also for mutual traffic exchange between national exchange points VIX, SIX, NIX and WIX.

In August 2002 was established a 110 km DF link between exchange points in Austria (Vienna) and Slovakia (Bratislava). This had been followed by links over similar distances between Slovakia and Czech Republic in April 2003. This second international connection has DF 100+90 km with repeater on the border and the third international connection had been followed technically as EoMPLS tunnel via CESNET network for Slovakia – Poland CBDF connection.

The Czech colleagues from CESNET will provide 10Gbps redundancy to AT/SK/CZ triangle with their own dark fibre link from Brno to Vienna in the in February 2006.

In the 2006 the Central European Countries (Austria, Czech Republic, Slovakia and Poland) will upgrade their dark fibre path (Vienna-Bratislava-Brno-Ostrava-Bialsko-Biala) to 10Gbps and start full network peering over these countries.

### 4. REGIONAL CROSS BORDER DARK FIBRE CONNECTION

All mentioned international links use as transport native support for L2 services with 802.1q Ethernet trunks. These links had attracted considerable user traffic, and performance as measured by RTT (Round Trip Time), was often much better than on conventional international links, such as GEANT.

SANET was planning new CBDF connection to Hungary and the Ukraine, as well as direct connection to Poland.



Fig. 2 : Cross-border DF connection

Some ISP use the small international bandwidth however their connection to the local exchange point is usually much better. The high RTT is very serious problem because transit providers might peer at other side of Europe, than the RTTs > 50 msec to the neighbour country is not uncommon; it means that packets travel more than 5000 km. In these cases is not possible to tune TCP stacks of all servers and users.



Fig 3: International cross-border connection

However is still available lot of wireless technologies Every terrestrial interconnection uses the shortest path and is the best solution. Good example for it is the roads, railways, power distribution etc. The same to do is the best way how to manage the best services with IP networks. Neighbour NREN have usually some PoP quite close to border, so only short piece of DF is to use to establish CBDF connection. No international circuit pricing is needed.

## 5. BACKBONE UPGRADE

In the second stage of the network development it will be focused on upgrade all backbone nodes environments to the 10 Gbps.

In January 2006 SANET upgraded its local lines in Bratislava and Inter-City link Bratislava-Trnava to 10Gb. In the November 2006 was upgraded the optical line from Bratislava to Zilina. In the 2007 will be upgrade of SANET backbone infrastructure finished. Whole backbone and all network nodes will be connected on the 10Gbps.

| Number of Schools/<br>number of students | Total in the towns<br>/w. new nodes | Total in the region | % Cover     |
|--|-------------------------------------|---------------------|-------------|
| Gymnasium                                | 198                                 | 243                 | 81,1        |
|  | 84612                               | 99931               | 84,6        |
| OŠ                                       | 221                                 | 253                 | 87,3        |
|  | 73312                               | 80339               | 87,5        |
| ZŠ                                       | 96                                  | 129                 | 74,4        |
|  | 59994                               | 71434               | 83,9        |
| <b>Total</b>                             | <b>515</b>                          | <b>625</b>          | <b>82,2</b> |
|  | <b>217918</b>                       | <b>251704</b>       | <b>85,3</b> |

## 6. SANET INTO THE SCHOOLS

The third stage in the very next step will be establishing 54 new nodes in the regional centres, which enables provide fibre to schools. In the next 5 years will be connected using this technology more than 600 secondary a primary schools.

The proposed project "SANET INTO THE SCHOOLS" is now in the projection phase. The all necessary plans, on the regional niveau is prepared, the Steering committee of this project will be established in the September 2007. Now is necessary to clarify where will be the next nodes and if the schools within the new node have the personnel are capable for the network equipment to maintain.

### The towns and the new nodes in the regions

- Bratislava region** – in the towns: Malacky, Pezinok, Senec – 3 new nodes
- Trnava region** – Dunajská Streda, Galanta, Senica, Hlohovec, Skalica – 5 new nodes **Trencin region** - Bánovce nad Bebravou, Nové mesto nad Váhom, Myjava, Považská Bystrica Partizánske, Ilava – 6 new nodes
- Nitra region** – Komárno (connection planed in 2007), Levice, Zlaté Moravce, Šaľa, Topolčany Nové Zámky, Štúrovo – 7 new nodes
- Zilina region** – Čadca, Dolný Kubín, Turčianske Teplice, Námestovo, Tvrdošín, Bytča, Kysucké Nové Mesto – 7 new nodes
- Banská Bystrica region** – Brezno, Lučenec, Poltár, Rimavská Sobota, Revúca, Žiar nad Hronom, Banská Štiavnica, Žarnovica, Veľký Krtíš, Detva, Krupina – 11 new nodes
- Prešov region** – Bardejov, Humenné, Medzilaborce, Snina, Kežmarok, Poprad, Levoča, Sabinov, Stará Ľubovňa, Stropkov, Svidník, Vranov nad Topľov – 12 new nodes
- Košice region** – Rožňava, Spišská Nová Ves, Gelnica - 3 new nodes

### Project realisation proposed time schedule in years 2007 – 2010:

| Year     |   | 2007 | 2008 | 2009 | 2010 |
|----------|---|------|------|------|------|
| Activity |   |      |      |      |      |
| 1        | Steering Committee establishing   | x    |      |      |      |
| 2        | Nomination of schools with the new nodes- to close the contracts with   | x    |      |      |      |
| 3        | To close the contracts with universities responsible for realisation the projects in regions.                                 | x    |      |      |      |
| 4        | Tendering process for projects of optical lines in towns.   | x    |      |      |      |
| 5        | Starting negotiations for lease lines between new nodes.  | x    |      |      |      |
| 6        | Tendering process for build up the MAN optical infrastructure in the towns with the new nodes, I. period, planed 15 towns     |      | x    |      |      |
| 7        | Tendering process for building up the MAN optical infrastructure in the towns with the new nodes, II. period, planed 20 towns |      |      | x    |      |
| 8        | Tendering process for build up the MAN optical infrastructure in the towns with the new nodes, III. Period, planed 19 towns.  |      |      |      | x    |
| 9        | Tendering prizes for supply the network equipment for the new nodes.  |      | x    | x    | x    |
| 10       | Star up the new topology of SANET network with the 54 new nodes.  |      |      |      | x    |

### Financial plan for project realisation

Draft for amount of finance needed for project realisation – very first proposal.

| Expenses  | Number of nodes | Number of connected schools | Price in kSk | Total expenses in kSk |
|---|-----------------|-----------------------------|--------------|-----------------------|
| Projects and engineering in towns with new nodes. | 54              |                             | 250          | 13 500                |
| Building up the new optical routes                |                 | 515                         | 700          | 360 500               |
| Network equipment in the nodes                    | 54              |                             | 1000         | 54 000                |
| Network equipment in the schools                  |                 | 515                         | 50           | 25 750                |
| <b>Total</b>                                      |                 |                             |              | <b>453 750</b>        |

## 7. CONCLUSION

SANET has established first CBDF to the Vienna at 2002 and since than the traffic grows much higher than expected. Users learn these new services and do prefer fast connection to the resources. Also new services appeared HRTV, cross border videoconferences, new access to distance learning etc.

Current status with the CBDF services:

- Connection between SANET (SK) and ACONET (AT) is approx. 300 Mbps
- Connection between SANET (SK) and CESNET (CZ) is approx. 300 Mbps
- Connection between PIONIER (PL) and ACONET (AT) is approx. 800 Mbps
- Connection between CESNET (CZ) and ACONET (AT) increased into approx. 300 Mbps

SANET is plan to establish CBDF connection to Hungary, Ukraine and to Poland (current connection is indirect throw CESNET)

Technical solution that has been used is technically feasible to establish much better access to resources in neighbour countries, bring several possibilities to improve Redundancy and improve competition in IP transit market. This new technical solution supports the new platform for cooperation between NRENs and is very important for future developments.

The upgrade of whole SANET network infrastructure into 10 Gbps will provide for academic community practically unlimited connectivity for several new activities as an on

line e learning and videoconferencing, TVoIP in common use of IP telephony and others.

Project SANET into the schools will provide the 85% students of secondary schools with the new quality of Internet connection and bring the new quality into the education on the secondary schools.

## 8. REFERENCES

[1] EARNEST Foresight Study, Project in the frame of PC GEANT 2007. In: WWW Terena.nl.

[2] Horvath, P., Durkovic, M. Weis, T.: Dark Fibre Cross Border Connections in Central Europe SANET experience. In: Workshop on Customer Empowered Fibre Networks, May 2005 Prague.

## THE AUTHOR



### Pavol Horvath

Professor, the Faculty of Informatics and Information Technology (part Time),  
Director of University Computing Centre  
President of Slovak Academic Network association

Work experience:

**Membership of Professional Bodies:** President of SANET - Slovak Academic Network Association since 1991, Representative in Consortium Policy Committee of - GEANT since 2000, Representative of Slovak Networking Organizations in CEENet (Central and Eastern Europe Networks) since 1994, Vice chairman of Alternative Telecom Operators Association.

**Professional Experience:** Head of several Projects in the field of Informatics and Information systems

**Professional Lecturing Experience:** University Study Program: Peripheral Devices, Department Computer Science of STU since 1976, Post Graduate Program: Local Area Networks, 1989-1993.

**Relevant Publications:** Books: Scientific Vocabulary-Cybernetics Systems, Co-Author in slovak, Alfa Publishing House, Peripheral Devices, Co-Authors, in slovak. Alfa Bratislava '91, Data Networks, Co-Author, STU Publishing House 1996, UNESCO Informatics Training Courses (on CD ROM) 1999, 35 Articles published in Scientific Journals in slovak, english, more than 60 Papers on Conferences and Workshops (publish. in Proceedings).



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## STRATEGIC LESSONS LEARNED – THE FINNISH VIRTUAL UNIVERSITY

Pekka KESS  
University of Oulu  
Department of Industrial Engineering and Management  
PO BOX 4610  
90014 UNIVERSITY of OULU  
Finland  
tel: +358 8 553 2932  
fax: +358 8 553 2904  
pekka.kess@oulu.fi  
<http://www.oulu.fi/english/>

**Abstract.** The challenge of universities in using ICT is the opportunistic strategy in full scale, which is only possibility for those who have sufficient resources to explore all possibilities. The Finnish Virtual University (FVU) was an ambitious target organisation at the time of the first and second round strategic planning. However there are not yet many good examples of successful strategic management cases from the academic world. A research carried out in Finnish university sector showed that there are no mature enough management processes and practices to execute any strategic objectives and changes. Even the strategic management has been widely accepted at the universities, the likelihood to achieve any objectives is not related to the management performance. The biggest problems in the virtual university setting, or more general in applying ICT in universities are not technical or pedagogical but they are managerial. In university eLearning issues all strategic targets, objectives, goals can not be reached by the current management methods. Instead it calls for a top-down approach to put the management system in place first, instead of the very common university cultures of bottom-up, which only by accident meets the strategic challenges of the whole university. The current eLearning developments like the Finnish Virtual University are not living up to the promises they had some years ago.

**Keywords:** Virtual university, strategic management, maturity, capability, quality.

### 1. INTRODUCTION

Universities are using in growing numbers strategic management methods and tools in order to meet the challenges of today and tomorrow. Strategic management typically takes a look at the opportunities organisation might have. The use of ICT has been an opportunity to many organisations. Either it has been used in the products or it has been utilized in the processes to produce goods and services. The Finnish universities have taken these both points of view into serious consideration. When it comes to improve the product many universities try to manage by themselves but when it comes to improve the academic processes it makes sense to try to collaborate. The universities formed together with Ministry of Education to meet these challenges. The Finnish Virtual University is not a university itself, but an eLearning arm to the existing universities. In this presentation the view is taken from one individual university and its eLearning strategy where the FVU is playing important strategic role.

### 2. UNIVERSITY E-LEARNING POLICY

All Finnish universities have developed an e-learning policy during the years 2001 and 2005. The policy formulation

actions were part of the annual planning agreements between the individual universities and the Ministry of Education. Some of the universities have already revised them based on the extensive eLearning work. In all universities the policy includes the membership in the Finnish Virtual University (FVU). This implies that all Finnish universities are member of at least one e-learning consortium. [4]

The FVU is based on collaboration, division of labour, shared expertise of these member universities. It promotes online learning and teaching and develops compatible information infrastructures. In the FVU framework, universities participate in the national collaboration, and in addition, each member university has a special unit to promote and support online learning and teaching locally. These units may be educational technology centres, learning centres or other locally relevant units. The idea to develop a national virtual university came from the universities themselves and also from the Ministry of Education's Information Strategy for Education and Research, 2000-2004. [4]

This strategy forms a ground for development of e-learning practises in Finland. The main objective of the strategy was that "by 2004 Finland should be among the leading countries in knowledge and interaction. The success is

based on the citizens' equal possibility to study and develop their own abilities and to broadly use databases and educational services".

The implementation of the strategy has been assessed in the Ministry of Education's Education and research information society report 2004-2006 by using the following points:

- the citizen skills of the information society,
- the training of teaching staff,
- the training of information industry and digital communications professionals,
- the development of virtual education in universities and the virtual school (the Finnish Virtual University, the Finnish Virtual Polytechnic, the Virtual School project),
- the research of learning environments (Life as Learning –research program),
- the designs of the information technology, digital study materials (for the educational institutes in the Edu.fi – service, Virtual Polytechnic portal and for the Finnish Virtual University portal).

This strategy forms a ground for development of e-learning possibilities in Finland. The collaboration of the Finnish universities in eLearning issues is still very much local or national. No significant international (EU or wider) collaboration has taken place yet. Also the level of eLearning strategies at universities is at rather low levels. This indicates that eLearning is still more an individual driven than an organisation driven activity in these universities. [4]

The number of programs and courses offered in the form of ICT enhanced or blended is still rather low. The FVU portal has a few hundred courses but no full programs in its data base as fully or partly eLearning delivery. The universities deliver some tens of thousands courses annually a few hundred eLearning courses is even less than 1 % of the total course offerings.

There are several reasons for using e-learning (fig 1) [4]

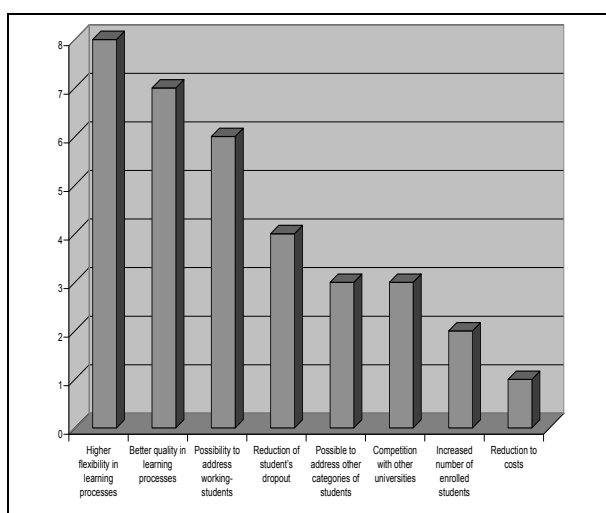


Fig. 1. Reasons for eLearning in universities

For most cases the reason is to increase flexibility in learning processes. This has been the dominant factor in the

Finnish eLearning and virtual university developments, when justifying the investments in eLearning. There is not yet sufficient research on how well this objective has been reached by eLearning. On the other hand the inflexibility has not been reported to be a significant problem in the Finnish HE systems. It seems that eLearning has been seen by various actors as a new opportunity for something. [4]

The second most important reason for using eLearning was better quality of teaching. The quality issue has been on the HE agenda in Finland for several years. The Finnish Virtual University and the Higher Education Evaluation Council have held discussions about including the eLearning into to the scope of quality evaluations. There are no real indications that the education in Finnish universities is of poor quality and therefore there would be a need to improve it by introducing the eLearning. On the other hand there has been a concern about the quality of the eLearning at the universities. To assess and to improve the eLearning quality several national and EU wide initiatives have been launched. It is worth mentioning here the eXcellence ([www.eadtu.nl/e-xcellence](http://www.eadtu.nl/e-xcellence)) project coordinated by the EADTU.

Finnish universities have a written strategy documents about eLearning. Some faculties, departments and other units have also produced their own strategic proposals. Most of the university level documents are stored and can be reviewed from the FVU strategy services web site. Figure 2 illustrates just briefly the strategy map of one university (University of Oulu) as a member of the HE family in Finland.

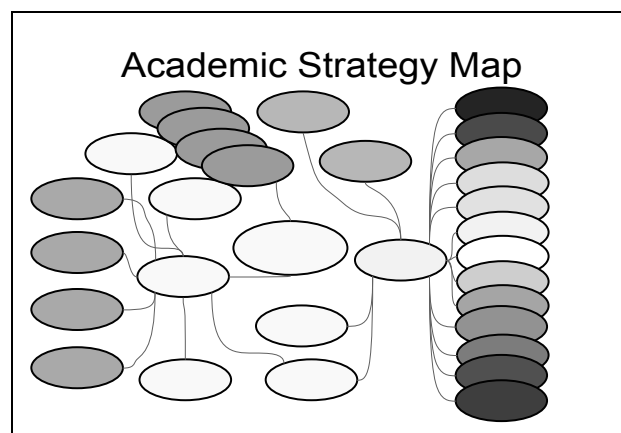


Fig. 2. Strategy map of the Oulu University

### 3. TESTING UNIVERSITY STRATEGIC CAPABILITY

In order to test the strategic capability of the university an empiric test was carried out utilising the P-CMMM model [2,3]. The objectives of the empirical research were [5,6]:

- to test the Strategic Organizational Capability Maturity Model in the university and
- to get a view of the management practices of various types of Finnish organisations in terms of the model.

Totally in the research in addition to the university organisations 4 other public sector organisations and 14 private companies were assessed.

The results from the evaluation can be summarized as follows:

1. The university does not have mature enough management processes and practices to execute the strategic objectives and change.
2. The studied private sector companies in average do slightly better, but there is a lot of room for improvement as well
3. The best organisations in this group have implemented very extensively management practices that are fully compatible with the model used in the research. These organisations are also known as successful global companies capable of executing and changing their strategies according to the changing operational environment.

Some of the results are presented in graphical form in the following figures 3 ... 7.

The university was placed at the very lowest level of maturity. It seems that the university does not manage in a systematic way its capability in order to face the challenges and fulfil its strategic objectives and change.

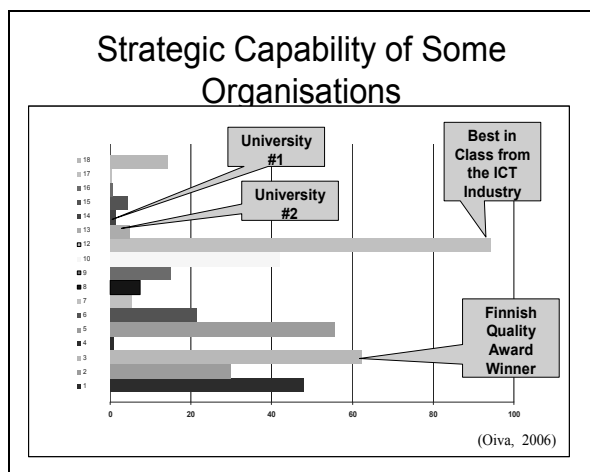


Fig. 3. Empirical findings on the strategic capability

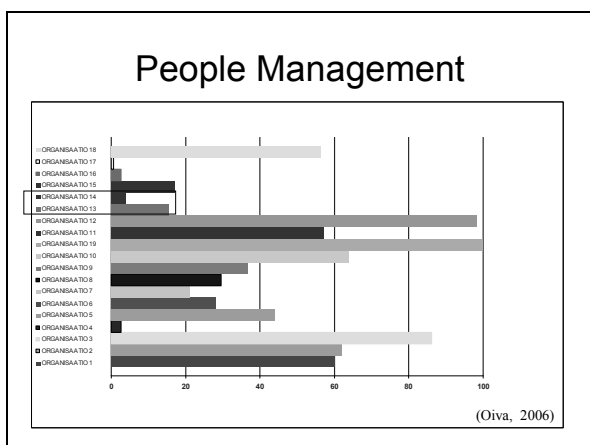


Fig. 4. Empirical findings on the people management

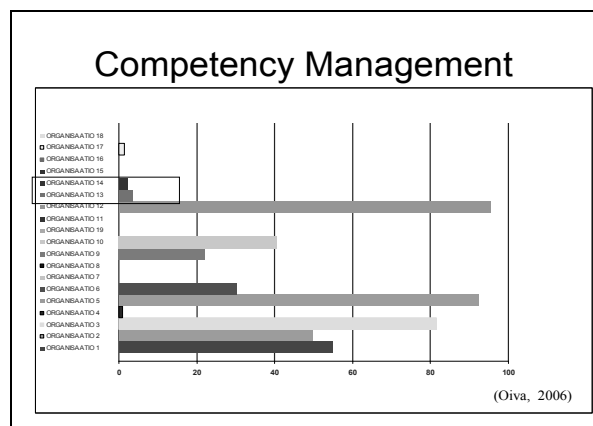


Fig. 5. Empirical findings on the competency management

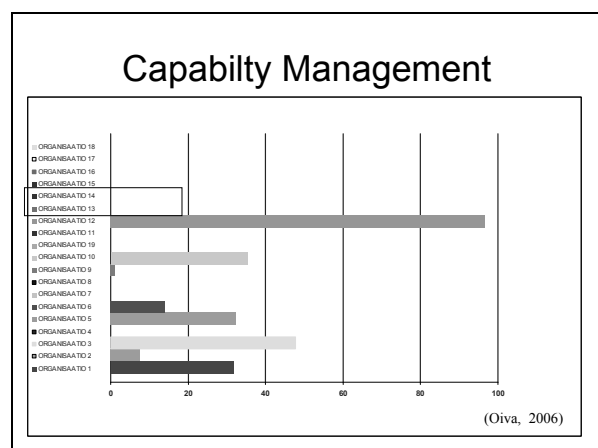


Fig. 6. Empirical findings on the capability management

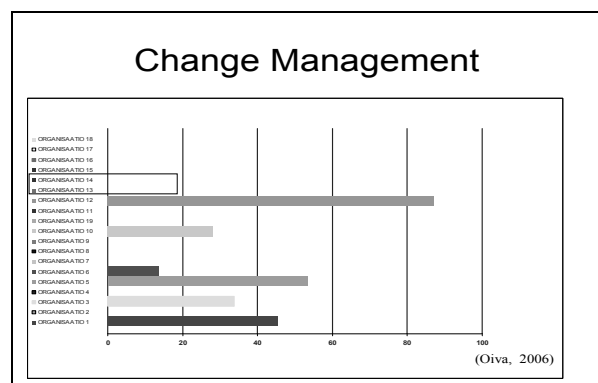


Fig. 7. Empirical findings on the change management

It does not have shared and institutionalized management processes and practices enough. The most common and widely used practices deal with the recruiting and the physical environment, because both of the processes are defined rather extensively by the Finnish law. On the other hand, for instance organisations do not make sure that the resources available are fit for the strategy and that all of the operations are in line with the strategic objectives. There are no shared practices to evaluate the performance, productivity and achievements. The reporting and practices are therefore all missing.

The results show that [5,6]:

1. The difference between the best and the rest is significant. The difference between the best private company and the worst public sector organisation is over 90 % measured by the number of implemented processes and practices.
2. The public sector organisational structure, roles and tasks are not defined by the strategy.
4. The performance objectives of units and individuals are not defined and therefore not managed.
5. Performance improvement is 'unknown topic' in public organisations including the universities.
6. Problems in performance are not discussed and therefore not removed.

The research took also a look into the level of implementation. The question was: how extensively the processes and practices have been institutionalised. Even when university does have some processes and practices – in some cases defined by the laws – the integration of them as a part of the management system of the whole organization is weak. The responsibilities of the practices might be defined and the tools with templates are available, but they are not part of the management process, there are no measurements to analyse and improve the practices. There are no review practices to these.

The work shows, that the universities do have very strong interest in using strategic management methods and the result of that approach is a relatively large number of documents called 'strategy of x' as shown in fig. 2. However the research shows that the university organisation does not have the capability to work out the strategy into practical actions and therefore the strategic will be reached only by accident and not with the help of strategic management.

#### 4. FINNISH VIRTUAL UNIVERSITY – FULL SPEED AHEAD

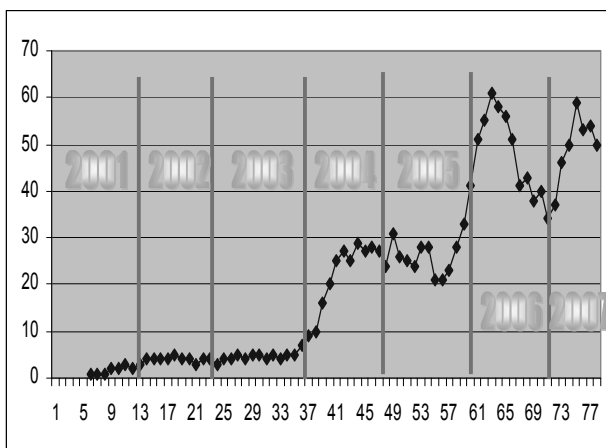


Fig. 8. FVU input activities

In the first six years of operation (2001-2006) The Ministry of Education (MOE) has put some 60 million euros on the virtual university developments in Finland. Based on a recent study [1] in addition to the ministry funding the universities have put some funding as well. The division of

funding was about 80 % from the MEO and 20 % from. This indicates a total funding of some 75 million euros in the six year period.

The activities of the FVU have been on a growing trend. An activity index calculated from the inputs is presented in fig. 8.

Despite of the increased activity the FVU has not produced any improvements in the results that are defined as strategic in the strategic planning for the years 2005-2010:

1. Flexibility in studies and development of electronic administration to support it.
2. Support of common use of eEducation and eLearning materials.
3. Extensive implementation of jointly produced ICT supported educational services and ICT support services.
4. Integration of the FVU to the European higher education system and other international collaboration.
5. The organisation, processes, decision making and funding of the FVU meets the requirements of the university network.

#### 5. CONCLUSION

In short we can say that in universities in general and in elearning questions especially there is a lot of strategic talking, but not much if at all, strategic thinking.

#### 5. REFERENCES

- [1] Aarveaara T., Saranki-Rantakokko, S., Stenvall, J. & Syväjärvi A. Suomen virtuaaliyliopistoverkoston arviointi, Opetusministeriön työryhmämuistioita ja selvityksiä 2007:28. Helsinki. 2007. 43 p.
- [2] Curtis, B., Hefley, W.E. & Miller, S.A. (2003) Introduction to the People CMM, Version 2. Carnegie Mellon. Software Engineering Institute. TeraQuest Metrics. USA. s. 338.
- [3] Curtis, B., Hefley W.E. & Miller S. A. (2001) The People Capability Maturity Model® (P.CMM®) Version 2.0 CMU/SEI-2001-MM-01, Carnegie Mellon University, Pittsburgh, USA. s. 735.
- [4] Kess P. Tolonen P. & Salovaara H., (2006) Finland. University towards e-learning: a focus on Finland, France and Italy. Ed. E. Chirichilli, Città Nuovo of the P.A.M.O.M., Rome, pp. 29 ...61.
- [5] Oiva A., (2007) Strategiakeskeinen kyvykkyyden johtaminen ja organisaation strateginen valmius – konstruktivinen tutkimus. (Manuscript), Acta Universitas Ouluensis, University of Oulu. 254 p.
- [6] Oiva A. & Kess P., (2005) Management Challenges in Public Sector Organisations. 2005 EFMD Conference



on Public Sector Management Development, 3-4 March 2005, Nottingham, United Kingdom, 9 p.

#### THE AUTHOR



**Pekka Kess** is professor and head of the department of Industrial Engineering and Management at the University of Oulu, Finland. Professor Kess has an extensive academic and industrial background. Before the academic career he gained production and R&D experience from heavy chemical, basic metal,

electronics and software industries at managerial and executive levels. He has gained international experience by working in the US and in the UK in addition to Finland. He has worked with ICT systems and solutions for 30 years.

Professor Kess's research areas are strategic management (both public and private sector organisations), knowledge management, quality management and eLearning. He is member of the board and executive committee as well as the chairman of the Quality Assurance task force of EADTU (European Association of Distance Teaching Universities).





## RECOMMENDATIONS FOR INSTITUTIONAL IMPLEMENTATION OF E-LEARNING TECHNOLOGIES

Dusan Kocur, Peter Kosc

Technical University of Kosice

Faculty of Electrical Engineering and Informatics, Letna 9, 04200 Kosice, Slovak Republic

Tel: +421-55-602-4233 (-2281) Email: dusan.kocur@tuke.sk, peter.kosc@tuke.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** In this paper, the phases of institutional implementation of e-learning technologies are presented. It includes rigorous analysis and planning, ensuring the management support including corresponding financial resources, selection of appropriate technologies and courses, ensuring e-learning acceptance at whole institution, and evaluation of e-learning contribution. Finally, the paper focuses on the case study at the Technical University of Kosice and on the recommendations to ensure successful e-learning implementation.

**Keywords:** e-learning, implementation, human resource, learning management system, management, methodology, portal, platform, quality of services, virtual university.

### 1. NEW CHALLENGES IN EDUCATION

Conclusions of European Board meeting held in Lisbon on March 2000 result from finding that a successful transition to knowledge economics and society has to be supported by education system change towards lifelong learning. According to independent studies confirming this European Union intention, it is expected that 70 - 80 % growth of economics and competitive strength in the nearest decade will be based on the „knowledge industry“. This fact follows especially from corporate environment changes, globalization, sharpening competition, accelerating innovation, etc.

It is evident, that the educational institutions face challenge in this transition and complex environment where they have to exploit all available opportunities and competencies. From the point of technological support, they can exploit extremely fast development and efficiency of information and communication technologies, in education field known as e-learning.

Generally, e-learning technologies can create multimedia databases of knowledge of an institution in the form of electronic courses available on arbitrary computers connected to Internet, they provide remote communication with teacher and the possibility to obtain a certificate in a such form of study. *Generally, e-learning can be defined as the ICT applications for education development, distribution, and management.*

In next paragraphs, the most critical phases of e-learning implementation at the institution of university type are described. Moreover, a case study of e-learning institutional implementation at the Technical University of Kosice is presented.

### 2. ANALYSIS AND PLANNING

The answers to questions like „what kind of benefits the institution can get by e-learning implementations“ or „what

kind of strengths, weaknesses, opportunities and threats can follow from e-learning application in every-day university life“ can be a basis for the following SWOT analysis [10]. The strengths of e-learning (S1, S2) follow especially from technological architecture of e-learning systems:

- *S1: Databases of e-learning materials and study results.* On-line available on Internet, plentiful interactive and multimedia resources, learning with own study style, independence on place and time, standard and interoperability support, thematic exchange networks.
- *S2: Internet communication tools.* Possibility to create new educational models combining face-to-face teaching with on-line individual study and collaborative learning (so-called blended learning), building the student motivation by team projects on Internet, national and international exchange of teacher experiences.

Not only strengths, but also the weaknesses of e-learning (W1, W2) follow from technological keystone of e-learning systems:

- *W1: It is „just“ technology.* It means, it is an additional tool of teacher (like book, blackboard, etc.) that should be managed in a proper way. The teacher personality, his or her personal approach to students, remains dominant for the overall success of study and education.
- *W2: Time and financial expenses.* The workload of teachers does not usually contain duties following from e-learning, no technical and/or organizational structures are available many times, institutional budget is not able to cover new expenses, etc. These problems can be solved by the change of institutional strategy, moreover, the expenses can decrease by building up thematic exchange networks. Generally, e-learning is going to be profitable only at the high repeatability of e-learning courses. On the other hand, with regard to competitive strength of institution the e-learning activities should not be neglected.

A proper implementation of e-learning can provide especially these opportunities (O1, O2):

- O1: *Increase of study efficiency*. More creative education and improved personal approach of teachers to students, study individualization, broad spectrum of multimedia databases, independence on place and time, automation of teacher routine activities (e.g. testing), possibility to enlarge the creativity and humanity of all participants.
- O2: *Improvement of institutional transparency*. Better transparency for students, teachers, faculty and university management as well as for third party through user-friendly educational web-portals including LMS/LCMS systems filled up with standardized educational modules and transferable study results.

At the end of this analysis, we should note that each technology has also some potential threats (T1, T2):

- T1: *Unilateral development of students*. Intention only on knowledge without any development on ethics and culture, on-line courses without personal contacts between students and teacher, locking into virtual world, decrease of social competency, elitism and humanity suppressing.
- T2: *Replacing teachers by intelligent machines*. Elimination of personal contacts between students and teachers, decreasing importance of educative impact of teachers on students, teacher as a tutor with possibility to replace him by intelligent machine.

#### Legacy of Jan Amos Comenius and didactics

According to Jan Amos Comenius, world-wide teacher of nations, schools should be „*humanity manufactories*“ that should not only teach human being, but also put forward him or her to such values as truth, justice, diligence, prudence, wisdom, respect to people and matters as well as faith, hope and love. Consequently, a right personal example of teacher to students is necessary. He thought of dialogue as the most naturalistic method of education, especially that one not prepared in advanced. On the other hand, he supported to include into education the prepared short performances. Moreover, he proposed to implement into education the methods making school like a play that enhance and vitalize educational process (up-to-date constructive approach). He talked that a teacher should not present the theory prosily and in a dry atmosphere staying „above“ students (traditional instructive approach).

*As a consequence, the technology must not replace the personal relationship between teacher and student, but on the contrary, it has to develop this relationship as well as creativity and humanity of all participants in education.*

With regard to practical implementation of e-learning technologies, the following three models can be used: *technology supported learning* (large part of face-to-face learning with support of different e-learning solutions, e.g. multimedia CD presentations in conventional classroom), *on-line learning* (small or no part of face-to-face learning, e.g. on-line courses in LMS/LCMS, video conferences, etc.) and *blended learning* (combination of face-to-face and on-line learning and/or collaborative work on Internet).

#### Blended learning

This particular learning model has been successfully used in enterprise training as well as in case of lifelong learning provided by universities. For the correct and efficient application of blended learning it is necessary to identify subject parts that are better to provide by face-to-face form and the others to be taught by on-line courses or collaborative work on Internet. Generally, *the most important knowledge should be presented to students with personal explanation*. It should be noted that the share of face-to-face learning and on-line courses depends on the student age and subject under consideration. In case of children and adolescents the personal contact and teacher attendance is necessary. Therefore, the technology supported learning can be a proper model of education here. On the other hand, in case of adult students the larger share of on-line self study can be applied. [11]

### 3. MANAGEMENT AND TECHNOLOGY

#### Management Support and Financial Costs.

For the success of any project the management support of particular institution including corresponding financial resources is absolutely necessary. [9] This is valid especially in case of e-learning implementation affecting the organizational structure and strategy of entire institution. As a consequence, a failure risk of institutional implementation of e-learning based on effort of individual e-learning fans not clearly supported by the institutional management is considerable high.

It should be noted that the e-learning implementation is a very cost-consuming process. It requires not only a purchase of some LMS/LCMS system (including license costs per year), but it is necessary all the time to cover the development or purchase of e-learning courses, teachers training, users support, etc. As the first implementation step can be useful to test some open-source solutions or to make mutually profitable agreement with a provider of commercial e-learning solution that has usually own implementation strategy.

At present time, the following e-learning solutions are frequently applied: simple informational solutions (on-line documents, web pages, etc.), e-books and e-textbooks, streaming media and presentations, virtual classrooms for live e-learning events, interactivity and testing, games and simulations, on-line courses and tutorials, learning by e-mail including e-mail games, collaborative learning (chat, discussion groups, social networks, wiki), blogging and RSS, mobile wireless learning (so called m-learning), etc. Games and simulations can take a special importance for enterprise training. Cost expenses and time to develop the particular e-learning solutions are illustrated in Fig.1.

From the point of e-learning content development, the following strategies are available: *purchase of courses* (low effort, low or medium expenses, low risk), *development of own courses* (high effort, medium expenses, high risk) or course development through *outsourcing* (low effort, high expenses, low risk).

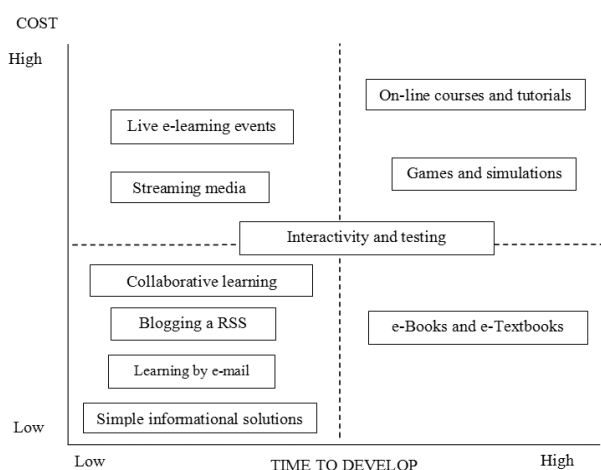


Fig. 1. e-Learning solutions - cost and time to develop.

### Selection of Technology

From the technological point of view, an appropriate *Learning Management System* (LMS) should be available to students. The LMS system provides on-line courses to students including basic or advanced communication tools, it monitors particular user activities, etc. If the system supports the development of e-learning courses, it is so-called *Learning Content Management System* (LCMS). The great advantage of LMS/LCMS systems is the interoperability of e-learning courses and study results, i.e., the standardized learning modules are transferable between different systems. In past, the standards for LMS/LCMS architecture, for content and personal information exchange, for interfaces, for data models and digital libraries have been proposed. Following, the compatibility of particular LMS/LCMS system with the complex *standard SCORM* ([www.adlnet.org](http://www.adlnet.org)) is important when selecting appropriate e-learning technology. The export of e-learning courses and tests into standardized xml schemes (so called *imsmanifest.xml* corresponding to static SCORM on asset level) should be a minimum requirement for the LMS/LCMS system. At present, there are only few producers providing the full support of SCORM standard.

To select an appropriate LMS system, the *EduTools* project can be a good resource ([www.edutools.org](http://www.edutools.org)). *EduTools* provides comparisons, reviews, analyses, and automated decision-making tools in areas of course management systems, student services, e-learning policies, etc. This site reviews each product by researching and describing more than 40 product features, in particular, *Communication tools* (discussion forum, discussion management, file exchange, internal e-mail, on-line journal and notes, real-time chat, whiteboard), *Productivity tools* (bookmarks, calendar and progress review, orientation and help, searching within course, work offline and synchronize), *Student involvement tools* (group-work, community networking, student portfolios), *Administration tools* (authentication, course authorization, hosted services, registration integration), *Course delivery tools* (test types, automated testing management, automated testing support, on-line marking tools, course management, on-line gradebook, student tracking), *Content development tools* (accessibility

compliance, content sharing and reuse, course templates, customized look and feel, instructional design tools, instructional standards compliance), *Hardware and software* (client browser required, database requirements, server software), *Company details and licensing* (company profile, costs and licensing, open source, optional extras).

## 4. ACCEPTATION AND EVALUATION

The next step in institutional e-learning implementation is to *gain acceptance* – from both employees and their managers. There are several strategies for providing a smooth transition: start small to build confidence; involve instructors early on and throughout the implementation; select external skill sets that compliment your own; make training and trial projects, etc. Except above, very important to success is to ensure institution-wide e-learning that is system-wide implementation of e-learning aimed at making a significant impact.

Finally, the last step is to *evaluate and measure* your benefits. To achieve these aims a *Quality Assurance System* [12, 8] for e-learning developers/users including the development of proper organization structures should be established. It should address the areas of *Strategic Planning* (market analysis, target group requirements, resources planning), *Framework or Program* (program planning, learning methods and materials, evaluation), *Cooperation* (establishing network of content providers, teachers, sponsors, etc.), *Course Development* (infrastructure, design, didactics, motivation, learning materials, assessments, student support, and evaluation), *Marketing* (strategy, test studies, evaluation), *Starting an Educational Activity* (prerequisites regarding certificates and technology, costs, support), *Introduction* (explaining objectives, test, feedback, rules and support, training of learning methods), *Realization* (interactions through e-mails, chat, etc., feedback system, evaluation), *Student Support* (technical and content support, improving motivation, monitoring performance, evaluation), *Teacher Support* (technological and didactical support, quality assurance by continuous training and evaluation, improving motivation by adequate resources, teamwork, teachers' feedback and common decisions), *Central Database* (collecting students' data and documentation from all mentioned areas), and *Evaluation* (assessment of all phases including quality assurance approaches, controlling).

Important issue is the *transparency of learning environments* for the learner. From this point of view, the information for learner can be identified through *General Information* (title, description, prerequisites for participation, technical requirements, guidelines and standards, update interval, language, student involvement, security and privacy), *Content* (objective, curriculum subjects, structure, classification), *Educational Concepts* (context, target group, typical learning time, teaching methods, learning resource type, collaboration), *Support* (kind and accessibility of support, intervals for delivering of learning materials, technical support), *Presentation* (media and applications used, layout guidelines), *Communication and Interaction* (types of interaction and applications,

guidelines for feedback), *Assessment* (types and dates of assessment, certification), and *Administration* (costs and dates, payment methods, expenses for telecommunications, contracts, and place, duration, frequency of accompanying instruction or service).

## 5. CASE STUDY

In order to support e-learning activities at the Technical University of Kosice (Slovak republic), a common technological and organizational platform available for all university teachers and students was necessary to develop. In next paragraphs, some important results of e-learning implementation projects are outlined [1-7].

The establishment of the University E-learning Board was the important output of the development project solved in 2004 [2]. Shortly, the E-learning Board is the consultative and advisory body of the university rector in the field of e-learning activities. Its competency is intent on university coordination of e-learning development, management of the e-Learning Portal, support of e-learning courses development including retraining activities, creating opportunity for discussions, consultations and exchange of experiences, etc.



Fig.2. e-Learning Portal - home page of particular subject.

The important step from the technological point of view was the establishment of the e-Learning Portal (<http://ep.tuke.sk>, see Fig.2) based on the commercial e-learning platform integrated with the university information systems. The e-Learning Portal provides detailed public information about university study programs and courses. In particular, in February 2007 almost 80% university study programs (exactly 214 programs and 9401 courses) were available on-line. The content of the e-Learning Portal is upgraded once per year using data import from the university information system Study Programs. The Portal

is also connected with the university employee database that enables user-friendly log-in of all university teachers.

Except detailed course information for public the e-Learning Portal provides the following support for every university teacher:

1. *Basic e-learning support.* The teacher publishes for students the study materials and the course announcements. All students studying such a subject have access to e-learning materials through one universal login and password provided by the teacher at beginning of the semester.
2. *Medium e-learning support.* It extends basic support in such a way that each student has available own login and password. This approach supports e-mail communication between teacher and students, discussions, tasks and assignments, student's evaluation, etc.
3. *Full e-learning support.* Except basic and medium support the multimedia lessons and electronic tests are available for students. The teachers develop standardized course materials using authoring tool.

The functionality of the adopted commercial e-learning platform ([www.gabrielsystem.sk](http://www.gabrielsystem.sk)) enables to create the hierarchical structure of portals and sub-portals that can be:

- *Information Portal.* It provides public information concerning selected topics (e.g., e-Journal) with functionality of the Content Management System. The Portal enables in user friendly way to create the menu structure and appropriate content (announcements, articles, discussions, documents, web pages, etc.).
- *Project Portal.* It supports project team work including email communication among team members, discussions, project activities and tasks, evaluation of team members, document sharing, etc. The project leader can define public parts of the Portal.
- *e-Learning Portal.* It has the functionality of the LMS/LCMS system. The course instructor can define public parts of the Portal. The authoring tool with the SCORM support is available. Developed multimedia courses are possible to export to off-line form as well.

Finally, we would like to note that the e-learning implementation at the Technical University of Kosice is just at the starting point. In next years the substantial effort in the area of human resources development, effective online teaching, standardization, and marketing should be done.

## 6. CONCLUSIONS AND RECOMMENDATIONS

From ethical and didactical point of view, teacher's personality including *human contact* is crucial for any educational process and it cannot be replaced by only technology. At the same time, specialized ICT supported services as easy-to-use portal solutions will provide opportunities to build *more transparent* educational institutions with well balanced blended learning supporting creativity, personnel development, and social cohesion of all parties.

The successful implementation of e-learning technologies at the particular educational institution can provide us with several benefits given in Tab. 1.

Tab.1. Benefits of successful e-learning implementation

| Technology                      | Students                        | Teachers                      |
|---------------------------------|---------------------------------|-------------------------------|
| <b>Study Results Database</b>   | Comparison Motivation           | Testing Transparency          |
| <b>Study Materials Database</b> | Rich multimedia Learning-styles | Methodology Fast Adaptation   |
| <b>Communication Tools</b>      | Collaboration Creativity        | Blended Learning Availability |

| Technology                      | Management                        | Third Party                   |
|---------------------------------|-----------------------------------|-------------------------------|
| <b>Study Results Database</b>   | Student analyses Quality System   | Availability of Study Results |
| <b>Study Materials Database</b> | Teacher Analyses Quality System   | Transparent Institution       |
| <b>Communication Tools</b>      | Exchange Networks Standardization | Lifelong Learning             |

In order to reflect the SWOT analysis of e-learning (see Analysis and Planning), especially to empower the strengths of e-learning, to overcome weaknesses, to utilize opportunities and to avoid threats, the following recommendations should be taken into account.

1. To build up *standardized* databases of study materials and study results (see strength S1 in SWOT).
2. To use Internet communication tools in an *effective way* (S2).
3. Not to overrate e-learning, but to perceive it as just another *teacher's tool* (W1).
4. To develop the *institutional strategy* including human sources development, to eliminate expenses by building up thematic *exchange networks* based on standards (W2).
5. To introduce *multi-level* e-learning according to user skills and learning models, i.e., from so-called lite e-learning portals for beginners up to complex LMS/LCMS with virtual classrooms for advanced users (O1).
6. To use simple and *user-friendly* e-learning portals with public information for third parties (O2).
7. To apply *blended learning* models (T1).
8. Not to replace the personal relationship between teacher and student, but on the contrary, to support the development of this relationship as well as *creativity* and *humanity* of all participants (T2).

Finally, we should promote substantial *research effort* on proper implementation of e-learning technologies in the European Higher Education Area with special emphasis on social and ethical consequences.

## 7. REFERENCES

- [1] Kocur, D. et al.: Standardized Laboratory for Implementation of e-Learning Technology at the TU Kosice. Project Report. Technical University of Kosice. January 2003.
- [2] Kocur, D. et al.: Implementation of E-learning Technology in Education at the TU Kosice. Project Report. Technical University of Kosice. January 2004.
- [3] Kocur, D. et al.: Sustainable Institutional Support of E-learning Technology the TU Kosice. Project Report. Technical University of Kosice. January 2005.
- [4] Kocur, D.; Kosc, P.: e-Learning Portal at the Technical University of Kosice. In: DIVAI 2004, Conference Proceedings, May 20, 2004, Nitra, Slovakia. Nitra: Kat. informatiky FPV UKF v Nitre, 2004, ISBN 80-8050-691-4
- [5] Kocur, D.; Sinay, J.; Kosc, P.; Benco, S.: Experiences with e-Learning Implementation at the Technical University of Kosice; In: ITHET 2004 – 5th International Conference on Information Technology Based Higher Education and Training. Istanbul. IEEE Catalog Number 04EX898C, ISBN 0-7803-8597-7.
- [6] Kocur, D.; Kosc, P.; Sinay, J.; Benco, S.: Institutional Implementation of e-Learning Technologies in Higher Education. In: ICETA 2004, Conference proceedings, September 16 – 18, 2004, Kosice, Slovakia. Kosice: Elfa, s.r.o., 2004, p. 451-456, ISBN 80-89066-85-2
- [7] Kocur, D.; Kosc, P.: Institutional Implementation of e-Learning Technologies at the Technical University of Kosice. In: Banse, G. – Bartikova, M. (Hg.): <e-learning? – e-learning!> Sonderausdruck aus Network Cultural Diversity and New Media; Vol. 8, Trafo Verlag, Berlin, 2007, pp. 167-175. ISBN: 978-3-89626-630-6.
- [8] Kosc, P.; Kocur, D.; Benco, S.: E-learning implementation at the TU Kosice and Quality Assurance System for Course Development, In: BELCOM 2004, Conference Proceedings, February 2 – 3, 2004, Praha, Czech Republic
- [9] Kosc, P.: Implementation of e-Learning Technologies at the Workplace. In: Industrial Engineering '04, Conference Proceedings, November 7 – 8, 2004, Horný Smokovec, Vysoke Tatry, Slovakia, pp. 204-211, ISBN 80-8073-190-X
- [10] Kosc, P.; Kocur, D.: Recommendations for Institutional Implementation of e-Learning Technologies, BELCOM 2005, 21-22 Feb. 2005, Prague, Czech Republic, ISBN 80-01-03203-5.
- [11] Kosc, P.: Importance of Open and Flexible Educational Institutions for Lifelong Learning and Enterprise Training, Conference on Industrial Engineering 03, Zlin, 24.-25.11.2005, Czech Republic.
- [12] Pawlowski, J. M.: Report on Quality Assurance Standards; In: CEN/ISSS Workshop on Learning Technologies. 2002

## THE AUTHORS



**Dusan Kocur** was born in 1961 in Kosice, Slovakia. He received the Ing (MSc) and CSc (PhD) in radioelectronics from the Faculty of Electrical Engineering, Technical University of Kosice, in 1985 and 1990. He is full professor at the Department of

Electronics and Multimedia Communications of his Alma Mater. His research interests are digital signal processing, spread-spectrum communication systems (MC-CDMA, CDMA), UWB technology and e-learning.



**Peter Kosc** was born in 1964 in Kosice, Slovakia. He received the MSc and PhD at the Faculty of Electrical Engineering, Technical University of Kosice, in 1988 and 1994. His research interests are information systems especially e-learning technologies and management of human resources. He managed for several years the development of e-learning platform.



## ICT – CHALLENGES FOR EDUCATION IN SLOVAKIA



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

Dušan Meško

Ministry of Education of Slovak Republic, Dept. of Informatics

Stromová 1, 813 30 Bratislava, Slovakia

Contact: cell-phone +421 905 512 933, [dusan.mesko@minedu.sk](mailto:dusan.mesko@minedu.sk), <http://www.minedu.sk>

**Abstract:** The world is more complex; the stakes are higher; more responsibility is focused to the individual. Every student today will be competing in the new global knowledge society and economy. The extent of new generation competition is changing. The nature of work is changing. The requirements of the workforce are changing – employers need workers with mastery of the basics+ [6]. In ICT strategy preparation in Slovak education we understand, it is a thrilling challenge for: pupils, students, teachers, parents, local authorities, commerce, industry, society. Slogan for changes is - everyone benefits by sharing information, knowledge and ideas. Informatics not as a target, but as a tool.

**Keywords:** information-communication technologies, education, knowledge society

### 1. INTRODUCTION

“Play – much can be learned in play that will afterwards be of use when the circumstances demand it. A tree must also transpire, and needs to be copiously refreshed by wind, rain, and frost; otherwise it easily falls into bad condition, and becomes barren. In the same way the human body needs movement, excitement, and exercise, and in daily life these must be supplied, either artificially or naturally” (Comenius).

We are living in information and knowledge society. Information society: a society in which information is a good that one can exchange, buy, sell, store, transport, process. The society of the digital divide.

Knowledge society: a human society, in which knowledge should bring justice, solidarity, democracy, peace... A society in which knowledge could be a force for changing society. A society which should provide universal and equitable access to information (UNESCO).

The Web doubles every 60-65 days, internet usage is increasing at the rate of about 140 persons a minute - almost 72 million a year, 3,6 milliards txt messages a month/2006. It is estimated that today learners will have 10-14 jobs by their 40th birthday.

Most of us believe in the power of information technology to bring about the most democratic revolution in literacy and numeracy the world has ever known. We also know that if we're not careful, this same power could be economically divisive. The ability to see, to sense, to visualize, is one way the thread of information technology wraps around and draws the sciences together. Information technology may be able to revolutionize the way we teach and the way we learn [2].

Most students entering our universities today are younger than the microcomputer, are more comfortable working on a keyboard than writing in a spiral notebook and are happier

reading from a computer screen than from paper in hand. For them, constant connectivity – being in touch with friends and family at any time and from any place – is of utmost importance. And they will be assuming responsibility in a world of incredibly rapid change [5].

We should also to think, where will our alumni go to upgrade their knowledge and skills. What will be the role for universities in this new environment? There is a must for the information-age mindset, for all people on the scene, stakeholders, providers, teacher, pupils, students, alumni etc.

The past couple of decades have seen a flood of new digital technologies, and innovations are emerging on an almost daily basis. When these new devices are introduced, the information-age mindset reaction is – what took so long? – rather than – Wow? Young people naturally gravitate to these kinds of interactive, input/output devices. They make the devices work without a manual, without the instruction set, as if the device is hardwired into their psyche [5].

Network is one of the strongest point of education fluency, it provides – what you need and when you need it. To disconnect from the network, the computer is nearly as useless as a cell phone in an area with no mobile service. Are we able to foretell how linking more people and devices through a shared network would alter how we work, learn, socialize and recreate?

Information technology is absolutely vital to our future. It can guide us to new frontiers in fundamental research and draw different disciplines together. It can integrate research and education, and most of all, it can link science and society in ways that we have never imagined [2].

### 2. WHAT IS AN INFORMATION REALITY (or . . . everyone benefits by sharing information)

The Internet – in everything we do – is changing the way we work, live, play, and learn. Over the last decade, the Internet has had its most profound impact on the first area: the way we work. Even in the higher education market, the

Internet has been used primarily in how one works to deliver education as opposed to delivering the education itself. Yet as we think about the next decade, we are looking not only at continuing to change the way we work but also at changing the way we live, play, and learn. Some of the most exciting things happening in the networking market are aimed at recognizing that potential. But to do that, we have to change our whole mindset [3]. We have moved from thinking about bits and bytes and wires and protocols to thinking about how to connect users to services. Today networking is about providing information, and it's about ubiquity. Because in the end, the technology is just the means to the end. It is the content that matters [3].

Thus education can no longer be seen as a discrete phenomenon, an option exercised only at a particular stage in life or a process following a linear course. Critical in nature and specialized in practice, education is progressively becoming the sine qua non of our economic survival, maintenance and vigorous growth. Not surprisingly, a new education paradigm has arisen to fit the needs of our progressively more knowledge-based economy. The education required today and into the future assumes that learners will need to be re-skilled numerous times in their working lives if they wish to remain employed. Access to lifelong learning will therefore become progressively more critical for both employees and their employers, who will find themselves pressured to provide or subsidize such learning if they want to retain their workforce and remain competitive. This new paradigm is also based on the need to provide learning experiences that are continually accessible everywhere and that use the most sophisticated information and telecommunications technologies [8].

Students want to be players in the new economy are clearly not going to be likely to tolerate a just-in-case education that is not practical, up-to-date, or career focused.

Web-based education, an inherently location less medium, is likely to push to the margins or even to the dustbin a substantial part of new philosophy education. The internet and data-base-management systems can provide time-constrained consumers with just-in-time information and learning that, because it can be accessed asynchronously, places the pedagogical focus on arriving at syntheses and developing critical thinking, thus making localized learning and mere memorization secondary. This all represents a huge challenge for higher education and technology. The predominance of the lecturing faculty member, the passive student, and the one-size-fits-all textbook is often condemned, yet the alternative are also problematic. Discussion-oriented education, which characterizes e-education, is not easily undertaken. It requires the right structure to make everyone contribute actively to his or her own education, it calls for unlimited Access to unlimited resources and not only fixed in brick-and-mortar classrooms and libraries. It also calls for a guidance, maturity, and discipline, that is often well beyond the reach of indifferent faculty members, and unmotivated students, and it is helpless in the face of a disorganized or illogical curriculum. In short, the online education world needed by the new economy, is a daunting one, with no place for jaded teachers or faulty pedagogy [8].

### 3. UNIVERSITY EDUCATION AND ICT

So how can we transform the institutions of the past into those that can serve the needs of the knowledge-based economy of today and tomorrow? Making front- and back-office functions convenient and accessible 24x7 is today primarily a matter of will, patience and money. But creating access to nearly 24x7 academic programs able to meet the needs of the new economy is a totally different matter [8]. This calls for rethinking the rules that guide higher education today, not only in informatics study programs, but preferably in non-informatics study programs. To change the philosophy of education with ICT usage: didactics, methodology, sociology, psychology, forms. Students want a curriculum and faculty relevant to the workplace. They want the course content to contribute to their success at work and in their career, and they want a faculty member who knows more than they do about the subject and who knows the subject as it is currently understood and as it is being practiced in fact, not merely in theory. The students want a time-efficient education. They want to learn what they need to learn, not what the professor may desire to teach that day, they want to gain their education in a structure that will maximize their learning, and they want to complete their degree in a timely fashion [8].

In higher education, the level of interest and enthusiasm for infusing information technology into the teaching and learning process is notable. For most institutions, however, new technologies represent a black hole of additional expense as students, parents and faculty. Making use of new technologies to reduce the cost of instruction requires a fundamental shift of thinking. It requires challenging the primary assumption of the current instructional model: that the only way to achieve effective student learning is for faculty members to meet with groups of students at regularly scheduled times and places. Rather than focus on how to provide more effective and efficient teaching universities must focus on how to produce more effective and efficient student learning. Instead of asking faculty to work harder, we need to enable them to work smarter [9]. Higher education around the world must undergo a dramatic makeover if it expects to educate a workforce in profound transformation [8].

### 4. CHANGE OF EDUCATION – comparison

It is a reality the young generation at all levels of school prefers style: of intensive (always on) access to technology and media, being able to use it autonomously. Based upon “hypertext minds” – leaping around, information are both pushed and pulled. They are preferably visual communicators, they are learning by exploring. They prefer multitasking – shifting attention rapidly, valuing speed. They are prolific communicators with peers.

High school and university present style: of restricted access to technology and media, preferring directed use. Mostly linear and relatively slow access to information, information are mostly pushed. Domination of text is present, learning is based upon being told. They prefer single tasking – sustained attention, valuing accuracy. There is limited interaction with teachers, communication with peers in lessons is restricted [10].

## 5. OPEN QUESTIONS

Do our students know how to deal with the massive amounts of information? Have we changed our teaching methods to reflect new technology? Do our students know how to communicate globally? Do our students understand how to be self-directed and how to organize their own learning?

## 6. DEMOGRAPHICS IN SLOVAK EDUCATION SYSTEM

13 000+ kindergarten teachers, 36 000+ basic school teachers, 27 000+ high school teachers, 13 000+ university teachers, 530 000+ pupils, 317 000+ high school students, 199 000+ university students, 2 400+ basic schools, 800+ high schools, 33 universities.

## 7. KEY TASKS OF CHANGES

Learners and their ICT skills (eLearning and eLearners) - standards of pupil competence, curriculum integration, accreditation and assessment for learners, homework policy, special education needs. Laptops/PCs for learners.

Teachers and learners (eTeaching and eTeachers) - teacher competence in ICT, the use of ICT in the professional development of teachers, access to personal computers for teachers. Laptops for teachers. Integrated learning environment.

Infrastructure, implementation, digital resources (eContent) and support - to address and resolve the issues of financial resourcing, levels of expected use of computers, technology refresh, and user training and support. Secure broadband network, internet services, on-line digital resources and tools, eAssessment tools. Anytime anywhere access [1 - partially].

Guarantee of: standards, system protection and security, intellectual property protection, measurability of outcomes in practice.

We need to take into account: new knowledge, access to knowledge, communication in a network, new teaching/learning, new tools, resources, pedagogies, new space/time, new teaching profession preparation. And – no child left behind.

Skills needed to teach our children: we need to teach our students to deal with massive amounts of information; we need to teach our students global communication starting with kindergarten; we need to teach our students to be self-directed and understand how to organize more and more of their own learning.

## 8. CHALLENGES FOR EDUCATION

Why build ICT and an international dimension into coursework? We need to prepare all students for working in the EU and around the world, as well as at home. Students need first-class skills in order to compete in a global, knowledge-based economy. Information-communication technology (ICT) projects can help achieve this by sharing and exchanging best practice with partners in Europe and beyond. Future education is to be found on making learning happen within activity rich and culturally

rich social environments that never existed. ICT logical implementation into education is a thrilling challenge for: pupils, students, teachers, parents, local authorities. Challenge for global partnership.

Pupils - to learn online, to research projects, to link up with their peers across Slovakia and across the world and to access school and curricular resources.

Teachers - to identify and collate content, courses and tools for their teaching, to share ideas and good practice with their colleagues elsewhere, to engage in online communities of interest, to track and monitor their pupils' progress, and to undertake necessary administrative functions.

Education authorities - to perform their school administration functions, to give their schools secure and filtered access to the internet, to make policy and guideline documents available to schools, to work in partnership with other local authorities.

All we need: a shared vision, an integrated strategy, planning and action by all stakeholders and participants, sharing services and partnership (private and public).

## 9. CORE CHANGES NEEDED

Human resources + content + infrastructure: teacher of future teacher education, future teacher education, teacher in practice education, curriculum review and rebuilding, distributed infrastructure and resources, wide area network and curriculum resources, improving classroom practice. And continuity – started at the level of kindergarten, basic and high school system, university studies of all three levels, career development, life-long education, formal, informal and public education.

## 10. ICT SCHOOL STRATEGY

Young people should be able to use digital and online technologies appropriately, effectively and creatively to acquire knowledge, to practise skills and to develop competencies: as individuals – to be creative, self-aware and able to communicate with and work well with others; as contributors to society – to act in informed and responsible ways as citizens; as contributors to the economy – to be economically aware and active, and to be excellent employees and employers in the 21st century global knowledge economy; as lifelong learners – to identify, address and meet their learning needs in formal and informal education settings, working both individually and with others, locally, and at a distance from school ([1] - Northern Ireland model).

Every student should be: a critical thinker, a problem solver, an effective communicator, an innovator, a self-directed learner, an effective collaborator, information and media literate, civically engaged, globally aware [6].

Possible targets of changes: collaboration, sharing and assessment (teacher-teacher, pupil-pupil, teacher-pupil), secure broadband internet connection and email, all spectrum and availability of educational resources from a variety of guaranteed sources, online classrooms, text and video conferencing, eLearning, podcasts, one-to-one feedback between pupil and teacher and parents.

ICT demands: students want to access new information regardless the time and space. ICT-education should be cost-efficient. ICT-education should be learner centred. ICT-education should develop learning skills and competencies [11].

Barriers to use of ICT in schools (potential risk points): lack of hardware and common infrastructure and connectivity, overcrowded curriculum, lack of teacher support, non-systemic access, reliability, consistency, affordability, sustainability and value for money of network and ICT. How do we turn our classrooms into learning engines? Pay attention to our children intensely rich information experiences.

## 11. BENEFITS OF INTERNATIONAL COLLABORATION IN EDUCATION

Benefits can include wealth creation, such as consultancy and advisory work, and the recruitment of more international students. Staff and students gain new skills and have more enthusiasm. Gain or improve language skills and cultural awareness. Exchanging ideas and best practice with colleagues across the world.

Virtual communities of learners and teachers are based upon 24/7: communication, collaboration, collective learning, collective competencies, collective memory, collective intelligence.

## 12. SUMMARY

Many of today university majors did not exist 10 years ago (new media, organic agriculture, e-businesses, digital atmospherology, nanotechnology). What will they study 10 years from now? Years it took to reach a market audience of 50 million: radio 38, TV 13, PC 4. Number of internet devices: 1984 – 1 000, 1992 – 1 000 000, 2006 – 600 000 000. The number of text messages sent and received today exceeds the population of the planet. The internet started being widely used by the general public in early 1995. There were more than 2,7 milliard searches/month performed on google in 2006. To whom where those questions directed before google? More than 3 000 books are published – daily. The amount of technical information is doubling every two years. By 2010 it is predicted to double every 72 hrs. The top 10 jobs that will be in demand in 2013 did not exist in 2007.

It is estimated that a weeks worth of New York Times contains more information than a person was likely to come across in lifetime in the 18th century. It is estimated that 1,5 exabytes (1,5 x 10<sup>18</sup>) of unique information were generated worldwide in 2006. That is estimated to be more than in the previous 5 000 years. For students starting a four-year technical or college degree, this means that half of what they learn in their first year of study will be outdated by their third year of study. The fiber is already there. They are just improving the switches on the ends, which means the marginal cost of these improvements is effectively 0\$. By 2023, when 1st graders will be just 23 years old and beginning their first careers it only will take a \$ 1 000 computer to exceed the capabilities of the human brain.

We are currently preparing students for jobs and technologies that do not yet exist. . . using technologies that have not been invented yet . . . in order to solve problems we do not even know are problems yet [4]. „We cannot solve problems by using the same kind of thinking we used when we created them“ (A. Einstein).

Parents could ask school board: are you providing the resources and training necessary to prepare students to be successful in 21st century society. . . and ask a principal: how are you helping my children become literate in the 21st century [4]?

## 13. REFERENCES

- [1] Austin, R.: E-Schooling; a critique of ICT policy and practice (evidence from Northern Ireland). Available at: [www.ucet.ac.uk/ac05raustinc9.ppt](http://www.ucet.ac.uk/ac05raustinc9.ppt)
- [2] Colwell, R.: IT Ariadnes thread through the research and education labyrinth. Educause review, vol. 35, 2000, May/June, pp. 15-18.
- [3] Estrin, J.: High level shifts in the networking market. Educause review, vol. 35, 2000, March/April, pp. 12-18.
- [4] Fisch, K: Did you know? Shift happens. Available at: <http://thefischbowl.blogspot.com>
- [5] Frand, J.L.: Changes in students and implications for higher education. Educause review, vol. 35, 2000, September/October, pp. 15-24.
- [6] Levin, D., Stein, B.: Partnership for 21st Century Skills, 2007. Available at: [www.usmayors.org/workforce/documents/2007win-levin.ppt](http://www.usmayors.org/workforce/documents/2007win-levin.ppt)
- [7] Meško, D. et al.: Informatics project of Slovak educational system (internal document), June 2007, 97 pp.
- [8] Alva, J. K.: Remaking the Academy. Educause review, vol. 35, 2000, March/April, pp. 32-40.
- [9] Twigg, C. A.: Institutional Readiness Criteria. Educause review, vol. 35, 2000, March/April, pp. 42-51.
- [10] Conlon, T.: “Teaching them Accordingly”: the New Literacies and Teacher Education. UCET Conference 2005. Available at: <http://www.ucet.ac.uk/ac05tconlonb3.ppt>.
- [11] Šťastná, V.: Lifelong learning for Equity and Social Cohesion. Available at: [http://www.bologna-bergen2005.no/EN/Bol\\_sem/Seminars/040604Ghent/040605\\_CoE.ppt](http://www.bologna-bergen2005.no/EN/Bol_sem/Seminars/040604Ghent/040605_CoE.ppt).

## THE AUTHOR



**Dušan Meško**, University Professor, General Director of Dept. of Informatics, Ministry of Education of Slovak Republic, Bratislava  
Work experience:  
**Previous Position:** University Professor,

Comenius University, School of Medicine, Martin (1981-)

**Membership of Professional Bodies:** Board for Informatics in Education Ministry of Education of Slovak Republic in Bratislava (2006-), Board for Hospital Informatics System, University Hospital in Martin (2001-), Board for Information and Communication System at Comenius University in Bratislava (1997-2001)

**Professional Experience:** Research activities (computer analysis of heart activity, occupational risk management), Graduate of Distance Education Course on Managing University-Industry Partnership“ IIEP UNESCO Paris and ECSM Brussels (2001), co-ordinator of Phare-Tempus Programs (ERQUAM, IQATFOQ, MED-NET, Management of Higher Education Institutions (1996-2001)

**Professional Lecturing Experience:** Comenius University, School of Medicine in Martin: all subjects associated with Internal Medicine, University of Twente, Enschede, Netherlands (2002), University of Limerick, Ireland (2001), University of Edinburgh, Scotland, (1999), Mayo Clinic – Rochester, Minnesota, USA (1995). European and World Congresses Lecturer (Athens, Zaragoza, Copenhagen, Philadelphia, Jerusalem, Zurich, Beer Sheva, Muscat, Beijing)

**Publications:** Textbook – Editor in Chief: Differential Diagnosis by Laboratory Medicine (Springer – Germany, Springer – India, Medico-Pharmaceutical PH – China, Paschalidis – Greece), Textbook – Editor in Chief: Medinfo (Osveta – Slovakia). Scientific Papers: 70+, scientific abstracts: 200+, scientific lectures: 270+





## THE VIRTUAL MOBILITY AND THE INTERUNIVERSITY STUDY

Petra Poulová  
University of Hradec Králové, Faculty of Informatics and Management  
Rokitanského 62, Hradec Králové, 500 03, Czech republic  
Petra.Poulouva@uhk.cz

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The modern term Virtual Mobility represents the use of information and communication technologies to obtain the same benefits as one would have with physical mobility but without the need to travelling. Since the academic year 2005/06 University of Hradec Králové, University of West Bohemia, Plzen and Tomas Bata University, Zlín have participated in the RIUS project (Initiation of the Inter-university Study in the Network of Selected Universities in the Czech Republic). The main objective of the RIUS project is to build a substructure of the network of selected universities in the Czech Republic and enable creation of working virtual interuniversity space where blended and distance form of study could be run via eLearning. Students have possibility to take part in educational activities guaranteed by experts with great didactic skills from various universities. The experience gained in the national RIUS project is fully utilized in an international context in the EVENE project solving which deals with virtual study mobility in the environment of Faculties of Economics at selected European universities.

**Keywords:** Education, E-learning, Virtual mobility, Virtual university

### 1. MOBILITY AND HIGHER EDUCATION

Importance of internationalization and mobility is growing in today's society and the same trend is reflected in the university education.

The term of **mobility** has been connected to the SOCRATES/ERASMUS programme; at the end of 2007 it will have been 20 years. Thanks to this programme more than 1.5 million of students have had possibility to study at universities abroad for three months at least. Czech universities have been participating in the ERASMUS programme for 10 years and more than 25 thousands of students have studied abroad [8].

The first action programme remained the framework of reference for all European Union educational programmes until the Treaty of Maastricht was signed in 1992 (articles 149 and 150). The programme set out three priority areas regarding higher education

- to increase cooperation between higher education institution;
- to improve possibilities for academic recognition of diplomas and periods of study;
- to encourage the freedom of movements and mobility of teachers, researchers and students [12].

Programme **ERASMUS** was established before this official Treaty in 1987. ERASMUS was created as grant scheme for the mobility of higher education institutions; it also included the ECTS (European Community Course Credit Transfer System). After 1st November 1993 arose three basic tracks educational programme:

- SOCRATES for the field of education, which is relevant for higher education mainly though ERASMUS and Lingua (language teaching and instruction);
- the Leonardo da Vinci programme for vocational training
- Young for Europe for activities outside the education system [12].

These programmes for the period 1995 - 2006 included the "traditional" activity tracks of promoting physical mobility, building cooperation networks and improve language skills. But at the same time the importance of virtual mobility (providing a European experience for those who are unable to study abroad) was stressed.

In 1998 the ministers of education of Germany, France, the UK and Italy signed the Sorbonne declaration. It was a call for a **European Area of Higher Education**, in which the European higher educational systems would be harmonized following bachelor-master model.

One year latter all ministers of the European Union and the associated countries signed the **Bologna declaration**, which define clear goals to be reached in 2010:

- enhancing the comparability of Europe's higher education systems on the basis of a two-cycle system, supported by the ECTS-compatible credit system
- enhancing the employability and mobility of European's citizens
- improving the competitiveness of Europe's higher education as a whole [12].

## 2. VIRTUAL MOBILITY

In today's society, called information or knowledge one, the **information and communication technologies (ICT)** play an important role which enable removing geographical obstacles, speed up communication and make some processes more effective.

ICT not only form an industrial sector, but also pervade all other sectors as integrating and enabling technologies. ICT change society and their production and use have an important impact on developments in economic, social and environmental areas [3].

On the other hand, the ICT influence is not only positive, it may build new, still unknown barriers (e.g. digital gap), speeding the communication does not always mean higher effectiveness, etc.

But the world of education has changed immeasurably over the last fifteen years. Technology is allowing students to be more flexible as to the time and place of learning in ways that were unimaginable then fifteen year ago.

The use of ICT in the field of university mobility is quite new and interesting way.

Staying at home students and teachers can get international and in other respects unattainable expertise via the use of ICT.

*Virtual mobility means the use of information and communication technologies to obtain the same benefits as one would have with physical mobility but without the need to travelling.* [4]

In the frame of the Being Mobile project the expert team defines virtual mobility in Higher Education Institution as a form of learning which consists of virtual components through an information and communication technologies supported by learning environment that includes cross-border collaboration with people from different backgrounds and culture working and studying together, having the enhancement of intercultural understanding and exchanging knowledge as its main purpose. [2]

The virtual mobility may be defined from another point of view – it is the way of collaboration of people from different backgrounds and cultures, working and studying together, and crossing borders in not a necessity any more. This is called **interuniversity study** in Czech educational environment.

Virtual mobility and interuniversity study fit well in the context of the Bologna process and e-learning Action Plan. The aim of the Bologna process is to create a European Higher Education Area. And one of its objectives is to facilitate interuniversity mobility and co-operation among universities.

According to the type of virtual mobility student is free to choose his professor regardless of the geographic distance that might exist between them.

Studying in a virtual university enables the student to acquaint himself with different educational and learning

systems. This way he improves his adjustability to different levels of culture and philosophy in the area of the university. [1]

## 3. CATEGORIZATION OF THE VIRTUAL MOBILITY

According to the wide definition the virtual mobility means a broad range of various activities divided into several categories and types.

This categorization can be done in different ways, using different views and there is no generally accepted set of categories.

Literary sources categorize activities

- according to the use of *virtualization*: totally virtual, partially virtual, dual or mixed;
- based on the used *technology*;
- based on the *educational aspects* - the teaching and/or learning scenario that has been used.

The expert team of the Being Mobile project based their typology of virtual mobility activities mainly on the terms in which the virtual mobility activity takes place [2].

They identified four main types:

- a virtual course (as part of a programme) or seminar (series) at a Higher Education Institution;
- the whole programme at a Higher Education Institution;
- virtual student placements;
- virtual support activities to physical exchange.

The finally mentioned categorization means to be the most suitable one. Single types are described according to [2]:

### A virtual course or seminars at a Higher Education Institution

This category contains activities which focus on the virtual course and are part of the whole study programme at a Higher Education Institution.

Students participate in Virtual Mobility only for a single course or seminar (series) and the rest of their learning activities take place in traditional way. There are two subtypes:

- collaborative arrangements;
- non-collaborative arrangements.

*Collaborative arrangements* hold those parts of a course, seminar (series) or other educational services of the awarding institution and are provided by a partner in another country, while non-collaborative arrangements include branch campuses, offshore institutions, corporate and international institutions whereby study programmes, parts of a course of study, seminar (series) or other educational services are provided directly by an awarding institution in one country to another country or countries [11].

*Collaborative arrangements* give the institutions the same roles and share creating and using courses.



Non-collaborative arrangements appoint one Higher Education Institution or Higher Education organization to lead the whole organization.

The main difference consists in the fact that there is no common consultation between the participating institutions - all communication goes through the leading organization.

#### The whole programme at a Higher Education Institution

This is a complete virtual study programme at a Higher Education Institution giving students from different countries or institutions the chance to take this study programme without having to go abroad or to another place for a whole academic year.

#### Virtual student placements

Using information and communication technologies supports some forms of Virtual Internship with a foreign company. Student placements are organized between an institution and a company in another country.

#### Virtual activities supporting the physical exchange

Virtual mobility opens up possibilities to both better prepare and follow-up students who take part in a physical Erasmus exchange.

A preparatory language and "cultural integration" course could be provided by the host institution supported via information and communication technologies.

At the end of the physical exchange, students can also keep in touch with their new friends and finish their common research project.

### **4. EXAMPLES OF VIRTUAL MOBILITY PROJECTS**

The European Commission and some national agencies actively promote Virtual Mobility by providing financial support to educational projects in this field.

There are several examples of Virtual Mobility projects in the European area:

#### VENUS – Virtual and E-mobility for Networking Universities in Society

This project implements two different models of virtual seminars: a virtual seminar series of monthly seminars during the academic year and a one-week virtual summer school. The seminars consist of three main parts: interactive preparatory activities, seminar delivery (presentation, localisation and discussions) and interactive follow-up activity. Seminars aim at promoting European citizenship, collaboration and personal development. [5]

#### EVICAB – European Virtual Campus for Biomedical Engineering

This project sets up an online platform on which the different partner universities and universities outside the consortium can offer their courses. These courses are offered to EVICAB free of charge. The responsibility for each course, its maintenance and its delivery remains within the universities. Each university offers its courses to the online programme, it can also take out courses from the online programme into its own study programme. [6]

#### REVE – Real Virtual Erasmus

The REVE project aims to enhance the impact and efficiency of traditional Erasmus programmes through the development and support of Virtual Erasmus actions. [7]

### **5. STARTING-POINTS FOR VIRTUAL MOBILITY AT THE UNIVERSITY OF HRADEC KRÁLOVÉ**

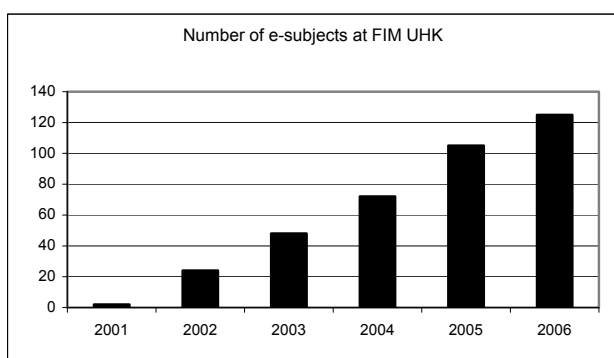
University of Hradec Králové consists of three faculties: Faculty of Education, Faculty of Informatics and Management and Faculty of Humanities. From the perspective of utilization of e-learning, the Faculty of Informatics and Management has been the most active one.

#### Brief history

Development of e-learning activities at the University of Hradec Králové has gone through several phases likewise development at other partner universities:

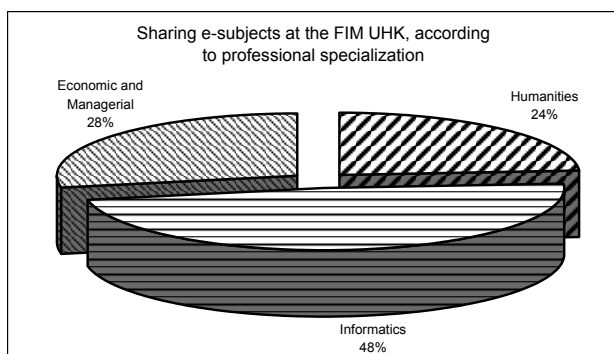
- *Utilization of shared information sources* (1991 ->)  
Teaching staff can place supportive electronic study materials into shared disc space so called SAMPLES
- *Utilization of Internet to support the process of education* (1994 ->)
  - Use of e-mail communication among teachers and students. Both staff and students get automatically their own university e-mail address and box at their enrolment into university.
  - Creation of web pages supporting education of single teachers (<http://lide.uhk.cz>)
- *Development of multimedia applications on CDs supporting the process of education* (1996 ->)
- *Support of the process of education with electronic tools* (1996 ->)  
Consecutive implementation and improvement of single tools supporting the process of education:
  - Information system ISIT (Internet application)
  - Electronic timetable SYLABUS Plus (Internet application)
  - Registration for exams via iExam, later ISIT/Events (Internet application)
- *First attempts with on-line courses* (1997 -1999)  
Creation and implementation of on-line courses for academic staff within the MUDILT project (Multimedia and Distance Learning for Teachers)
  - Internet in the Process of Education
  - Modern Presentation and Education
- *Project cooperation with prominent European centres focused on e-learning* (1996 ->)  
European projects support (TEMPUS, SOCRATES/MINERVA, GRUNDTVIG, eLearning, ...)
  - MUDILT (Multimedia and Distance Learning for Teachers)
  - PATTER (Public Administration Trainers Towards Europe)
  - E-DILEMA (e-Resources and Distance Learning Management)
  - ODL NET (Open and Distance Learning Network for Exchange Experience)
  - ICOTEL (Information and Communication Technologies in Life –Long Learning)
- *eLearning courses for further education* (1999 ->)

- *Preparation of e-courses for students (2001 ->)*
  - Creation of the project OLIVA (On-Line Education) and draft of its realization team
  - Market analysis of professional LMS and selection of an appropriate tool for educational support of students (WebCT)
  - Creation and implementation of supportive e-subjects for students of present and combined forms of study
- *eLearning as a strategic priority at the Faculty of Informatics and Management, University of Hradec Králové (2002 ->)*
  - Financial backing from University of Hradec Králové development projects
  - Imbedding of the development trends of new forms of study in the long term concept of FIM UHK till 2010.



Graph 1. Number of e-subjects at FIM UHK

Number of eLearning e-subjects created at FIM, UHK, and implemented in gradual education was over 130 till the end of the year 2006



Graph 2. Type of e-subjects at FIM UHK

## 6. THE RIUS PROJECT

The success in the implementing e-learning course in the graduate and life-long education motivated the Faculty management to decide on cooperation with another educational institution.

Since the academic year 2005/06 the University of West Bohemia, Plzen, Faculty of Informatics and Management, Hradec Králové and Faculty of Management and

Economics of Tomas Bata University, Zlín have participated in the **RIUS** project (*Initiation of the Interuniversity Study in the Network of Selected Universities in the Czech Republic*). The project belongs to those which are supported from European social funds.

The main objective of the RIUS project is to build a substructure of the network of selected universities in the Czech Republic and thus enable forming the working virtual interuniversity space where blended and distance form of study could be run via e-learning.

Gathered results of the project make up basis for continuous enlargement of the university network in the Czech Republic offering and operating interuniversity study as virtual mobility.

The aims of the project could be expressed in the following way:

- to build strong fundamentals of the network of universities and colleges and launch interuniversity study in the Czech Republic.
- to enable start of interuniversity study in the network of selected universities
- to improve quality and attractiveness of study programmes and subjects offered by single universities and colleges
- to increase effectiveness of financial means invested into blended and distance forms of study benefiting from eLearning
- to prepare universities and colleges in the Czech Republic for more intensive and closer cooperation with counterpart institutions abroad.

The whole project has a positive and beneficial impact on students from participating universities in the following areas:

- the offered subjects are supposed to be of high quality and backed by notable experts.
- students have opportunity to create individual study plans based on a wide offer of educational subjects of participating universities.
- time and place flexibility of study. [9]

Information on e-subjects offered within interuniversity study are in catalogues of subjects and in the information system of study agenda of student's "mother" university. If a student is interested in some of the "outside" subject s/he will register it into their study plan in a common procedure, so the subject will be recorded in a student's study register. Interuniversity study runs in a distance way. Only opening meetings to e-subjects and final exams are held in a traditional manner at "mother" universities of enrolled students.

At the end of the semester when the subject is finished, the tutor informs the study department of students' "mother" universities on their results. Study department is responsible for writing these results into study records of participating students who successfully completed the subject. The students are granted the reached credits (ECTS).

The project prosperously goes on in 2005/06 and 2006/07 academic years and over 1,000 students have registered into more than 80 e-subjects.

## 7. THE EVENE PROJECT

On the basis of the RIUS project experience, another one, called EVENE, arose. The EVENE project creates a core network of traditional European higher education institutions operating in the field of Economics and Management study [13].

## 8. REFERENCES

[1] Anastagiades, P.,S. (2002) Virtual Universities: a Critical Approach. Proceeding of International Conference on Computers Education (ICCE'02)

[2] Bijmens, H. Boussemaere, M. (2006) European Cooperation in Education Through Virtual Mobility – A Best-Practice Manual,  
[http://www.elearningeuropa.info/out/?doc\\_id=9957&rsr\\_id=11436](http://www.elearningeuropa.info/out/?doc_id=9957&rsr_id=11436)

[3] Casal, C.,R., Wunnik, C., Sancho, L.,D. (2005) How will ICTs affect our environment in 2020?. Foresight: the Journal of Future Studies, Strategic Thinking and Policy. 2005, 7, 1. pp.77

[4]<http://www.elearningeuropa.info/main/index.php?page=glossary&abc=V>

[5] <http://www.venus-project.net/>

[6] <http://www.evicab.eu/>

[7] <http://reve.europace.org/>

[8] Národní agentura pro evropské vzdělávací programy, <http://www.naep.cz/>

[9] Poulová, P, Černá, M., Hán, J., Zimola, B. (2006) Initiation of the Inter-University Study in the Network of Selected Universities in the Czech Republic. Virtual University. E-Academia Bratislava, pp. 115-9.

[10] Shabha, G. (2000) Virtual universities in the third millenium: an assessment of the implication of teleworking on univer sity buildings and space planning. Facilities, 2000, 18, 5/6, pp. 235-244

[11] UNESCO/Council of Europe. (2001). Code of Good Practice in the Provision of Transnational Education; <http://www.unesco.org/education/studyingabroad/index.shtml>

[12] Wit, K. (2003) The Consequences Of European Integration for Higher Education. Higher Education Policy, 2003, 16. pp.161-178

[13] Zimola, B., Poulová, P., Hán, J. (2006) eLearning project EVENE - Erasmus Virtual Economics & Management Studies Exchange . Virtual University. E-Academia Bratislava, pp. 98-100.

## THE AUTHOR



RNDr. Petra Poulová, Ph.D.  
Univerzita Hradec Králové,  
Fakulta informatiky a managementu  
Rokitanského 62  
Hradec Králové, 500 03  
[Petra.Poulova@uhk.cz](mailto:Petra.Poulova@uhk.cz)

Work experience:

2002 – Vice-dean, Faculty of Informatics and Management,  
University of Hradec Králové

1998 – 2002 Head of the Institute of Further Education,  
Faculty of Informatics and Management,  
University of Hradec Králové

1991 – 1998 University of Hradec Králové

Several international eLearning projects in various EU programmes (TEMPUS, SOCRATES/MINERVA, Grundtvig, eLearning). Over 100 academic and professional publications.

Currently active participation in the EUNIS-CZ (European University Information Systems Česká republika) as member of executive committee and ČADUV (Czech Association of Distance University Education) as member of the board.



## HP MANAGED LEARNING ENVIRONMENT



*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

Boris Tvaroška  
Hewlett-Packard Slovakia s.r.o.

Abstract: *"HP Managed Learning Environment".*

The presentation cover The HP's Managed Learning Environment (MLE) as complex ICT support of education process. MLE can provide effective way for one learning activities, but also supports complex colaboration among participants, including students, teachers, parents, etc. MLE consists from integrated set of tools ranging from knowledge and collaboration portals, e-learning through Virtual Classroom, content creation tools and others.

The presentation will use the existing HP implementation in EU countries and as an example of effective use of ICT in learning process.

(Power Point Presentation)





5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## SOCIAL LEARNING - HOW WEB IS CHANGING THE WAY WE PROCESS INFORMATION AND KNOWLEDGE

Kimmo Salmenjoki<sup>1</sup>, Aki Vainio<sup>1</sup>, Fredrik Paulsson<sup>2</sup>

<sup>1</sup> University of Vaasa, Dept. of Computer Science, Box 700 65101 Vaasa, Finland

kimmo.salmenjoki@uwasa.fi, <http://www.uwasa.fi/~ksa/>

aki.vainio@uwasa.fi, <http://www.uwasa.fi/~akivain/>

<sup>2</sup> Umeå University, Dept. of Interactive Media and Learning, SE-90187 Umeå, Sweden

fredrik.paulsson@educ.umu.se, <http://www.iml.umu.se/>

**Abstract.** We will consider how web (World Wide Web) environment has affected learning in and beyond classrooms. The paper shows how learning is turning towards an open ended dialogue between the learner and various online communities. The essential role of semantic web and its implications on generic knowledge processing will be described. We oversee some knowledge, activity and process based models of supporting knowledge intensive tasks needed in our networked world and online learning communities. Based on various approaches taken by different online learning organizations and virtual communities, both in Finland and international, some generic architectures and models of knowledge organization in web based learning or e-learning will be described. Practical and technical examples in universities and learning societies of the Kvarken region in the Baltic Sea will be briefly described to support our point of view.

**Keywords:** e-learning, VLE, knowledge management, software architectures

### 1. INTRODUCTION TO SEMANTIC WEB AND KNOWLEDGE ORGANIZATION

In this paper we show how web changes the information sources of web to more knowledge oriented and context aware counterparts. In combining the metadata and processes of information organization we propose concepts to build personal or context-aware knowledge services that could be used as elements in e-learning. In this situation the teacher is taking more the role of a tutor and expert in supporting the individual learning processes instead of controlling and supervising them. For more pedagogy focused issues in conceptualizing shared content and user context see [36].

The semantic web development, coordinated by W3C (World Wide Web Consortium), is a very important initiative affecting the future architecture of the web environment for our purposes. It can be used to address problems of personal and social knowledge management, including information search and consumption, in new ways. Advanced semantic web technologies also enable means of automated information access and context based access to machine-processable semantics of data. Besides web based information metadata will take a crucial role in today's and tomorrow's web. Ontologies are decentralized vocabularies of concepts and their relations, which can be used with existing web content providing today islands of semantically rich web pages. Ontologies are used for presenting this metadata and it enables computers to categorize, retrieve, query and deduce information from the web. When semantically rich information is combined with methods or services of personally relevant information access, they together facilitate online knowledge sharing

and reuse. Thus semantic web will be a core component of future knowledge management and e-learning. Using semantic web we show how to change the information sources of the web to more knowledge oriented and aware counterparts.

The web service initiative and standards coordinated by W3C effectively adds online, fine grained software components to the static information contained in the classical web. In principle, it can offer distributed services of knowledge over communication networks and online communities. Web services create new paradigms for both the delivery of software access methods and models by which information and other services can be composed for online access.

In software engineering, the concepts of Service Oriented Architectures (SOA) and Software Factories provide new methodologies of delivering knowledge-based services. Web service technology can be combined with semantic web technology to deliver a new breed of information services. Web services provide an easy way to make existing (or new) building block type components available to other applications via the Internet. However, currently, web services are essentially only described using semi-structured natural language mechanisms. This means that considerable human intervention or software engineering is needed in practice to find and combine individual web services into web based applications [32].

The semantic web will enable the access of web resources by semantic content rather than just by keywords. Resources and web services defined in semantically rich format can be automatically understood and processed by machines. This will enable the realisation of semantic web services, involving the automation of service discovery,

acquisition, composition, and monitoring of dynamic information sources and components [25, 33].

The essential role of semantic web and its implications on generic Virtual Learning Environment (VLE) applications and e-learning scenarios will be described from a technical point of view in this paper. In combining the metadata and processes of information organization using XML, XML Schemas, RDF, RDFS and OWL we propose to build personal knowledge services that could be used in providing ubiquitous and universal knowledge islands for e-learning. Based on various approaches taken by different online learning organizations, both in Finland and internationally, some generic viable architectures and models of knowledge organization in web based learning or e-learning will be described. In next chapter we oversee some knowledge, activity and process based models of supporting knowledge intensive tasks that today's students and ICT technology usage in general need in our networked world and communities.

## 2. APPROACHES AND MODELS OF E-LEARNING FOR NETWORKED COMMUNITIES

In this chapter we will overview the information and software architectures of online communities and applications. Our goal is to provide generic means and ends for sharing knowledge online. Mostly classical web approaches like email, message boards, portals, blogs and live online communities are taken as the tools and means of sharing the user experiences in VLEs of today. However, these will result in a too scattered agenda for focused online learning sessions and all learners will work pretty much asynchronously and in uncoordinated manner in various VLEs like Moodle [24] or WebCT [44]. Here we see a big conceptual mismatch between existing VLEs and present Web 2.0 like community approaches springing up in the social online communities like Flickr, De.licio.us or Amazon's Mechanical Turk [8, 5, 1].

For more systematic approaches more coherent approaches have to be used for the presentation of the content. Using the approaches of previous chapter for both information sources and their access as services we have to use existing standards, technologies and tools for information organization and sharing in e-learning scenarios. The most well-known and widely used standards in online learning contain technical specifications like metadata related IMS [11] and SCORM [37] that together with standardization communities like IEEE LOM with LTSC [10] community expand to recommended practices and guides of learning technology. In Europe there have been some projects like ELF [13], ETB [7], CEN-ISSS Learning Technologies Workshop [4], LIFE [19] and e-Framework [12] to coordinate the online communities and resources. These all use XML, vocabularies and repositories with related technologies and tools to provide coherent and hierarchically organized learning resources consisting of learning objects as building blocks. The most well known effort in online learning, the Open Courseware by MIT provides also a service type interface in OKI OSID for connecting to these online learning objects, [38]. The

overall structure of the parts in the ELF framework gives a nice non-technical overview of all aspects of building online learning communities:

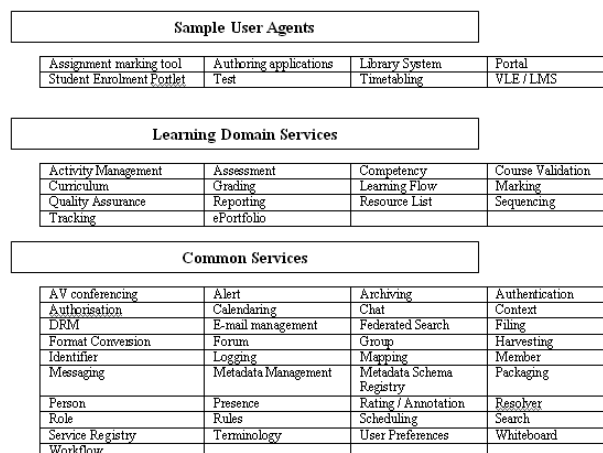


Fig. 1. ELF e-learning framework [12]

In Figure 1 the agents currently represent students and teachers, but in the semantic web view these can also presented agents that are automated participants either for help, tutoring, communication. These agents can be technically composed using the methodologies of [20]. Further on, these software agents can be used to automatically create new services from already published services, with potentially huge implications for models of e-learning also. Using the agent approaches with multi agent systems (MAS) we will start to see automated systems of knowledge mining that could be used in e-learning scenarios also.

The big coordination and consortium approaches like IMS and IEEE provide highways for big academic and commercial partners in establishing coordination for educational resources. Due to their size and complexity these approaches have been slow to mature and develop further. However, to address the previously discussed dynamic nature of today's web environments, other approaches have to be used. For this end, we will next describe SCAM (Standardized Contextualized Access to Metadata) framework developed by IML at Umeå University in Sweden [42], in cooperation with the KMR group at KTH, Sweden [15]. While being based on RDF, the SCAM system is still compliant with IMS/LOM metadata and IMS content packaging. The advantage of SCAM is that it is designed to provide a SW infrastructure and SW services to be used by other applications or services in the learning infrastructure. This is for example the case with the VWE (Virtual Workspace Environment) framework [28] for build up of modular VLEs, as can be seen in figure 2. The goal of SCAM is to provide an open source based conceptual framework for dynamic semantically described content, while VWE provide the dynamic functionality of the VLE, using a modular approach. With this, VWE and SCAM are able to provide a platform for building new e-learning (and other) applications utilizing online metadata, information structures and communities extensively. Some examples of



the new e-learning applications developed in Sweden that are built on top of, or using SCAM services, are ePortfolio [27], the Nimble Learning Object Repository, and VWE [35]. These have been actively used in the Swedish learning organizations and online communities for coordinated national approaches.

The core of the VWE functionality is its taxonomy, which is described in figure 2:

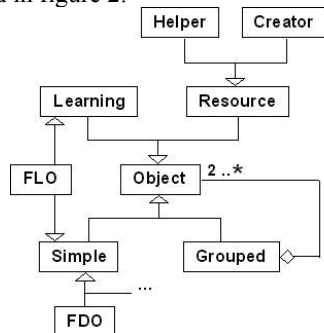


Fig. 2. The VWE taxonomy of concepts for dynamic learning objects [30]

Here various learning object types (Simple LO, Resource O, Grouped LO) utilizes the RDF descriptions of the semantic web towards e-learning and dynamic learning situations online. These LO use the core Fundamental Learning objects FLO and Fundamental Data Objects as their data resources and bundle up further into learning modules. The VWE/SCAM frameworks uses core open source semantic web tools, like Jena, with server side Java technology to provide five core services and interfaces to construct, share and access the online learning resources in more fine grained manner than today's structurally static VLEs.

Using this VWE/SCAM software framework, existing (and newly developed) learning objects and modules can be accessed using the in-built VWE services, the VWE Kernel and VWE tools, which are constructed as modules, using Creator Resource Objects. By these concepts one is able to provide three different contexts (Creator, Helper, Learner) to any resource or learning object. These views can also be accessed via software, so the framework provides a wide variety of adaptability beyond the present structurally static VLEs. Through the IMS/LOM compatibility of the SCAM framework these learning communities can even be coordinated administratively on national scale like in [13, 30,40].

Some other examples of similar approaches are the commercial products and services provided by the Giunti Labs Inc to access MIT Open Courseware type learning resources [19] and the SOA for the JISC repository at [29]. For more technical overview of the online learning systems, see [10]. For more human oriented approaches for building online learning communities, see SIOC [5], for example.

### 3. CASES OF COMMUNAL E-LEARNING

One approach to VLEs is the use of wikis. Many teachers have negative experiences with students relying too much on Wikipedia, which can include false or incomplete

information and students do not crosscheck as often as they should. However, as a tool for collaborative learning, wikis can be an excellent choice. One of Wikipedia's sister projects, Wikiversity, has taken this approach. It implements Learning projects, which are community projects started by a group of people with an interest in learning about common subject. In the beginning of the project a goal is set, although many of these projects are more or less open ended. Then the participants work to gather knowledge and information on the subject from various sources and attempt to explain the subject to each other in a meaningful way. Analyzing the information is also a part of the learning and dividing the information into separate pages and forming the links between them in a meaningful way can help the student understand the subject more thoroughly. Wikis are now becoming an important part of learning environments and both Moodle [24] and now defunct OurWeb incorporate one [22]. OurWeb included an excellent tool which enabled the users to include highlights and comments on the text, which might be seen as a modern version of underlining parts of a book and writing comments in the margins [22].

Some wikis incorporate semantics by enabling the system to identify metadata from the pages themselves or their relations to other pages. These are known as semantic wikis. Other wikis can extract some information from the relations of the pages and the structures used, but semantic wikis attempt to make these relations more explicit by including information on the type of the relation (e.g. inheritance or association). Semantic wikis can take several approaches to semantics. In some cases semantics can be simple annotation to the links, describing the relation between the two pages, in other cases semantics can be separate fields within the page, which help machines to understand the content, not just the structure.

Besides the instructive examples of semantic web based knowledge processing discussed in previous chapter, we will consider next some real life cases of our e-learning in shared Technobothnia laboratories and in the Baltic Sea Network BSN with its Baltic Sea Open University BSOU concept [2]. In comparing the curricula of the about 30 BSN partner higher educational institutes, we used PiggyBank [23] to harvest the web sites of the units. Although PiggyBank automates the conversion of web based information to semantic format, we still had to do considerable manual work and scriptlets in order to align the curricula contents of the different units. This semantic information was inserted to the BSOU portal [17]. More technical details of this case can be found in [16]. However, this case should still be extended to use the standardized structures discussed in previous chapter to provide more dynamic and coherent coordination to the overall BSOU curriculum.

As a second example, the Technobothnia laboratory in Vaasa provides high technology facilities for teaching and research of technology, see [40]. As an interface to one of its labs, we established a MyHome web based portal for its Digital Livingroom laboratory. To provide user context related or automated services in the DLR space and portal, we have extended the portal with the core semantic web platform open source components, Jade agent platform

together with the COBRA framework [8], which provides a test-bed for providing context aware services to users residing in some physical spaces. Even in this case, the crude semantic web descriptions provide means of communicating and sharing the home like environment and its digital (media and other) services. With sensors and automated software components implemented as agents, this system can be extended further to provide intelligent environments. A similar approach could also be used for e-learning purposes.

We have used the agent approach for the KMO communication sharing; see [15, 32, 36] for more details. When this approach is used for e-learning, we could use the agent architecture

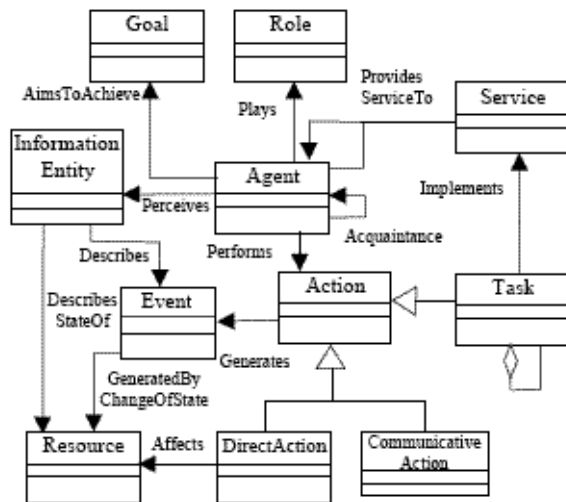


Fig. 3: Overall agent structure for shared communication using agent architecture of MESSAGE project, [3].

This software agent architecture should be combined with novel learning object structures with context like in Figure 2 of the VWE framework to enhance and support the activities and processes of individual online learning. Based on these considerations and examples we present the following thesis for the future of online e-learning:

- Individuals, both students and teachers are acting as consumers and producers in future e-learning in P2P manner
- Closed technological platforms are overridden either by personalized information services and agents or semantically organized online communities.

#### 4. CONCLUSIONS

Various socially organized online communities, like web based learning environments including web portals, blogs, Wikipedia, online games and other mobile and Web 2.0 type applications provide less coordinated models of future online learning environments. For e-learning purposes specifically, the cumulative and hyperlinked approaches of individualized e-learning knowledge sources are natural extensions for the future constructive learning processes. The individualistic approaches advocated by the present

society in e-learning have been discussed with some shared learning example scenarios.

When these are combined with learning related metadata and novel new architectures like VWE for the VLE construction we will start to see the new breed of user assisting agents and tutors that will be the e-learning of our future. Some unorthodox and innovative approaches for individual learning has to extend the present philosophy of e-learning in open network environments beyond the closed e-learning environments like Moodle towards CSCW (Computer Supported Collaborative Work) and CSCL (Computer Supported Collaborative Learning).

#### 5. REFERENCES

- [1] Amazon's Mechanical Turk, <http://www.mturk.com/mturk/>
- [2] Baltic Sea Network, <http://www.balticseanetwork.org/>
- [3] G. Caire : Agent Oriented Analysis using MESSAGE/UML., <http://www.auml.org/auml/supplements/Caire-AOSE2001.pdf>
- [4] CEN-ISSS Learning Technologies Workshop, <http://www.cen.eu/cenorm/businessdomains/businessdomains/iss/activity/wslt.asp>
- [5] De.licio.us, <http://del.icio.us/>
- [6] DERI: Semantically-Interlinked Online Communities, <http://sioc-project.org>
- [7] European Treasury Browser, <http://etb.eun.org>
- [8] Flickr, <http://www.flickr.com>
- [9] H. Chen: COBRA, <http://cobra.umbc.edu/>
- [10] IEEE Learning Technology Standards Committee, <http://ieeeltsc.org/>, <http://www.ieeeltsc.org/standards>
- [11] IMS Global Learning Consortium Inc.: Learning Resource Meta-data specification, <http://www.imsglobal.org/metadata/index.html>
- [12] JISC: The e-framework for education and research, <http://www.e-framework.org>
- [13] JISC, DEST: The e-learning framework, <http://www.elframework.org>
- [14] J. Koljonen, O. Kanninen, H. J. Salminen, J. Alander, K. Salmenjoki, N.-E. Eriksson, E. Fällman : Cross border education- Case study of engineering courses, New Horizons in Industry, Business and Education (NHIBE 2005), 25-26.8.2005, Corfu, Greece

- [15]Kungliga Tekniska Högskola KTH: Knowledge Management Research Group, <http://kmr.nada.kth.se/>
- [16]A. Kumarresan, L. Uden, K. Salmenjoki: Designing usable collaborative e-mail using activity theory, Information Society 2006 multiconference, Intelligent systems conference, Ljubljana, Slovenia, ISBN 961-6303-71-6, p. 279- 284
- [17]S. Kheng Lee, Yaroslav Tsaruk, Kimmo Salmenjoki, Lorna Uden: Web mining with PiggyBank for automated description of the Baltic Sea Open University, Information Society 2006 multiconference, Intelligent systems conference, Ljubljana, Slovenia, ISBN 961-6303-71-6, p. 290- 293
- [18]S. Kheng Lee, Yaroslav Tsaruk, Kimmo Salmenjoki: BSOU portal, <http://ttwin.techno.uwasa.fi/bsou%5Fportal/>
- [19]LIFE, <http://life.eun.org/>
- [20]M. Luck, R. Ashri, M. d'Inverno: Agent-Based Software Development (Agent-Oriented Systems), Artech House, 2004
- [21]Massachusetts Institute of Technology MIT: Open Courseware, <http://ocw.mit.edu/index.html>
- [22]M. Miettinen, J. Kurhila, P. Nokelainen, H. Tirri, OurWeb - Transparent Groupware for Online Communities. Pp. 53-61 in the Proceedings of the IADIS International Conference on Web-Based Communities 2005 (Algarve, Portugal, February 2005).
- [23]MIT: PiggyBank project, [http://simile.mit.edu/wiki/Piggy\\_Bank](http://simile.mit.edu/wiki/Piggy_Bank)
- [24]Moodle, <http://moodle.org/>
- [25]M. Nagarajan (2006). Semantic Annotations in Web Services. In J. Cardoso & A. P. Sheth (Eds.), *Semantic Web Services, Processes and Applications* (pp. 35-61): Springer Science+Business Media, LLC
- [26]F. Paulsson, Learning Technology Enterprise Specification , Position paper to be published in LIFE roadmap on interoperability, L. Anido, Editor. 2006
- [27]F. Paulsson: SCAM software, <http://scam.sourceforge.net/index.html>
- [28]F. Paulsson, M. Berglund (2006). A Service Oriented Architecture-framework for modularized Virtual Learning Environments. In the proceedings of m-ICTE2006, Seville, FORMATEX.
- [29]F. Paulsson, & J. Engman (2005, 19 - 21 October 2005). Marking the National Curriculum - a new model for semantic mark-up, eChallenge 2005 (p. 1731-1738), Ljubljana, Slovenia.
- [30]F. Paulsson, A. Naeve (2006). Virtual Workspace Environment (VWE): A Taxonomy and Service Oriented Architecture Framework for Modularized Virtual Learning Environments - Applying the Learning Object Concept to the VLE. *International Journal on E-Learning*, 5(1), 45-57.
- [31]A. Powell: A service oriented view of the JISC information environment, <http://www.ukoln.ac.uk/distributed-systems/jisc-ie/arch/soa/jisc-ie-soa.pdf>
- [32]K. Salmenjoki: Introduction to web service usage in software engineering and enterprises: A Tutorial, available online at <http://www.e-technik.fh-kiel.de/itworkshop-aveiro/proceedings.shtml>
- [33]K. Salmenjoki: Semantic Web: A Tutorial, 3rd International Workshop on Embedded Systems, Internet Programming and Industrial IT 16-17 October, 2004 Aveiro, Portugal, available online at <http://www.e-technik.fh-kiel.de/itworkshop-aveiro/proceedings.shtml>
- [34]K. Salmenjoki, Y. Tsaruk, A. Vainio: Multi-agent Approach for Knowledge Processes between Research Organisations, KMO'2006 Knowledge Management conference in Maribor, 13-14.6.2006, ISBN 86-435-0780-6, p. 134-140
- [35]SCAM: SCAM related projects, <http://scam.sourceforge.net/related.html>
- [36]K-D. Schewe, B. Thalheim: Storyboarding concepts for edutainment WIS, in H. Jaakkola, Y. Kiyoki, T. Tokuda (eds): Proc. Of the 17<sup>th</sup> European-Japanese Conference on Information Modelling and Knowledge Bases EJC 2007, p. 59-78
- [37]SCORM <http://www.adlnet.gov/scorm/>
- [38]S. Thorne, J. Kahn (2003). *O.K.I.™ Architectural Concepts* (Technical report (draft)): Massachusetts Institute of Technology
- [39]L. Uden, K. Salmenjoki, M. Hericko: Finding organizational processes and communicative knowledge patterns in a R&D collaboration network (project proposal), 2007
- [40]L. Uden, K. Salmenjoki, M. Hericko, L. Pavlič: Metadata for research and development collaboration between universities, Int. Journal of Metadata, Semantics and Ontologies, International Journal of Metadata, Semantics and Ontologies, International Journal on Metadata Semantics and Ontologies, Vol 1, Issue 4, 2006
- [41]L. Udel et al. KMO research group and conferences, <http://ttwin.techno.uwasa.fi/kmo/>, <http://kmo2007.dti.unimi.it/index.php?id=main.htm>
- [42]Umeå University: Interactive Media and Learning, [http://www.iml.umu.se/forskning/index\\_eng.html](http://www.iml.umu.se/forskning/index_eng.html)

[43] Vaasa Korkeakoulukonsortio: Technobothnia laboratory, <http://www.technobothnia.fi/en/>

[44] WebCT, <http://www.webct.com/>

## THE AUTHORS



**Kimmo Salmenjoki:** received the Master of Philosophy degree in Mathematics at the University of Jyväskylä in 1985 and a Ph.D in Mathematical Computer Science from the University of Jyväskylä, Finland in 1991. At present he is acting professor in the University of Vaasa, Department of Computer Science in web technologies. He has contributed to many research projects both locally and internationally and he has actively participated in many international conferences as participant, referee and program committee member.



**Aki Vainio:** After receiving his M.Sc. degree in Technology in 2005 (and even before that), Aki has been busy teaching a variety of courses at the Department of Computer Sciences at the University of Vaasa. In his other life, Aki is the chairman of the board and the head of research and

development for Necora System Ltd., a company dedicated to making the world a better place through database systems. In his free time, Aki has been busy taking steps into the science community with some work on knowledge management among other subjects.



**Fredrik Paulsson:** holds a position as a Senior Lecturer (Lektor) at the department of Interactive Media and Learning (IML) at Umeå University. His main research interests are modular system architectures for virtual learning environments, and Semantic web technology. Since 2000 he is a member of the Knowledge Management Research group (KMR) at the Royal Institute of technology. He is actively involved in several national and international research projects, and is, among other things, the project leader for the Semantic Web-repository, Open Source project SCAM.



## IMPORTANCE OF COMMUNICATION IN ONLINE DISTANCE EDUCATION OVER THE INTERNET

Frank Schindler

*Department of Applied Computer Science and Engineering, Faculty of Electrical Engineering & Informatics, Slovak Technical University, Ilkovičova 3, 812 19 Bratislava, Slovakia, E-mail: frank.schindler@stuba.sk*

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The main objective of this paper is to discuss importance of proper communication in an online distance education course offered via an LMS system over the Internet. To make such online education effective, it is very important that students do not feel isolated. They should be involved in problem-based learning taking part in properly chosen subject-oriented discussion forums. In addition to that they should get appropriate and prompt feedback whenever they need it. Some of it should come from the teacher and rest of it from their classmates. Most of the student work ought to be evaluated. In an ideal case teacher's evaluation of the student work should coincide with the student self-evaluation. Therefore at the very beginning of every online teaching there must be clearly defined evaluation criteria that ought to motivate students in their online work. In some instances verbal evaluation of the student work might be sufficient, e.g. by the evaluation of student work made in some discussion forums. Of course, students should not only be asked to solve online problems, but also to present online assignments and/or discuss them in a very definite manner in web-based discussion forums. We should keep in mind, that students frequently require a very fast feedback regarding their solutions in the virtual classroom. Undoubtedly that could be a quite tricky chore for every online teacher. In this paper I would like to share with you a couple of my experiences that I gained during the period of last six years of the time when I was teaching online web-based undergraduate lectures via WebTycho for the University of Maryland University College<sup>1</sup>.

### 1. INTRODUCTION

In the last decade new communication and information technologies brought about tremendous changes especially in the area of educational software tools used nowadays in the modern school. Some of them allow implementation of a „100-percent pure virtual“ learning environment in which students gain new knowledge in relatively simple and new ways. Moreover, in our everyday life we are constantly bombarded with a huge amount of new information. In order to cope with it there is a need to steadily improve quality and level of education and learning. Learning Management Systems (LMS) seem to become a widely accepted instrument used in distance education over the Internet (see [8]). They exploit web-based technology via hypertext and multimedia study materials (see fig. 1, 2), which are uploaded into them to support such virtual learning over the Internet.

Most of my experiences with online teaching I gained during the period of the last six years when I was teaching online web-based undergraduate lectures in Computer and Information Science program via an LMS system known under the trademark WebTycho. In my online classes there were only a handful of students able to comprehend all study materials directly from such electronic study materials without any other outer help. Therefore there is a need for some sort of virtual collaboration and/or teamwork within the online classroom involving not only the class teacher or tutor, but also other online classmates to facilitate grasping the taught subject and provide fast feedback to students if

necessary. The authors of e-learning courses and materials should realize that intense and involved communication among online students is not automatic and it does not come by itself. Online teachers and tutors must introduce into such classes several online elements, which would stipulate a basis for such collaboration (see [5]). The students studying in pure virtual classes meet only exceptionally together. For that reason they miss traditional social contacts of conventional face-to-face classes. As a consequence of it the feeling of isolation may result from it and the given student often stops working and drops the class. The simplest way to deal with just that is formation of good online subject-oriented discussion questions that cover all principal concepts and most of their relationships. Such questions ought to be discussed in discussion groups in which different students express their own ideas of how they image and understand discussed topics. Of course, such contributions are of varying quality. Through process of stepwise refinement students among themselves may eliminate missing elements of some of the contributions or they can disclose their weaknesses directly from within their work in the discussion forum. To make all this possible the online teacher must closely supervise all the happening in it and must guide the responses in desired direction by means of properly chosen public comments that support high-quality contributions and/or disclose weak points in them. The main goal of such online discussions is not only to express actual knowledge of students, but also to share it with the rest of the class. Of course, some of such discussion forums must be mandatory in order to keep students active on daily basis during the term. These

<sup>1</sup> University of Maryland University College, European Division, Im Bosseldorn 30, D-69 126 Heidelberg, Germany

discussion questions may involve group work and/or project assignments. We should keep in mind that the actual learning process is usually not straightforward process and there must be a way to overcome eventual obstacles should they occur. Self-study is here considered to be an extreme case that ought to be avoided.

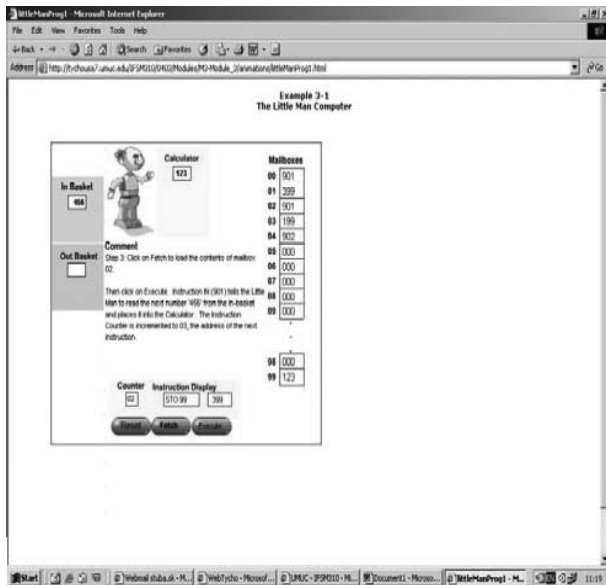


Fig. 1 A Little Man Computer Used to Teach Basics of Machine-Level Programming

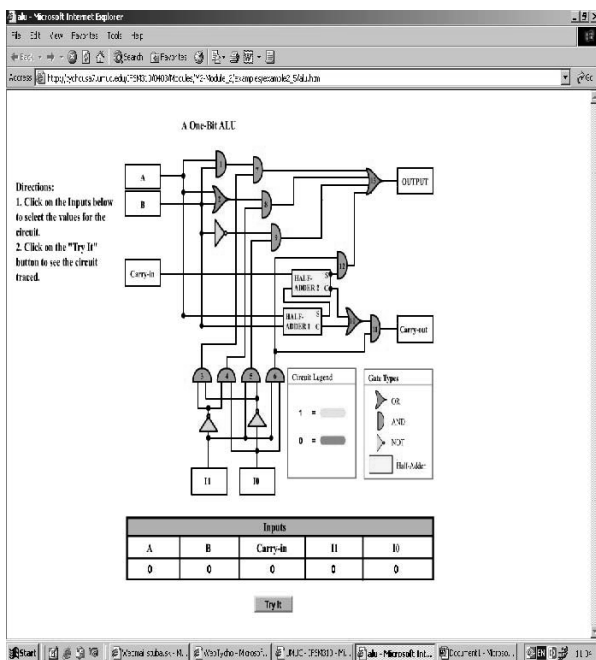


Fig. 2 A Simulation of One-Bit ALU

## 2. EXAMPLES OF ONLINE STUDY MATERIALS

As an example of electronic study materials I would mention here a simulation of a hypothetical computer known under the nickname “little man computer” (LMC). It

contains a general-purpose register (accumulator), program counter, instruction register, operational memory, one input and one output port. LMC comes along with about a dozen of basic machine instructions written for simplicity in decimal form as three digit strings. The very first digit represents the operation code and remaining two digits are specifying the memory location in LMC from which the given operation is taking its operand. A prospective student gets a task to execute a simple machine program written in the above-mentioned format that is loaded directly into the operational memory of LMC (see fig. 1). Using fully interactive program the student is able to step through given short machine code by clicking the mouse and watching the contents of the accumulator, program counter and instruction register as they are being changed after each single step. Besides that the mnemonic representation of each instruction is displayed in an additional register for better understanding. Such study materials are undoubtedly valuable in teaching basic operations of the computer and/or teaching machine-level programming in the virtual classroom. For the student to fully grasp all this it is necessary that he/she may write short programs that may be executed directly on the LMC. In regard to this example I would like to mention that only essential attributes of the real computer are simulated here. All other unnecessary technical details are purposely suppressed to make the taught subject simpler and more digestible. Also there is no need to unavoidably deal with binary numbers in order to comprehend basics about machine-level programming.

As another example I would mention a one-bit arithmetic and logic unit (ALU) simulation (see fig. 2). In this case the suggested unit can execute four different operations if we specify input values for two extra input parameters I0 and I1. Again the student can enter all of input values into the attached table and as a response he/she gets output values for the executed operation simulated by the specific circuit.

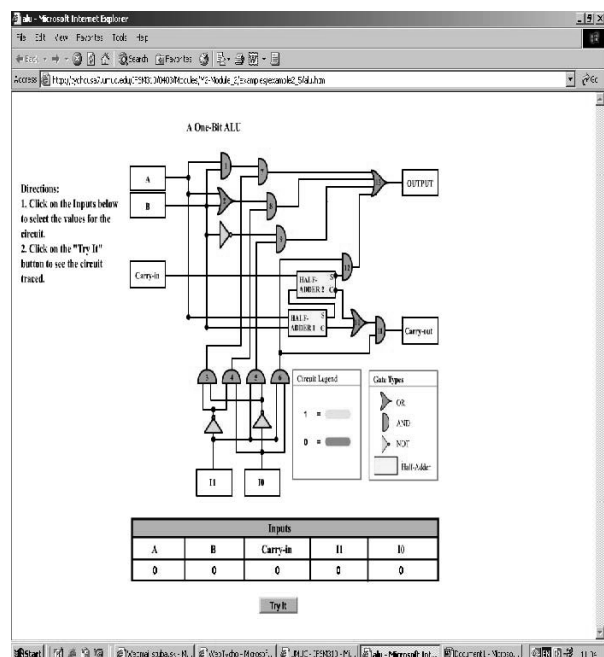


Fig. 3 A Simulation of One-Bit ALU

Both examples presented in this section show how easy it is in the virtual environment to simulate basic computer concepts via interactive electronic study materials. Of course, students enjoy them a lot in their online classes. By playing with them students get a lot of inside of underlying topics, but to get a full understanding of it students have to be involved in solving associated tasks that relate directly to it (see fig. 4). To be more specific students need to be involved in problem-based learning related to this subject (see [11]). True/false, fill-in and multiple-choice questions could be helpful in testing acquired knowledge. Though they are not enough to do so, because they do not support a true learning. Often it happens that students learn such questions along with their correct answers. That proves to be counterproductive (see [3],[10]). As a remedy I recommend here usage of study groups coupled in some way with each such study material. In them students may naturally discuss occurring difficulties related to specific problems either with the teacher or other classmates.

Good electronic study materials are hard to come by. They require teamwork of many different professionals including computer programmers, psychologists, teachers and tutors. Their development is consequently expensive and also time lengthy. Moreover, their transfer and sharing among various schools and LMS systems is often limited in spite of existing standards.

Question 10: The following LMC instructions are found at the given location in memory:

```

30 LDA 63
31 ADD 61
60 720
61 C37

```

Show the contents of the IR, the PC, the MAR, the MDR, and the A registers at the conclusion of each step of the fetch-execute cycle for instructions 30 and 31.

Answer:

| Step              | PC | MAR | MDR | IR  | A   |
|-------------------|----|-----|-----|-----|-----|
| PC → MAR          | 30 | 30  | --- | --- | --- |
| MDR → IR          | 30 | 30  | 530 | 563 | --- |
| IR[address] → MAR | 30 | 60  | 530 | 563 | --- |
| MAR → A           | 30 | 60  | 720 | 563 | 720 |
| PC + 1 → PC       | 31 | 60  | 720 | 563 | 720 |

| Step              | PC | MAR | MDR | IR  | A   |
|-------------------|----|-----|-----|-----|-----|
| PC → MAR          | 31 | 31  | 720 | 563 | 720 |
| MDR → IR          | 31 | 31  | 151 | 161 | 720 |
| IR[address] → MAR | 31 | 61  | 151 | 161 | 720 |
| A + MDR → A       | 31 | 61  | 037 | 161 | 720 |
| PC + 1 → PC       | 32 | 61  | 037 | 161 | 720 |

It is important to remember that the contents of a register stay the same until something happens to change them. The dashes in step 30 are there because we do not know what value was already in them. Then in step 31, the values from step 30 are retained until they are changed.

Fig. 4 Task given to students in connection with machine-level programming

### 3. VIRTUAL LEARNING COMMUNITIES

As I said before learning within study groups may be implemented by means of properly chosen discussion forums, that can be either strictly organized or managed as web-based conferences, or also as somewhat less structured study groups. The reason for this division is that both individual and group study should be supported. In both of

them the problem-based learning could be utilized. It must be a vital part of every meaningful distance learning class over the Internet above all as a complement to self-study, for it supports not only better understanding of new material, but also creativity and writing skills of students (see [11]). Moreover students involved in it may feel to be part of a virtual learning community (see [9]).

Of course, that could help to overcome the feeling of isolation that most of online students suffer from. Evaluation of the written work of students done as a part of problem-based learning within discussion forums is for sure a challenge for every online teacher.

### 4. GRADING ONLINE WORK

Since assignment of online tasks should be a rule in every online class there is a need for their prompt evaluation including accompanying teacher's feedback.

Though online grading requires some experience, most definitely it can be done. At the very beginning of every online teaching there must be clearly defined evaluation criteria that ought to motivate students and show their progress in the online class. There is no need to mark every little piece of the student work. A verbal evaluation may suffice in most cases. On the other hand if the teacher does not provide any comments to the student work then students do not know what they did good and what they did wrong.

At this place I would like to point out a need for good and efficient grading software to make life of online teacher easier. Traditional packages such as MS Word, etc. are not the best suited for online grading of the student work. Consequently, some companies offer commercial products for online grading. One such product is the product known under the name "Markin". It is a shareware and as such it can be easily downloaded from <http://www.cict.co.uk/software/markin/index.htm>. It supports rtf documents and contains features such as: one-click comment, longer comments as footnotes and addition of summary feedback paragraphs or the final grade of the graded work.

Of course, plagiarism poses a great challenge for every online learning and therefore it should be uprooted from the very beginning through an official policy concerning copying and citing any information coming from outer sources. Strict plagiarism rules are more than necessary and above all it is important to adhere to them. To endorse it in the virtual classroom an efficient anti-plagiarism software tool seems to be needed and it would be also helpful. Though at this moment there is no such effective product on the market in the future I anticipate that we will have them soon at our disposal.

### 5. CONCLUSIONS

In this paper I discussed existing possibilities for online learning via contemporary web-based technologies. In each such virtual class there should be included not only

electronic study materials, but also they ought to be accompanied by accompanying problem-based learning in discussion forums. Good study materials are hard to come by because their development is time consuming and they are expensive. Also their sharing among different schools is problematic.

A new form of online learning often referred to as problem-based learning is particularly suitable for usage in a virtual classroom taught via an LMS system. Discussion forums should support both individual and group study. Students cannot study alone. They need teamwork and also class assignments or projects. Online students often require fast feedback. Therefore most of the student work must be evaluated and/or graded. Evaluation of all written work of students done as a part of problem-based learning within discussion forums is most definitely a very difficult task. Consequently, there is no need to grade every little piece of the student work. Verbal evaluation should suffice in most cases. Its main purpose is to motivate students in their further work. Computer literacy is needed for an online learning to function smoothly. It includes full mastery of essential skills in a plain text editor such as cut-and-paste technique, work with text files and html files. Any file documents that could port damaging computer viruses should be used with an extra care. Teachers could offer an option to „download to a local PC“ for as many of their electronic study materials as possible. We should bear in mind that most of the course work completed by students is often done off-line on a piece of paper. The bigger part of online students is very good at using text editors. Simple text files are easy to manipulate and fast to display or download. We have to remember that students might have some problems with being online everywhere and always. Furthermore a printed version of web-based documents is often awkward when compared to a corresponding printout from a standard text editor.

## 6. REFERENCES

- [1] B. Collis, J. Moonen, *Flexible Learning in a Digital World*, Kogan Page, London, UK, 2001.
- [2] M. Coomey, J. Stephenson, "Online learning: it is all about dialogue, involvement, support and control – according to research". in: Stephenson, J. (Ed.) *Teaching and Learning Online*, Kogan Page, London, UK, 2001.
- [3] P. Čičák, I. Grellnes, I., M. Kotočová, P. Mesjar, Contribution to the Evaluation Methodology, Proceedings of Conference „ICETA 04“, Košice, 2004, pp. 515-518, ISBN 80-89066-85-2.
- [4] L. H. Distlehorst, R. S. Robbs, A comparison of problem-based learning and standard curriculum students: Three years of retrospective data, *Teaching and Learning in Medicine*, 10(3), 1998, pp. 131-137.
- [5] J. Hvorecky, Team projects over the Internet, Proceedings of Conference ICL '06, Villach, Austria, 2006.
- [6] M. Huba, K. Žáková, P. Bisák, Development of On-line and Web-based Training, ŠEVT a.s., 2005, ISBN 80-227-2237-5.
- [7] D. C. Leonard, *Learning Theories A to Z*. Oryx Press, Phoenix, AZ, 2002
- [8] F. Schindler, WebTycho: A Tool for Distance Education over the Internet, Proceedings of International Conference "E-Learn 2004", Žilina, 2004, pp. 231-236, ISBN 80-8070-190-3
- [9] F. Schindler, Virtual Communities in E-Learning, Proceedings of International Conference Virtual University '04, Bratislava, 2004, pp. 281-283, ISBN 80-227-2171-9
- [10] F. Schindler, WebTycho: A Web-Based Tool to Test and Grade Students over the Internet, Proceedings of Eighth International Conference "Informatics 05", Bratislava, 2005, pp. 211-216, ISBN 80-969243-3-8
- [11] F. Schindler, Problem Based Learning over the Internet, Proceedings of Seventh International Conference CBLIS '05, Žilina, 2005, pp. 361-366, ISBN 9963-607-63-2
- [12] E. Wenger, *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press, UK, 1998





## AMBIENT INTELLIGENCE IN ELDERLIES AND DISABLED LIFE IN EUROPE

Dušan Šimšík, Alena Galajdová

Department of Instrumental and Biomedical Engineering, Faculty of Mechanical Engineering,  
Technical University of Košice, Letná 9, 042 00 Košice.

Tel., Fax: +421 55 602 2654, e-mail: Dusan.Simsik@tuke.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The overall objective of e-Inclusion programme of the 6FP is to mainstream accessibility in consumer goods and services, including public services, through applied research and development, using advanced technologies to help ensure equal access, independent living and participation for all in the Information Society. Ambient intelligence stands for an environment where people are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects and an environment that is capable of recognising and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way. The first and most important need within our life and working environment is social communication. Then, the need to feel safe is also very important. The services that 'empower' the user attract different subgroups of the population and have a big potential. The concept of Ambient Intelligence and mainstreaming in MonAMI 6.FP integrated project is trying to meet those human needs. Research approaches and first experience is described.

**Keywords:** Ambient Intelligence, People with disabilities, Elderly people

### 1. INTRODUCTION

#### 1.1 Ambient Intelligence - AMI

The concept of Ambient Intelligence was developed in the ISTAG reports (ISTAG 2001, 2002) in order to combine the most successful areas of the ICT (wireless communication technologies, consumer electronics, Automotive and Aerospace technologies). It is a vision where humans are surrounded by computing and networking technology unobtrusively embedded in their surroundings. Ambient Intelligence refers to electronic environments that are sensitive, adaptive and responsive to the presence of people. It's a digital environment, in which people are living easily and the electronics is sensitive to people's needs, personalized to their requirements, anticipatory of their behaviour and responsive to their presence. In fact, each one has some needs that have to be fulfilled.

On the MonAMI integrated project it will be demonstrated that accessible, useful services for elderly and persons with disabilities living at home can be delivered in mainstream systems and platforms. This will be done in close cooperation with users and by involving key mainstream actors throughout the whole process. In the case of MonAMI mainstreaming means - that services for elderly people and people with disabilities are part of the ordinary supply of services offered to the general public.

Previous European projects have shown that technological augmentation of the living space can help elderly people and people with disabilities to carry out daily living tasks increase their quality of life, thus reducing the need for institutional and other care. Unfortunately, the results of these projects have often stayed in the laboratory or only been implemented on a small, local scale. MonAMI will

build on these experiences and aim for large-scale mainstream deployment.

Bouquets of services and AMI applications will be selected and developed with the "Design for All" approach together with potential users in the following areas:

- health
- safety and security
- communication and information
- activity planning
- comfort applications

The platforms to deliver the services will be derived from standard technology. They will integrate elements such as reliable self-organizing networks, wearable devices, user interaction technology, monitoring capability and service infrastructures that ensure quality of service, reliability and privacy. The services will be delivered on mainstream devices and services such as digital TV, third-generation mobile telephones and broadband Internet. To facilitate use and user interaction, MonAMI will develop an innovative interface, involving an embodied conversational agent.

Ambient Intelligence (AMI) is characterized by three main aspects:

- Ubiquitous computing - integration of microprocessors into everyday objects like furniture, clothing, white goods, toys, even paint
- Ubiquitous communication - enables these objects to communicate with each other and the user by means of ad-hoc and wireless networking
- Intelligent user interfaces - enables the inhabitants of the AMI environment to control and interact with the environment in a natural (voice, gestures) and personalized way (preferences, context)

Autonomy and quality of life of elderly and disabled people living in smart private or public homes designed under the Ambient Intelligence paradigm can experience significant enhancements due to the increased support received from the environment. This support includes facilities for environmental control, information access, communication, security monitoring, health monitoring. Nevertheless, users can find accessibility barriers frequently related to the diverse user's interfaces with heterogeneous devices and procedures. These problems include both, physical difficulties to handle the devices, and cognitive barriers to understand use procedures and navigation. Consequently, accessible unified interfaces are required to control all the appliances and services. This is possible only, if the network technology used for smart homes is able to support interoperability and systems integration. Each person is different and his/her needs depend on the different roles along the day, according to the circumstances, their state, and needs. To satisfy those human needs, the 'Ambient Intelligence' has following characteristics:

- Context Awareness - applications that are conscious of the context where they are running.
- Personalised - reflect our personality and identity.
- Immersive - enriched experience through the addition of new real elements (sound, images, vibrations, lightening) where we can "enter".
- Adaptative - AMI is adapting to our preferences and is self responding.
- Anticipatory - AMI anticipates our desires and environment as much as possible without conscious mediation.

## 1.2. Overview of AMI services and devices

The AMI systems structure consists of the following modules:

- Micro-servers. Any device will be client and micro-server with process/application that could be used by others.
- Terminals and sensors - integrated in the ambient (invisible) can measure environmental parameters like temperature, light, sound, humidity, and house technical parameters like structural pressure, pipes degradation, etc...
- Biometrics – integrated security measures like fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements.
- Personalization and DRM. Services available for users at any moment, everywhere, with the selected look and elements context and adjusted for the person.
- Adaptable DRM elements for the Ambient Intelligence:
  - Adaptability, learning, reconfiguration, ...
  - House in the future will be reconfigurable, adapting its space to the new needs of its owners, and learning from them.
  - Multimodal interfaces

Multimodal interfaces (keyboard, mouse, image and gesture interpretation,...) will allow access to any service from any location, at anytime.

Some examples of AMI solutions:

FIFA has implanted an RFID chip in tickets to the 2006 World Cup football matches in Germany to cut down the number of cases of theft, counterfeiting and black-market trading of tickets.

The Baja Beach Club, a discotheque in Barcelona, uses RFID chips as a club card for cashless payments. The club injects a chip under a member's skin using a syringe.

New York's Jacobi Medical Center has its patients wear an RFID wristband. The idea is that the stored medical data will enable more efficient treatment.

Daimler Chrysler offers a child seat with RFID. The chip controls the airbag pressure, helping to prevent injuries to small children.

At Legoland in Billund, children have to wear an RFID wristband. It enables the park administration to track missing children.

## 2. SOCIAL CRITERIA

### 2.1. Population changes in EU and Slovakia

There are approximately 74 million people over the age of 65 living in the European Union, and an estimated 37 million people with disabilities. This amounts to approximately ten percent of the population at risk of social exclusion arising from physical barriers as well as from discrimination in many economic, social and cultural environments, potentially leading to a severely diminished quality of life.

The ageing of human population is becoming an actual problem in Slovakia too. The recent report of the World Bank says that in 2025 population of East Europe countries will belong to the oldest populations in Europe, and in the same time they will challenge a relative poorness of population. In 2025 nine states of East Europe (including Slovakia) shall have 20-25 % citizens older than 65 years. Regarding to this fact there are new requirements arisen to assure better quality of technologies, services and care for people with limited autonomy due to health condition and/or their special needs. The producers and/or providers of the mainstream technologies and services from different areas (telecommunication, industry, IT, engineering, etc.) are improving the tools for environment control based on the principles of universal design to be usable for any end user. This is also goal of the EU project MonAMI in 6.FP e-Inclusion, where TUKE team participates.

The main aim of our research and study is to help elderly people and people with limited mobility to achieve higher quality of life, satisfaction with their life conditions and with position within the society by supporting their autonomy (daily life activities, home and work environment, and preferring the home care rather than institutional care) using the ambient intelligence and development of broadband services in the Information society.

Ambient intelligence stands for an environment where people are surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects. That type of environment is capable recognize and react to the needs of different individuals, mostly those technologies are seamless, unobtrusive and often invisible. Once they are in the home or work environment of user, it is important to evaluate the efficiency of their usage – how much do they make the life easier, how much are they user friendly, feasible and valuable for the daily life activities.

The MonAMI project aims to select services and technologies, which are relevant to older and disabled people as well as to the communities in which they live. In order for MonAMI to make decisions about the appropriateness of the services and technologies, Work Package 3 (WP3) has been mandated to develop the “community criteria”, by which they will be assessed.

## 2.2. Community Criteria

Articles 25 and 26 of the Charter of Fundamental Rights of the European Union recognises the rights of older and disabled people to lead independent, dignified lives and to participate in European Society. However, independence and autonomy are often greatly compromised for older and disabled people, which in turn can result in depression, anxiety, further physical deterioration and social isolation, and social exclusion more generally.

Protection of the independence and dignity of older and disabled people is part of the Charter of Fundamental Rights of the European Union. Technology applications and solutions can be instrumental in preserving and improving the quality of life of those living with disabilities and therefore it is in the interest of the European Commission to encourage the development of such technologies.

The community criteria are developed within a socioeconomic framework, which reflects the social, economic, cultural and political life in Europe. The description of this framework and the component criteria delineate the minimum requirements, which the services should meet in order to qualify as part of the MonAMI project.

In order to derive the initial framework and community criteria, members of Work Package 3 (WP3) team asked all members of the MonAMI project for their ideas about community criteria. They also performed a literature search for examples of studies, which discuss criteria for social inclusion.

The framework consists of an introduced technology and it has effects at three levels of policy and stakeholders:

- at the community,
- national level,
- and European level.

At the first level, the community, the stakeholders are the users (older and disabled people receiving the technology), local health and social care resources, which are affected by local policies, as well as businesses. At the national level,

there are also health and social care policies, which set the regulatory and provision standards. Finally, at the European level, there are the charters and declarations of human rights, which apply to all European citizens, despite national or municipal boundaries.

Next to each of the domains in the framework is a list of community criteria, which affect each stakeholder of the domains. These community criteria originate from perceived benefits for not only that group of stakeholders alone, but the wider impact on society in general.

The following activities have been identified.

- Clarify and define the sociological and economic framework
- Enable social integration requirements to be prioritised in FU centres and Validation centres
- Liaise with experts, e.g. community leaders, social landlords, local government officers and specialist NGOs
- Benchmark existing services
- Deploy monitoring in terms of social integration
- Evaluate social integration aspect
- Formulate future recommendations.

## 2.3. Users

We recognise following important issues for users criteria:

Social Inclusion: The value of an assistive technology is directly proportional to how it allows the user to maintain or to regain his/her social, economic, political and cultural participation in society and so promote their quality of life.

Suitability: The degree to which the chosen technologies provide instrumental support to meet the needs of older and disabled people has a direct impact on their quality of life. Therefore, the technology should be able to help to meet an individual's specific needs and ultimately improve their autonomy and independence.

Flexibility: As the emphasis on independence and control increases, naturally so does the level of responsibility of older and disabled people become responsible for arranging their care. Organising equipment, services and assistance amongst the list of informal and formal services, which are available to them can be an arduous and frustrating task, especially for those living with a form of impairment. Therefore the more a technology or service can be flexibly adapted to the user's abilities, preferences and schedule, the more useful the amenity, and in turn, the less isolated and anxious users become.

Accessibility: The accessibility of services encompasses the affordability, availability, eligibility (in terms of policy and practice), ease of use, and convenience of a product or service to people in that particular community. Gaining access to a technology or service can sometimes be hindered by a particular disability.

Independence and Control: Evidence suggests that the crucial factor for sustaining a good quality of life for older and disabled people is the ability to maintain one's

independence. In response, policies targeted at marginalised groups of society over the past few decades have shifted from directive, prescribed forms of care towards programs, which promote personal empowerment. The MonAMI project should therefore seek out technologies, which give older and disabled people the opportunity to become more independent and which enable them to take personal control over their health and social care.

The lack of social acceptance could be a limit on the expansion of Ambient Intelligence.

Social acceptance will depend on many factors and Ambient Intelligence can only succeed if:

- It makes everyday life easier,
- It offers additional opportunities for personal expression
- It facilitates human interaction.

However, there are some reasons that could explain the social reject, such as:

- the feeling of being always in control
- violations of privacy
- the lack of trust
- information overload.

## 2.4. Health and Social Care Policy

Building Social Capital: Social capital refers to the level of community cohesion, networks, cooperation and trust that exists amongst its members. The degree of social cohesion will help to determine the ability of a community to perform collective roles. Therefore a technology, which enables people's participation and level of commitment to society, could facilitate the creation of a friendly, supportive and efficient community.

Cost-effectiveness: Most communities, local authorities and individuals are budget-and-cost-sensitive, and are continually searching for therapies, which provide the better outcomes for lower costs. New technologies therefore must prove that they offer value for money relative to existing arrangements or to other uses of the same scarce resources.

Safety: Under both National and European jurisdictions, technologies need to comply with safety regulations.

Long Term Care Perspective: All European countries will experience ageing populations over the next few decades, and so governments are keen to find not only current solutions to the perennial challenge of meeting needs from limited resources but also to ensure that such solutions are sustainable over the longer term. For instance, the development of technologies, which allow people to stay in their own homes as long as possible, while enjoying a good quality of life, might help national health systems to redirect resources from costly long term institutionalisation to meet other needs.

Mainstreaming ability: As one of the primary objectives of the MonAMI project, the selected technologies need to be specific enough to meet the needs of disabled people. However they must also be useable across the European Union.

## 2.5. Business/Industry

Business Opportunity: The technologies will also have to be economically viable to the groups who develop and produce them. The costs of inception to market of a product are high as are the risks of investments in new technologies. Therefore businesses need to be confident there is sufficient demand for their products, if a technology is to be considered a genuine opportunity.

Innovative Nature: The technology needs to demonstrate innovation and creativity in order for the industry not only to remain competitive, but also to prove that modern techniques are more beneficial than the current status quo.

## 3. FEASIBILITY AND USABILITY CENTRE DESIGN SPECIFICATIONS AND USER CONTROLS

The aim is to concern on an integration of useful domestic appliances and services that can be delivered in mainstream systems and platforms directly to end user in the ambient intelligent environment. Controlling of the kitchen environment provides independence, self-activity to elderly, disabled person in general and the entire community in the home environment is one of the services that will be provided in FU centre 5 Slovakia.

The creation of possible scenarios facilitates conception of daily activities in the home environment shows an overall view of development of mutual human-user and intelligent environment relationship according to home automation requirements and the principles of design for all.

The result is providing comfort and security to elderly and disabled people, who are ageing in their smart homes and do not have to stay in the institutional care.

The services will be selected among the following types of envisioned services:

- Home safety and control (e.g. intrusion detection, home automation, videoconferences, emergency alarm handling, heating, lighting, inactivity detection, etc.)
- Safety and security (e.g. fall detection, unusual behaviour detection, technical alarms management, visitor validation, etc.)
- Activity detection (e.g. permanent human location and recognition, etc.)
- Household appliances (e.g. refrigerator, washing machine, oven, cooker, dishwasher, microwave)
- Home appliances (e.g. set top boxes, DVD player / recorder, TV sets, etc.)
- Communication devices (e.g. telephones, Internet access, wireless connection etc.)
- Activity planning (e.g. agenda and reminders, palm-tops, etc.)
- Support to wheelchair navigation & navigation for sensory impaired (e.g. assistance in passing doors and automatic or semi-automatic navigation, opening and closing windows, doors, switching on/off the devices in distance or not easy-reachable, etc.)
- Health (e.g. monitoring of intake of medication, health monitoring, telemedicine, etc.)

- Information (e.g. community video-on-demand, conference-calling, building community, translation, education, e-Democracy, video telephony, specialist TV channels, etc.)
- Entertainment.

## 4. METHODS

### 4.1 Feasibility and Usability Centre

The main task for TUKE is to build a new laboratory equipped with ambient intelligent tools – Feasibility and Usability centre (FU Centre) in Slovakia based on the experiences of the Department of Instrumental and Biomedical Engineering and also the Access Centre at Technical University of Košice. We need to choose appropriate technologies, services and products that are matching the best the needs of the tentative target group. It includes rather wide selection of the users – elderly, sensory impaired individuals and people with limited mobility.

The FU centre will identify the end user needs in relation to the service to be tested, define the technology sets and services that will be delivered to users according to their special needs, implement technology in tested sites, both in laboratory conditions at University and also at households and residential areas that means to purchase and to build in all necessary mobile and communication devices. The services will be tested according to the home situation, individual's disability and his/her special needs.

As a first step after the overview about the existing technologies and services is a selection and development of a set of services with focus on mainstream services which can be adapted for e-Inclusion through the Design For All approach. The selected services will first be tested in our Feasibility and Usability centre at TUKE with user tests in lab-like conditions. The work is focused on the improvements of available products and/or new products to bring them into the market in Slovakia. The main direction leads us to assure better conditions of life for people who are elderly and/or with limited mobility, certain level of impairment. The ambient intelligence tools installed in the users' environment (laboratory, home, work, school, etc.) will be a part of the platform and will be embedded into all different types of the objects to create an interactive interface that will help to support the autonomy of the user. This will logically lead to strengthening the individual's position within the society even he/she will first not realize it and will treat the modern technology in various way of understanding, accepting and effective usage.

Once the services and applications have been found to be feasible, usable and appropriate to user needs, large-scale validation will be carried out in Validation centres in four countries. Hundreds of users will try out the services in their homes and the impact and consequences will be analysed. The economic viability and long term sustainability of the services will be addressed in order to facilitate real mainstream implementation.

Most of the projects done in the field of e-accessibility, support of autonomy of elderly and impaired people and their inclusion into the information society approved that the technical support of life environment can really help people to meet the needs for daily life activities. The implication of intelligent technologies that help people to control the environment /fully or partially/ reduced the need of institutional and social care and move it more into the home care and self-treatment. On the other side even the ambient devices and services were successful, the results of the study and research mostly stay in the laboratory conditions on the level of the experiments or they are applied into the praxis only on the local level, so they are not widely spread and accessible, available and accepted by all potential users. This is the main initiative we have – to show, approve and apply the useful smart technologies and services within the mainstream products offered to wide range of population.

### 4.2. Technology platform of the TUKE FU Centre

The selected ambient intelligence tools (AMI) are applied and the interaction of the man and machine are evaluating in the Feasibility and Usability (FU) centre at our University in the lab conditions, as well as in several external testing sites by individual users.

The full range of roles for the FU centre covers training, demonstrating and testing, data collection, evaluation and comparison with results of other MonAMI project FU centres.

Accessibility – assistive technology is a very important component in all man-machine interaction tasks managed by people with disabilities and it has its role also in an environment as ambient intelligence. We have in our FU centre for accessibility testing and demonstration tasks the wide collection of different types of assistive technology:

#### For users with visual impairments:

- optical character recognition software
- Braille displays, Braille and speech note-takers
- magnifying software
- screen Readers,
- magnifying cameras for text and pictures
- ZY-FUSE heater for tactile diagrams or graphics.

#### For users with hearing impairments:

- MicroLink FM, FM system for use with existing hearing aids.
- Conversor, miniature Radio-microphone system for use with an existing hearing aid, without requiring direct connection to the hearing aid.

#### For users with motoric impairments:

- Headmaster, mouse emulator head mounted pointing system
- JOUSE, joystick-operated mouse kept in a mouth controlled by head movements
- WiViK, on screen keyboard

Ambient technology components and sensors that will be used in new services will be partially obtained at the market, and partially developed within technology platform of the Project partners.

### 4.3. Selection of services

Selection of the services required providing an analysis of existing services, and then to derive from the identified list of services those, where we can add new functions covering requirements of the ambient intelligence. Services are analysed from the content point of view, from the service, network and customer points of view. Description of services includes also scenarios, diagram of sequences and interfaces used.

FU centre at TUKE provides already a packet of existing services based on an experience with Assistive technology (AT) and Accessibility solutions of the Access Centre. These services are continuously completing with AMI components and modules so we can offer and test now the following services:

- Assessment of user's abilities and AMI technology needs.
- Demonstration of technology – different variants of AT, AMI
- Selection of AMI technology
- Training on Equipment – Assistive technology, AMI
- Evaluation of the effectiveness of the AMI equipment.
- Consultations on home computer equipment/software, AMI.

To improve the structure of existing and derived services regarding the project goals, we have applied a specific approach to analyse Slovak conditions.

We recognise two main groups of the Criteria for new services development:

1. **SYSTEMATIC - SMART HOUSE FUNCTIONS**  
Those services are more-less like standards for building of an intelligent technology in homes, and they create the main basis for other services.
2. **INDIVIDUAL'S SPECIAL NEEDS AND REQUIREMENTS**  
Those services are selected by the designer of the ambient technology and by user based on:
  - user's abilities (accessibility creating, ...),
  - user's needs (work, education, monitoring of health status,...)
  - user's requirements (entertainment, teleshopping,...)

More detailed description of the functions follows:

#### Smart house functions – systematic:

- Environment management
  - energy distribution, regulation
  - air conditioning
  - water heating
  - illumination
  - opening system drives

- Communication and information
  - telephone
  - inside intercommunication, video interphones
  - news, information
  - data transfer
  - data transfer for working and learning activities
  - others
- Security and personal safety
- Alarm systems with indicators of unwanted visitors, camera systems, sensors for monitoring of a fire, flood, smoke, gas,
- Control of domestic appliances
- Others

#### Individual's special needs and requirements

- Teleassistance
- Telemedicine/Hospital control
- Daily life activities support
- DfA access to control
- Entertainment
- e-government
- e-shopping, e-banking
- Education
- Homework

As an example for the Home services description and deconstruction we present the next picture and table describing one service in kitchen.

Possible scenario for using a Talking microwave:

Miss Green has low vision ability. She tries to reheat her food in talking microwave oven. She selects button of the asked program for preparing her food and microwave oven talks her through pressing the buttons. She puts her dinner into microwave oven and hears current power level and each step of the microwave cooking process. She likes to reheat potatoes too. She opens the microwave door and puts potatoes there. After closing the microwave door, she selects button of the asked program for preparing her food again and she is able to hear all announcements of microwave cooking process. Finally, her potatoes are reheated.



Fig. 2 Talking Microwave Oven I

We are developing a database - catalogue to ensure an effective way of the realisation of services. The Catalogue specifies the available and recommended technology for the development of the so called derived services based on existing services and technology platforms available in Slovak and European market.

|                     |   |  |  |
|---------------------|---|--|--|
| <b>Service Name</b> | <b>Controlling of kitchen environment S1.1</b>            |  |  |
| Field               | Comfort application: home control                         |  |  |
| Main target         | Elderly, disabled person in general, the entire community |  |  |

| <b>Service Description</b>   |  |  |  |
|--|--|--|--|
| Service description for everyone: Ability to control kitchen environment<br>Service description for elderly and disabled: Access to common facilities in the kitchen environment, ability to control electrical appliances as everyone else.<br>Illustrative playlet: Miss. Green is an old lady with low vision ability. She is preparing food in her kitchen. She is using commonly available and used technologies and electrical appliances such as talking microwave oven.<br>Comments: Controlling of the kitchen environment and providing independence, self-activity to elderly, disabled person in general, person with low vision ability, the entire community and their family members. |  |  |  |

| <b>Value for the customer</b>   |                                     | <b>Value for the provider</b>                                |  |
|---|-------------------------------------|--|--|
| Independence and self-activity during daily activities in the home environment.                                 |                                     | Much larger market.  |  |
| <b>Actors on the customer's side</b>  |                                     | <b>Actors on the provider's side</b>                         |  |
| Actor   | Role                                | Actor  | Role   |
| End user<br>Family  | Beneficiary<br>Potential subscriber | TUKE<br>Whirlpool<br>GoldStar<br>The Hamilton Beach products | System integrator<br>Technology supplier<br>Technology supplier<br>Technology supplier |
| <b>Needed technologies</b>  |                                     | <b>Others</b>  |  |
| Existing  | To be developed                     | Success-key factors  | Risks  |
| Talking microwave oven T1.1<br>Compact Microwave Oven with Tactile Touchpad T1.2<br>Talking microwave oven T1.3 |                                     | Number of applications                                       | High prices on market  |
| <b>Synergies with the other services</b>  |                                     |  |  |
| Exploiting the common infrastructure in the kitchen   |                                     |  |  |

Table 1. Interactive kitchen appliance

#### 4.4 Existing technologies and services available in Slovakia

We have analysed the situation on the Slovak market with services intended to support daily life of aged population. Slovakia has some delay in the development and implementation of ICT. We have found only a few services on the market. On the other hand our market is relatively better prepared with the Assistive technology that often has to be a part of the interface enabling a good communication environment for services with ambient intelligence. In Slovakia, we have identified some ambient intelligence technologies already in the practical use - voice interactive information about weather, trains time table provided from internet, information about railways via phone – automatic answering system.

One example of a good already running service is *Distress calling centre* available so far in three regions - Bratislava,

Nitra and Banská Bystrica. The users (they count only on tens so far) use the portable device equipped with the button placed on the bracelet or necklace worn by user on the neck or wrist – and in case of an accident or in emergency situation after pressing the button there is the call centre. Operator investigates the situation and then he/she calls the nurse, family, neighbour, relatives. The call centre can have also information about the user health condition and communicates with user about what happened and what's the problem. It works mostly for users whose diagnosis is known but we tend to apply it also for cases when accident happens to person without known diagnosis so in any situation or position user can communicate with emergency. On the basis of that Centre, we plan to build a home monitoring/control system.

One part of the ambient intelligent system shall be an accessible control of environment – using simple graphical “language” - pictures, letters, or other Assistive technology

tools for people with sensorical impairments. That system will work with sensors based on Zigbee radio technology, and broadband systems that connect user with computer and use the embedded and intuitive tools and interfaces. Sensors should be controlled by PDA or PC and it'll be monitoring a room, user and supervisor will have information about the facilities, and their quantitative values about gas, fire,, etc.

#### 4.5 Testing of services

To build testing sites for our FU centre, we prepare "Realisation projects":

- Internal – Laboratory of ambient technology at TUKE
- External – 10 sites at homes of individuals and social houses
- We test already next simple services:
- Voice interaction dialogue system for weather forecast.
- Usability of Linux operating system for blind and visually impaired users.
- Assessment of ageing population's abilities and technology needs.
- We prepare testing of the following services:
- Selection of Assistive technology and Training of users.
- Evaluation of the effectiveness of the used equipment.
- Adaptations of home computer equipment/software for e-Accessibility – consultations, realisation.
- Smart house functions:
  - Doors, lights shutters - electric appliances control
  - Home control, safety and security
  - Emergency alarm
  - Communication and information for elderly and disabled persons in their homes,
  - Energy saving using 1wire, or ZigBee technology
  - MMS to TV
  - Localisation
  - Medical monitoring, reminder, emergency help.

We understand a psychological dimension of the testing services with elderly and people with disabilities. Therefore we put much effort in the ethical legislation and work with other professionals - psychiatrists, geriatrics, rehabilitation staff and social medicine staff. This is very important in the phase of selection of the external testing sites. It is also the question of the acceptance of the services by users.

Different testing sites will be equipped with different technology. For communication goals, we have already an experience in using video communication system - Skype for regular contact with our quadriplegic client. He has been involved in several research and education projects with us.

## 5. CONCLUSIONS

The MonAMI integrated project main goal is to improve life of the ageing population and people with various impairments in Slovakia and in this way to contribute to better life in Europe generally. This paper describes the main objectives, current state and future directions of the project MonAMI we are involved in. It is very important to implement the mainstream intelligence tools that become accessible available and acceptable for all the users in the unified technology&service platform. MonAMI has a responsibility to address the needs of elderly and disabled people in the context of an aging population that increases the financial burden on public services and also the personal life of the target group is more dependent on the surrounding.

To ensure the difficulties encountered by the individuals concerned are alleviated, the services we use are sustainable; our initiative is to make existing services cheaper, more widely available and not necessary used in the first place. It would be an ideal situation if the elderly and disabled users were self-sufficient in the terms of provided services and so fully participating in the society. Based on the existing technologies and services and its analysis we plan to adjust and modify them into the technology platform according to the current situation and the needs of users in Slovakia respecting the Community Criteria for Social Integration.

The elderly and disabled people will be able to use the mainstream technologies and services to avoid the institutional care and replace it with home care that is more acceptable, comfortable and emphasize the preferences of individuals as well as society – to support living at home, communicate and have own life.

Testing process in our FU centre will be focused on the human-machine interaction between user and technology (existing, derived, innovated or newly developed). Another important goal is to create a unified control system for easier provision and more effective application, spreading and using the services. The wider the range of intelligent technologies and services will be on the market, the more universal the covering the sources of the ambient intelligence tools will be.

The long-term function of the Slovak FU centre is to serve as the Demonstration and Training Centre for new EU countries. Different kind of technologies, services and devices will be installed and maintained.

The project follows the three basic priorities – unified European informatics market, innovation and investment development and inclusive European information society.

## 6. REFERENCES

- [1] Abascal J. " Ambient Intelligence for people with disabilities and elderly people" Laboratory of HCI for Special Needs, University of the Basque Country-Euskal Herriko Unibertsitatea, Spain



[2] MonAMI Project *internal sources*.  
<http://monami.info/>

[3] ROE P. R.W. 2007. Towards an inclusive future Impact and wider potential of ICT. Swiss Federal Institute of Technology of Lausanne. Accessible on: <[http://www.tiresias.org/cost219ter/inclusive\\_future/inclusive\\_future\\_book.pdf](http://www.tiresias.org/cost219ter/inclusive_future/inclusive_future_book.pdf)>. ISBN: 92-898-0027.

[4] ANDRICH R., ŠIMŠÍK D., GALAJDOVÁ A.: Podporné technológie: Rovnaké príležitosti pre osoby so zdravotným postihnutím. Vydavateľstvo Technickej univerzity v Košiciach; 2002; pp.130; ISBN 80-7099-953-5.

[5] EDEAN Newsletters – project internal sources, [www.edean.org](http://www.edean.org)

[6] ŠIMON,P.: Services and technologies for ambient intelligence in home environment. Master thesis. Department of Instrumental and Biomedical Engineering, Faculty of Mechanical Engineering, Technical University of Kosice, 2007; 88 pp.

[7] ŠIMŠÍK,D., GALAJDOVÁ,A., ARA,G., MICANGELI A., ANNAN,A.: ATTRAIN Assistive technology, Edícia vedeckej a odbornej literatúry, Strojnícka fakulta, Technická univerzita v Košiciach; 2004; pp.419; ISBN 80-8073-231-0.

[8] ZELENÁKOVÁ, J.: Ambient intelligence tools applied in everyday activities in the home environment. Master thesis, Department of Instrumental and Biomedical Engineering, Faculty of Mechanical Engineering, Technical University of Kosice, 2007,102 pp.

## THE AUTHORS



**Dušan ŠIMŠÍK:** Full Professor, Head of Departmental Biomedical Engineering Division, and Head of Access Centre, Technical University of Košice, Slovakia, Coordinator and Contractor in several international R&D projects in various EU programmes (TEMPUS, Leonardo, Socrates, Grundtvig, 6.FP). Over 160 academic and professional publications. Member of several Slovak Professional Associations, member of the International Committee IMEKO TC17; AAATE member, national contact for Slovakia; chair of ICTA EUROPE Rehabilitation International; National Coordinator of EDeAN, e-Accessibility Network.



**Alena GALAJDOVÁ:** Senior Assistant at the Department of Instrumental and Biomedical Engineering, and Secretary of Access Centre, Technical University of Košice, Slovakia, involved several international R&D projects in various EU programmes (TEMPUS, Leonardo, Socrates, Grundtvig, 6.FP). Over 60 academic and professional publications. Member of several Slovak Professional Associations; member of AAATE, ICTA EUROPE Rehabilitation International, EDeAN, e-Accessibility Network.

## ACKNOWLEDGEMENT

*The authors would like to thank the European Commission for the support within the 6th Frame-work Program by the grant of the integrated project within the priority 2.3.2.10 e-Inclusion “ Mainstreaming on Ambient Intelligence” - MonAMI IST-5-0535147.*



## FLEXIBLE LEARNING FUTURES



*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

Professor James C Taylor  
Deputy Vice-Chancellor (Global Learning Services)  
University of Southern Queensland Australia

**Abstract:** The growing influence of Web 2.0 and the emergence of vast quantities of “user-generated” content have led to predictions that by 2010 the world’s stored knowledge will be doubling every 11 hours! How will educators deal with this proliferation of so called “collective intelligence” or “wisdom of the crowds” emanating from the ever growing number of blogs, wikis and other social-networking sites? Further, the growing influence of the OpenCourseWare (OCW) Consortium and associated Open Educational Resources (OER) movement is creating challenges for higher education institutions. Will the OER movement have a significant impact on higher education? Will the role of university teachers in engendering the discipline, knowledge and complex cognitive skill performance underlying the development of expertise in students survive the challenge of emerging social-networking technologies? How should institutions respond in order to maintain and enhance the quality of higher education in this rapidly changing complex environment?

(Videoconference presentation)



## E-LEARNING –REVOLUTION IN EDUCATION



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

Peter Tomčák  
Oracle Slovakia, Dunajska 15, 811 08, Bratislava  
+421915837 150, peter.tomcak@oracle.com

**Abstract.** Many experts predict that we are in the middle of a transition from “teaching by telling” with a human instructor to “learning by doing” with technological support. Learning will be facilitated through the use of simulations and augmented reality. Employees will be guided through their first performance of a task and thus be productive the first time. In this paper we aim to describe today’s E-Learning market with a focus on new trends supported by the latest technologies. This paper is based on Oracle’s experience in e-Learning space. Most of the information is a part of Oracle’s knowledge base and influenced by Naj Rahman who is Director - HCM Solutions at Oracle. The objective of the paper is to look at E-Learning from different angle and start the discussion how performance management supported by latest technology can help increase effectivity and efficiency of E-Learning. That will be important because in the new constantly changing and chaotic economy for many, if not most workers, the frequency of task repetition will approach zero. Performance support and just-in-time learning will be critical. In effect, everyone will be a novice all of the time so it will be critical that organizations deliver just the right information in just the right way at just the right time to facilitate effective performance the very first time.

**Keywords:** E-Learning, competence, technology, training, talent.

### 1. INTRODUCTION

#### E-Learning revolution - forget what you knew yesterday.

Not visible on everyday basis, but we live in the era of revolution. The way people live, entertain and do the business is rapidly changing. E-Learning revolution started few years ago with the invention of Internet. But was it really a revolution? The world has changed, but has the revolution already finished? This is still a topic for a discussion.

In the book: *Funky Business - Talent makes capital dance*, Kjell A. Nordström & Jonas Ridderstråle launch a manifesto for the new world of business. They emphasize that the new world is different. Forget the old world order. Forget what you knew yesterday. The revolutionary reality is that 1.3 kilograms of brain holds the key to all our futures. Competitive advantage comes from being different. Increasingly, difference comes from the way people think rather than what organizations make. Today, the only thing that makes capital dance is talent. In such times we cannot have business as usual - we need funky business.

#### E-Learning – New technologies, but the old approach

E-Learning seems to be also a part of that new funky business. It is based on new technologies, it can be used globally, any time and it can also reduce the costs of training. It’s definitely a new way how people develop new skills and learn new processes. But did E-Learning really become a tool used in the new economy? “Over 84% of Finance Directors have little or no confidence that they are getting a return from training investment.”<sup>1</sup> So why is this so? Why corporations do not believe in e-learning even it is

so cost effective? Is it because of the bad content or is there any other reason?

#### Companies do not want to have e-Learning, they want to be successful.

The reason is, that up to date, learning industry is offering only a more cost effective way of the old approach to learning. According to Naj Rahman (Director - HCM Solutions at Oracle), in its current form E-Learning is too content-centric. This is because the focus to date has been on how well training content could be ported to the new medium and the effectiveness of the medium as a learning tool. But business leaders don’t want learning initiatives, training programs, or e-Learning. They want to be successful. Truly effective online learning will undoubtedly require more than simply creating a multimedia equivalent of the content used in a classroom and putting it up on the corporate intranet. It is now widely acknowledged that online content must be blended with collaborative learning opportunities, and off-line interventions, all combining to increase effectiveness and actual usage.

Because of that, those who argued that Learning Management Systems were a non-essential requirement for E-Learning must surely concede that in the implementation of this so-called blended learning, the LMS has an important role to play. The LMS provides the tools to design and deploy blended learning. It will enable the multimedia component of an e-learning course to be wrapped with offline and collaborative experiences, and the whole package sequenced and scheduled to the needs of individual learners. Using an off-the-shelf package from a trusted supplier is a far more cost-effective way of achieving this than writing bespoke functionality with each separate e-learning course.

<sup>1</sup> (CFO Research Services, 2003)

For example Oracle Learning Management System (LMS), which is tightly integrated into HRMS, enables every employee to take control of their own personal development. When a personal development need is identified, it's possible for an employee to link straight into the LMS. They can then check whether training to meet that development need is available, whether it is online or instructor led, when it happens and then enroll. When the course has been completed, online courses have a built-in assessment and when completed satisfactorily, this automatically updates the competency framework for that individual. The solution is open to all systems, and it easily integrates external content because it is built on industry standards such as SCORM and AICC. This integration means greater efficiency for your training department. On the managerial side, there are also administrative elements within the LMS that for example, allow for cross charging internally for training. Measurement of training and learning effectiveness can be achieved by the use of key performance indicators covering areas such as training costs and revenues, course assessments, ratings and surveys.

## 2. NEW GENERATION OF E-LEARNING – AS A PART OF TALENT MANAGEMENT

In order to help companies succeed in reaching their valued outcomes, learning industry should focus on creating value. And if we agree, that value comes from talent and talent is the crucial factor to be different and to be successful, we need to start thinking of talents as our core business. The core business of each company then should be to create, develop and manage talents, and also to compose an environment, so they have freedom to create values and to achieve business objectives.

If we start thinking of our employees as talents and want to develop that talent, the first thing we need to do is to measure them. The same way as we measure our assets we need to start measuring our employees. If we care about buildings, equipment and vehicles, which do not bring a competitive advantage anymore, the more we should care about talented employees.



Fig. 1. Skill Gap analysis

We should exactly know who the critical employees are, what competencies they possess, what are their weaknesses, what are their working preferences and what is the value we will lose when they leave the company.

We need to change a definition of E-Learning. As described by Naj Rahman<sup>2</sup> from Oracle, this means applying the e not only to the content and its mean of delivery, but to the wider process of managing competencies and performance. The e-learning paradigm must evolve beyond just delivery of blended learning. It must encompass the process of managing competencies where training plans are created according to roles.

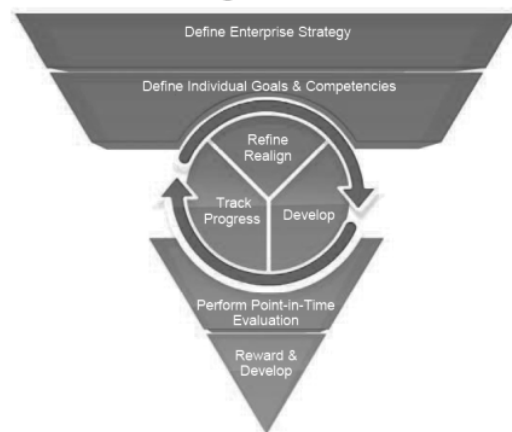


Fig. 2. Performance management business process

Competency management naturally evolves to managing the performance of individuals where training plans are driven from performance appraisals and development plans. This is in turn linked to managing the performance of the business, linking training to business objectives and the broader issues of talent management.

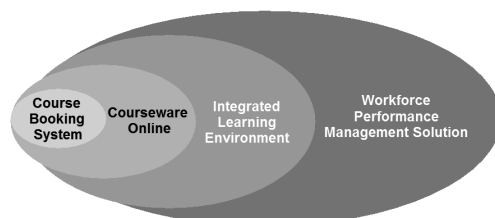


Fig. 3. Evolution of E-Learning

By redefining the scope of e-learning beyond the content, we can apply the power of technology to support the whole end-to-end process from identifying performance gaps, assessing competencies and skills-gaps, scheduling the most appropriate training in whatever form, through to assessing outcomes and delivering business performance.

This broader definition of E-Learning will inevitably require implementation of enterprise-scale application software to manage and integrate the various processes. Yet, another reason why the training department alone cannot be expected to be solely responsible.

<sup>2</sup> Naj Rahman is Director - HCM Solutions at Oracle. Naj can be contacted at naj.rahman@oracle.com

### How can competency management help increase the effectivity of e-learning?

Competencies can become the building blocks or “units of analysis” for understanding, describing and categorizing labor. They form the best way of easing the translation of business objectives into appropriately applied human capital.

Bernthal puts it nicely:<sup>3</sup> “Competencies tie human resource systems together by providing a common framework.”

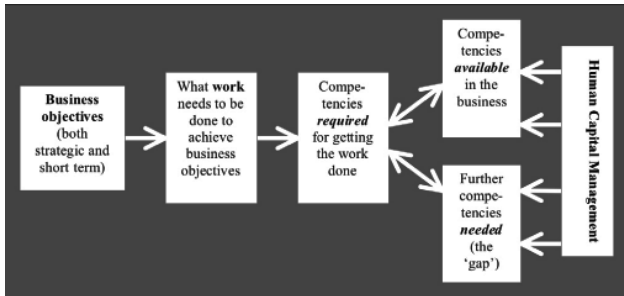


Fig. 4. Competencies providing the “glue” for a human capital management system.

If competencies deliver a consistent means to align best practices in human resource management systems, integration amplifies these best practices throughout the organization. A simple example highlights the benefits of leveraging competencies and integrating this information throughout key business processes:

*Your recruiting department receives a request from a line manager to hire a new person. The job analysis for the position identifies the specific competencies that are required. You can use this competencies list to select the best internal candidate or new hire. While this position is being filled, you can use the same competency list to set the performance criteria for that employee. This information can be directly imported into the performance management application to monitor performance, set goals, and provide feedback to both the employee and manager early in the on-the-job adjustment period.*

*If you identify any immediate or longer term training requirements through the performance monitoring process, the training application can leverage the same competency listing. A specific performance rating can be linked to a development opportunity to improve the employee's proficiency for that competency. If the employee fails to meet this specific rating an automatic trigger will notify the manager and the employee that a training plan for the employee is in place to assist.*

*Additional integration can update the performance management system once the employee has successfully completed this training and achieved the desired proficiency level for the competency identified. Integrated workflow can then notify the manager that the employee has completed this requirement and update these changes in the*

*performance management system. The integrated process can even prompt the manager or employee on the next step in the development plan for the position and the new competencies for the next level of development.*

### Why companies are not investing into competency management?

As organizations move toward a more people-centric approach, the systems and processes to support that change have been developed in a patchwork fashion. For example, in multinational corporations, each country operation typically has its own HR function. The result is that many international companies have a complex matrix of custom-built or locally supplied HR management systems that have been developed in isolation from one another. Not only is this approach costly and inefficient, it also creates an enormous challenge when trying to identify key talent across the enterprise.

As a result of that, one of the biggest HR challenges facing organizations is the difficulty of achieving a “single global view” of key data such as recruitment processes and trends, staff deployment decisions, remuneration and benefits information, and information about existing skills and competencies. Without this kind of visibility, chance rather than strategy begins to dictate an organization's talent management and of course learning as well.

The second reason is that all implementations of a competency management system start with the identification of the competencies that will be tracked and monitored by the system. This sounds like an easy and straightforward step, but it is this step that usually leads to the biggest challenges—especially when the implementation of competency management system crosses departmental borders.

The problem is that departments often struggle to reach consensus on the definition of critical competencies—and even the number of critical competencies—that should be tracked. In an attempt to satisfy all stakeholders many organizations end up with defining hundreds of “critical” competencies, resulting in an administrative nightmare and a competency catalog that is largely useless because there is no differentiation between the various competencies. Imagine what happens when the process is on an international basis.<sup>4</sup>

### **3. MANAGING COMPETENCE WITH ORACLE HUMAN CAPITAL MANAGEMENT SOLUTIONS**

Oracle's Human Resources module is at the heart of the solution to manage competencies in your organization. It is the foundation on which integrated competency management is built, and it is leveraged by many other modules.

With the Oracle HRMS module you can:

<sup>3</sup> Cook, K.W., and Bernthal, P.B. (1998), Job Competency Practices Survey Report, Issue 4 (Vol. 1) Pittsburgh, Pa. Development Dimensions International.

<sup>4</sup> Maximizing the Impact of Competence on Business Outcomes By Human Capital Alliance, An Oracle White Paper May 2005

- Set up a catalog of competencies and accomplishments specific to your organization's needs.
- Assign competency profiles to functional roles in your organization.
- Track your employees' and applicants' competence and accomplishments.
- Perform gap and match analyses.

These functions are all linked together, and there is a logical order for setting them up. For example, before you can perform a gap and match analysis you first need to define your competencies, assign them to organizational roles, and rate your employees' proficiency levels for these competencies. Figure 2 illustrates how these functions are related:

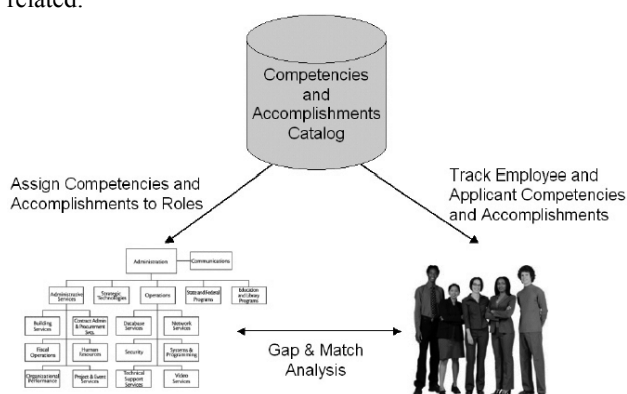


Fig. 5. Competency management functions

Once you have entered employee competency and accomplishment data, you can use Oracle suitability matching tool to start searching for candidates or employees with certain skills or credentials. For example, if your company is planning to expand to France, you can determine which employees or applicants speak French.

#### Enterprise learning effort can be focused on the “wrong” competencies.

Not all the competencies identified though are of equal importance. Focusing human capital management effort on critical competencies rather than on all those associated with a job or work role could enable a company to achieve the maximum outcome in performance from the least cost effort, thus enhancing the potential to achieve a return on investment.

Central to adopting a business approach to competency management is also the concept of business risk. Interviews of a significant number of Australian employers have found that they are continually assessing the risks of incomplete competence and making judgments on a worker's need for, and level of competence in relation to, some type of risk to an enterprise.<sup>5</sup> These employers identified the most common and important risks (nominated by at least 60 percent of employers) to their businesses:

- Quality of product or service.
- Non-compliance with legislation and government requirements.
- Loss of contract and funding.
- Loss of customer base.
- Loss of core knowledge, skilled personnel.
- Obsolete technology.
- Affect on professional reputation.
- Diminished competitiveness.
- Critical incidents.
- Supply chain disruptions.
- Failure and absence of critical machines or processes.

Our research shows that critical competencies are often small in number but powerful in influencing business results. Lominger has summarized this very succinctly in the following table:<sup>6</sup>

| How many competencies do we need? | Number        |
|-----------------------------------|---------------|
| For development                   | All available |
| For strategy                      | 20 to 30      |
| For job profiling                 | 10 to 15      |
| For hiring                        | 5 to 7        |

Tab. 1. Importance of critical competencies

Critical employees are those that are most closely associated with risk to sustaining business viability and achieving business outcomes. Often the assumption is that these people will be managers, but this in fact is not always the case. It makes sense to focus competency management effort first on the critical competencies of these key people, but often the effort is diverted to development of easier to identify and more prevalent competencies.

## 4. CASE STUDY

### Proven to cut costs and increase compliance levels

Seventeen of the world's top 20 banks, 12 of the top 15 life insurers, and hundreds of smaller financial institutions across the globe already run Oracle Applications to manage their people and core business processes. Financial institution that have chosen to implement Oracle Learning Management system as an integral part of their Oracle Applications infrastructure includes Deutsche Bank.

Deutsche Bank is a leading global international financial services provider. With 68,000 employees, the bank serves customers in 74 countries worldwide.

Cost reduction and containment is one of Deutsche Bank's imperatives; with another being compliance with national and international laws and regulations. Driven by the need for greater efficiency, the bank chose to consolidate and rationalize its worldwide IT systems, including those for

<sup>5</sup> Selby-Smith, C., Ridoutt, L., Hummell, K., and Cheang, C. The Valuing of Qualifications by Australian Employers. (published by the National Centre for Vocation Education Research in 2005.)

<sup>6</sup> Lombardo, Michael M. and Robert W. Eichinger (February 2001) *The Leadership Machine: Architecture to Develop Leaders for Any Future*, Lominger Limited, Inc. page 194.



learning and development. It was running eight legacy systems for training and 16 separate learning catalogues, a set-up that required 30 administrators.

The fragmented systems were not only costly, but also prevented the bank from being able properly to monitor and enforce regulatory compliance training. For these reasons it chose to replace the existing systems with a single enterprise-wide instance of Oracle Learning Management System, implemented by Oracle partners Deloitte and Accenture. The software required very little customisation and integrated automatically with Deutsche Bank's existing investment in Oracle Applications for human capital management. Since implementing its single organisation-wide learning management system, Deutsche Bank has increased the efficiency and uptake of its internal training programs. Three hundred separate training processes have been reduced to just nine, and user logins to the training system have increased dramatically.

## 5. SUMMARY

So is the revolution finished? Even though E-Learning boom has been here for some time and definitely brought new ways of developing skills and knowledge, we believe there is still a big amount of work to be done until E-Learning will become a key solution to managing the knowledge of your human capital. It requires investing in and implementing a competency model. Competence is seen as a valuable strategy in both helping to avoid the risk areas and in limiting the damage of adverse outcomes in nearly all areas of high risk but particularly where there are regulatory requirements to meet and where product and service quality and reputation are important. But to implement effective competency model is not an easy task. There has to be very close cooperation between departments, HR experts, business leaders and all supported with one integrated solution for talent management. And this is a challenge which also E-Learning needs to face.

## 6. REFERENCES

- [1] Kjell A. Nordström & Jonas Ridderstråle, Talent makes capital dance, 1999 BookHouse Publishing Sweden AB
- [2] Cook, K.W., and Bernthal, P.B. (1998), Job Competency Practices Survey Report, Issue 4 (Vol. 1) Pittsburgh, Pa.

Development Dimensions International.

- [3] Selby-Smith, C., Ridoutt, L., Hummell, K., and Cheang, C. The Valuing of Qualifications by Australian Employers. (published by the National Centre for Vocation Education Research in 2005.)
- [4] Lombardo, Michael M. and Robert W. Eichinger (February 2001) The Leadership Machine: Architecture to Develop Leaders for Any Future, Lominger Limited, Inc. page 194.
- [5] Maximizing the Impact of Competence on Business Outcomes By Human Capital Alliance, An Oracle White Paper May 2005
- [5] (CFO Research Services, 2003), <http://cfoenterprises.com/research.shtml>
- [6] [www.oracle.com](http://www.oracle.com)

## THE AUTHOR

**Peter Tomcak** is responsible for consultative selling of Oracle eBusiness Suite, mainly working as a product Specialist for HCM area. Peter is involved on tenders, RFI's, RFP's in Central and Eastern Europe and provides delivery of product presentations and demonstrations to prospects and Oracle partners in CEE countries. He is as well responsible for discovery sessions and workshops for Oracle learning management solutions and talent management tools.

08/2003-08/2004 – Business development hSenid Software International, Colombo, Sri Lanka - software development company with offices in United States, Singapore, India and R&D centers in Sri Lanka & Malaysia. Peter was involved in business development-marketing activities for hSenid business solutions division, and also initiator of research and development of Competence management solution. After graduating from Faculty of economics and management, Engineering (Honours) degree in International Trade, he worked also for Southwestern Company in Nashville, USA as an independent contractor and became member of DSA-Direct selling association.





## IT LITERACY ACQUISITION COURSES DESIGNED FOR UNIVERSITY AND COMMUNITY SUPPORTED BY GOOD PRACTICE PROGRAM

Tsuyoshi Usagawa, Hiroshi Nakano, Norio Iriguchi, Ken'ichi Sugitani  
Center for Multimedia and Computer Science, Kumamoto University  
+81-96-342-3622, +81-95-342-3599, {tuie@cs., nakano@cc., irig@, sugitani@cc.}kumamoto-u.ac.jp

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Demands of IT literacy education have been increased dramatically over a decade. Kumamoto University has started the university level trial in order to support the IT literacy education at general education since 1996. And since 2002, the Center of Multimedia and Information Technology has provided the compulsory courses of IT literacy for all fresh students of Kumamoto University. More than 8000 students have took IT literacy courses last 5 years and the course has been managed by WebCT since 2003 including course contents, assignments and reports beside the communication between students and lecturers. In 2004, we have awarded the “Good Practice – Distinctive Educational Activity” program from the Ministry of Education, Culture, Sports, Science and Technology by the IT literacy education at CMIT. This GP program assists the activity of IT literacy education over four years including not only education for fresh and foreign students, but also the courses for staff and faculty developments and domestic and international societies. In this paper, the activities of IT literacy education are discussed within Kumamoto University as well as at Institute of Technology Surabaya, Indonesia.

**Keywords:** IT literacy education, WebCT, Good practice program, Indonesia

### 1. INTRODUCTION

Demands of IT literacy education have been increased dramatically over a decade. Kumamoto University has started the university level trial in order to support the IT literacy education in the category of general education since 1996. And since 2002, the Center of Multimedia and Information Technology (CMIT) has provided the compulsory courses of IT literacy for all fresh students of Kumamoto University. More than 8000 students have took IT literacy courses last 5 years and the course has been managed by WebCT since 2003 including course contents, quizzes and assignments.

In 2004, we have awarded the “Good Practice (GP) – Distinctive Educational Activity” program from the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan on the topic of the IT literacy education delivered by CMIT. The awarded activity is named as “Campus wide IT literacy education in order to evolve the activities on campus as well as in society.” Under the name of this program, the GP program assists the activities of IT literacy education for all fresh students and foreign exchange students, as well as the activities for staff and faculty developments at Kumamoto University. Also this program assists to share the experiences with local and international societies.

In this paper, the activities of IT literacy education for fresh students and courses opened as staff and faculty developments are discussed at Kumamoto University as well as in field of international corporation, especially at Institute of Technology Surabaya, Indonesia related to GP program and international corporation program.

### 2. ABOUT GOOD PRACTICE PROGRAM

#### Good Practice (GP) Program started in 2003

In 2003, MEXT of Japanese government starts a new program to enhance the educational capabilities of national and private universities in Japan. This program is named as “Good Practice” program because of its objectives; awarded activities should share their experiences and knowledge with others in order to enhance the educational capabilities. The awarded GP program of Kumamoto University in 2003 is the activities related to Web-based School Information System called SOSEKI after the eminent Japanese novelist *Soseki Natsume*, who had been a professor at the 5<sup>th</sup> high school (the origin of Kumamoto University) in Meiji era[1]. This school information system takes care of registration of course and scoring of all students, and it is a main constituent system of university’s “Integrated Campus Information System Plan.”

#### IT literacy education awarded in 2004

In the next year, another activity related to the Integrated Campus Information System Plan is awarded under GP program. This activity titled as “Campus wide IT literacy education in order to evolve the activities on campus as well as in society” was awarded for the IT literacy education. This activity has started in 2002 for providing well organized IT literacy education for all fresh students of Kumamoto University with homogeneous course contents and evaluation of score. GP program supports 15,500JPY (about US\$13,000) per year during 2004-2007 fiscal years for this activity. Because of the objectives of GP program, we are asked to improve the courses themselves, but we also need to expand our activities in order to share the knowledge and experiences on IT literacy education with staffs and faculties

of Kumamoto University, other universities in Japan and public including local society and international academic institutes.

In the following sections, the activities under GP program as well as other activities related to the GP program are detailed.

### 3. ACTIVITIES ON CAMPUS

In order to improve and control the campus wide IT literacy level, there are two kinds of activities on our campus; one for students and one for staffs and faculties[2].

#### IT literacy courses for all fresh students

When we design the courses to meet the requirement for assuring the IT literacy level for all fresh students, we use the analogy of driver's license. In order to get the driver's license in Japan, we need to pass three categories of examinations;

- [A] driving skill,
- [B] knowledge of road traffic law, and
- [C] first-aid for traffic accident.

Almost all who wish to get the driver's license can pass those examinations after sufficient practice; some may pass them right after practice, but some may take examination several times until they pass. In the latter case, yesterday's examination is not the same as today's, but the effectiveness of those examinations are the same because the level and context of examinations are treated as the same. This scheme of examinations provides that every licensee has sufficient skill and knowledge to drive an automobile.

We have designed the IT literacy courses, all students have to pass the examinations of three categories;

- [A] skill to use IT,
- [B] IT ethics such as intellectual property and related legal issues, and
- [C] first-aid for virus and other emergency in order to use network information high-way on campus,

as same as the driver's licenses. From those three points of view, the campus wide IT literacy education consists of three credited classes as shown in Tab. 1. "Basic Course of IT - A" and "Basic Course of IT - B" are for fresh students and "Information Processing," which is designed to assist to get the official certificate from governmental organization, is for sophomores. Although those three courses are designed as the IT literacy courses, hereafter only "Basic course of IT - A & - B" will be discussed because major part of IT literacy is included in these two courses.

Tab. 1 : Classes for IT literacy; Semester and credits.

| <i>Name of Course</i>     | <i>Semester</i> | <i>Credit</i> |
|---------------------------|-----------------|---------------|
| 1) Basic Course of IT – A | 1               | 1             |
| 2) Basic Course of IT - B | 2               | 1             |
| 3) Information Processing | 3 or 4          | 1             |

Note: that both Basic Course of IT-A & B are compulsory for all fresh students.

#### Details of course contents

Contents of the IT literacy education are categorized into three corresponding to the three topics; [A] IT skill, [B] IT ethics and [C] first-aid of security issues. Detail syllabuses for "Basic Course of IT – A & - B" are shown in Tab. 2. As shown in Table 3, there are not specific contents specialized for [C] because some of contents related to the ethics includes them.

#### Software environment :Site licensed & GPL based software

For the [A] IT skill, "Basic Course of IT A" takes care of the basic literacy including office tools such as word processing, spreadsheet, drawing, painting and presentation tools. Because Kumamoto University has obtained the campus-wide license of StarSuite[3] by Sun Microsystems, Inc., all of lectures are based on the following software.

Word processor: **Writer**  
 Spread sheet: **Calc**  
 Drawing Tool: **Draw**  
 Presentation Tool: **Impression**

Because of licensing condition, all of students are allowed to install StarSuite software into her/his own computer while she/he is a registered student of Kumamoto University. Also as a painting tool, GIMP (The GNU Image Manipulation Program) distributed under GNU GPL (General Public License) is used.

As a mail client, the original mailer named "Seemit" developed by Kita et al[4][5] is used in order to explain the "smtp" and "pop3" protocol visually. In face-to-face lecture,

Tab.2 Syllabuses of "Basic Course of IT –A & -B"

| Basic Course of IT – A   |
|--|
| 1. Password and registration of subjects with SIS*<br>2. IT ethics(1) and e-mail(1)<br>3. Word Processor<br>4. Paint (1)<br>5. Paint (2)<br>6. Draw and IT ethics(2)<br>7. Search on Web & Library, and IT ethics (3)<br>8. Spread sheet (1)<br>9. Spread sheet (2)<br>10. OS with file/folder, e-mail(2) and related topics<br>11. Introduction of Network<br>12. Submission of work (continue to 15.)  |
| Basic Course of IT – B   |
| 1. Basics of WWW and how to write Web page<br>2. IT ethics (4): Legal responsibility<br>3. Publication of Web page<br>4. Introduction of HTML (1)<br>5. HTML and animation<br>6. Introduction of CSS<br>7. Layout of Web page and IT ethics (5)<br>8. Decoration of Web page and IT ethics (6)<br>9. JavaScript (1) and IT ethics (7)<br>10. Submission of work (also 13. – 15.)<br>11. WWW server implementation<br>12. Information Security and online questionnaire |

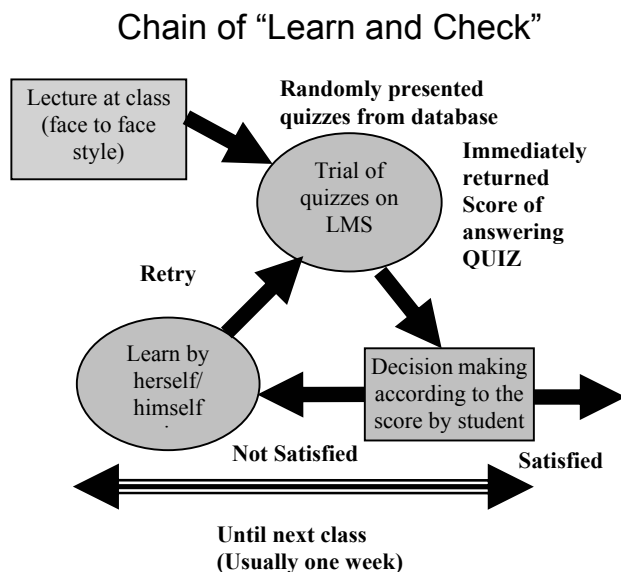
Note: SIS = School Information System, called SOSEKI at Kumamoto University, which manages the all of the subjects provided with online connection with LMS (WebCT).

lecturers demonstrate the usage of those protocol with visualized transaction as well as the usage of Seemit as the mailer. In the demonstration of “pop3” protocol, students are able to take a look the detail transaction of not only mail body but also user ID with password as the plain text. On the demonstration of “smtp” session, students also see their own mail body as the plain text. In those demonstrations, the security issue emphasize in order to let them understand the possible risk on the usage of e-mail.

#### Cross-listed Contents on LMS

All of the contents are edited by one lecturer in order to keep consistency; technical level of contents, notation of technical word, wording and writing style, etc. Although around 30 “Basic Course of IT-A & B” classes in each semester are delivered by 7 permanent teaching staffs with a few temporal staffs, the same contents are used for all the classes on LMS (WebCT)[6]. Because each class has to be managed by the assigned teaching staff, the privileges as the “instructor” on LMS is given to each assigned staff. On the other hand, the “editor” can control all the contents of all classes by means of “cross-list” function provided as the part of Instructional Management System (IMS) implemented on WebCT.

Fig.1 Diagram of Chain of “Learn and Check” used in Quizzes on LMS



#### Tasks of courses

The assurance of understanding is the most important issue in order to design the courses. For the IT literacy education, as already mentioned, three topics [A-C] have to be assured. And there are obvious difference between [A] skill and [B][C] IT ethics and first-aid. On IT ethics and first-aid, all the students have to understand very well because the comprehension of those topics is not easy to build up after the IT literacy courses. On the other hand, students will have various and many chances to practice and learn [A] IT skill after those courses. This difference requires the different assurance levels.

Based on the above mentioned situation, three types of tasks are employed;

(T1) Online quiz ; 21 times/30classes

Sets of quizzes are categorized into two; (T1-1) for IT skill and (T1-2) related to the ethics including intellectual property and legal issues.

(T2) Submission of results of practices and online registration of attendance; every class

(T3) Submission of two works; once/semester

(T3-1) Presentation file combined with writer, calc, draw, and GIMP.

(T3-2) Interactive HTML file written with JavaScript and CSS.

Sets of online quizzes (T1) are designed for corresponding to each week. They provide students with chance to confirm their understanding of the topics mentioned in the context at assigned week. Figure 1 shows schematic diagram to show the process of face-to-face lecture combined with online quizzes. Students take a lecture by face-to-face style at class room. After each lecture, students are asked to try quizzes until next class. A set of quizzes is automatically generated by random selection of quizzes sufficiently large volume database of quizzes. Also alternatives in selection problem are also randomized. Because of those treatment of quiz, students allow to try quizzes as many times as they want, in other words, until they satisfied. When a student submit the answer of quizzes, LMS system immediately feedback her/his rank in 1800 students as well as the score of submitted answer. Students are told a priori that the highest

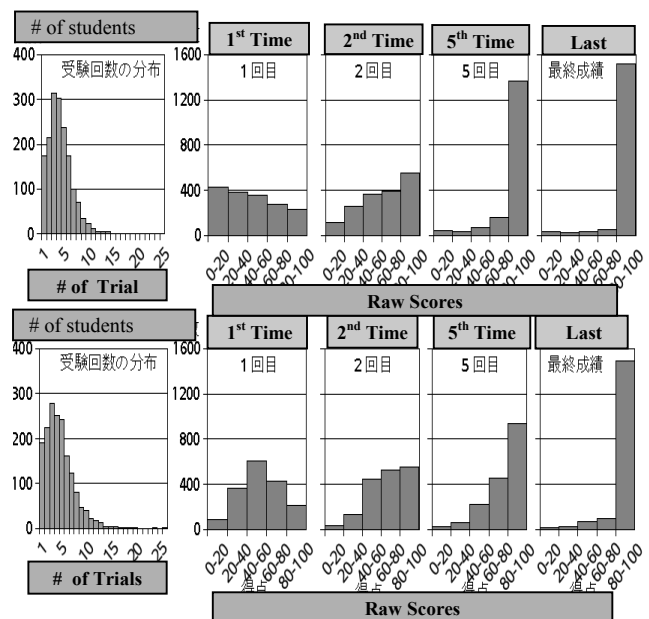


Fig.2 Two examples of results of quizzes. From left to right, distribution of number of trials, distribution of scores (highest one for each individual) at 1<sup>st</sup>, 2<sup>nd</sup>, 5<sup>th</sup> and last trial. Ordinate shows the number of students. Note that the total number of students is around 1800.

Figure 2 shows the two examples of results of quizzes. Upper and lower graphs are corresponding to the two examples. In each row, from the left to right, frequency distribution of number of trials, score distributions at the 1<sup>st</sup>, 2<sup>nd</sup>, 5<sup>th</sup> trials and at last. All of ordinates show the number of students. Abscissa of left most graph is the number of trials. And abscissas of other graphs are scores of quizzes where 100 is the top score. As shown in those examples, even if the initial distributions of score are varied, the final distributions are very similar; more than 90% of students made score equal or higher than 80. This tendency of score distributions is very similar for all sets of quizzes. These data provide the assurance of learned level of students by quiz.

For each semester, students must submit a work (T3-1) or (T3-2) by uploading to the students' server. Requirements of works are clearly noted and it emphasizes the legal issues on materials in works.

Evaluation plays very important for assurance of students' level. A committee organized by all teaching staffs for "Basic course of IT literacy –A & B" discusses not only contents and requirements but also the method of evaluation including scoring weightings. The weightings for each categories are (T1) 40%, (T2) 30% and (T3) 30%. Required levels for those categories are 60% or higher, except (T1-2). Because (T1-2) related the ethics, the requirement of understanding level is set no less than 90% in order to survive the network society to protect themselves even after they graduate Kumamoto University.

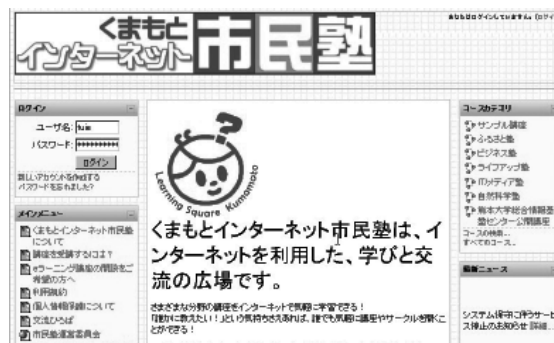
Because the law protecting personal information has established on May 2003 and enforced on April 2005 in Japan, IT literacy level of staffs and faculties of university is very important especially on security issue including anti-virus activities and protection of PC used for daily job. Also the intellectual property issue is attracted the attention including software license control. The courses for "Protecting personal information" and "Intellectual Property Right" are provided as contents of WebCT, on which all of permanent staffs and faculties have accounts, with automatically evaluating quizzes. Accesses and scores of all trial of quizzes are recorded on WebCT. Although it is informed to staffs and faculties that those information are recorded, it is not used for any evaluation except as the statistical data.

Before GP program is awarded, other grand, named LINK project, supported an e-Learning system which provides various courses for public via free-of-charge registration as shown in Fig.3. After this grand had finished, most of contents are still accessible, but they are not maintained well due to shortage of financial and human resource support.



(<http://www.link.kumamoto-u.ac.jp/station/index.html>)

In order to overcome the license issue related to LMS, Moodle[7] is chosen as the LMS for public usage. Also in order to shift the activities more public, the non-profitable organization (NPO) named “Kumamoto Chimin-jyuku” (Kumamoto private school for citizen) is officially registered at local government of Kumamoto in 2005. It opens own Web site (<http://www.learning-square.jp/>) operated by Moodle as shown in Fig.4. The objective of this NPO is to provide all citizen the chance to be a lecturer as well as learners. One can deliver the lecture for free of charge style or he/she may charge on learners according to the lecturer’s wish. As of May 2007, there are six categories of lectures; (1)our home town, (2)business, (3)IT, (4)daily life, (4)science and technology and (6)courses from CMIT, Kumamoto University, and there are 14 courses available, and some of them are transformed from former contents in LINK project and some are newly developed related to GP program.



<http://www.learning-square.jp/>

## 5. ACTIVITIES FOR INTERNATIONAL CORPORATION

Based on the previous activities under Japan International Corporation Agency (JICA) during 2000-2005 and the official agreement between universities established in 2004, Kumamoto University and JICA concluded the contact for the Project for Research and Education on Information Communication Technology – Institute of Technology Surabaya (PREDICT-ITS) during 2006-2009 Fiscal Year in order to improve the capabilities for Master Course research activities. In this project, we have provide various type of distance and e-Learning contents. In August 2006, the Indonesian Higher Education Network (INHERENT) was installed to connect major national universities in Indonesia. In Java island, backbone network connect major node university with 155Mbps, and other islands are also connected via satellite as well as microwave channels with a few Mbps level. ITS is the node university for eastern part of Indonesia.

Based on this infrastructure, lectures had been delivered via TV conference system from Kumamoto University to ITS and other Indonesia universities such as Sam Ratulangi University (UNSRAT) at Manado, North Sulawesi and Mataram University (UNRAM) at Mataran, Lombok. Delivered contents includes Content Building on Moodle, Intellectual Property for e-Learning Contents, and ICT related research topics. Also ITS are operating two Moodle systems, one of which provide the special courses on the intellectual property issue for e-Learning contents. Also ITS has strong relationship with national and private universities in eastern part of Indonesia, it provides digital contents for Moodle to share its experiences on delivering contents, and universities at Manado and Mataram are trying to open their own Moodle for preliminary usage. The snapshot of e-Learning introduction page at ITS is shown in Fig.5.

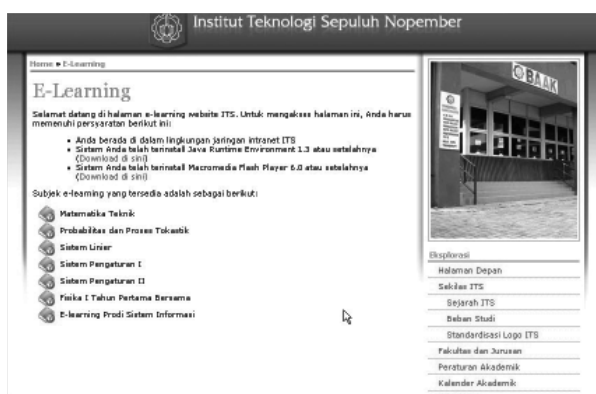


Fig. 5 Snapshot of ITS e-Learning entry page (<http://its.ac.id/akademik.elearning.php>)

Figure 6 show the snapshots on “e-Orientation” in which two lectures are delivered from Kumamoto University over TV conference system connected to ITS as well as UNSRAT and UNRAM. “e-Orientation” attracted the attention from faculties from the viewpoints of i) making contents with Master students, who are faculties of other university, as part



Fig.6 Snapshots of “e-Orientation” on October 17<sup>th</sup>, 2006; Screen and delegates at ITS

of daily education activities, ii) sharing resources with potential e-Learning providers and users, and, as participants at ITS included many of the young faculty members of universities in the eastern part of Indonesia, iii) developing practical tool for cooperation among ITS and other universities.

IT literacy, especially on intellectual property, ethics and security issue, can be one of most popular contents on e-Learning system. Part of IT literacy contents developed under GP program are already translated into English for foreign students at Kumamoto University and can transferred into Moodle sytem at ITS. During the period of PREDIT-ITS project, we are expecting the further expansion and further collaboration on this issue.

## 6. CONCLUDING REMARKS

In this paper, we have introduced the activities on IT literacy education as the campus wide compulsory courses which is supported under the Good Practice program sine 2004. The contents as well as experiences are shared and transferred to activites for local society via NPO and international corporation under JICA project as well as staffs and faculties developments within Kumamoto University. Without e-Learning system and network infrastructure, any of our activities can not be made and we are expecting further expansion of our activities.

## 7. REFERENCES

- [1] Usagawa, T., Nakano, H.: Campus-wide IT literacy education for all students by effective e-Learning environments, Proc. ICETA2005, 2005,
- [2] Usagawa, T., Nakano, H., et al.: Assuring the basic IT literacy levels for every student by the University-wide blended learning, Proc. ITHET2006, Paper No.258, Sydney, 2006.
- [3] <http://www.sun.com/software/star/starsuite/>
- [4] <http://seemit.info/>
- [5] Miyazaki, M., Kita, T.: Development of an Education-Oriented E-mail Application "Seemit" and its Utilization in a Information Literacy Course, Proc. ITHET2004, Paper No.208, Turkey (2004)

[6] <http://www.webct.com/>

[7] <http://moodle.org>

## THE AUTHORS

**Tsuyoshi Usagawa:** He received M.E. and Ph.D. degrees in Information Science from Tohoku University, Sendai, Japan in 1983 and 1989, respectively. In 1983, he joined Kumamoto University, Kumamoto, Japan, where he has a professor since 2003. Since 2004, he is a director of Center for Multimedia and Information Technology, Kumamoto University. His major interest includes acoustic and speech information processing for e-Learning. He is a member of the ASJ, ASA, IEEE, IEICE etc. He received the Awaya award and Sato paper award from the ASJ in 1992 and 2006, respectively. He was a vice president of the ASJ during 2005-2007.

**Hiroshi Nakano:** He received B.E., M.E. and Ph.D. degrees in Kyushu University, Japan in 1982, 1984 and 1987, respectively. In 1987, he joined Nagoya University, Japan. Since 2002, he has been a professor of Center for Multimedia and Information Technology, Kumamoto University. Since 2004, he has served as a member of advisory committee for the president of Kumamoto University. Since 2006, he is also holding the hosts of a professor of Instructional Systems Program, Kumamoto University, and an invited professor of the National Institute of Multimedia Education, Japan. His research interest includes various kinds of IT systems related to e-Learning and distance education. He did program committees on several international conferences, ICIMADE2001, ITHET2003, 2004, 2006, 2007 (chair), ICETA2004, 2005, 2007.

**Norio Iriguchi:** He received B.E. and M.E. degrees in Electronics Engineering from Kyushu Institute of Technology, Kitakyushu, Japan, in 1969 and 1971. He received a Ph.D. degree from the University of Tokyo in 1995. In 1971, he joined Asahi Kasei Corporation, and he has been a researcher in the field of computer tomography as well as a director of intellectual property section during 1998-2002. Since 2002 he has been a professor of Center for Multimedia and Information Technologies, Kumamoto University. His research interest includes IT literacy education, especially on intellectual property (IP) issues and network ethics as well as computer tomography. He is a member of IEEE, AAAS and NYAS.

**Ken'ichi Sugitani:** He received B.E., M.E. and Ph.D. degrees in Electrical Engineering from Kumamoto University, Kumamoto, Japan in 1982, 1984 and 1994, respectively. In 1984, he joined Kumamoto University, Kumamoto, Japan. Since 2003, he has been a professor of Center for Multimedia and Information Technology, Kumamoto University. His research interest includes network and server systems, especially system operation concerning security issues, and analogue and digital hybrid circuit system especially on switched capacitor circuits. He is a member of IEICE, IPSJ and JSET.

## ACKNOWLEDGEMENT

*Major part of this work is supported by the "Good Practice – Distinctive Educational Activity" program from the Ministry of Education, Culture, Sports, Science and Technology by the IT literacy education granted in 2004 except the activities at Institute of Technology Surabaya in Indonesia.*





5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## CHANGING ROLES FOR TEACHERS AND LEARNERS IN ONLINE COURSES: EVOLUTION, NOT REVOLUTION

Susan M. Zvacek, Ph.D.  
Director, Instructional Development and Support  
University of Kansas  
Lawrence, KS 66045 USA  
785-864-2600  
szvacek@ku.edu

**Abstract.** The adoption and diffusion of e-learning has prompted a much-heralded change in the expectations and responsibilities of teachers and learners in post-secondary education. Although the change is welcomed by many, teachers and learners facing the daily reality of figuring out “What am I supposed to do?” are frequently less-than-pleased with their new roles. Teachers, long familiar with the job of performer in the classroom, may find themselves at a loss when they no longer hold centre stage; learners, meanwhile, often feel frustrated by tasks required in their online courses – tasks for which they may feel ill-prepared. The obvious question arises: “Why should we take on these new roles if we’re comfortable with the old ones?” This presentation will respond to that query by providing evidence (based on cognitive processing and constructivist learning theories) to support this instructional evolution, discussion of the new [unfamiliar] roles, why they’re an improvement over previous models, and how we can help teachers and learners adapt to the changing landscape.

**Keywords:** Teaching, E-Learning, Pedagogy, Interactive Learning, Student, Web-based Courses

### 1. INTRODUCTION

When an instructor contemplates teaching online for the first time, he or she will probably hear something about how the teacher’s role is different in e-learning than it is in the traditional, face-to-face classroom. What that instructor might not hear, however, is what that role change will mean in a very practical sense, why it happens, and what outcomes to expect, as a result. This paper will discuss these issues, as well as the theoretical bases behind the change, how roles also change for students, some teaching strategies that take advantage of those new roles for teachers and learners, and why few online instructors have greeted this evolutionary development with enthusiasm.

The role change in question is based on the incorporation of active learning into online coursework. Although some teachers already rely on active learning methods in their face-to-face classrooms, the environment doesn’t require them to do so, and in some instances it may actually discourage their use. (Ponder here the difficulties inherent in student collaborations in a classroom in which the chairs are bolted to the floor.) Within the virtual classroom environment exists a multitude of possible instructional strategies that have one thing in common: they all depend on the student’s active involvement in order for learning to occur. It no longer makes sense (if it ever did) for us to consider what we will do to teach, without first deciding what students will do to learn.

In the interest of full disclosure, it should be mentioned here that the author believes that the role change accompanying e-learning is not only a welcome phenomenon but is

unfortunately long overdue. E-learning can be – that is, should be – a catalyst for educational improvement overall as we re-think our long-held notions of how teachers and students are expected to behave and how learning occurs.

### 2. CONVERGING TRENDS

The acceptance and growth of active learning strategies for online coursework is a natural, evolutionary development stemming from a convergence of three important trends. The first trend is the development of easy-to-use, cheap, reliable, ubiquitous *communication technologies*. Widespread access to hardware and software that support e-learning has changed our idea of what a “learning environment” looks like. Additionally, as mobile computing, social networking, and anywhere-anytime communication gain footholds internationally, our traditional ideas about classrooms begin to take on a rather quaint aspect with a soft-focus appearance, not unlike our memories of Grandma’s kitchen we knew as children.

The second important development has been the rapid advancement of *cognitive processing research*. Technologies allowing glimpses into the brain and its functioning are informing developmental psychologists, physicians, learning theorists, instructional designers, and countless other interested professionals. These research efforts support the use of instructional models that incorporate student engagement, multi-sensory stimulation, robust feedback, and learning strategies to enhance retention of newly-acquired skills and knowledge.

Finally, the third coinciding trend is the *growth of e-learning* as an accepted instructional model for teaching and learning. The needs for e-learning are diverse, including career re-training or re-licensure, advanced or specialized curricula for remotely located students, accommodating the competing priorities of working adult students, delivering instruction on a just-in-time basis to the workplace, addressing teacher shortages, and upgrading the skills of military professionals deployed throughout the world, just to name a few. With this relatively rapid adoption of e-learning has come a somewhat slower (and, at times, grudging) acceptance of the integrity of distance education as a potentially viable and rigorous method of instruction.

The convergence of these trends has led to an unparalleled opportunity for innovation in teaching and learning, and although this paper will focus on new roles in online environments, the roles of teachers and learners in face-to-face classrooms are changing, as well. These changes, wherever they occur, must be viewed as a natural progression, an evolution, rather than as an anomalous event (indicating a revolution), in order to understand fully their significance and potential.

### 3. CHANGE AND THE ADOPTION OF INNOVATIONS

As with most opportunities, however, there are a few hurdles to overcome – and almost all are based on our built-in, human resistance to change. When humans are faced with something new – a product, an idea, a way of doing things – they behave in surprisingly predictable ways. Sociologists studying the adoption and diffusion of innovations within and among groups have noted that we consider five different factors when deciding whether to adopt an innovation. Rogers [1] was one of the first to document these concerns and they have been observed in widely disparate cultures and settings, with “innovations” as varied as agricultural practices, laptop computers, birth control methods, and bottled water. Applying these factors to the innovation we’ll call “role change” may help explain why professors, trainers, and teachers worldwide have not embraced their new roles with unbridled enthusiasm.

The first, and most important, of the factors is known as *relative advantage* – i.e., is the innovation better than what we are doing (or what we have) already? In this example, abandoning one’s familiar classroom role would require great confidence that the new role (one’s behaviors, methods, style) offers an improvement over the old. Considering that the vast majority of university professors (in the United States, at least) see themselves as “above average” teachers [2], it seems unlikely that such change will result from any intrinsically felt need.

Another important factor weighed by potential adopters is referred to as *compatibility*. Here, the new role (the innovation) must fit into existing structures (e.g., standard course design practices) and it also must be congruent with the adopter’s philosophy and values. For example, if I simply don’t believe that students can learn from me when

they’re not in my physical presence, it is unlikely I’ll adopt a teaching role that incorporates little or no face-to-face interactions with students.

The third factor deals with the perceived *complexity* of the innovation itself. Is it difficult to understand, to use, or to implement? In our role-change example, this characteristic may, in fact, be hugely significant. Except at the elementary or secondary level (k-12, in the US), few teachers, professors, or trainers have had formal instruction in learning theory, instructional design, teaching, or assessment. Those who are successful typically either: 1) have imitated the good teachers they remember from their own school days or whom they’ve observed in their departments, or 2) have relied on trial-and-error methods of figuring out how to teach. Unfortunately, few of the imitators will have online teacher role models to emulate, and the trial-and-error group may not be eager to re-experience the “error” phase of the learning cycle again.

The two remaining factors – trialability and observability – are somewhat related. *Trialability* refers to the possibility of a “test drive” prior to fully adopting the innovation and *observability* is the degree to which the results of the adoption (the change) are apparent. Some instructors may, in fact, be willing and able to “try on” their new role to see how it fits, and the results may be apparent. However, these two characteristics are often the least influential when considering an innovation, so a positive outcome might not be persuasive in the long run.

Based on the decision factors described above, is it any surprise, then, that we have yet to detect a sea-change in how teachers, trainers, and professors view their role in the e-learning environment? One answer may be to clarify what the new roles might consist of and to support instructors in adopting new teaching methods that are consistent with those roles. For example, over the past several years, many of us in the field of instructional design have reliably trotted out a piece of well-worn advice for aspiring teachers and trainers, “Don’t be a sage on the stage, be a guide by the side.” This is often touted as the mantra for teacher role change in a learner-centered environment, and although it embodies the advantages of brevity and rhyming, it has two significant flaws: 1) It may not be clear to the recipient of this pithy advice exactly what a “guide by the side” *does*, and 2) it ignores the role of the student, whose participation in the educational endeavour is at least as important as that of the teacher, if not more so.

### 4. DEFINING AND DESIGNING ACTIVE LEARNING

At this point, it may be useful to digress momentarily and revisit one of the three converging trends discussed earlier. Rapid advances in neurological and information processing research are beginning to have an impact on how we design instruction that results in long-term retention of knowledge and far transfer of newly acquired skills. What this means

for online instructors (or any instructor, for that matter) is that students need to be actively engaged in their own learning.

Active learning (engagement) results when learners *do something* with course content, beyond passively absorbing it. They might compare it to similar content they learned in the past, categorize it according to a specific set of criteria, use it to solve equations, summarize it by identifying key ideas, or evaluate its usefulness in developing an argument. Although each of these tasks could be performed “invisibly” by students, with no outward indication of their accomplishments, activities that include observable behaviors provide instructors with important clues regarding student progress.

When designing instructional activities, *feedback* to the learner on his or her progress is a necessary element of active learning. Without feedback to guide the student’s performance and to encourage improvement, practice with new skills is meaningless. It is through feedback that learner abilities are shaped and gradually honed, enabling master to occur.

Engagement will frequently involve some kind of *interaction* between the learner and the teacher or with other students. For example, in order to explain a concept to a classmate, the learner must not only understand it but be able to put it into words that a peer – presumably not expert in the topic – could grasp. Or, with a group-based project, the process of negotiating a consensus response among peers refines and clarifies each student’s understanding.

An instructional technique known as the “advance organizer” exemplifies another component of active learning: linking newly-created mental structures to those already built. Advance organizers may consist of narrative text, graphics, concept maps, or other stimuli, with the express goal of *activating prior knowledge*. This technique encourages the student to purposefully retrieve what they have already learned, examine it in light of the incoming message, and build one or more relationships between the old and new. This process of adjusting the existing frameworks to accommodate new content is useful for identifying misconceptions and refining understanding.

Finally, learners will adopt active learning behaviours more readily if they are appropriately *motivated*. Keller [3] identified four components of learner motivation: Attention, Relevance, Confidence, and Satisfaction (ARCS). In order for students to remain motivated (i.e., for them to persist in their learning behaviours) we must consider the attention-gaining and –holding qualities of the instruction, whether the content and learning activities are considered relevant beyond the classroom environment, the degree of confidence students have in their ability to be successful in this undertaking, and the long-term satisfaction they will gain when they do attain mastery of the new skills. Our goal, as instructors, is for learners to be motivated to engage fully in the instructional activities we’ve designed.

### Instructional Strategies

Some practical strategies for integrating active learning into online coursework are offered to illustrate the preceding points.

- *Concept Mapping*: A concept map is a visual representation of knowledge and its organizational structure. Using concept maps as an active learning strategy is an excellent way to ensure that students can identify key ideas, but more importantly, it confirms that they understand the relationships among those ideas. Concept maps frequently are used to identify student misconceptions early in the course, before those false notions can negatively affect subsequent learning. Assign students to create concepts maps on the specified topic, or create one yourself and leave portions of it blank for them to fill in. Learners should be able to explain their concept maps to the instructor or to classmates, and groups of students may be assigned to work collaboratively to build a map. (Free concept mapping software is available for download, or an institution may choose to invest in a site-licensed product that may offer more features. See [4] and [5] for two examples.)
- *Collaborative Writing*: One of the few universal truths of higher education is that students (and faculty, in some instances) hate group work. It’s difficult to find suitable meeting times to get projects done and there is always one person who doesn’t do his or her share of the work, but plans on taking a share of the credit when grading time rolls around. Wiki software can alleviate, if not entirely eliminate, both of these problems. A wiki is an online environment designed for collaboration. The philosophy behind wiki software is that “anyone can edit anything at any time.” [6] Within an instructional setting, wikis can serve as groupwork sites to allow the asynchronous development of a report, project, essay, model, or other digital file. The wiki site (depending upon the software used) can be visible to only a few members, to anyone at all, or visible only to members initially, then later made available to others. Permissions for contributing, editing, and commenting can also be assigned to specific individuals or left open to anyone who’s interested. Every version of the site is retained, so if a student inadvertently deletes something important it can be retrieved or if a user determines that an earlier incarnation of the work is preferred that version remains readily available. Some wiki software provides an “audit trail” identifying who made which revisions to the site, therefore allowing an instructor to keep track of student contributions and detecting if there are slackers among the group participants. The instructor typically has the option to participate as a contributor, but this can have an unfortunate inhibiting effect, so it may be best to remain unobtrusive.
- *Interviewing or Shadowing*: For students interested in exploring a particular career, having the opportunity to interview or work with professionals in an authentic setting provides built-in relevance to long-term goals. Here, the “active” element of the strategy is obvious, although the instructor must ensure that the “learning”

component is also clear. Students will probably find interactions with professionals in their field of study enjoyable and motivating, but without a clear set of expectations the time spent may result in only a vague sense of frustration. With these types of assignments, establishing a set of objectives cooperatively with the student prior to the activity will preclude such difficulties, help them to develop a more positive attitude, and adopt a proactive role in completing the project successfully.

- *Problem-based or Case-based Learning:* The central tenet of problem-based learning (PBL) is that students are presented with a problem or case that resembles a real-life challenge with all its accompanying messiness. The term “ill-structured” is often used to describe the problems designed for PBL assignments, meaning that the challenges do not have clear-cut answers and there may be multiple paths to one or more appropriate resolutions. As in real life, we are faced with a challenge and must engage our problem-solving abilities to address it. With PBL, learners first identify the core issues of the problem, determine what information and skills they already have that may be applicable, locate information or gain skills they need to solve the problem, consider alternate resolutions, and select a problem solution. By using collaborative tools in an online environment, students can work together with classmates, minus the logistical difficulties inherent in face-to-face groupwork. Proponents of this teaching strategy stress the importance of the teacher’s guidance to ensure steady progress, clarify expectations, help students discover important connections, and to confront learners from a “devil’s advocate” position. (From more information on PBL in online environments, see, for example, [7].)
- *Evaluating Websites:* One of the frustrations for many postsecondary teachers is the lack of critical thinking exhibited by students when searching for material online. An active learning strategy that helps develop those sceptical skills involves students purposely searching out websites that contain inaccuracies, bias, or obsolete information. Following this up with a description of what specifically is wrong with the information provided and how it could be improved requires that the learner understand the course content well enough to evaluate someone else’s presentation of it. This assignment carries with it the added advantage of reminding students to not believe everything they read online. The activity adapts well to group work or the results may be posted for the entire class to review within the course site, thus benefiting not only the student who completed the assignment but his or her peers, as well.
- *Discussions/Chats:* Asynchronous discussions are probably the most frequently used strategy for facilitating student interaction in online courses. The numerous advantages (everyone can participate, having time to think about a response before posting, etc.) make this tool especially popular among instructors new to the online classroom. Many instructors have found that requiring students to participate in

discussions is necessary, as well as requiring students to respond to other student postings (in addition to an instructor-provided prompt, for example). Expecting students to attach their papers or projects to discussion board postings where classmates can read them has resulted in improved student work for many online instructors, probably as a result peer pressure. The danger in using discussions with a large online class (anything over 25 or 30, typically) is that reading all of the messages can prove daunting for the instructor, so it may prove helpful to not have every student respond to every prompt, or to have students work in small groups to arrive at a group response for the discussion. Synchronous chats are used less often, usually because the inconvenience of scheduling makes them problematic, but the rewards can be worth the hassle. Because chats work best with small groups of around 10, or so, not every student needs to participate in every session. These interactions can be somewhat free-flowing or they can be rather structured, with the instructor posing a question or comment and then “calling on” one or more students to respond, prior to opening the floor to anyone who would like to comment. This reduces the spontaneity of the chats, but provides enough structure to alleviate the alternately chaotic “everyone talking at once” problem and the “no one talking at all” outcome. An advantage of chats (especially when the instructors calls on participants to respond to a question) is that the students must be prepared in advance, thus these sessions are excellent motivators to help students stay on schedule with readings and other coursework.

The common characteristic of the strategies described above is that they result in observable behaviours from which we can infer that learning has occurred. Realistically, until there are methods that measure our students’ progress in a more direct manner, it will be crucial to design assessments that require meaningful responses and enable a valid and reliable demonstration of abilities. The design of an online course can be captured in a nutshell with a new mantra: “Don’t tell me what you will do to teach, tell me what your students will do to learn!”

## 5. NEW ROLES, NEW CHALLENGES

Although the adoption of a new role can be as liberating as the sloughing off of an old, unwanted skin, the reality can also be intimidating, confusing, and/or overwhelming. Teachers and students alike may find themselves hesitant and wondering if they have what it takes to be successful in an unfamiliar educational structure

### The Teacher’s Role

The reins of power cannot be clutched quite so tightly in the virtual classroom as in a face-to-face environment, planning and organizational skills are more important than ever before, and clarity in communications and of expectations become critical. However, it is also useful to remember that, while a website may have the advantage over humans when

it comes to disseminating information quickly, consistently economically, and continuously, there are much more important teaching tasks that are best handled by people. The hats you choose to wear as an online instructor will vary based on your strengths and teaching style, the content being taught, and your students. Note, also, that these tasks do not preclude the necessity of knowing the subject matter inside and out; only when teachers feel confident in their own disciplinary knowledge can they devote attention to innovative teaching practices.

It may be helpful to use a metaphor, such as coaching or gardening, to develop this new persona. Coaches typically design a game strategy, ensure that required equipment is available, plan and lead practice sessions, offer guidance and feedback on performance, identify weaknesses, and motivate players. In a similar vein, gardeners create a fertile area for growth, determine what vegetation is best suited to the environment, plant seeds or seedlings, ensure that each plant has what it requires to thrive, monitor the garden for invaders that may slow the growth process or damage the plants, trim and shape the vegetation to maintain optimum health, and evaluate the outcome of fruits or flowers.

Whatever theme or metaphor may be selected, the teacher's role in an online course requires the skills of management, communication, assessment, and resource evaluation, in addition to a strong grounding in the scholarly discipline. As it becomes increasingly apparent that the online environment doesn't readily support "sages on stages," the realization also dawns that it is the students who belong in the spotlight.

#### The Student's Role

In an online course designed for active learning, the familiar task of absorbing content takes a back seat to a much more demanding set of duties. Students who previously enjoyed the job of audience member may suddenly find themselves cast in a leading role, expected to perform and participate on a regular basis. The character known as "lurker" ends up deleted from the script, and the only way to be "in class" is to be actively participating – interacting with the instructor, practicing new skills, collaborating with peers, or using self-assessments to check one's progress toward the course goals.

Students initially may dislike their new role and resent what they consider the teacher's abandonment of their primary task: disseminating information. However, as it becomes apparent that when they (the students) participate in the assigned activities they do indeed learn the content, attitudes begin to change. Eventually, even die-hard traditionalists may be won over, in part because active learning is more fun, to put it plainly.

The most rewarding element of the role change, however, may be the increased emphasis on the value of learner contributions and products. In traditional educational models, students frequently minimize or devalue their own work (their intellectual property) because the teacher is the one who owns the "real" knowledge. Recognizing the

worth of each student's contributions and output reinforces the relevance of their participation in the course.

When incorporating active learning strategies into an online course, many students will benefit from a scaffolding approach that allows them to gain familiarity with new tasks early in the course in a low-stakes assignment. Being good at online learning requires the ability to express ideas well in writing, to develop the self-discipline needed to stay on track, to ask questions or request assistance when necessary, to work collaboratively with others using synchronous and/or asynchronous tools, and to take responsibility for one's own learning. This can be a tall order for students who are the successful products of an educational system that rewards passive obedience (as is also the case for many postsecondary faculty members). Providing opportunities to practice collaborative writing or peer editing, develop basic problem-solving skills, and describe their own thinking or learning processes will alleviate the disorientation of a brand-new learning model.

## **6. RELEVANT THEORY BASES AND RESEARCH**

There are two schools of thought especially relevant to the use of active learning strategies: cognitive processing and constructivism. *Cognitive processing* theory (encompassing theories related to brain-based learning, cognitive load, schemata structures, information processing, etc.) focuses on using what we know about how the brain works – in terms of memory and perception, for example – to enhance learning. While this seems like a patently obvious approach to teaching, the reality is that we (educators) have too often expected students to demonstrate understanding via rote memory, a tactic that not only ignores what we know about cognition, but is ultimately counter-productive. [8]

The *constructivist* approach focuses on the idea that human learning is a dynamic process of building (i.e., constructing) mental networks that represent knowledge and that such collections of understanding do not exist outside of human consciousness. Each individual creates his or her own knowledge structures, assigning and re-assigning meaning to the components as these structures grow increasingly robust. [9] Motivation is a critical component in the creation of these networks, because the perceptual processes within each learner are dependent on attention to essential or pivotal stimuli, thus requiring that learners actively participate in developing their understanding. Metacognition, the awareness individuals have of their own cognitive activity, also plays an important part in maintaining our mental structures and our ability to manipulate and retrieve information when necessary.

The "so what?" factor of active learning and online education resides in what we know (or presume to know) about teaching and learning. A significant body of research supports the notions that active learning results in enhanced long-term retention of concepts, that it promotes transfer of newly-acquired skills to unfamiliar environments, that it facilitates higher order thinking, and that it encourages

positive attitudes toward the content area. (See, for example, [10], [11], and [12].) These are results to wish for in any instructional setting and the kind of outcomes that cannot be ignored in times of rapid change and calls for increasing accountability of educational institutions.

## 7. SUMMARY

“The truth is, when all is said and done, one does not *teach a subject*, one teaches a student how to learn it.” [13] This is at the heart of how roles change in e-learning – teachers can only provide the resources, design the activities, and guide learners in a way that moves them toward a desirable goal, but the learner must accept responsibility for his or her part of the process. (There is a reason, after all, that this field is known as e-learning, and not e-teaching.) Teachers do, however, have the freedom to determine for themselves how the nuances of that new role will play out on a day-to-day basis and can help students get comfortable in their new roles, as well.

As an evolutionary development arising from a convergence of trends in software development, cognitive processing research, and widespread acceptance of e-learning, the importance of active learning strategies should not be ignored nonchalantly as “only a phase.” The accompanying focus on the student’s understanding and progress will allow educators to reconsider their role and adopt behaviours best suited to their strengths as professional educators – and humans – while delegating tasks such as information dissemination to a variety of technological devices. Active learning may not solve every educational problem, but it can put the emphasis in e-learning back where it belongs – on learning.

## 8. REFERENCES

- [1] Rogers, E.: Diffusion of innovations, 5<sup>th</sup> ed. Free Press. 2003.
- [2] Price, P.: Are You as Good a Teacher as You Think? Thought and Action: The NEA Higher Education Journal, Fall 2006, pp. 7-14.
- [3] Keller, J. & Suzuki, K.: Learner Motivation and E-Learning Design: A Mutinationally Validated Process. Journal of Educational Media, Vol. 29(3), October 2004, pp.229-239.
- [4] IHMC Cmap Tools. Free, downloadable concept mapping software (link viable as of 6/15/07) from <http://cmap.ihmc.us/>
- [5] Inspiration. Concept mapping software; not free, but considered the standard in education; downloadable (link viable as of 6/15/07) from <http://www.inspiration.com/>

[6] Richardson, W.: Blogs, Wikis, Podcasts, and Other Powerful Web Tools for Classrooms. Corwin Press, 2006.

[7] Malopinsky, L., Kirkley, J., Stein, R., & Duffy, T.: An Instructional Design Model for Online Problem Based Learning (PBL) Environments: The Learning to Teach with Technology Studio. Available from ERIC Document Reproduction Service, ED 455778. 2000.

[8] Sousa, D.: How the Brain Learns, 3<sup>rd</sup> ed. Corwin Press. 2006.

[9] Conrad, R., Donaldson, J.: Engaging the Online Learner: Activities and Resources for Creative Instruction. Jossey-Bass, 2004.

[10] Harasim, L., Starr, R., Teles, L. & Turnoff, M.: Learning Networks: A Field Guide to Teaching and Learning Online. Massachusetts Institute of Technology, 1997.

[11] Prince, M.: Does Active Learning Work? A Review of the Research. Journal of Engineering Education, July, 2004, pp. 223-231.

[12] Salmon, G.: e-tivities: The Key to Active Online Learning. Kogan Page, 2002.

[13] Barzun, J.: Begin Here: The Forgotten Conditions of Teaching and Learning. University of Chicago Press. 1991.

## THE AUTHOR



**Susan M. Zvacek** oversees instructional design consultations, classroom technologies, and instructional technology workshops at KU. In 2006, she was a Fulbright Scholar at Charles University in Prague. Dr. Zvacek holds a Ph.D. in Curriculum and Instructional Technology from Iowa State University and is an experienced faculty member, administrator, and consultant. She is a co-author of *Teaching and Learning at a Distance* (now in its third edition) and the recently-released *Blackboard for Dummies*.

## ACKNOWLEDGEMENTS

The author wishes to thank her colleagues Mikulas Huba, Lubica Rovanova, and Lubomir Marko at the Slovak University of Technology, and Stanislav Zelenda at Charles University in Prague for their encouragement and friendship. She also acknowledges, with appreciation, her colleagues at the University of Kansas for their support of her international activities in the field of e-learning.



**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**Infrastructure**







5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

## PACKET LOSS CONCEALMENT BY SHIFTED BASIS

Katarína Bachratá, Juraj Boroň, Boris Rosival  
Department of InfoCom Networks,  
Faculty of Management Science and Informatics,  
University of Žilina, Slovakia  
e-mail: Katarina.Bachrata@fri.uniza.sk, Juraj.Boron@fri.uniza.sk, brosisval@gmail.com

**Abstract.** The Shannon sampling theorem allows us to recover a continuous bandlimited signal from its samples. This technology is applied to speech transmission over the IP networks. It is intuitively convincing that the speech signals are only small part of all bandlimited signals. Hence, there can be more profitable methods for digitalization such special signal. The cyclostationarity of the stochastic process is the most important property we will use for the modeling the speech signal. This property can be measured in real speech and in the theoretical models can be achieved in the spaces with shifted basis. The objective of this paper is to describe the impact of the shape of generating function to the quality of the recovered speech signal. The signal to noise ratio between the original signal and the recovered signal is the criterion for quality in this article. The transmission over IP network is affected by the jitter and some of the coefficients are lost. In the simulation is modeled the independent coefficients loss and the results for digitalization in shifted basis are better than in Shannon digitalization.

**Keywords:** Voice over IP, Quality of service, Shannon sampling theorem, cyclostationary stochastic process, shift invariant spaces, signal to noise ratio

### 1. INTRODUCTION

The quality of IP telephony service is achieved by different ways and technologies. There are many factors impact to the contentment of customers. This contentment can be measured by the subjective tests as MOS, or described by the complex set of factors influent to quality. The methods and quality parameters have been explained in [1], [2], [3]. We will use only one of parameters the SNR. It is the ratio of the power of transmitted signal  $f$  and the noise signal  $n$  (difference between transmitted signal and received signal) in logarithmic scale.

Current IP transmission of the voice signal uses the samples of the signal for digitalization. This is the classical Shannon model of analog-digital decomposition and reconstruction. The reconstruction of the voice from the samples consists in computing the expression

$$f(t) = \sum_{k=-\infty}^{\infty} f(k\Delta) \frac{\sin \Omega(t - k\Delta)}{\Omega(t - k\Delta)}, \quad \Omega = \frac{\pi}{\Delta}$$

for all value of  $t \in R_0^+$ .

Because of the unsteady congestion there occurs the jitter of the network. Jitter is defined as a variation in the delay of received packets. This variation causes the loss of delayed packets. The degradation of the speech quality is lower in case of lost delayed packets, than in case of waiting for them. The lost samples are compensated by various replacements. The simplest replacement is the zero substitution, which is used for estimation in this article. We suppose new method of the corrections of losses, which uses non-orthogonal basis for digitalization and

reconstruction. The main idea of this method is in correlation between lost and transmitted coefficients. The lost one can be repaired by the others, correlated with it.

### 2. BASIS SUITABLE FOR TRANSMISSION

The mathematical model of the analog-digital conversion is the representation of the process in orthogonal generalized

Fourier series:  $f(t) = \sum_{k=-\infty}^{\infty} c_k \Phi_k(t)$  with non correlated coefficients computed by inner product as  $c_k = \frac{\langle f(t), \Phi_k(t) \rangle}{\langle \Phi_k(t), \Phi_k(t) \rangle}$ . The orthogonality of coefficients

guarantees not only the most effective representation, but at the same time, the expression with uncorrelated coefficients. For obtaining the correlation between coefficients, we have to use non orthogonal basis. The space of all voice signals is the infinite-dimensional space and the Shauder basis is used for unique non orthogonal representation. The independent of infinity basis elements must be guaranteed. This kind of independence is called  $\omega$ -independence. The conditions for  $\omega$ -independence are described by using properties of Fourier transform of generating function. Those conditions are presented and proved in article [4]. The Shauder basis for voice representation is creating by the shifts of the one generating function like in the case of a Shannon basis. The idea of shifted basis can be promoted by the statistical properties of voice signal, as a stochastic process which has special kind of periodical characteristic: cyclostationarity.

To better understanding, we give the definition of cyclostationarity:

A stochastic process  $\mathbf{x}$  is called cyclostationary process iff the mean and correlation of  $\mathbf{x}$  are periodic functions:

The stochastic process created of the shifted basis with independent random coefficients has cyclostationary character.

Let  $\mathbf{x}$  is a stochastic process

$$\mathbf{x} = \sum_{k=-\infty}^{\infty} c_k h(t - kT)$$

with deterministic function  $h(t)$  and stationary series of random variables  $c$ . Then the process  $\mathbf{x}$  is a cyclostationary process.

A prove of this proposition can be find in [5].

The classical telephony decomposition uses the shifts of Shannon generating function:

$$h(t) = \frac{\sin \Omega t}{\Omega t}, \quad \Omega = \frac{\pi}{\Delta}.$$

We will use the functions, with limited support in time domain, for generation of the basis.

According to the condition of  $\omega$ -independence, the generating function  $h(t)$  has to have the Fourier transform  $\hat{H}(\omega)$ , which satisfies to

$$\sum_{n \in \mathbb{Z}} \left| \hat{H}\left(\omega + \frac{2\pi n}{\Delta}\right) \right| \neq 0, \quad \omega \in \left(-\frac{\pi}{\Delta}, \frac{\pi}{\Delta}\right)$$

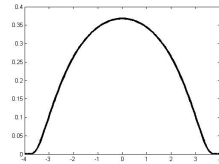
Then the functions  $h(t - k\Delta)$  create the  $\omega$ -independent system, which can be used as a Shauder basis for speech signals.

We will not prove that the basis function system creates the total set in space of all continuous signals with finite energy. The suitability of the basis for the speech representation we will test experimentally. The first attempts, described in this article, were checked only by few respondents. Later, for the basis systems (which we evaluate as the best), we will use for testing subjective MOS and also objective tests.

The shapes of some generating functions:

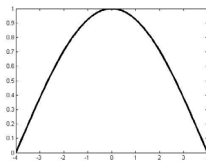
Function “Hat”:

$$h_1(t) = e^{\frac{\Delta^2}{(t-\Delta)(\Delta-t)}}$$



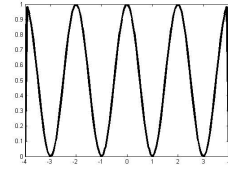
Function “Cosine”:

$$h_2(t) = \cos\left(\frac{\pi t}{2\Delta}\right)$$



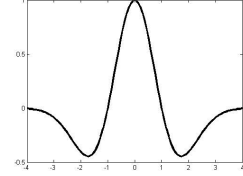
Function “Square sine”:

$$h_3(t) = \left(\sin \frac{\pi}{2}(t-1)\right)^2$$



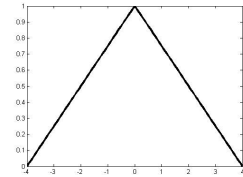
Function “Mexican hat”:

$$h_4 = (1-t^2)e^{-\frac{t^2}{2}}$$



Function “Bartlett”:

$$h_5(t) = 1 - \frac{|t|}{\Delta}$$



We can't use function, like last one, because, it has big disruptions and that's not suitable for speech signal approximation.

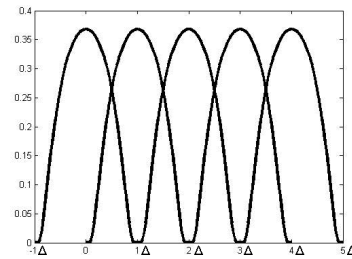
The Fourier transforms of the generating functions  $h(t)$  are such, that their sums on intervals

$$\dots, \left(-\frac{5\pi}{\Delta}, -\frac{3\pi}{\Delta}\right), \left(-\frac{3\pi}{\Delta}, -\frac{\pi}{\Delta}\right), \left(-\frac{\pi}{\Delta}, \frac{\pi}{\Delta}\right), \left(\frac{\pi}{\Delta}, \frac{3\pi}{\Delta}\right), \left(\frac{3\pi}{\Delta}, \frac{5\pi}{\Delta}\right), \dots$$

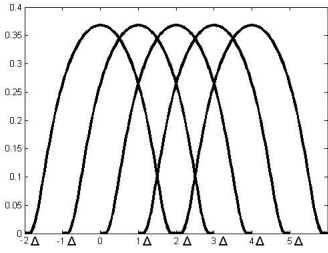
don't have the zero value and convenient to the  $\omega$ -independent condition.

The shapes of those functions  $h(t)$  are not the only one thing we will concern. There is also very important the shifting of the generating functions. We can shift two or more basis functions. If we expect the lost of coefficients, it is better if we have more overlapping of the functions. The missing coefficients on a specific interval will be covered by other coefficients of the shifted basis functions in the same specific interval. Than the reconstructions can be made like we didn't loose the data.

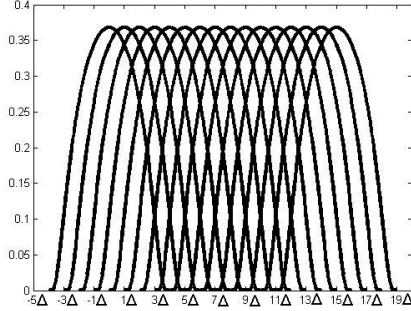
Shifting of the “Hat” basis function:



The support of the function is on  $2\Delta$  and the shifts are  $\Delta$ .

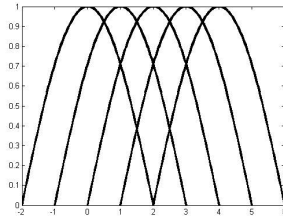


The support of the function is on  $4\Delta$  and the shifts are  $\Delta$ .

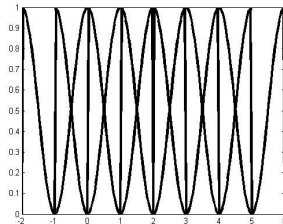


The support of the function is on  $8\Delta$  and the shifts are  $\Delta$ .

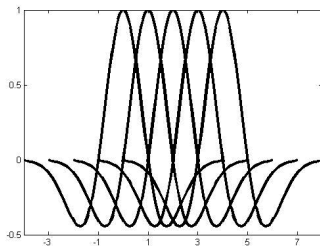
Shifting of “Cosine”, “Square sine” and “Mexican hat” functions. The support of the function is on  $4\Delta$  and the shifts are  $\Delta$ .



“Cosine” function



“Square sine” function



“Mexican hat” function

### 3. COMPUTING OF BASIS COEFFICIENTS

The computing of the coefficients of decomposition can be more complicated then a few years before. Now, the computers can make higher number of operations and there is only one limitation: we can't transmit the speech signal for the second time. In VoIP it is not time enough for next transmission. The calculation of coefficients  $c_k$  in the

decomposition  $f(t) = \sum_{k=-\infty}^{\infty} c_k \Phi_k(t)$  gets the system of the

linear equations:  $\langle f(t), \Phi_n(t) \rangle = \sum_{k=-\infty}^{\infty} c_k \langle \Phi_k(t), \Phi_n(t) \rangle$

When substitute  $f(t) = \sum_{m=-\infty}^{\infty} f(m\Delta) \frac{\sin \Omega(t - m\Delta)}{\Omega(t - m\Delta)}$

$$\sum_{m=-\infty}^{\infty} f(m\Delta) \left\langle \frac{\sin \Omega(t - m\Delta)}{\Omega(t - m\Delta)}, \Phi_n(t) \right\rangle = \sum_{k=-\infty}^{\infty} c_k \langle \Phi_k(t), \Phi_n(t) \rangle$$

Let us denote

$$S_{mn} = \int_{-\infty}^{\infty} \frac{\sin \Omega(t - m\Delta)}{\Omega(t - m\Delta)} h(t - n\Delta) dt \quad B_{kn} = \int_{-\infty}^{\infty} h(t - k\Delta) h(t - n\Delta) dt$$

then we get a system of linear equation for coefficients  $c_k$ :

$$\sum_{m=-\infty}^{\infty} f(m\Delta) S_{mn} = \sum_{k=-\infty}^{\infty} c_k B_{kn}$$

The values of some generating functions vanish in short time, therefore the coefficients  $B_{kn}$  and  $S_{mn}$  have only a few non zero values. There are many numerical methods for solving the systems of linear equations with the sparse matrixes of coefficients. We have used the solving of linear equations in Matlab, but it is possible to use some of open source software's, see [8]: Using the build in SPDIAG function we create the sparse matrix. The elements in this matrix present the  $B_{kn}$  coefficients. Then the  $c_k$  coefficients are placed on the right place in the linear equation. The  $S_{mn}$  elements are counted as the scalar product of Shannon basis and e.g. Hat function. After that the coefficients  $S_{mn}$  are multiplied by the samples of speech data.

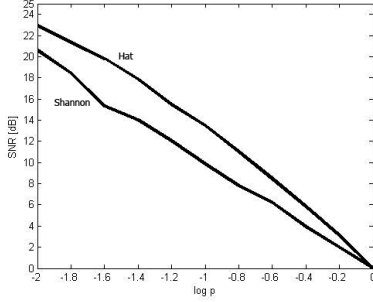
### 4. SNR FOR INDEPENDENT SAMPLES LOSS

The first model of the packet loss during the voice transmission will be independent losses of the samples, or more precisely losses of the coefficients of decomposition. The lost coefficients we will represent by zero value. The quality of the transmission we will measure as signal-to-noise ratio. It is the ratio between of the power of input signal (more precisely decomposition of input signal to the concrete basis) and the noise signal (difference between original signal and received signal). For transmission we can use basis generated by the function  $h(t)$  with finite support. The shape of the generating function affects to SNR. If the lost coefficients are substitute by zero there can be found the theoretical limitations for SNR. The theory of

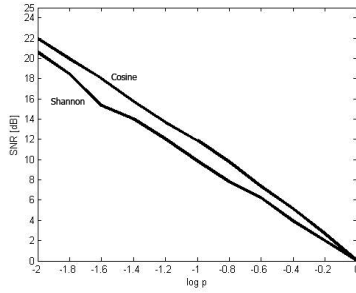
the impact of independent losses to the signal-to-noise ratio has been elaborated in article [10].

In the figures below, we can see the results of simulations of the reconstructed signals and the comparing to the classical Shannon sampling, transmission and reconstruction. In both situations, classical and experimental, there were used the same models for selecting the values, which will be lost.

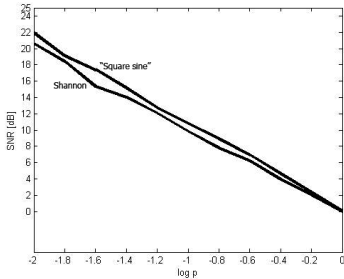
Shannon – “Hat”



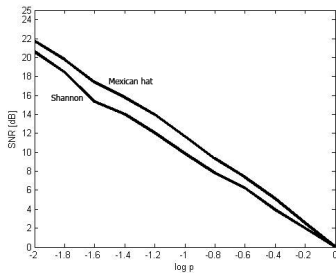
Shannon – “Cosine”



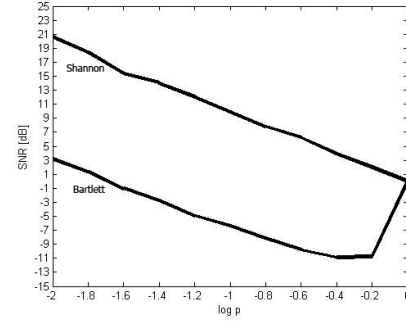
Shannon – “Square sine”



Shannon – “Mexican hat”



Shannon – “Bartlett”



The result of simulation losses and description of SNR in the case of “Bartlett” function has showed, that this function has got bad properties for approximation of speech.

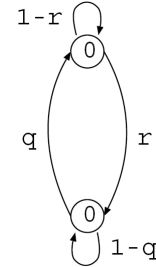
## 5. CORRELATED COEFFICIENTS LOSSES

The IP telephony service is based on the packet switching principle. It means the separate samples loss is not usual in VoIP. Mostly parts of speech lasting 20 ms are lost. The packets have deterministic length but their loss have stochastic occurrence. The approximation of this situation can be obtained by Markov on-off model, known as Gilbert model, see [9].

*Gilbert model*  $\mathbf{L}_k$  is Markov chain with two states 0 and 1.

$\mathbf{L}_k = 0$  if coefficient was transmitted and  $\mathbf{L}_k = 1$  if it was not.

The figure below shows the graph of the transitions of Gilbert model.



Probability of the loss of the coefficient  $c_k$  is  $p_k = \frac{r}{r+q}$

and probability  $q_j$  of the simultaneous loss of coefficients

$c_k$  and  $c_{k+j}$  is  $q_j = \frac{r}{q+r} \left( \frac{r}{q+r} + (1-r-q)^j \frac{q}{q+r} \right)$  in a

stable Gilbert model.

We will use the stochastic model of the speech signal

$$f(t) = \sum_{k=-\infty}^{\infty} c_k \Phi_k(t), \text{ where } \Phi_k(t) = h(t - k\Delta) \text{ are the}$$

deterministic functions and coefficients  $c_k$  create a discrete stationary stochastic process. Let the probabilities  $P_k$  of the sampling loss  $c_k$  are independent of the values of  $c_k$  and are described by Gilbert model and in the reconstructed process the lost samples are represented by 0.

Then the mean power of the noise process satisfies the condition:  $\sigma_n^2(t) \leq \sigma_f^2(t) \left( \frac{r}{q+r} + 2 \sum_{j=1}^M q_j \right)$

where

$$q_j = \frac{r}{q+r} \left( (1)^j \frac{r}{q+r} + (1-r-q)^j \frac{q}{q+r} \right)$$

In this formula we have used the computation of the power of the transition matrix:

$$\mathbf{P}^n = \mathbf{1}^n \mathbf{A} + (k_1)^n \mathbf{A}_1 \text{ where } (\mathbf{I} - z\mathbf{P})^{-1} = \frac{\mathbf{A}}{1-z} + \frac{\mathbf{A}_1}{1-k_1 z}$$

The losses of the correlated coefficients are elaborated in article [10].

## 6. CONCLUSIONS

It is often not possible for the delay sensitive applications to retransmit packets due to delay constraints and they must therefore be resilient to packet losses. This request can be achieved by designing the networks, specified in ITU recommendations [7], creating buffers and guaranty of the quality in virtual canals. Another way rests in linear approximation of the lost samples, see in [6]. Our experiments objectively measured one parameter of quality of the speech reconstruction. The results show that this technique is more successful at repairing speech than in a case of classical decomposition. The aim of the next work will be to identify how this technique might be used in the real applications and describe the work that has to be done towards the implementation of such a tool to reliably transfer speech across the Internet.

## 7. REFERENCES

- [1] Klimo M., Kováčiková T., Segeč P.: Hlas cez Internet. Košice, Elfa, 2005, ISBN 80-8086-007-6
- [2] Jakab F., Jakab M., Janitor J., Kleinová K., Vozar M.: Possibilities to provide VoIP with required quality, Proceedings of ECI'2006, 7-th International Scientific Conf. on Electronic Computers and Informatics, September 20-22, Herľany-Košice, FEEI TU, 2006, ISBN 80-8073-150-0
- [3] Čáky P., Klimo M., Palúch P., Škvarek O.: End-to-end VoIP quality measurement, In: Acta Electrotechnica et Informatica ISSN 1335-8243. Vol. 6, No. 1 (2006), p. 47-51
- [4] Klimo M., Bachratá K.: Basis of Regularly Shifted Functions, Scientific papers of the University of Pardubice, The Jan Perner Transport Faculty 9, 2003, ISSN 1211-6610, p.163-172
- [5] Papoulis A.: Probability, Random Variables, and Stochastic Processes, Polytechnic Institute of New York, McGraw-Hill, Inc., New York Toronto London, 1991, p.374
- [6] Klimo M.: Cell Loss Noise in the Case of Linear Reconstruction, ICT'98, Porto Carras, Greece, 21-25 June, 1998
- [7] Ivaniga P., Herman I., Mikuš E.: The relationship between G.826 error performance objectives and BER, In: Telecommunications and Signal Processing TSP, 2006, 29th international conference, Czech Republic, Brno: ISBN 80-214-3226-8. - P. 100-102.
- [8] Kaukič M.: Open source software resources for numerical analysis teaching, In: International Journal for Mathematics Teaching and Learning 2005 - ISSN 1473-0111
- [9] Sanneck H.: Packet Loss Recovery and Control for Voice Transmission over the Internet, Doktor-Ingenieur genehmigte Dissertation, Berlin, (2000)
- [10] Klimo M., Bachratá K.: Impact of correlated loss on VoIP quality, Scientific papers of the University of Pardubice, The Jan Perner Transport Faculty 11, (2005), ISSN 1211-6610, str.125-134
- [11] Bachratá K., Boroň J., Rosival B.: New methods proposal for VoIP transmission, Scientific papers of the University of Pardubice, The Jan Perner Transport Faculty 12, (2006)

## THE AUTHORS



**Katarína Bachratá:** has graduated in MFF, Comenius University, Bratislava, graduated in mathematical analysis and differential equations (1984). She has stayed for 2 years in Department of algebra, MFF, Bratislava, then moved to Žilina. There, in FRI of ŽU she has received a PHD in stochastic models for voice over IP. She has taught mathematics and applied mathematics in ŽU. She is member of VoIP and text to speech research teams. She has worked as a volunteer in activities for mathematic talented children.



**Juraj Boroň:** has finished high school in Spišská Nova Ves. In year 2002 started his studies in Faculty of management science and informatics of ŽU in Žilina. Nowadays is a student in 5th year of study at FRI of ŽU. Now working at his graduation theses in area of voice over IP.



**Boris Rosival:** has finished high school in SPS Partizanske (2000). In year 2001 started his studies in Faculty of management science and informatics of ŽU in Žilina. In year 2005, he spent a half year studying informatics in University of Vaasa in Finland. Nowadays he is in the last semester of his studies, preparing for final exams.





## UTILIZATION OF VIDEOCONFERENCES IN EDUCATIONAL ENVIRONMENT

Miroslav Biñas, Iveta Adamuščinová, František Jakab, Miroslav Michalko  
Computer Networks Laboratory, Department of Computer and Informatics  
Faculty of Electrical Engineering and Informatics, Technical University of Košice  
Letná 9, 042 00 Košice, tel. +421 55 602 2500  
iveta.adamuscinova@cnl.tuke.sk, miroslav.binas@tuke.sk, frantisek.jakab@tuke.sk,  
miroslav.michalko@tuke.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The progress in the information technologies has impact not only in the area of computer sciences, but also in the area of education. Following this trend, students have not only a great opportunity to search for the information resources on the Internet, but they can also use plenty of media with various information for their study. Nowadays the number of services providing not only the textual information, but also multimedia information, is growing. Many of them have educational character, so they can be used for wide educational purposes. This paper is focused to the problem of videoinformation usage for the educational purposes; the usage of videoconferences for the distance learning; and the usage of distributed systems for the creation of archive service of multimedia content based on the running videoconferences, which can be used later in the educational process. In this paper also an idea of creating a formal model of presented distributed system is imposed, with regard to its use within an educational process in all aspects of system's design and implementation.

**Keywords:** videoconference, repository, Coloured Petri Nets, distance education

### 1. INTRODUCTION

In the past few years, videoconference systems became almost inevitable part of a scientific collaboration and a quality education process. Nowadays, VRVS (or EVO) videoconference system presents one of the most progressive technological solutions in the area of education, which provides fast and mutual communication between the users in the form of videoconference connections. This system however doesn't allow the archivation of videoconference transfers in order of their latter presentation. Because of this major disadvantage, a distributed archivation system for the videoconference transfers with orientation on VRVS and EVO was designed. Since the created system is of distributed nature, a phase of its design presents a quite challenging task, and the implementation itself without a detailed analysis also a very critical aspect.

To overcome the problems relied to analysis and design of such complex systems, a multiple kinds of formal methods are used. They permit a detailed investigation, adjustment and verification of individual system's parts even before the start of implementation. In the systems, where the aspects of concurrency, distributism, synchronization and parallelism predominate, a formal model of Coloured Petri Nets acquits well, which was sufficiently proven in presented system by creating a solution of pilot simulation model of an allocation part, a part that secures a reservation of needed network resource in order to establish a quality transfer connection between a videoconference and archivation system and subsequent achievement of an archivation record of an appropriate quality.

### 2. MULTIMEDIA IN THE EDUCATION

**Multimedia** [1] is media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, video, interactivity) to inform or entertain the (user) audience. The problem of including the multimedia in the process of education is not young. The debates and articles about this topic can be found from the time, when Internet started to expand. As an example can be Allyn Radford [2] (1997): *It is not feasible to discuss the role of multimedia in the future of education without paying some attention to the future of education itself... There is much current debate in the educational community regarding the concepts of putting education "on line". [2] When dealing with the role of multimedia in education, it is obvious that little useful information will result from debate that becomes focused on technological ability rather than pedagogical strategy; achievement of machines, software and programmers rather than achievement of learners and mentors; and quality of technological wizardry rather than quality of learning experiences and outcomes. That is not to say that the technological parameters and achievements are not important. They are vital, as long as you have suitable educational strategies, goals, experiences and outcomes at which they can be focused.* [2]

We can strongly agree with the second paragraph – in the usage of multimedia content in education we often forget for the pedagogical strategy and the learner and we mainly focus on the technological aspects of the multimedia contents. These days, we have many options how to assure multimedia content for education. Plenty of images and sounds, the video and audio presentations in the materials. It enables teachers to provide additional instructions to students and involve them in the interaction. It is especially useful for the students with learning difficulties. [3] One of

the special area of including the multimedia in the process of education, is videoconferencing, which usability presents the main focus of this paper.

### 3. USAGE OF VIDEOCONFERENCES IN THE EDUCATION

Because of the growth of the Internet speed, the usage of videoconferences is not dedicated only for the special laboratories but also to wide academic environment. Also home users can use technologies for video communication in the realtime. There are still various environments, where is usage of videoinformation very helpful [4]:

**Distance Learning** - Videoconferencing is an exciting technology for education. Teachers and students are able to see each other, share documents and discuss topics together in a situation similar to a traditional classroom setting. The main difference being that the teachers and the students may be in different countries.

**Video on demand** - Video on demand (VOD) systems allow users to select and watch video content over a network as part of an interactive television system. VOD systems either "stream" content, allowing viewing while the video is being downloaded, or "download" it in which the program is brought in its entirety to a set-top box before viewing starts.

**Sharing of education materials** - Each lecture can be recorded and stored in multimedia archive for later usage. With the increasing number of records, the multimedia archive can be easily created and the lectures can be streamed back to the class for the students again and again.

### 4. ARCHIVATION OF VIDEOCONFERENCES

As was mentioned in the previous section, the usage of videoconferences in the education is great mainly for the distance learning. Each videoconference in this meaning is unique because of the mentor's teach and the number and / or interactivity of students. There are plenty of solutions how to include videosequences to the education. Also there are several software and hardware solutions for the videoconferences. In most of the cases the most important decision, which system to use, is based on the price. In our academy environment, the one of the most widely solutions used are VRVS [5] system and the next generation videoconferencing tool EVO [6]. There are several advantages of these systems:

- free for academic environment
- no limitations in the number of connected clients
- multiplatform solution (Linux, Windows, Mac OS)

#### Definition of an archive

An **archive** refers to a collection of records, and also refers to the location in which these records are kept [1].

**Archives** are made up of records which have been created during the course of an individual or organization's life. In general an archive consists of records which have been selected for permanent or long-term preservation. Records, which may be in any media, are normally unpublished,

unlike books and other publications. Archives are distinct



Fig. 1. VRVS videoconference system

from libraries insofar as archives hold records which are unique [1].

One of the solution how to provide an effective and reliable videoconference archive is to create some kind of relatively large network of computers which communicate together in a predefined way in order to get an archivation record of transfered videoconference which can be used for latter presentation. So the recording of transfered videoconferenced can be simply done with a group of computers, which act to the end user as a single computer or single system. The client is usually contacting one of this computers directly using the communication protocol or using the information system. The system decides itself, which of its components/computers is the best for the requested task and the system is responsible for the reliability of the whole process. The decision can be made with close look on several aspects, what can have positive effect for the optimalization of the recording process. It is then also more easily to record several streams of videoconferences at the same time [8].

### 5. DISTRIBUTED SYSTEMS AND THEIR USABILITY IN ARCHIVATION PROCESS

One of the definitions describing what is the distributed system (according to [9]) follows: *A distributed system is a collection of independent computers that appear to the users of the system as a single computer.* Distributed system is a non-centralized network consisting of numerous computers that can communicate with one another and that appear to users as parts of a single, large, accessible "storehouse" of shared hardware, software, and data. A distributed system is conceptually the opposite of a centralized, or monolithic, system in which clients connect to a single central computer, such as a mainframe. (More about distributed systems can be found in [9]).

#### Components of a created distributed archivation system

The proposed archivation system consists of three main types of nodes groups. The first node's type is a **client** - the environment that transfers the videoconference, mainly the system VRVS or EVO.

Designing the distributed version, a system will contain another two types of devices [8]:



**Manager node** – a device (system node), that is responsible for managing a distribution of requests for the record. It is also responsible for mapping a temporary storing operation and in the case of occurrence of an unexpected error, it's intended to find a substitute in a form of new node.

During a recording session, the manager node task is to monitor an ability of disk storing and to control the right function of this mechanism. In the case of occurrence of an unexpected error (connection problem, full disk), it's intended to find a new free storage node immediately, to which the recording request will be sent.

**Storage node** – a device where the record will be stored. The storage node task is to record the videoconference. It's important to applicate this function in the simplest possible way – to connect a videoconference virtual room and to start recording in appointed time. Within a storage node, there will be some kind of a simple management and monitoring client that will communicate with manager node and monitor the actual state of a recording process.

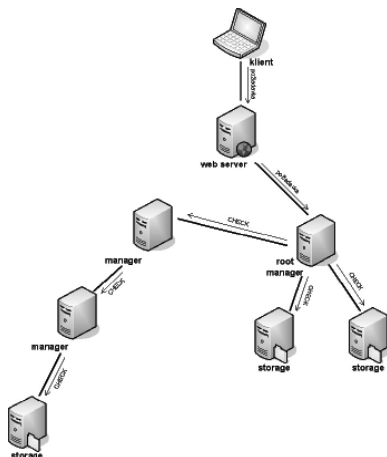


Fig. 2. Basic structure of a designed system

The basic system configuration (Fig. 1) consists of manager nodes connected to disk subsystem (storage nodes) on one side and to web server on the other side. Data flows from the disk subsystem through a manager node to an user interface and backwards.

Additional part of a distributed system is an **archive** – after the end of the videoconference, whole recorded data (record) is moved from the recorder element to the archive (ftp server).

## 6. MODELING OF A DISTRIBUTED VIDEOCONFERENCE SYSTEM

An understanding and getting a proper knowledge of structure, dynamics and behaviour of such complex systems as distributed systems are in every way, can be a truly cumbersome challenge. This obstacle is unveiled mainly in the latter phases of design, implementation and testing. One of the most effective methods used to overcome this problem is creating a proper model, which can be extensible, analysed and examined in a detailed way. Using the mathematic and simulation tools they allow us to investigate the attributes and behaviour of the modelled

system, which is specifically important while teaching and step-by-step explaining the miscellaneous parts of the complex system in every design phase, mainly to the people which are not familiar with the particular details of a created system [9].

### Coloured Petri Nets

The Coloured Petri Nets (CPN) provide an environment for design and analysis of distributed systems. In principle, they are derived from General Petri nets, that are considered to be one of the most acceptable formalisms for modelling and analysing of concurrent and distributed systems. In the beginning they were designed especially as a suitable theoretical model, but later it became the full-edged language for design, specification, simulation, control and implementation of large software systems.

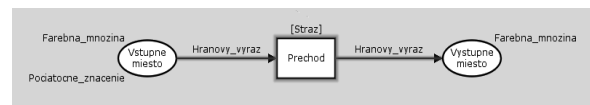


Fig. 3. Basic elements of CPN

The coloured Petri nets are based on the concepts and terminology taken from modern programming languages and so it's relatively simple to learn to use it, especially for the people that have some programming experiences. The construction of CPN models is in many ways similar to a construction of prototypes, as it permits developer to proceed concrete and thorough verification of key design parts of the system. This manner actually uncovers not only some specific and often hidden possibilities of a final project's behaviour, but also widely improves a user's understanding of basic concepts of a future real system [11].

### Structure of a videoconference system

The whole system in its most general embracement consists of two parts – **application** and **allocation** part [12].

**Application part** deals mostly with sending the various kind of messages between the particular system's nodes and with subsequent monitoring of its behaviour based on sending and receiving those messages. The functions that this part deals with, include the recording, playing, storing the videoconference records, a calculation of topological changes and a communication with client.

The second part of the system is the **Allocation part**, that deals with an allocation of system's network resources, mainly from the view of quality of service's requirements, as the allocation of bandwidth, which is one of the most important factors, that need to be considered in relation of videoconference broadcasts.

If we take into account the fact that the success of a videoconference and also of its archive recording depends on the sufficient quality of a network transfer, it's obvious that the effective design of network resources' allocation within the archive system is crucial for its planned functionality.

### The System's message communication

The communication between particular nodes' types occurs in a form of exchanging two message types – a *message about route* and a *message about allocation* itself [12].

**Route message** idea comes from the initial design of a little more complicated topological message, and its main contribution is in general to find a transfer route from the client (VRVS/EVO) to storage system, which is supposed to record the transferred videoconference.

All nodes located on this route have a complex overview about the actual network status thanks to parameters attached to a message and together with the informations attached to an **allocation message**, they can serve many unwanted situations (connection release, loss of route's informations, allocation time-outs...), that can jeopardize the allocation of network resources along the created and reserved route.

#### Construction of a CPN model

The pilot model of resource allocations of an archivation system is designed with a help of hierarchies [10] (Fig. 3) which are widely supported by design environment CPN Tools, whilst every nodes' group (VRVS/EVO, Manager system and Storage system) is widely divided into two more detailed submodels (Fig. 4) [12]:

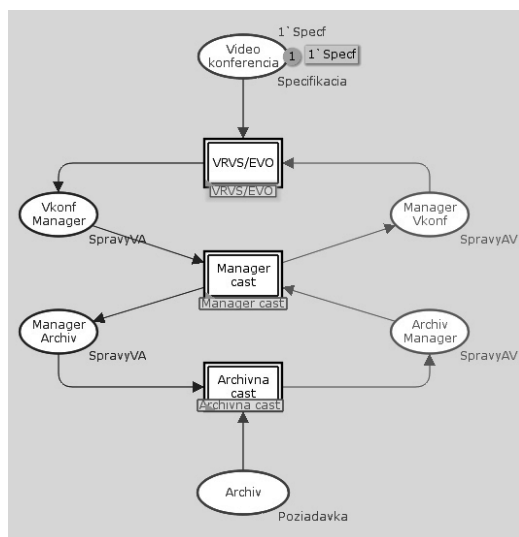


Fig. 4. Main CPN model structure

- **Route securing** within this submodel, we model the situations related to a setup of a route from the VRVS client to Storage system.
- **Allocation securing** within this submodel, we model the situations related to an allocation of resources along the created route, from Storage system to VRVS client, which implies that the main condition for a successful allocation is the creation of a transfer route.

To assume all, it's important to realize that coloured Petri nets are used for three different but however very similar goals. A CPN model is essentially a description of a modelled system and it can be used as a specification (of a system meant to be built) or as a presentation (of a system meant to be explained to other persons).[10]

By creating a model we can study a new system sooner than it's constructed in real. This property is an obvious advantage, especially in systems where the design errors

could seriously jeopardize the security or would be too expensive to repair.

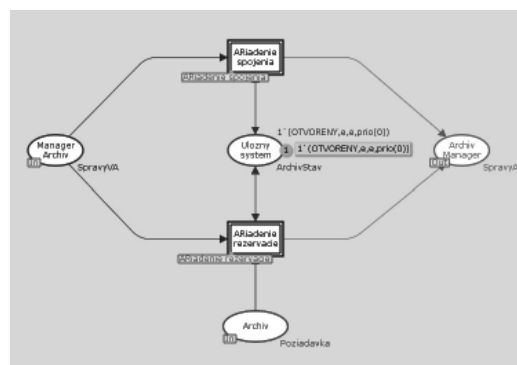


Fig. 5. CPN submodels

A CPN model's behaviour could be also analysed, by simulation (which is an equivalent to execution and debugging of a program), or by form of various formal analytic methods (which are equivalent to a program verification) [11]. The goal should be however an understanding of the fact that a process of creating a description and of analysing usually provides a student with an enormously improved ability of understanding of a modelled system and an often case is that this knowledge is in fact even a more valuable than a description or the results of analysis themselves.

## 6. CONCLUSION

The presence of e-learning in today's education became common and very popular. E-learning courses and elearning systems are available all over the world. There is also boom in providing educational content in other forms than printed books or e-learning materials. One of the key factor for the personal communication in close future is transmission of videoinformation. Today, the videoconference systems present a very powerful tools for a collaborative work over the Internet. They also provide a great possibility for a distance study, where neither the teacher or students have to be physically present in one room.

This work was dedicated to the problem of archivation of running videoconferences using the distributed architecture. Distributed systems are nowadays one of the fastest developing types of modern compute systems and because of their extent, complexity and composition, the knowledge of their modelling techniques is almost inevitable for a construction of their quality designs.

Because those systems in large extent use parallelism and concurrency, a very good solution for their constructions present the Coloured Petri Nets. In this work we also presented some aspects concerning the modelling of distributed systems and subsequently we applicated successfully these aspects to a designed model of a part of distributed archivation system that deals with an allocation of network resources and which is inevitable for reaching the planned functionality and effective securing of accomplishing the tasks of an archivation system during the videoconference transfer.

The results of this work are implemented and tested with the VRVS (Virtual Room Videoconferencing System) and EVO (Enabling Virtual Organization) system [5]. The project is still in development.

## 7. REFERENCES

- [1] Wikipedia, the free encyclopedia; <http://wikipedia.org>
- [2] Radford, A.: *The Future of Multimedia in Education*, firstmonday (<http://www.firstmonday.org>), 1997
- [3] Pod Casting; <http://www.onlypodcasting.com>
- [4] Picture phone direct; <http://picturephone.com>
- [5] VRVS; <http://www.vrvs.org>
- [6] EVO; <http://nextgencaltech.cern.ch/evoGate/>
- [7] Biñas, M.: *The usage of distributed systems for videoconferences archivation purposes*, the work for PhD thesis, 2006
- [8] Biñas, M., Adamuščinová, I., Jakab, F.: *Videoconference archive solution based on distributed architecture*; In proceedings of the Seventh international scientific conference Electronic Computers and Informatics, ECI 2006, Košice-Herľany Slovakia, Sept. 20-22, 2006, VIENALA Press, Košice, 2006, First Edition, pp.19-22, ISBN 80-8073-598-0
- [9] Tanenbaum, A. S.: *Distributed systems - Principles and paradigms*; Prentice Hall, 2002, ISBN 0-13-088893-1
- [10] Jensen, K.: *Coloured Petri Nets - Basic Concepts, Analysis Methods and Practical Use*, Volume 1, Springer-Verlag, 1997, ISBN 3-540-60943-1
- [11] Girault, R.: *Petri Nets for Systems Engineering, A Guide to Modeling, Verification and Applications*, Springer-Verlag, 2003, ISBN 3-540-41217-4
- [12] Adamuščinová, I.: *Concepts of distributed systems' models*. Diploma thesis, Technical University of Kosice, Faculty of electrotechnical engineering and informatics, 2007. 87 pp.

## THE AUTHORS



**Miroslav Biñas** is internal PhD student at Technical University of Kosice. his research activities are related distributed systems, videoconferencing technologies, ambient intelligence and to streaming

technologies. He is responsible for newly developed archive system for VRVS and EVO videoconferencing systems and he is a member of Computer Networks Laboratory.

You can contact him at [miroslav.binas@tuke.sk](mailto:miroslav.binas@tuke.sk).



**Iveta Adamuščinová** received the MSc. degree in Informatics from the Faculty of electrotechnical engineering and informatics, Technical University of Kosice in 2007 with diploma thesis Concepts of distributed systems' models. She's a member of Computer Networks Laboratory, where she's focused on the analysis and design of distributed archivation system for videoconference transfers as a part of VRVS research team. Her research interests include the modeling and verifications of complex distributed systems using the formal method of Coloured Petri Nets. Among other research activities, she's also interested in various database systems and methods of communication and interactions between the individual layers of systems' models.

You can contact her at [iveta.adamuscinova@cnl.tuke.sk](mailto:iveta.adamuscinova@cnl.tuke.sk).



**Frantisek Jakab** was born in 1959. He received the MSc.degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Rusia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modeling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)).



**Miroslav Michalko** is internal PhD student at Technical University of Kosice. his research activities are related to streaming, mobile multimedia technology and web services. He is responsible for Videoserver platform development as project manager and member of video@lab team at Computer Networks Laboratory.

You can contact him at [miroslav.michalko@tuke.sk](mailto:miroslav.michalko@tuke.sk).





## PROCESS VISUALIZATION SYSTEM DESIGN BASED ON CO-DESIGN METHODOLOGY

Erik Csókás, Pavel Čičák  
Faculty of Informatics and Information Technologies  
Ilkovičova 3, 842 16 Bratislava  
csokas.erik@gmail.com, cicak@fiit.stuba.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The purpose of this work is to analyze, design and implement an integrated development environment for embedded systems design and evaluate this system in the field of visualization. In order to fulfil the criteria of the proposal we will define the requirements on the system, input and the output of the system and create a functional specification. The architecture of the system and the user interface will be presented. Our goal is to design a system which enables robust visualization of systems.

**Keywords:** Co-design, visualization, visual programming

### 1. INTRODUCTION

A *system* is defined as a set of concepts or parts that must work together to perform a particular function. An organization is a system or a collection of systems. Every job in an organization is used by a system to produce a product or service. The product or service is the means by which a organization supports itself [7]. A *process* is a planned series of actions that advances a material or procedure from one stage of completion to the next within a system. A system generally has several processes in it. Like a system, it also has an input and an output [7]. "Systems design is the process or art of defining the hardware and software architecture, components, modules, interfaces, and data for a computer system to satisfy specified requirements. One could see it as the application of systems theory to computing. Some overlap with the discipline of systems analysis appears inevitable." Design is the act of defining a system or subsystem. Usually this involves defining one or more models of the system and refining the models until the desired functionality is obtained within a set of constraints [8]. Executable models are sometimes called simulations, an appropriate term when the executable model is clearly distinct from the system it models. However, in many electronic systems, a model that starts as a simulation mutates into a software implementation of the system. The distinction between the model and the system itself becomes blurred in this case. This is particularly true for embedded software [8].

#### Co-Design

Embedded controllers for reactive real-time applications are implemented as mixed software-hardware systems. These controllers utilize Micro-processors, Micro-controllers and Digital Signal Processors but are neither used nor perceived as computers. Generally, software is used for features and flexibility, while hardware is used for performance. Design of embedded systems can be subject to many different types of constraints, including timing, size, weight, power

consumption, reliability, and cost. Current methods for designing embedded systems require specifying and designing hardware and software separately. A specification, often incomplete and written in non-formal languages, is developed and sent to the hardware and software engineers. Hardware-software partition is decided a priori and is adhered to as much as is possible, because any changes in this partition may necessitate extensive redesign. Designers often strive to make everything fit in software, and off-load only some parts of the design to hardware to meet timing constraints. There are many different academic approaches to try to solve the problem of embedded system design. In our opinion, none of them address satisfactorily the issues of unbiased specification and efficient automated synthesis for control-intensive reactive real-time systems. Therefore, we are developing a methodology for specification, automatic synthesis, and validation of this sub-class of embedded systems (that includes the examples described above).

#### Visualization

To control an (industrial process, hardware component) technically seen a controller is enough, but in the real life the more typical situation is that live data will be presented from the process in a (visual) form which is easily understandable. A visualization system can collect data from the industrial process (for ex: assembly line) from controllers or various data sources, process the data, display the data and store the data for further processing.

### 2. CO-DESIGN METHODOLOGY

In our solution we have proposed an approach of hierarchically networked communicating actors. The communication between actors is modeled with tokens – object carrying packets of information. The communication between actors is generally asynchronous, but the firing of the actors can be controlled by models of computation (domains) – so creating synchronized communication. An

actor can have input and output pins. These pins are used to connect the actor with the other actors.

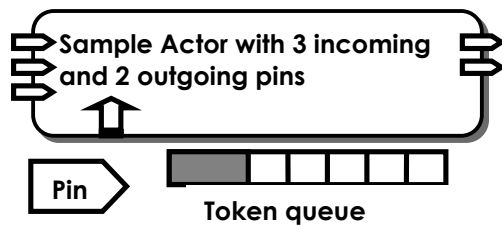


Fig. 1 Sample actor, incoming pin and token queue

Actors [Fig. 1] communicate via sending tokens. The incoming tokens are inserted into the incoming token queue and processed (consumed). On the output port the tokens are produced by the actor. The processing, order of processing, scheduling of execution is controlled by the controlling domain. Domain Dm is the model of computation, which governs the interaction between actors and fires the transformation function of actors. In our work we will use the term domain as specified by prof. E. Lee [4]. The Normandy co-design methodology provides graphical representation for the system designer and has powerful design and verification capabilities. Our mission was to develop a methodology, which fulfills the key features identified in [5]. In order to model hybrid systems our methodology should be able to fulfill these criteria:

- Visual notations for different domains
- Hierarchical design extensions
- Design specification with heterogeneous domains

The design flow is based on refinement through inheritance. During the refinement the designer overwrites the abstract instances with more specific instances. To model this process, the development process in the Normandy design method consists of three layers:

#### Abstract layer

On the topmost layer an abstract schematic view of the system - this view has the most expression power. The system architecture is modeled on this layer. The abstract blocks are connected via communication paths.

#### Hierarchical layer

The middle layer is a hybrid layer. On this layer the designer can use basic building blocks, hierarchical building blocks or abstract building blocks. On this layer the designer can use the benefits of inheritance.

#### Implementation layer

The lower layer is the implementation layer. This layer is the nearest to the implementation of the model. All abstract and hierarchical blocks must be replaced with basic building blocks with a process called 'flattening'.

**Abstract block** – [Fig. 2] has no specific behavior. This class has only an interface. During the design all abstract classes will be substituted with hierarchical blocks or basic building blocks.

**Hierarchical object block** - its behavior is described with other hierarchical and basic building blocks. These several types of nets are connected through message links [5]. This type of object is used on the hierarchical layer. Behavior is modeled with communicating and concurrently executed processes.

**Basic block** - the basic building block of the system. This block has a strictly defined interface and behavior. To aid visual programming a simple graphical representation can be used.

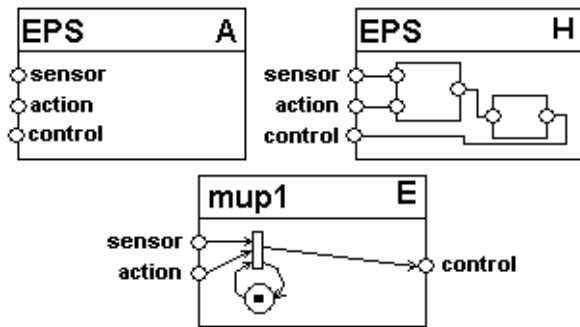


Fig. 2 Abstract block, hierarchical block, block with behavior

### 3. DESIGN FLOW

The design flow [Fig. 3] is centered on a hierarchical block based design. After the design phase is done, the co-simulation can help find design errors or bottlenecks. Using co-synthesis can help the designer to create an executable model of the system for more performance estimation. Using the results from performance estimation the designer can manually divide the design to software and hardware and use hardware (VHDL) and software synthesis (C, java, c#).

1) Abstract model of the system: This is a high-level model - the system behavior is modeled with abstract blocks and hierarchical blocks. Communication between the elements is modeled with communication paths.

2) Refinement - the behavior of all abstract blocks will be modeled with hierarchical objects or basic blocks. This process is recursive, and will be continued until all the abstract blocks are replaced. The designer can independently refine the elements of the system models in which different components are described at different levels of abstraction [2].

3) Design verification. Since the Normandy design methodology supports inheritance, the formal verification is straightforward. The interface inheritance rule is based upon the principle that a subclass can replace the superclass without modifying the interface. The constraint inheritance rule forces a subclass to fulfill the constraints of the superclass too [5].

4) Co-simulation – Since our models are executable models, the designer can simply run a simulation and check the design. The built-in simulation tools (xy plotter, logger, and graph) can create a graphical output or an output to a file.

5) Performance estimation. Accurate performance estimation is critical to the success of a digital synthesis system. Performance estimation can be done on the model or on the generated model (co-synthesis). Performance estimation can help detect bottlenecks. The results of the performance estimation can be used in the design partitioning step.

6) Co-synthesis – An executable model can be generated from the design. The designer can use later this executable model for performance estimation or for production use in a

real-time OS or even as a separate application. Using a software-based system model in the design process, an engineer can create a testable prototype without the need for hardware, which provides a documented method for verifying and validating the design against requirements prior to moving to developing the actual controller and hardware.

7) Design partitioning – Design partitioning is done by the designer using the results from performance estimation.

8) Software synthesis – The software synthesis step generates a software representation of the software blocks. The heterogeneous model of the Normandy design process allows code generation for various programming languages.

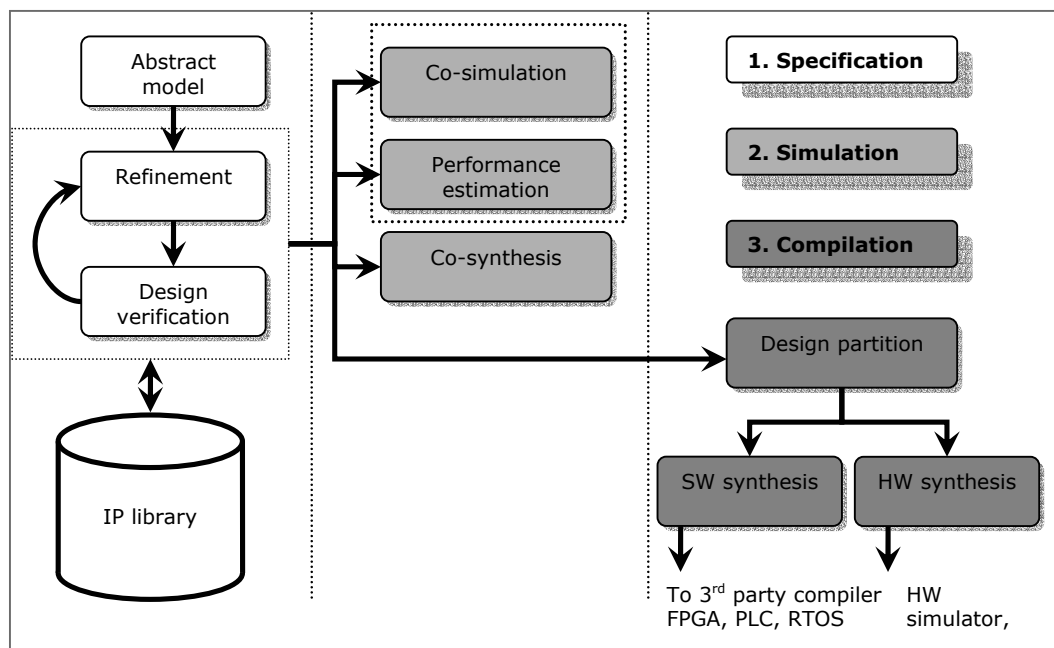


Fig. 3 Design flow

9) Hardware synthesis – The purpose of this step of the design flow is to generate a hardware representation of the selected parts of the design.

Code synthesis - is the process of generating source code from the inner representation of the design. In our case we have to deal with hardware and software code generation. In this section we will show how we solved the code synthesis problem.

Hardware code synthesis - To solve the problem of hardware synthesis we have created a simple Petri Net – VHDL translation algorithm. In our analysis we have studied 2 different methods to solve the translation and came up with the combination of these 2 methods. The Petri Net – VHDL transformation was discussed in our previous work. Modeling Petri Nets in VHDL was already debated in 1990. Experimental results, developed as Inmos in practical design achieved a 50% area reduction and a 40% speed

improvement over the best FSM synthesis [6]. There are several methods to convert a Petri Net to VHDL.

#### 4. VISUALIZATION DOMAIN

Controllers and visualization systems work side-by-side in the real world, and in our work we wanted to evaluate an extendable co-design methodology in the field of visualization. To implement the visualization system we had to make some changes in the behavior of the blocks and the design flow.

The function of the abstract and block remained the same. The hierarchical object blocks function is as follows: The behavior of the block is described with a C# script (or a visual programming language) – and is generated from the containing shapes.

The function of the elementary object block is described with a C# script. The visual representation is generated also using a C# script for each type of visualization client.

The Shapes Library contains a list of pre-defined shapes with defined behavior and graphical representation. The architecture of the visualization domain is shown on Fig. 4. The data sources (PLC, assembly tools, etc.) are accessed via data access plug-ins. Over these plug-ins is a data access manager, which provides a simple caching mechanism. In the data and control processing block the visualization scripts are being run. In the next step the graphical processing creates a graphical representation for

each page (and each shape on the page) for the visualization servers..

## 5. CASE STUDY: ASSEMBLY LINE VISUALIZATION

To test the visualization domain an application has been developed. The visualization applications purpose is to display data from an assembly line. There are various types of data sources from which data will be collected and there should be a way to display the results to a connected client with rich graphical experience, and also to a remote client with limited connection speed.

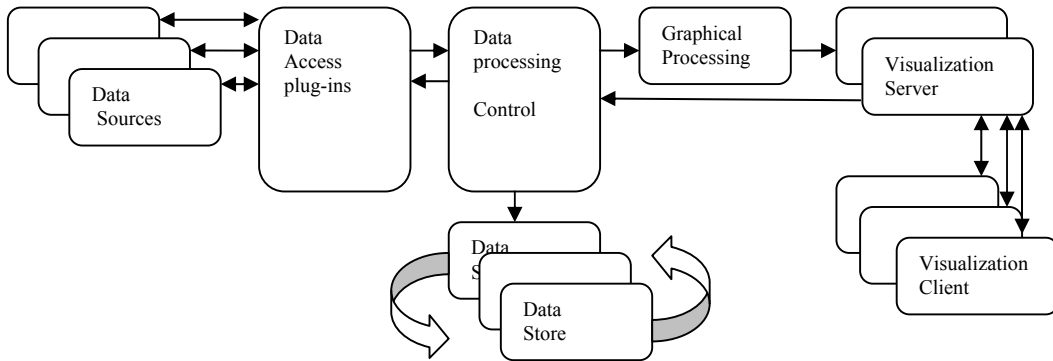


Fig. 4 Visualization architecture

Data sources – these are the hardware components from which we are gaining data, and optionally send commands. To test the design we have used Simatic S7 PLCs and assembly line tools with OpenProtocol interface.

Data and control processing – In this part the data processing takes place. The visualization scripts are being executed over the data, and the results are sent to graphical processing. This part is responsible for control processing.

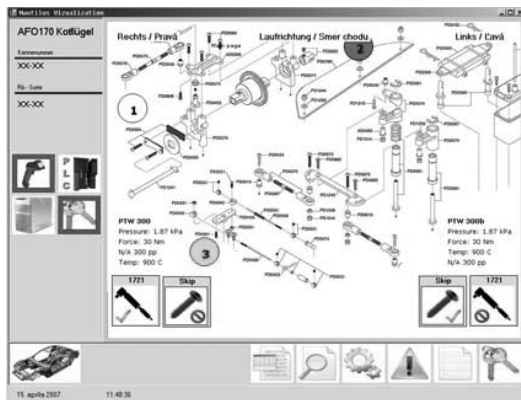


Fig 5: GDI client for the visualization application

Data access plug-ins – provide access to the data sources. For this purposes a Simatic S7 driver and an openprotocol driver has been created. To meet timing schedules, a distributed data acquisition system can be used. This is especially true when there are a large number of data sources, or the network connection has limitations on data throughput or a not acceptable latency. In such cases data acquisition servers are used. The placement of these servers over the network is critical to achieve the speedup. Using more data acquisition servers make the data access part more robust.

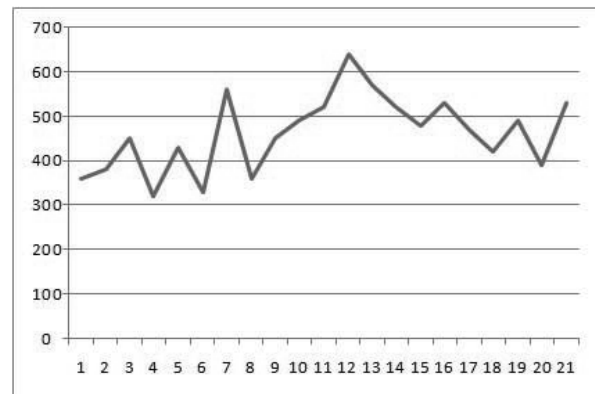


Fig. 6: Performance test: Reading 30.000 variable values from 40 Siemens Simatic S7 PLCs. X-axis: nr. of read, y axis: lag [ms]

Data store – The data from the data sources and data processing can be optionally stored in databases. The databases are being mirrored thus providing robustness in cases of data loss.

Graphical processing – The graphical part is being generated in this step. For each connected plug-in (client type) there is a separate graphical processing (generate) part.



Visualization servers – The end clients connect to visualization servers. The visualization servers cache pages, images and send the updates to visualization clients. The visualization server has web server application to support web clients.

Visualization clients [Fig. 5] – at this time 2 types of clients exist, web clients and desktop clients. In the future there could be the need for mobile (or PDA) clients. The web client uses scalable vector graphics (SVG) to provide rich user experience.

This work was supported by Slovak Science Grant Agency within:

- project No. VG 1/3104/06 „Systems of grid computing and its components”

## 6. REFERENCES

[1] Čičák, P.: Príspevok k návrhu riadiacich jednotiek číslcových systémov. Dizertačná práca. FEI STU 1998

[2] Jókai, D.: Programová podpora návrhu riadiacich systémov. Diploma thesis FIIT STU 2004/2005.

[3] A Ptolemy webpage <http://ptolemy.eecs.berkeley.edu/>

[4] E. Lee: The Ptolemy Overview  
<http://ptolemy.eecs.berkeley.edu/publications/papers/03/overview/> *Technical Memorandum No. UCB/ERL M03/25*, University of California, Berkeley

[5] Csókás, E.: Program support for controller design. Diploma project FEI STU 2002/2003.  
<http://normandy.webpark.sk/documentation/dipproject.pdf>

[6] G. Swaminathan, R. Rao: A VHDL Based Environment for System Level Design and Analysis, 1994,  
<http://www.eda.org/viuf/papers/spring94/swaminathan94a.pdf>

[7] Introduction to Instructional System Design  
<http://www.nwlink.com/~donclark/hrd/satl.html#systems>

[8] J. Davis, Ch. Hylands: Overview of the Ptolemy project,  
[ptolemy.eecs.berkeley.edu/publications/papers/01/overview/overview.pdf](http://ptolemy.eecs.berkeley.edu/publications/papers/01/overview/overview.pdf)

## THE AUTHORS

**Pavel ČIČÁK** has got M.Sc., Ph.D. degrees in Computer Science and Networks at The Faculty of Informatics and Information Technologies of the Slovak University of Technology in Bratislava in 1979 and 1999 respectively.

He is Associate Professor at the Institute of Computer Systems and Networks of Slovak University of Technology teaching in courses Engineering Methods, Machine and System Level Programming, Computer Organization, Computer Application Design. His scientific interests include Digital Control Systems Design, The New Methods of Computer Communications, Real-time Systems, means of hardware (and software) specification, as well as other topics in Computer Engineering. He has been with Slovak University of Technology since 1978. During these years he co-operated on several scientific and research projects including Autonomous In-Circuit Emulators, Fault-Tolerant Computer Systems of New Generation, High Performance Parallel and Distributed Fault-Tolerant Computer Structures, Parallel Real-Time Systems, Methods and Resources of the Computer Mobile Networks Safety Development etc. He co-authored several textbooks for students (15), scientific papers (28) and contributed to several international conferences (13).

Since 2000 he has been Main contact and Director of Regional Cisco Networking Academy RCNA FIIT STU Bratislava, he is CCNA, CCAI of Cisco Systems and FIET, CEng. of the IET.

**Erik Csókás** has got M.Sc. degree in Computer Science and Networks at The Faculty of Informatics and Information Technologies of the Slovak University of Technology in Bratislava in 2004. He is an external Ph.D. student at the Institute of Computer Systems and Networks of Slovak University of Technology. His research areas include Distributed Visualization Systems, Co-Design and Petri Nets. He authored scientific papers and contributed to an international conference.





## CENTRALIZED SYSTEMS IN THE AREA OF NETWORK MONITORING AND MANAGEMENT

Peter Fecilák, Katarína Kleinová, František Jakab  
Department of Computers and Informatics,  
Technical University of Košice, Letná 9, 042 00 Košice, Slovakia  
E-mail: { peter.fecilak, katarina.kleinova }@tuke.sk, jakab@elfa.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The aim of this article is to contribute to the method of network management in the networks based on centralized management through the LDAP directory services and the mechanisms of the system virtualizations. In this article I am trying to elucidate the problems of the centralized management of the network components. In the paper there are analyzed the possibilities of the centralized management of the services with the suggestion of the modular system for the need of the next expansion of the system services, which are provided in the network. This article sketches the need of the analysis of the network communication protocols and their modeling which is useful for network administration and also for the need of building centralized system with virtualization techniques management for the management of system resources in the distributed area.

**Keywords:** Centralised systems, network administration, virtualization techniques, distributed system, thin clients

### 1. INTRODUCTION

In the present the information technologies are daily part of our lives. We can not sometimes imagine the life without them. Everyday we are in the contact with the different forms of the information intermediation which is also realized using computer networks in the area of information technologies. Everyday work of the network specialists who manage the computer network includes problems which these specialists must solve to satisfy users.

I decide to advice this problem because the network specialists who allow the access to the information by the network administration have not enough complex tools to monitor, analyze and control wide networks.

This paper deals with the suggestion of the model for network administration, its analysis and administration methods and so allows the network specialists to simplify everyday work through the centralized solutions for the services administration which is put on in the networks.

In the present the information network itself is made by the services in the network about which it is necessary to supply, set them, keep running and adapt to the demands of the users.[1] Network specialists - administrators who manage the network carry out this task to allow user's access to the information daily.

### 2. NETWORK SERVICES

Every offered service in the network has its own representation of information which is shared to the network users. Network specialists put in a lot of effort by

the administration of the wide network by inserting the same information to many computers which provide the relevant services. An example is an organization providing the access to the post services (e-mail) for users and in the same time allows storing information (files) through the FTP (file transfer protocol) service. Each of services need the internal data representation relate to logging and privileges under the term of the relevant service (typically login and password). From the point of view of the network administrator it is a duplicate action for the relevant service in the process of the user registration. It is the user addition to the computer which provides service to the e-mail and the addition to the computer which provides service of the file transfer. The need of recording registered users originates in these organizations which provide services for the users who use these services. For that reason it is necessary to record users electronically.

The service for the presentation of information about the users, services, devices, and computers and so on is the key component of these tools for user recording [2]. This service can be represented by the information system. The main problem for the network administration is the user registration and allocation services which user can use. If the complex of the provided services is too extensive under the term of network which is administrated, recording the new user can take several hours. It is mainly the administrator's work by which user access data is inserted to the independent systems for the services. In this case it is appropriate to create a form of the centralized "store" of the information, which is represented by the service itself and other services in this system behave according to the user of the central services for providing the information.

### 3. CENTRALISED SYSTEMS

There are many mechanisms of the centralization and the centralized management of the network which are based on the different network services. One of the implementation is the utilization of the LDAP as the centralized solution for making the information accessible. It provides the network administrators immediate application of the provided services settings and user administration with the immediate effect from the moment of the user recording [4].

For the network administration it is necessary to permanently modify the configurations of the network services with the respect to the users – add, remove users from the system of the services. In the most examples the configuration of the provided network services is the one-off issue of the system administrator and all other steps relate only to maintenance and modification of the accesses to the services. Here is a question, if it is possible to set all known services for one-off and provide them as a complex solution of these services in the network area. But here is one problem. This problem is a variety of the network settings for the individual networks. It is not problematic to create the complex system services, but its initialization is necessary for each specific network. The modification of the configuration for the network services lies only on the data modification for the chosen network (commonly only IP addresses, network masks and firewalls), but not on the modification of the settings for the service itself (providing of the cipher connection of the e-mail services and so on).

Here it is necessary to create “store” of the information which includes only the information which is supplied for these network services by the administrator and not the internal behavior of these services which can be made in the form of the service configuration. As it is a centralized “dump” of data, the advantage arises for administrator. If the services can their basic settings of the network environment ask from the other service (central information storage), so it does not take place the problem of repeated change of the same information for each of services individually. By this way, it just changes the information about the network environment by the centralized services solution at one place and this information can utilize all other network services. It is possible to solve the centralized information storage in the form of the directory services or in the form of the database.

### 4. SCALABILITY OF THE SYSTEM

The problem of the information processing from the side of the network administrator (user of the service of the centralized management) arises by the realization of the central solution of the information storage for the services via the database or the directory service. The need of user interface definition also arises, which fills the centralized information storage with data. The simplest user interface representation for the network management is the information system (WEB application in the form of the internet site). In relation to the centralization of information through the network information service NIS, the need of back up arises not only in the side of the physical

realization of the network infrastructure so the services will be available, but also on the level of individual services (multiple database, directory services with the same content). By the central information storage, the modularity of network services arises. The kernel creates the information storage not only in the form of the database but also in the form of the directory service and individual services represent the system modules as the whole. These modules – the individual services must have the support for the communication with the selected central service of information, which can be e.g. directory service LDAP.

For the administration of the wide network it is necessary to build a modular system of services so the services could be continuously complementing to the existing computer network and the modularity must be keep in the future [3] [4].

Demands on the modular system of services:

- Centralized information administration through directory service or database. According to the consistency of data that occur in this information database, it is necessary that central environment for information store to be constantly available and backed up.
- Internal representation of data that are provided to the services should be in cipher form so that such information will not be abused by the attack upon central data “storage”.
- From security point of view, services should be separated in such a way that the central storage information service will be the join point between referred services.
- By weakening some of the services through the network attack upon service it is not allowed to affect the other services.
- The services should communicate exclusively using the cipher protocol so that the communication will not be abused.
- Network services should allow run time migration of service on other technical equipment in the modular way without the fail of service.

There are many service mechanisms for the network administration that have different process mechanisms applied in the network components administration process. These mechanisms are different in dependence on controlled component, maintenance of selected service depend on protocol and so on. Each of provided services has its own particularity what offers which form of the security are available and what it has to make provision for implementation.

### 5. VIRTUALIZATION AND MODULARITY

Within the context of the centralization mechanisms on the application layer – centralization of particular provided services, the need of control over the components arises that allow running of provided services. With regard to security and effective using of system devices, virtual mechanisms for virtual systems, in which the services are provided, are going to use. Within the context with the virtualization

mechanisms the area is opening for the examination of the possibilities of the control resources using virtualization techniques [5].

Many systems of the virtualization technique administration exist, which it is possible to use for management and control of the virtualization systems. In spite of these systems are at the disposal and with their way make ease the work of the system administrator, line of problems arise which follow from the absence of the system resources by the building of the complex wide network. By the complexity of the offered services the need of the distributed solution arises, when it is needful also to control systems offering virtualization as the service for the administration of the virtualized systems [6].

The common problem of the network administrator by the resource administration is after the addition of the new server its introductory installation and preparation for the use virtualization technique. It is also necessary after the gradual addition of the hardware resources into the complex of the technical equipment on which the virtualization techniques are offered.

The need of solution suggestion in which it is possible to remove mentioned repeated activity is also important. The area which is not research sufficiently is the area focused on the resource providing in the environment of thin client using the virtualization technique. For the simplicity and automatic work is possible to create the complex systems, which must include [4] [7]:

- system for the hosts administration without the need of individual installation (use thin client, start through the network)
- system for the virtualization techniques administration above thin client, which the virtualization techniques offer
- system for the resource administration on the application layer (use of centralization, e.g. through the directory services of the LDAP protocol)
- system for the network resources management (maintain and actualize the settings)

## 6. AUTOMATICAL MANAGEMENT

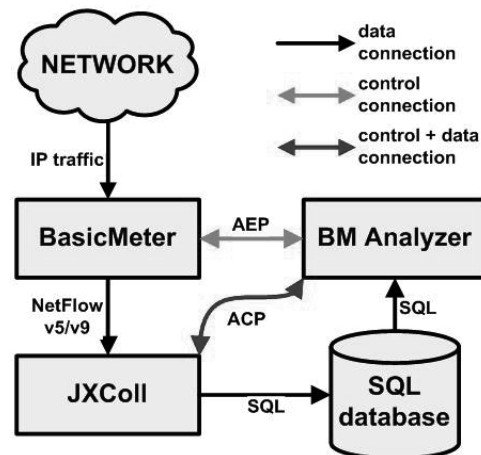
Data flow analysis in computer network can be divided into number of categories depending on measured parameter. Each monitored parameter can be associated to group of services that are influent by specified parameter [4] [9]. For network type analysis in this project will be used Basic Meter which was developed in Computer Networks Laboratory at Technical University of Košice [9].

Basic Meter consists of the four parts as shown in picture 5.1:

- BM analyzer
- JX collector
- Basic meter central service
- SQL database

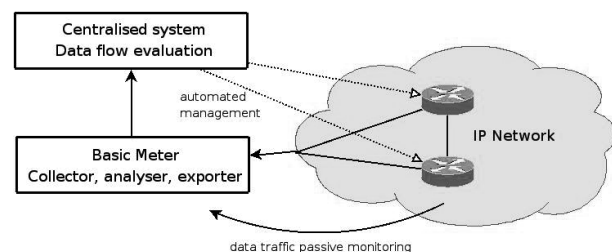
This tool can be used for data collection (JX Collector), monitoring specified parameters in IP traffic (BM Analyzer) and for their classification (Synets module). Data

traffic classified by parameters into groups will indicate to centralized system which type of traffic is currently flowing through the network.



Picture 5.1: Basic Meter

Centralized system will evaluate incoming traffic information to decide whether there are some services that are endangered by data traffic. Typically this means, that if data traffic (e.g. Voice or Video traffic) is inclined to failure due to problems in network (mapped to monitored parameters as packet loss, delay, bandwidth), centralized system must be able to detect endangered service and to choose proper action for solving the problem. Solution can be done by reconfiguring network components (e.g. forward traffic through another gateway or to affect dynamic routing protocols). This communication is shown on picture 5.2.



Picture 5.2 Automatic management

## 7. SIMPLIFYING MANAGEMENT WITH MODELS

It proved to be true, that it is necessary for the needs of network administration to create model that describes the behavior of provided services in the network in the relation to the network parameters that affect the delivery of such services. Each of the provided services and elements which is necessary to control in the network can be described independently by using the particular models. These models "of network services" and their relation to the parameters allow us to create model for network administration that makes provision for the most of provided services in the network.

On the base of this model, it is possible in practice to implement tools to control network communication, priority in dependence on the selected services and so on. Models

that allow such administration mechanisms can be described by layers that are interdependent. Also it will be possible to verify proposing model by using the formal languages and specifications. For this purpose can be used UML or the Petri Nets.

## 8. CONCLUSION

In the Computer Networks Laboratory - the Synets project at the Technical University of Košice we deal with a problem of using virtualization techniques in thin client environment and with systems that use directory services LDAP on virtual systems for providing services in the network environment and administration of network components. In the present, an environment that use thin clients (diskless stations) with availability of virtual techniques and with the distribution of performance through the distributed system of thin client is implemented. In the Synets project, there is system for virtualization techniques management implemented on thin clients using openvcp protocol. The complex system of services provided in the network environment using directory services of LDAP protocol has been established.

In the near future, in the Computer Networks Laboratory we are going to deal with a design of model for network administration and with a design of system for automatic administration and audit of the network. This can be done by passive monitoring of the network, automatic detection of endangered services offered in the network environment and the automatic network reconfiguration reflecting the best practices in network performance optimization.

## 9. REFERENCES

- [1] Miroslav Biñas, Peter Feciľak, František Jakab, Juraj Gierťl, Katarína Kleinová: Efficient system for monitoring and management of the campus network environment
- [2] James W. Hong, Michael A. Bauer, J. Michael Bennett: The Role of Directory Services in Network Management, September 28, 1992
- [3] Miroslav Biñas: Systém na správu topológie siete pomocou LDAP, Diplomová práca, Technická Univerzita, Košice, 2004
- [4] Peter Feciľak: Modulárny systém pre správu počítačovej siete, Diplomová práca, Technická Univerzita, Košice, 2006
- [5] Robert Rose: Survey of System Virtualization Techniques. [online]. Available on internet: <http://www.robertwrose.com/vita/rose-virtualization.pdf>, 8.marec 2004
- [6] L.Breslau, P.Cao, L.Fan, G.Philips, and S. Shenker, "Web Caching and Zipf-like Distributions: Evidence and Implications," in INFOCOM (1), 1999, pp.126-134, [Online]. Available on internet: <http://citeseer.ist.psu.edu/breslau98web.html>
- [7] G. J. Popek and R. P. Goldberg: "Formal requirements for virtualizable third generation architectures," Commun. ACM, vol. 17, no. 7, pp. 412 – 421, 1974.
- [8] Jakab František, Bača Ján, Šuba Stanislav, Sivý Igor, Genčí Ján, Gierťl Juraj, Biñas Miroslav, Kleinová Katarína, Michalko Miroslav, Feciľak Peter: New Form of Communication based on Multimedia: Effective Methods of Information Transfer, Computer Science and Technology Research Survey, Košice, Elfa s.r.o., 2007, pp. 30-36, 978-80-8086-046-2
- [9] Gierťl Juraj, Jakab František, Bača Ján, Andoga Rudolf, Mirilovič Michal: Contribution to Adaptive Sampling of QoS Parameters in Computer Networks, Acta Electrotechnica et Informatica, 6, 1, 2006, pp. 52-59, ISSN 1335-8243, <http://www.aei.tuke.sk/pdf/2006-01/Gierťl.pdf>

## THE AUTHORS



**Peter Feciľak** is internal PhD student at Technical University of Košice. His research activities are related to distributed systems, centralized systems, traffic engineering, network topology discovery, network topology visualization, network monitoring and managing. He is responsible for newly developed system for network monitoring and managing called SYNETS and he is member of Computer Networks Laboratory. You can contact him at [Peter.Fecilak@tuke.sk](mailto:Peter.Fecilak@tuke.sk).



**Katarína Kleinová** is internal PhD student at Technical University of Košice. Her research activities are related to IP telephony, voice over IP traffic analysis and quality evaluation. She is responsible for development of IP telephony applications as project manager and member of VoIP@lab team at Computer Networks Laboratory. You can contact her at [katarina.kleinova@tuke.sk](mailto:katarina.kleinova@tuke.sk).



**Frantisek Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical University of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modelling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)). You can contact him at [frantisek.jakab@tuke.sk](mailto:frantisek.jakab@tuke.sk).



## METHODICAL INSTRUMENT FOR THE STUDY AND PROPER ANALYSIS OF DISTRIBUTED ALGORITHMS OFF IEEE 802.1D AND IEEE 802.1W STANDARDS.

Igor Grellneth, Martin Kvasnička  
Faculty of Informatics and Information Technologies, Bratislava  
grellneth@fiit.stuba.sk, martinkvasnicka@gmail.com

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Spanning Tree protocols prevent loops occurrence at 2. RM OSI layer, so they support fluency of network communication. Fundamental standard is IEEE 802.1D published in 1998, which was evolved in 2004 into IEEE 802.1w. Therefore the authors designed the program as a methodical instrument for the study and proper analysis of distributed algorithms' operations described in the standards mentioned. This product is unique due to its presentation style, which utilizes the ability of virtual algorithm suspending during its phases. So the user can gain better overview of its activities. The program is executable in all platforms compatible with .NET 2.0 framework.

**Keywords:** network, software, learning object, STP, RSTP, simulation, analysis

### 1. INTRODUCTION

Nowadays computer networks are very common in our everyday life. In many of them, there are specialized devices called switches or bridges which forward traffic within LAN. However, the whole switching function could be easily destroyed by misconfiguration. In special cases it could lead even to DOS attack. Such an event should be gained by loops existence in the LAN. This problem is as old as the computer network itself, so many algorithms are released.

#### Loops occurrence preventing algorithms

Algorithms preventing loops occurrence in Bridged LAN are generally divided into two main categories:

- centralized
- distributed

Algorithms in the first group are not very complicated to implement (e.g. using graph theory), but their disadvantage is bad scalability and problems resulting from failure of the central node. On the other hand distributed algorithms don't need any centralized management – each switch react as single entity communicating with the others. However, these algorithms are not very easy to implement reliably.

IEEE organization has determined some requirements for these distributed algorithms:

- Convergence resulting in single spanning tree.
- Automatic reconfiguration during some failure in the network.
- The entire topology will stabilize in any sized LAN.
- The active topology will be predictable and reproducible, and may be selected by management of the parameters of the algorithm.
- It will operate transparently to the end stations.

### 2. SPANNING TREE PROTOCOL IEEE 802.1D (1998)

The fundamental distributed algorithm for gaining loop free topology is STP, defined by IEEE 802.1D from 1998 [1]. Although this protocol is nowadays very slow, it is the root of other ones used and therefore still important.

Each switch has its own unique MAC address within LAN – determined by the manufacturer and should be unchanged. STP defines switch priority which is concatenated with MAC address and constitutes a unique switch identifier. While creating a spanning tree within a network, algorithm estimate switch will the lowest identifier value – root switch.

Only this switch can acknowledge others about topology change and initialize MAC tables flush.

Switches implementing STP regularly (default 2 seconds) send protocol information – Bridge Protocol Data Unit (BPDU). There are two kinds of BPDU:

- Configuration BPDU (35 bytes)
- Topology Change Notify BPDU (4 bytes)

These data are carried in each Configuration BPDU:

- BPDU version (STP has 0).
- Identifier of switch and port which the frame sends from.
- Identifier of switch, which is supposed to be the root.
- Cumulated path cost from the sending switch to the root (called *root path cost*).
- Timers' values.

After determining the root switch, other switches try to establish the shortest connections to it. The path length is computed from manageable path cost parameters, which should reflect the link bandwidth.

STP assigns switch ports states which results in their actual algorithm role as follows:

Tab. 1. Port states and their actions in STP

| state \ action | processing BPDUs | sending BPDUs | receiving frames | sending frames |
|----------------|------------------|---------------|------------------|----------------|
| disabled       | no               | no            | no               | no             |
| blocking       | yes              | no            | no               | no             |
| listening      | yes              | yes           | no               | no             |
| learning       | yes              | yes           | yes              | no             |
| forwarding     | yes              | yes           | yes              | yes            |

While the port is in forwarding state, it could have two port roles:

- root – port, where best BPDUs from root switch are received and Topology Change Notification BPDUs are sent,
- designated – others ports in forwarding state.

Port states forwarding and blocking are gained only as a result of algorithm, so there are two possibilities of port states pair on the link:

- blocking vs. forwarding (designated) where traffic is not forwarding,
- forwarding (designated) vs. forwarding (root) where traffic is forwarded.

Algorithm in STP relay on several timers:

- Hello timer – The time interval between the transmission of Configuration BPDUs by a Bridge that is attempting to become the Root or is the Root.
- Forward delay - The time spent by a Port in the Listening State and the Learning State before moving to the Learning or Forwarding State, respectively.
- Message age – The age of the Configuration Message, being the time since the generation of the Configuration BPDU by the Root that instigated the generation of this Configuration BPDU.
- Max age – The maximum age of received protocol information before it is discarded.

All these timers have manageable values so the administrator could easily adjust them for concrete network or situation.

The big disadvantage of STP is the convergence time. By default it is up to 50 seconds, which can't be acceptable in any expanded network.

### 3. RAPID SPANNING TREE PROTOCOL IEEE 802.1D (2004)

Therefore, there was an upgrade invented and in 2004 the standard 802.1D was re-established (formerly 802.1W) [2].

The main goal was to accelerate the convergence while staying compatible with STP. With RSTP the convergence times are in a few seconds, however it will be also unacceptable due to the present network speed progress and users requirements.

RSTP is based on the current situation in computer networks, where the shared medium (more than two devices on the same network segment) is obsolete. That's why some major changes were made according to STP:

- Edge ports – ports where no bridges will be attached to.
- Link type – shared medium (old one) or point-to-point (rapid convergence is possible)
- States disabled, blocking and listening were merged into one state – discarding.
- New port roles – alternate and backup, which are relevant in discarding state.
- BPDUs are generated by all switches, not only by root.
- New BPDU format, which is made for rapid transition.
- No more Topology Change Notification BPDU (only in STP compatibility mode).
- Better topology change notifying algorithm.
- Faster ageing of information.

### 4. LEARNING OBJECT

Although, it is rather hard to understand whole STP and RSTP algorithms, for network administrators it is essential. Therefore the authors have designed an application for facilitating their learning process.

The product consists of two individual programs. The first is used for designing logical network topology and simulating its convergence using STP or RSTP. The second is dedicated to analysing simulation results and so facilitating the understanding process. The application is implemented using C# language, which was chosen for its full objected-oriented environment.

The programs are executable in any framework compatible with .NET 2.0 technology. For example using Mono platform, you can execute them using Windows, Linux, UNIX, Solaris and even MAC OS X.

#### Designing topology

While designing network topology the user could add switches and connect them with "cables" or change all necessary network parameters. There are also options for saving and loading the designed topology. While not in simulation mode user can configure simulation scenarios. These scenarios are time lists of actions which will happen during the simulation without any user interaction. This function is very useful especially for tutors which could construct scenarios resulting in specific situations. Student should use these scenarios so they can see and learn the algorithm behaviour in prepared cases. In figure 1 there is being designed sample screen showing topology.



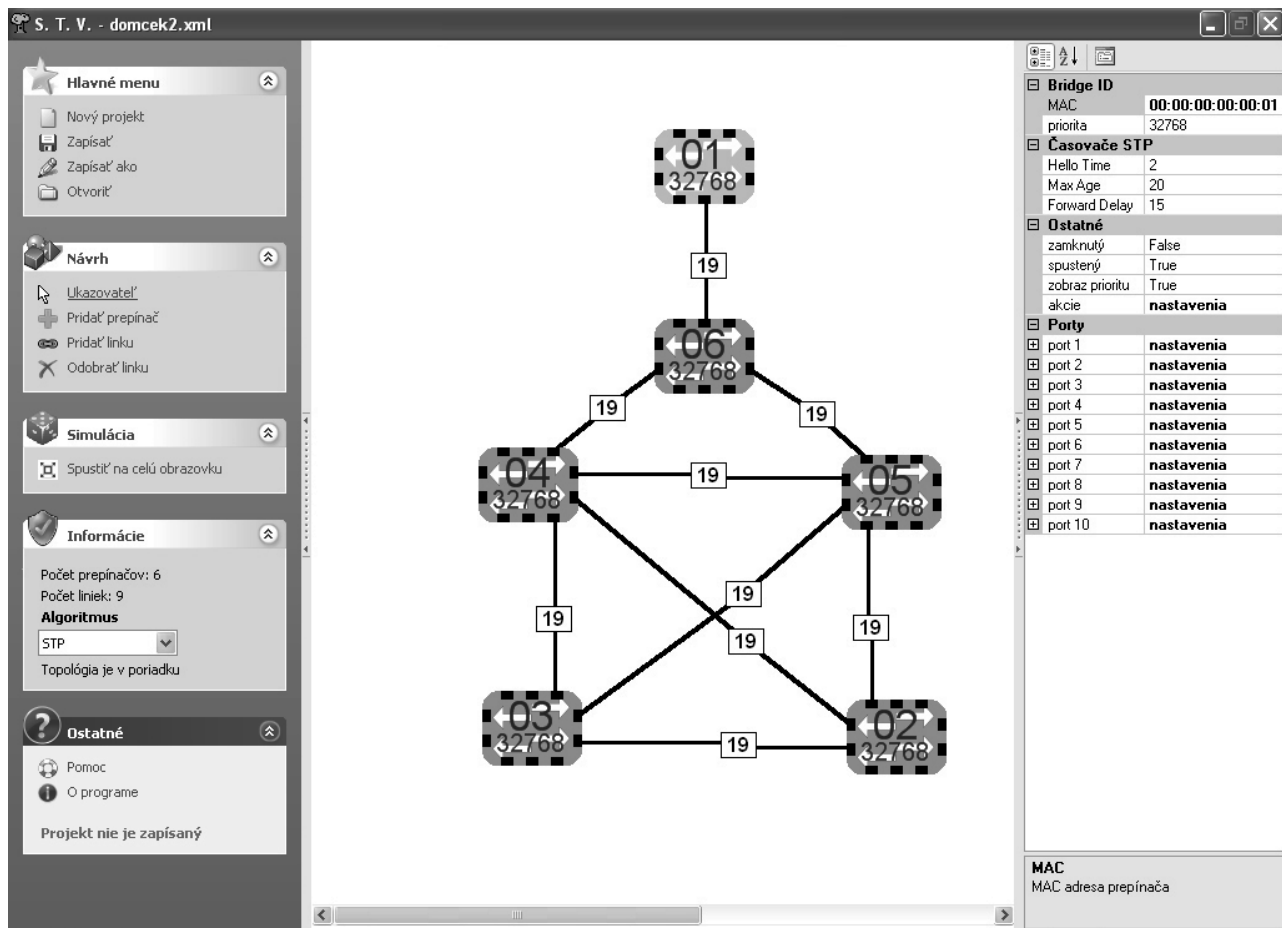


Fig. 1. Topology design sample screen

### Simulating topology

Simulation is real-time visualization of selected algorithms, where the user can watch the convergence process. When starting the simulating mode of the application, the user can choose number of topologies to simulate (one or two) and he has choices to record all changes during convergence into the JPEG pictures or regular screen capturing. As mentioned above, the application allows parallel simulating of two topologies, so the user can compare STP and RSTP topology convergence at the same time. Each port state has its own unique color, so port states are easily recognizable. Also in each topology region (one on the left and next on the right side of screen), there is a special watch, which displays the time topology is not converged. During the simulation, the user could manage the topology and the parameters by mouse clicking or automatically by simulating scenarios. Figure 2 shows a sample application screen during the simulation.

### Analyzing topology convergence

During the simulation process there are many parameters that the user has to follow concurrently, therefore it is impossible to analyze the whole convergence in ones mind. This purpose is served by the second program, which offers the convergence post-analysis. The data are taken from the simulation and passed to this part of the product. The user can then choose ports he wants to analyze and the program

will construct a time graph with port states of selected ports during the simulation. The user can easily walk through the timeline and the current topology state is always shown. So he can compare the graphs with the topology state. This post-analysis is not real-time because all the data are just ready, so the user has plenty of time to think about the reasons and effects of the situation. This function presents a very unique and powerful instrument for learning STP and RSTP algorithms behavior. At figure 3 there is a sample post-analysis screen.

### Advantages over similar applications

- main goal is to learn algorithms, not just simulate them
- simulation scenarios
- post-analysis function

### Disadvantages

The disadvantage of the application is the way it simulates the algorithms. Both STP and RSTP are distributed ones, but the simulation process is located in only one computer. So the time results are logically not the same as in the reality. However, the differences are only of a few hundredths of a second, which have no impact on the results and learning process itself.

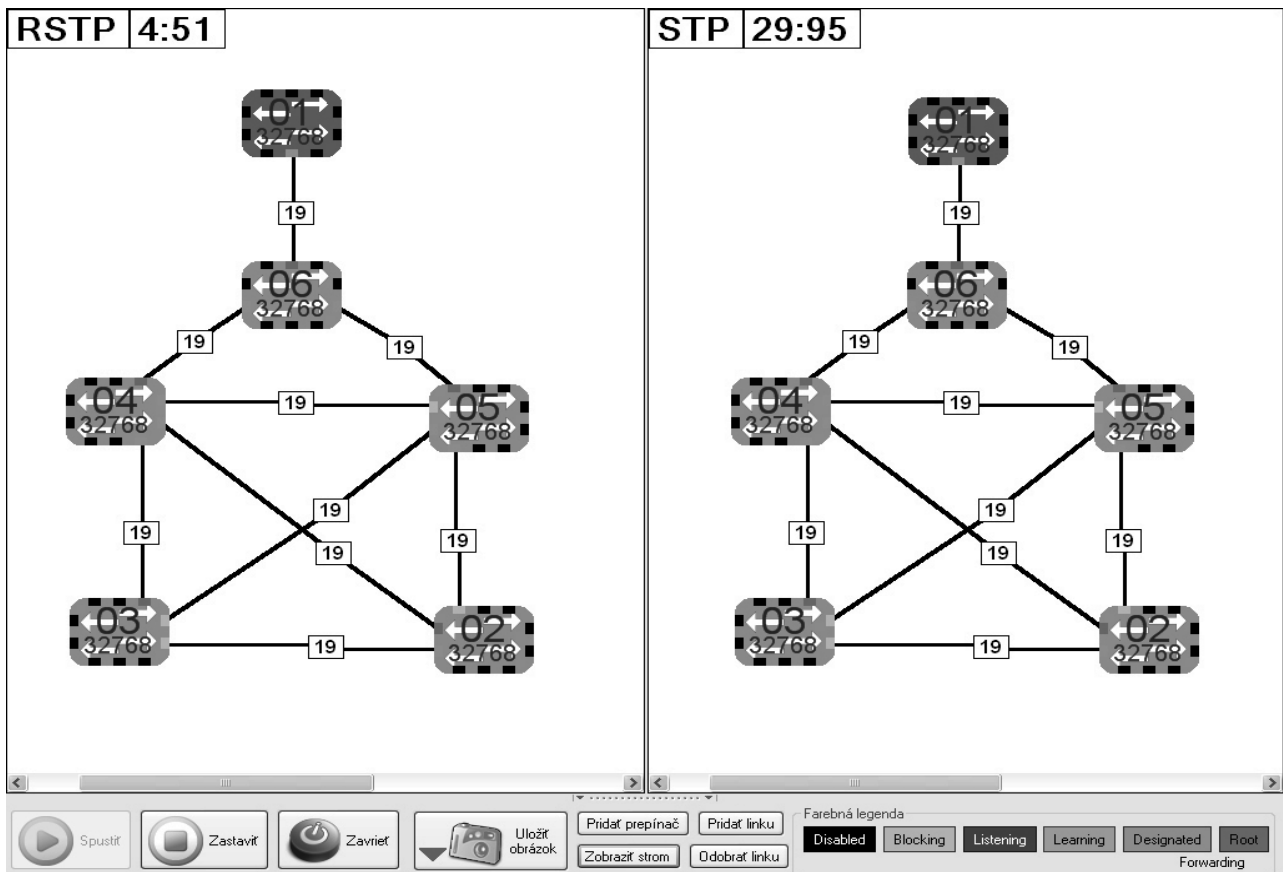


Fig. 2. Simulation mode sample screen

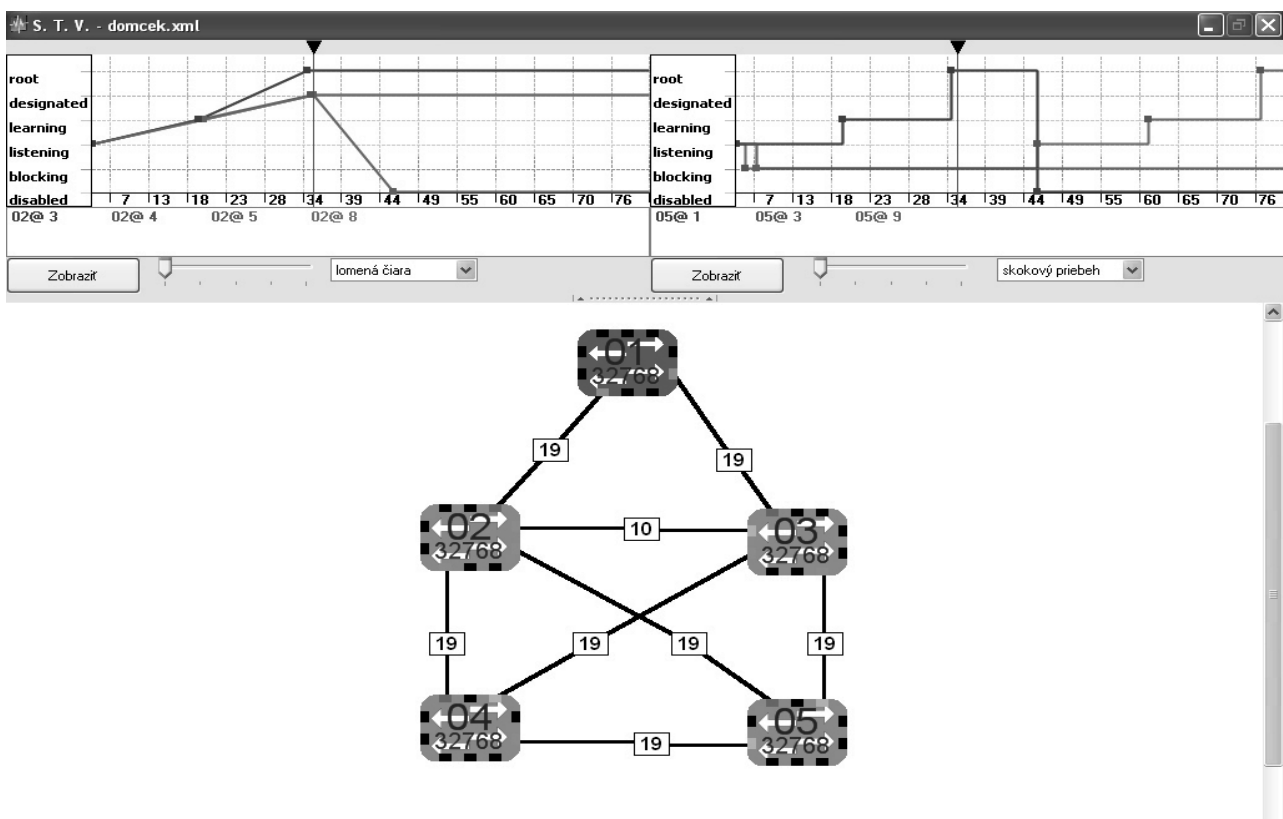


Fig. 3. Post-analysis sample screen

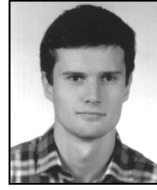
## 5. REFERENCES

- [1] IEEE Computer Society, IEEE Std 802.1D, 1998 Edition, Media Access Control (MAC) Bridges
- [2] IEEE Computer Society, IEEE Std 802.1D – 2004 (Revision of IEEE Std 802.1D – 1998), Media Access Control (MAC) Bridges

## ACKNOWLEDGEMENT

This paper was written with assistance of project VG 1/3104/06 (VEGA).

## THE AUTHORS



**Igor Grellneth MSc. PhD.:** assistant professor at Faculty of Informatics and Information Technologies of Slovak University of Technology in Bratislava since 2003.



**Martin Kvasnička:** student of Master degree study program at Faculty of Informatics and Information Technologies of Slovak University of Technology in Bratislava





## FACTORS INFLUENCING VOICE QUALITY IN VOIP TECHNOLOGY

Michal Halás<sup>1)</sup>, Bakyt Kyrbashov<sup>2)</sup>, Miroslav Vozňák<sup>3)</sup>

Department of Telecommunications, Slovak Technological University, Faculty of Electrical Engineering and Information Technology, Bratislava, Slovakia<sup>1)2)</sup>, halas@ktl.elf.stuba.sk<sup>1)</sup>, kyrbashov@ktl.elf.stuba.sk<sup>2)</sup>, Department of Telecommunications, Technical University of Ostrava, Faculty of Electrical Engineering and Computer Science, Ostrava, Czech Republic, miroslav.voznak@vsb.cz<sup>3)</sup>

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Transmission technology used in VoIP technology is diametrically different from the classical telecommunication networks. Connection less orientation of IP protocol in conjunction with very low possibility to ensure QoS, bring lot of negative factors which degrades final quality of voice transmission.

This paper presents a survey of the factors that influence the final quality of voice conversation, about the mechanism of their generation and possibilities to eliminate their negative impact. It deals about the negative impact of delay, echo, jitter, packet lost and inconsistency of packet stream. Besides, the paper handles also with an overview of some techniques to determine the voice quality perceived by the end users and impact of codec selection.

**Keywords:** Voive over IP, Quality of service, MOS, delay, jitter

### 1. INTRODUCTION

Using the Internet Protocol for transfer of voice connection, on final speech quality influences some negative factors. The majority of them directly depend mainly of connection less orientation of IP networks and almost with non support of the quality assurance of connection from a network.

Classical telecommunication networks always have been focused on connection orientation Initial PSTN networks worked essentially on the basis of circuit switching. With arrival of technology ATM this situation has changed. In spite of the ATM networks work on a principle of fast packet switching, these networks for application, which use their services of transfer, transparently emulate circuit switching. Nevertheless for it, ATM networks offer very good support of the quality of connection.

At use IP networks significantly varies the basis of the transfer environment for telecommunication services. IP networks work on a principle connection less transfer and the present time offer very minimal quality assurance of connection. From the above-stated reason to transfer of voice connection influence set of factors, many of which till the present moment in the classical telecommunication environment almost did not meet at all.

### 1. ESTIMATION SPEECH QUALITY METHODS

In VoIP networks on running speech transfer, influence set of factors in the different ways. Factors in the essential way influence to result of speech quality, from this reason the estimation of speech is not such day pigeon. At consideration of optimum parameters of speech it is necessary to compare the received results among themselves and define one value which suitable for finding-out speech quality

More used method of estimation speech quality is MOS (Mean opinion score) The method is described in the ITU-T P.800 recommendation and works on a principle at which chosen sample of speech is estimated by many participants in an interval 1-5 where 1 corresponds to poor quality and 5 means the best quality

From simple estimations in the subsequent is calculated arithmetic average which defines result of speech quality, so-called MOS parameter. The estimation of speech quality by one user is rather subjective, therefore it is necessary to provide enough number of listeners that is a hard task.

By reason of difficult realisation mentioned method it is necessary to find preferable technique how to objective measure final voice quality. Method which should be easy to repeated the measurement in the same conditions always with the same results.

ITU-T in the G.107 recommendation, defines E-model, which allow defining final voice quality level using known VoIP connection parameters. Method comes out from the base recommendation P.800 where is described mechanism how the human ears respond to individual factors negatively influencing the conversation quality. Using the mathematical formulation of these factors negative impact, it is possible to enumerate the R-factor.

This factor represents the level of final voice conversation quality. It should gain values within 0-100. 0 means the worst quality and 100 the best one.

The big benefit of the E-model is that if we know all of the necessary network parameters, we don't need to know the infrastructure of the network, to be able to calculate the final voice quality level. This feature is suitable to utilize in the network simulations. Another plumbless feature is that the method estimates the final quality objectively based on the input parameters, so there is no problem to duplicates the measurement still with the same results.

The R-factor is easy to recalculate to MOS factor which is still the most used form of the final voice quality evaluation. The technique of recalculation between both factors describes the figure 1.

Other used methods for estimation of the quality are PSQM and PASM. They work using the technique where the known reference signal is transferred through the network, which is consequently evaluated using various digital signal processing algorithms.



Fig.1 Dependence MOS and R factor

## 2. SPEECH ENCODING

The choice of corresponding algorithm of compression plays a key role for provision satisfactory quality of the transferred signal. Each of codecs has different features, for everyone is required the corresponding bandwidth, each of them gives the defined quality to the reproduced signal. In the different ways react to losses, in particular on a delay of arrival of packets.

| Coder               | Type     | Rate [kbit/s] | MOS  | MIPS |
|---------------------|----------|---------------|------|------|
| G.711               | PCM      | 64            | 4,20 | 0,1  |
| G.723.1             | MP-MLQ   | 5,33          | 3,65 | 16   |
| G.723.1             | ACELP    | 6,4           | 3,90 | 16   |
| G.726               | ADPCM    | 32            | 3,85 | 12   |
| G.728               | LD-CELP  | 16            | 3,61 | 33   |
| G.729               | CS-ACELP | 8             | 3,92 | 20   |
| G.729 x 2 encodings | CS-ACELP | 8             | 3,27 | 20   |
| G.729 x 3 encodings | CS-ACELP | 8             | 2,68 | 20   |

Tab. 1: Baseline parameters of codecs.

Each of codecs offers different quality for conversation. Estimation final quality of speech often judge by means of MOS factor. From estimations resulted in table 1 it is visible that the maximum compression not necessary should mean always the worst quality. At a choice of suitable algorithm of compression, undoubtedly it is necessary to take care on the other aspects such as for instance a delay of a signal which arises at its compression and the calculated factor of compression.

## 2. ECHO

Echo is a common problem for VoIP networks. It is important to note that, unlike packet jitter, packet loss, and delay, echo is not caused by the IP network. It rises interconnected with the VoIP network.

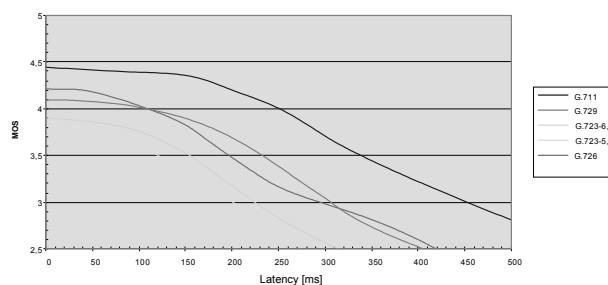
The best way to detect echo is by placing a call onto the network with a known good device or capturing the voice packets of a call and playing them back for analysis.

There are two types of echo on analogue voice networks – hybrid and acoustic echo. Hybrid echo is generated by impedance mismatches at various analogue or digital points on the network. The most common location for the generation of hybrid echo is at a 2-wire to a 4-wire conversion point. Acoustic echo is generated at the phone. It occurs when the voice leaving the speaker is picked up by the microphone.

Though the problematic of occurrence of an echo is very well familiar in traditional telecommunication networks with circuit switching, in VoIP compensation of an echo remains even more difficultly. In this case it is necessary to compensate much greater network delays. The decision of a problem of an echo disappears when connection is carried out within packet switching networks. The problem arises at transition between IP and classical telecommunication networks. In a public telecommunication network it is supposed elimination an echo within the limits of above than 50ms. Accordingly the maximal duration of an echo which should support IP gatekeeper usually does not exceed 64 ms.

## 3. LATENCY

The delay of the voice communication between simple subscribers is one of critical parameter at an estimation of definition of quality of phone conversation. Under recommendation ITU-T G.114 the maximal unilateral delay at which high quality of a voice is kept, is defined as 150 ms. From researches it is really visible that for the majority of users the delay at a level 200 ms is admissible. Influence of a delay on the result of end speech quality for simple codecs is shown on graph 1.



Graph 1: Dependence MOS on a delay for simple codecs.

From graph 1 it is visible that quality of transfer of speech using each codecs does not change linearly from the growing measured delay. Therefore it is necessary at a choice of the suitable codec will pay attention what end result of estimation MOS for a prospective delay in a network.

In IP networks exists some types of latencies which differs in a place of their occurrence, the mechanism of their creation and other properties. Each component of delay

influences a final delay of a voice package in the different way.

The total delay of voice connection in VoIP networks consists of following components:

- service delay,
- access delay,
- transmission delay.

Each kind of partial delay components illustrates figure 2.

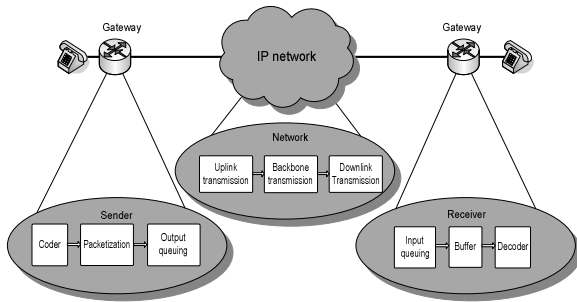


Fig. 2: Delay components

The delay is the factor which in real VoIP networks most of all influences impairment of the communication.

#### Service delay

This part of delay rises in the transmitter of the voice signal which generates the RTP stream. It should be hardware IP telephone, computer application or the voice gateway.

Here raises the impact of the voice compression, mainly the codec delay which works on principles of linear prediction. The coder delay is sum of the predictive delay and the algorithmic delay of the coder. Predictive delay rises when the codec uses linear predictive algorithms. Algorithm need to know to compress the actual sample also multiple following samples, so there is necessary to keep the signal back in the sender. Coder delay is defined for every codec.

Another kind of delay is the packetization delay which rises when multiple speech samples are encapsulated into one RTP packet. This process doesn't work continually so the size of delay depends on the size of the packet and the capacity of the processor. Otherwise when the decompression happens the jitter also applies. It belongs also to the family of service delay because its negative influence rises in the packet receiving.

#### Access delay

Queuing delay rises when the packets are arranged into the output queue, where they wait for transmission to the output line. Here influence the methods of output queuing methods and the voice packet prioritization.

The queuing delay depends on the size of transmitted packets, output line speed and their actual load.

#### Transmission delay

This part of delay rises in the physical transmission of the electrical or optical signal in the transmission wire. It straight depends on the speed of the signal in the medium and the transmission length.

## 4. JITTER

IP networks haven't got the opportunity to guarantee time of delivery of data packets. Data are transferred not with constant bit speed and consequently there can be divergences between expected time of acceptance of a followed package and time when the package is really accepted. This variation in time between packets arriving, caused by network congestion, timing drift, or route changes defined as jitter. The problem of jitter very narrowly depends with delay, is concreted with its variable components when change of various components directly influences on jitter.

As algorithms of compression demand, that packages on the input supported identical time intervals it is necessary to compensate jitter. Indemnification is carried out so-called jitter buffer which detains packages for the certain period and in identical time intervals transfer packets further to the codec. The size of jitter buffer directly influences its properties to eliminate jitter.

The bigger is the size of the buffer the more dispersion of jitter can eliminate. On the other hand its size directly influences the size of final delay. Accordingly it is necessary to find the suitable compromise between these two opposite requirements, the basic problem is always to find the size of a variable component and its dispersion. The final size can be chosen statically but also it is possible to change still dynamically in conformity to state of the network load.

## 5. MISTAKES AT FOLLOWING PACKETS

From basic philosophy of IP network it is considered that each package in a network destined by own. It means that in the accepting terminal packages can be received in the different order unlike sent. Naturally that in case of real time application it not a desirable situation and accordingly is necessary to redistribute again packages up to the corresponding order. The decision is the delay of packages with high speed thus those packages with low speeds were in time and accordingly it would be possible to build them up to corresponding sequence.

In other words, the decision of the problem is use of buffer in the receiver and algorithms which purpose will be ordering followed packages up to necessary sequence. The bigger size of correcting memory allows correcting better disorder in following packages but on the other hand raises a delay of messages. Thus it is necessary to find the suitable compromise between size of correcting memory and a delay of a signal. All packages which will come in such order when correcting memory not in a condition will redistribute them will be considered for lost.

## 6. PACKET LOSS

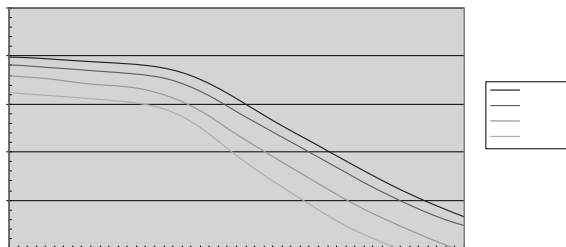
In IP networks packet loss is both common and expected. Source of losses is the connection less structure of a network. In services of data transmission with packet loss there is a property rather not bad to compensate losses and it is how much possible to carry out their restoration. For

application working in real time transfer of the lost files really is not meaningful.

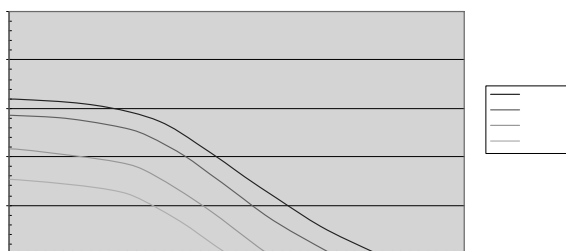
Retransmission certainly it is possible to carry out however again sent package has come to receiver with big delay and would be useless. For this reason codecs need to be designed to be able to correct up to the certain measure with partial losses of the transferring information, without essential degradation of speech.

Each of codecs reacts to loss of packages by different ways. In general it is possible to tell that loss of 1-2 % of packages in most cases for human hearing is not swept up completely not in particular it is possible to neglect very easily with it without essential deterioration of speech. But at loss of 5-10 % from total of voice packages, it is a question already about essential to deterioration of speech. Dependence of initial quality of speech on set of casually lost packages and delays for codecs G.711 and G.729 are shown on graph 2.

G.711



G.729



Graph 2: Dependence MOS on set of the lost packet for codecs G.711 and G.729.

## 6. CONCLUSION

Transport of voice through IP network has got a lot of positives against the classical telephony network. But there are also a lot of specific problems, which doesn't exist in classical telephony or did not play such as important role. The most important problem in VoIP technology is the securing of the acceptable delay and minimization of jitter level. Anyhow very important is also to provide an adequate transmission bandwidth to be able, in cooperation with one of the codecs, to transport speech signal on the acceptable level of quality.

## 5. REFERENCES

- [1] Medvecký, M. Orgoň, M.: Bezpečnosť IP sietí, In: Časopis TELEKOMUNIKACE, č. 3/2005, roč. XLII, s. 13-18, Praha, 2005
- [2] Chromý, E.: Optimizing processes in convergent networks. In: RTT Conference focused on Research in Telecommunication Technology, RTT 2006. Nové Mesto na Morave, Czech Republic, Sept. 11-13, 2006, ISBN 80-214-3243-8, pp. 295-299.
- [3] Filanová, J. - Baroňák, I.: Multipoint Control Unit for Multipoint H.320 Videoconference. In: International Conference "Applied Electronics 2002". Plzeň, 11.-12.9.2002. - s. 59-62.

## THE AUTHORS



**Michal Halás** was born in 1978. He graduated from Slovak University of Technology and received the electronic engineering degree in 2003. Since this year he has started postgraduate study at Department of Telecommunications STU Bratislava. In 2006 he submitted PhD work from the field of Delay in VoIP networks. Nowadays he works as a lecturer in Department of Telecommunications of FEI STU in Bratislava.



**Balyt Kyrbashov** was born in Kyrgyz Republic in 1981. He graduated from Kyrgyz National Technical University in 2003. Since 2003, he has been with OJSC Kyrgyztelecom, where he was worked an engineer in Modernization and Development Department. In 2005 after his experience, he is granted a scholarship of Slovak Government to study the Doctoral Program in Telecommunication. Nowadays he is a PhD student at the Department of Telecommunication of FEI STU in Bratislava.



**Miroslav Vozňák** was born in Czech Republic in 1971. He graduated from VSB Technical University of Ostrava in 1995. Since this year he has started postgraduate study at Faculty of Electrical Engineering and Computer Science. In 2002 he submitted PhD work from the field of Quality optimization in VoIP networks. Nowadays he works as a lecturer in Department of Telecommunications of VSB - Technical University of Ostrava.

## ACKNOWLEDGEMENT

*This work is a part of AV 1002/2004, VEGA 1/0156/03 and VEGA 1/3118/06 projects.*





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## COMMUNICATION CHALLENGES IN ELEARNING SOLUTIONS

František Jakab, Michal Jakab, Jozef Janitor, Katarína Kleinová, Miroslav Biñas, Martin Révés.  
Computer Networks Laboratory, Department of Computers and Informatics, Technical University in  
Košice, Contact: +421-55-602-7075, {name.surname}@cnl.tuke.sk, <http://www.cnl.tuke.sk>

**Abstract.** The possibilities of direct communications in real time are missing in most current eLearning solutions. This article describes the methods and technologies from the Unified Communications Family that may be used as a direct communication platform in real time for eLearning environments. Majority of described methods is based on VoIP (Voice over Internet Protocol) technologies and protocols.

**Keywords:** VoIP, QoS, Security, Unified communications, eLearning.

### 1. INTRODUCTION

Learning is a process of acquisition of new knowledge in various fields. In the last 10 years this process matured and is undergoing striking changes. Ten years ago, before introduction of internet, the most effective method to acquire new information was a visit to a library, or purchase of specialized journal. Number of texts had to be studied in order to get a grip of the subject, but in more complicated cases the information was not available with adequate effectiveness.

Nowadays almost every household is connected to Internet and as a result the access to information is much faster and the process of learning can be much more effective. The Internet boom brought not only faster access to information, but also many multimedia options for effective provision of information. Multimedia teaching material provides better background for learning that conventional reading of papers.

The word eLearning was used for the first time mostly in connection with publication of teaching materials on internet. Gradually eLearning as a teaching method has grown into a complex environment enabling inclusion of students in virtual classes. These virtual classes have teaching materials and means for knowledge tests [1]. Communication and collaboration means of these systems are still not adequate. The most frequent communication takes place by e-mails or by the information that are displayed to students after they log in the virtual class.

Communication environment is an imperative and absolutely necessary part of the teaching process. Integration of the suitable communication environment in the eLearning solution facilitates the students to exchange and share information faster and to discuss the relevant issues [2]. Suitable communication environment for eLearning solutions should contain the options for real time communication, instant messaging, documents and file exchange, forums and blogs.

Real time communication means include technologies for transmission of voice and video, or of other contents that

needs to be transmitted in real time. Technologies on which these means are based are derived mostly from standards used in VoIP (Voice over IP).

### 2. VoIP

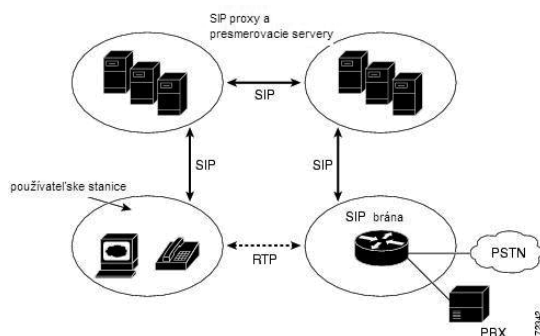
Voice over IP (VoIP) is a technology for transmission of voice in real time. A virtual communication canal using several protocols needs to be created in order to create VoIP connection between two or more participants in the voice communication. For the log-in itself the so called signaling protocols are used. Data protocols are used for the voice transmission using various codecs for voice digitalization and compression. Various encryption techniques can be added in order to secure safety of voice transmission.

Signaling protocols create, manage and end the VoIP voice connection. The end stations agree on the method of communication on the basis of the signaling process at the beginning of the call. Most frequently it is an agreement on the codec, encrypting, ports and addresses used for transmission of the data packages containing the voice or video. The best known signaling protocols are SIP, H.323, SCCP, MGCP.

#### SIP

Session Initiation Protocol (SIP) is an IETF standard that defines the basic communication elements in the VoIP network and the communication between them [3]. SIP Proxy server, registration server, location server and User Agent are the basic elements of the VoIP network built on SIP protocol. Registration server is used for IP registration of end equipment (IP Telephones) in the location database. Location database is then used by the so called location server to provide information on location and the method of access to individual end equipments, telephones. Proxy server is the intermediary between two or several end equipments. It enables routing of conversation on the basis of rules and requirements defined in advance. The concept of User Agent represents the actual end equipment – IP telephone, or special type of application supporting the initiation of voice communication. In most cases we come across the practical implementation of registration, location

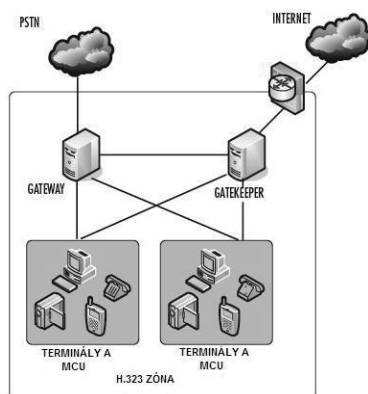
and proxy server within one application. SIP user agents are registered with log-in data on the registrations server that saves the contact information in the location database. In case of a request to contact the respective user agent first the location server is contacted that responds with the information on how to contact the client.



Picture 1 - SIP Infrastructure

### H323

H323 is a ITU-T standard based on the ISDN technology. The basic components of H323 infrastructure are H323 gatekeeper, H323 gateway and H323 terminals. H323 gatekeeper meets the function of an intelligent router that registers H323 end stations. Gatekeeper frequently implements also the function of Call Admission Control (CAC) that enables intelligent routing of calls on various transmission routes while maintaining expected quality of service (QoS). H323 gateway meets the function of the gate between the VoIP infrastructure and the PSTN telephone network. H323 terminals are mostly end equipments - telephones.



Picture 2 - H323 Infrastructure

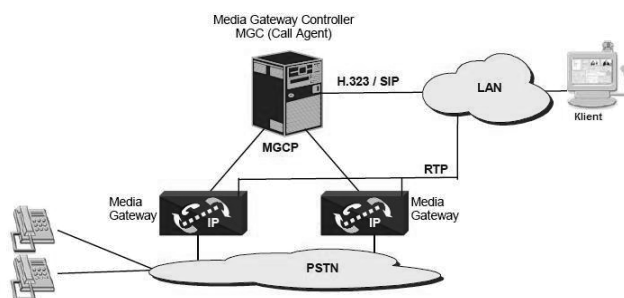
### SCCP

Skinny Call Control Protocol (SCCP) is a proprietary protocol developed by Cisco Systems. SCCP is based on H323 protocol. It is used to secure communication between Cisco IP telephones and Cisco Communications Manager (CallManager).

### MGCP

Media Gateway Control Protocol (MGCP) is a signaling protocol used for administration and control of gates between VoIP and PSTN network. The basic components of

the MGCP infrastructure are Media Gateway Controllers (MGC) and Media Gateways (MG). MGC creates a signaling interface for the elements of VoIP network and manages the actual MG gates used for transfer in the PSTN network. One MGC may serve several MG gates at the same time.



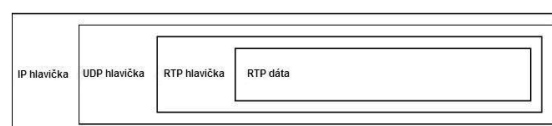
Picture 3 - MGCP Infrastructure

For the actual transmission of voice, video, or other information channels encapsulation protocol RTP is mostly used.

### RTP

Realtime Transport Protocol (RTP) is also a communication protocol that defines the standard format of the packet that serves to transmit audio and video through the packet oriented IP net. It was created by Audio-Video Transport working team within IETF in 1996. RTP secures transmission of multimedia data such as audio or video in real time.

Protocol UDP is used as the transport protocol on the 4<sup>th</sup> layer. Since UDP protocol does not guarantee any rearrangement of the data packets in the correct sequence this task must be solved by the RTP protocol itself. During transmission of information in real time it is possible to neglect certain loss of packets, or to tolerate their delivery in incorrect order, if lesser delay in the data transmission can be achieved.



Picture 4 - RTP Headings

Packet loss, delay and delay fluctuation are the network parameters that strikingly reduce the quality of transmitted voice or video. In order to secure service quality also the elements of the QoS need to be implemented.

### QoS

Quality of Service (QoS) during voice transmission using IP network depends on the loading and quality of network used for the transmission of IP packets [4]. The bandwidth which is necessary for the voice transmission in RTP packets depends on the used codecs for the voice compression. The following table shows digital data flow generated while using various codecs for the voice and video compression:

| Service Type | Codec     | Bandwidth (kbit/s) |
|--------------|-----------|--------------------|
| Voice        | G.711 PCM | 64                 |
|              | G.726     | 32                 |
|              | G.729     | 8                  |
|              | G.723.1   | 5.3                |
| Video        | MPEG-1    | 500 – 1500         |
|              | MPEG-2    | 1500 – 1000        |
|              | MPEG-4    | 32 – 1024          |
|              | H.261     | 100 – 400          |

Table 1 – Digital bandwidth for various codecs

The digital data flow generated by codec is further packed in RTP and IP protocol, so that the resulting bandwidth requested is several bytes higher. As compared with other data flows in the IP network the bandwidth necessary for the voice or video transmission mostly does not change during the whole call, i.e. it remains constant. VoIP is mostly implemented within one convergent network with VoIP packets transmitted together with the data flow of other applications (Web, Email, ...).

The quality of information transmission in real time is prone to loss of packets, delay and delay fluctuation that are very probable during transmission of VoIP packets in convergent networks. Therefore, the priority of real time services has to be set over the best-effort type of services. Priority setting of services may be implemented on the basis of different methods. Priority setting on the basis of priority definition while using information contained in the headings of the transmitted frameworks and packets (CoS, ToS, DSCP) is implemented on the active network equipment. This equipment then prioritizes the data packets depending on the priority indicated in the respective headings. No signalization protocols are used for this type of prioritization. Knowing the generated data flow for the respective codec in the signalization process at the start of the call we can reserve within the network the requested bandwidth [5] and consequently guarantee the voice or video transmission of desired quality.

### 3. UNIFIED COMMUNICATIONS

Unified communications technologies integrate several communication and supporting services in one complex solution. Services that are integrated are mostly Voice over IP (VoIP), Instant Messaging, email, sharing of files and of drawing tables etc. These services may be based on diverse architectures and protocols. The most used protocols and architectures for the Unified communications technologies come directly from VoIP solutions.

Unified communications are focal points of several discussions concerning direction and future of communication technologies. Unified communications

include wide spectrum of technologies and many potential applications. It should be noted that many of these technologies are in the development stage and some definitions may differ depending on the authors.



Picture 5 – Unified communications

#### Presence services

Presence services may be defined as the information on the condition and ability of the partner to communicate. This information may be used to make contact on the basis of the communication canal with the currently highest priority. We can take an example of a person which after the closure of the meeting changes its presence condition from “inaccessible” or “text information only” to the condition “accessible”. Consequently if somebody wishes to communicate with such person, its accessibility can be checked through the relevant communication canal before this communication canal is used. Other example is the automatic videoconference connection through the conference server after the end communication equipment is changed from the wireless telephone to video IP telephone.



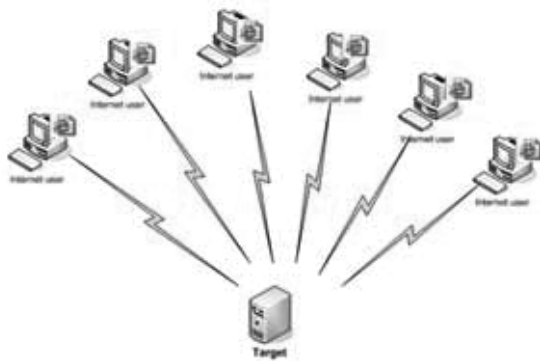
Picture 6 - Application of Unified Communications

### 4. SECURITY

Unified communications applications use the services provided by the computer network and internet for communication. In early stages of internet development and computer networks the threats to security were not taken

into account even though such threats can strikingly influence the quality provided by the respective network. These threats may be described using several models. One of these models is the description of security threats on individual levels of ISO OSI model. The most threatened layers are the link layer, network and transport layer. In case of many types of attacks the attacker must get to the level of the access part of the network and utilize the shortcomings in the security of the link layer.

Using the false ARP reports the attacker may redirect the communication flow of information to the equipment of the attacker, follow it and eventually alter it. Protection against false ARP reports is possible using active equipment in the network for check of ARP reports sent by the end stations. The attacks against the application servers or DNS servers may result in making the services inaccessible, or in rerouting of the services to the applications of the attacker. Protection against some attacks focusing on Denial of Service – DoS is rather complex. In some cases of distributed attacks (Distributed DoS – DDoS) the protection is virtually impossible. These distributed attacks are mostly used for the so-called botnet networks with several computers (mostly infected by some virus) that can generate together high data flow of requests to the servers providing unified communications services.



Picture 7 - DDoS attack

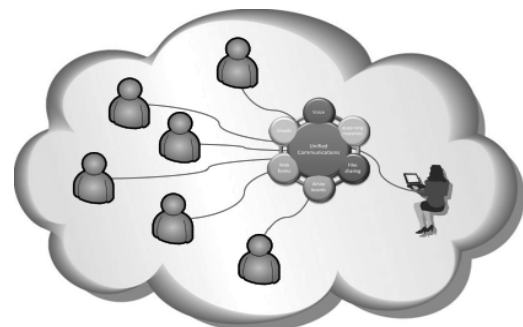
Protection against the attacks on the network infrastructure and applications should include the active as well as passive protection. The active protection should be on the level of correct configuration of network equipment, requesting the authentication of the users, or of the network equipment [6] upon access to the network, assurance of backup transmission routes etc. The passive protection should include the methods and ways of detection of penetration (IDS), or use the services of detection to prevent penetration (IPS).

#### 4. MODEL SOLUTIONS

The ABC Company is active in the field of teaching foreign languages. It plans to use modern technologies to achieve its objectives. They use their own web portal for the provision of e-learning materials in a safe and simple way. Teachers or tutors are distant employees connected through internet by special applications used for administration of

virtual classes. Students may also be on remote locations (at home, at work, etc.) and join the virtual class through the internet. The students use only standard web browser with applications based on Java or ActiveX so that they do not need to install any additional software to their computers. After they log in the virtual class they have access to the resources provided by the web portal. The web portal provides access to services as well as the direct access to e-learning materials, tasks, tests (exams) and communication facilities of the e-learning solution of the ABC Company. Since both students and teachers are remote they need suitable options for mutual internet communication. The relevant solution was achieved using the Unified communications technologies. The ABC Company created its own solution that unifies the communication canals, such as voice, video source sharing, immediate report transmission (IM), etc. All these services, such as ActiveX or Java applications are accessible to students directly from the window of the web browser. The teachers may access these communication services through the application designated as IP communicator that implements the communication services and the services of class administration in one application.

After joining virtual class all students may use e-learning materials, work on exercises and tasks, do e-exams and use VoIP application included in the Unified communications in order to talk to other students or teachers. The teacher may create groups of students and then interconnect these groups through VoIP conference call. After that any group may join the conference call. In this way the students may practice conversation in a foreign language. If any sources need to be shared (documents, pictures,...) from computers, these shared objects can be easily transferred (drag-and-drop) in the Unified communications solution for the source sharing. After that all participants may access and review all shared sources.



Picture 8 - Virtual class

Implementation of e-learning solution using Unified communications enabled the ABC Company a more effective “e”-method of teaching. The students have faster access to resources; they may practice their skills, directly communicate with other participants thus making their studies more effective. Thanks to the e-learning solution the ABC Company is no longer limited to local provision of services but may offer its courses all over the World.

## 5. REFERENCES

- [1] NetAcad, <http://www.cisco.com/web/learning/netacad/index.html>, 12.4.2007
- [2] František Jakab, Michal Jakab, Jozef Janitor, Katarína Kleinová, Virtual University 2006, *Unified commucations in eLearning environments*
- [3] RFC 3261 - *SIP: Session Initiation Protocol*
- [4] František Jakab, Michal Jakab, Jozef Janitor, Katarína, Martin Vozár, ECI 2006, *Possibilities to provide VoIP with required quality*
- [5] RFC 2205 - *Resource ReSerVation Protocol (RSVP)*
- [6] 802.1x, <http://en.wikipedia.org/wiki/802.1X>, 12.4.2007
- [7] Michal Jakab, Dissertation, *VoIP Security*

## AUTHORS



**František Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering at the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Department. of Computers and Informatics of the Technical University of Košice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modeling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in the Slovak Republic. You can contact him at [frantisek.jakab@tuke.sk](mailto:frantisek.jakab@tuke.sk).



**Michal Jakab** is the graduate of the Technical University in Košice. As a member of the Computer Network Laboratory he is active in the field of VoIP security. You can contact him at [Michal.Jakab@cnl.tuke.sk](mailto:Michal.Jakab@cnl.tuke.sk).



**Jozef Janitor** is student at Technical University in Košice. As a member of the Computer Network Laboratory he is active in the field of VoIP implementation and integration in the heterogeneous environments. You can contact him at [Jozef.Janitor@cnl.tuke.sk](mailto:Jozef.Janitor@cnl.tuke.sk).



**Katarína Kleinová** is a full-time PhD student at the Technical University in Košice. As a member of the Computer Network Laboratory she is active in the field of assurance and measurement of QoS in VoIP. You can contact her at [Katarína.Kleinova@tuke.sk](mailto:Katarína.Kleinova@tuke.sk).



**Miroslav Biñas** is a full-time PhD student at the Technical University of Košice. His research activities are related to distributed systems, videoconferencing technologies, ambient intelligence and to streaming technologies. He is responsible for newly developed archive system for VRVS and EVO videoconferencing systems and is a member of Computer Networks Laboratory. You can contact him at [miroslav.binas@tuke.sk](mailto:miroslav.binas@tuke.sk).



**Martin Reves** is a full-time PhD student at the Technical University in Košice. As a member of the Computer Network Laboratory he is active in the field of QoS measurement and security control. You can contact him at [Martin.Reves@tuke.sk](mailto:Martin.Reves@tuke.sk).

## ACKNOWLEDGEMENT

This work a part of research activities within the scope of the project KEGA No. 3/3121/05, (Network of virtual laboratory for real system control).





# PRACTICAL USE OF TRAFFIC CONTROL SIMULATIONS FOR EDUCATION PURPOSES

Matej Kavacký, Ivan Baroňák

Department of Telecommunications, FEI STU, Ilkovičova 3, 812 19 Bratislava, Slovakia  
matej.kavacky@stuba.sk, ivan.baronak@stuba.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia

September 6-8, 2007

**Abstract.** In this paper we present Quality of Service (QoS) simulations in broadband networks for educational purposes. The introduction is dealing with QoS and traffic control in ATM networks. In the second part we propose the way of performance simulations of connection admission control methods and used traffic models. The next part of the paper presents example of performance evaluation of two CAC methods based on MATLAB simulations and achieved results. The final part concludes utilization of our simulations in the learning process of QoS.

**Keywords:** Quality of Services, modeling, evaluation, traffic control

## 1. INTRODUCTION

Today, not only the learning of broadband technologies is important, but efficient utilization of these technologies is also necessary in order to manage the Quality of Service (QoS). With QoS the customer can choose required QoS level and pay only for what he really need. The traffic control mechanism, traffic management, should be implemented in the network to ensure QoS.

The Asynchronous Transfer Mode (ATM) technology ensures the most sophisticated QoS provision by various traffic control functions. The connection admission control is one of these traffic control functions.

Connection Admission Control (CAC) is the preventive function of traffic control, which determines if a new incoming connection can be accepted to the network or it should be rejected. Decision process is based on the various traffic parameters, such as current traffic load, values of characteristic parameters (e. g. mean and peak cell rates), availability of network resources, required QoS of existing and new connections.

In this paper we present created simulation scripts for evaluation of two CAC methods for variable bit rate traffic.

## 2. CAC METHODS AND SIMULATIONS

Our selection of connection admission control methods is based on the performed analysis in the field of traffic control functions. The method selection is based on the following criteria – the same input parameters for comparison purposes, acceptable computation requirements and simple implementation in real solutions. Two methods from the group of statistical methods best fit to these criteria – Method of effective bandwidth and Method based on diffusion approximation.

### Effective Bandwidth based Method

Method based on the effective bandwidth is also called equivalent capacity method. It is frequently used and popular method. Decision about the acceptance of the group

of connections from different sources depends on the amount of equivalent capacities of individual sources with the total link capacity.

The equivalent capacity can be defined by following thought. Each source is simulated as interrupted fluid process (IFP). If  $R$  is the peak source rate,  $r$  is the time when the source is active and  $b$  is the average time of active source period, then IFP source is fully described by vector  $(R, r, b)$ . Let the source have waiting queue with the end capacity  $K$ , then from the distribution of the queue length the service rate  $c$  can be calculated, which matches the given cell loss  $\varepsilon$ . This service rate is the equivalent source capacity and we can calculate it by solving following equation:

$$\varepsilon = \beta \exp \left\{ -\frac{K(c - rR)}{b(1 - r)(R - c)c} \right\}, \quad (1)$$

where

$$\beta = \frac{(c - cR) + \varepsilon r(R - c)}{(1 - r)c}. \quad (2)$$

For the calculation of equivalent capacity  $c$  the simplification is used, when  $\beta=1$  (usually  $\beta < 1$ ). Then for the equivalent capacity of one source we get:

$$c = \frac{a - K + \sqrt{(a - K)^2 + 4Kar}}{2a} R, \quad (3)$$

$$\text{Where } a = \ln\left(\frac{1}{\varepsilon}\right)b(1 - r)R. \quad (4)$$

For  $N$  traffic sources the equivalent capacity is also defined as the service rate, which ensures the required cell loss  $\varepsilon$ . Its calculation is more difficult, therefore the approximation is used:

$$c = \min \left\{ \rho + a' \sigma, \sum_{i=1}^N c_i \right\}, \quad (5)$$

where  $c_i$  – represents equivalent capacity of  $i$  source, calculated following the ratio for one source,

$\rho$  – aggregate average bit rate, e.g.  $r = \sum_{i=1}^N \rho_i$ , where  $\rho_i$  is the average bit rate of  $i$  source,  
 $\sigma$  – the total variances of bit rates of individual sources  $\sigma_i^2 = \rho_i(R_i - \rho_i)$ .

This approximation for equivalent capacity of  $N$  sources can be applied only for following cases:

- $N$  multiplexed sources with the equivalent capacity, which is the summary of equivalent capacities of individual sources.
- Stationary bit rate of  $N$  sources has approximately normal distribution with the average value  $\rho$  and variance  $\sigma^2$ .

#### Diffusion Approximation based Method

This CAC method is based on estimation of statistical bandwidth based on the model of diffusion approximation. Two models for ATM switch are used in order to improve the exactness of this method:

- model for ATM switch with the finite buffer size FB (*Finite Buffer*),
- model for ATM switch with the buffer of infinite size IB (*Infinite Buffer*).

In the model with the infinite buffer the probability of cell loss is calculated by the overflow probability, which is the general formulation of overflow probability of the actual buffer capacity  $K$  in system with the infinite buffer size. The cell loss probability expressed from these two models is

$$L_{FB} = \frac{1}{\sqrt{2\pi}} e^{\frac{2K}{\alpha}(\lambda-C)} e^{-\frac{(\lambda-C)^2}{2\sigma^2}}, \quad (6)$$

$$L_{IB} = \frac{\sigma}{\lambda\sqrt{2\pi}} e^{\frac{2K}{\alpha}(\lambda-C)} e^{-\frac{(\lambda-C)^2}{2\sigma^2}}. \quad (7)$$

For  $N$  sources of interrupted fluid processes characterized by three parameters – peak cell rate  $R_i$ , period when the source is active  $r_i$  and average duration of active source period  $b_i$  for each  $i$  source, we gain the total variance  $\sigma^2$  and total average value  $\lambda$  of transmission rate of consolidated traffic as:

$$\sigma^2 = \sum_{i=1}^N \sigma_i^2 \text{ and } \lambda = \sum_{i=1}^N \lambda_i, \quad (8, 9)$$

$$\text{where } \sigma_i^2 = \lambda_i(R_i - \lambda_i), \quad (10)$$

$$\lambda_i = r_i R_i. \quad (11)$$

The instantaneous variance of the cell arrival process  $\alpha$  can be calculated according to the following equation:

$$\alpha = \sum_{i=1}^N \lambda_i \frac{1 - (1 - \beta_i T_i)^2}{(\beta_i T_i + \gamma_i T_i)^2}, \quad (12)$$

where  $T_i = 1/R_i$ ,

$\beta_i = 1/b_i$  - represents the average value of active period duration,

$1/\gamma_i$  - is the average value of passive period duration of  $i$  source transmission.

The statistical bandwidth is defined as the bandwidth necessary for multiplexed connections that ensures the cell loss probability less than the required cell loss  $\varepsilon$ . For two above mentioned models we get equations for statistical bandwidth:

$$C_{FB} = \lambda - \delta + \sqrt{\delta^2 - 2\sigma^2\omega_1}, \quad (13)$$

$$C_{IB} = \lambda - \delta + \sqrt{\delta^2 - 2\sigma^2\omega_2}, \quad (14)$$

$$\text{where } \delta = \frac{2K}{\alpha} \sigma^2, \omega_1 = \ln(\varepsilon\sqrt{2\pi}), \quad (15, 16)$$

$$\omega_2 = \ln(\varepsilon\lambda\sqrt{2\pi}) - \ln(\sigma). \quad (17)$$

As the estimation for the worst status of the traffic, the final value of statistic bandwidth  $C_{DF}$  is defined as the minimum from both previous bandwidths:

$$C_{DF} = \max(C_{FB}, C_{IB}) \quad (18).$$

#### Simulations

Maximum number of accepted connections we have chosen as main parameter for their comparison from the Quality of Service point of view. Following dependencies can be studied in our simulations:

- impact of buffer size to number of accepted connections,
- impact of required cell losses to number of accepted connections,
- statistical multiplexing gain,
- admission regions for two types of traffic.

In the following part of the paper we present example of the first two dependencies. In our simulations we assumed ATM switch with  $N$  input links, one output link with capacity  $C = 155,520$  Mbit/s (STM-1) and finite buffer of size  $B$  for output link. For particular simulations we used one class of connections, so that all incoming connections have the same traffic parameters (peak cell rate, sustainable cell rate and mean cell burst size). All parameters can be simple changed. Simulations were performed in simulation environment Matlab 7.1.

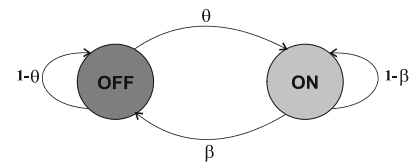


Fig. 1: ON-OFF traffic model



Table 1: Parameters of selected traffic sources.

| Source no. | PCR [Mbit/s] | SCR [Mbit/s] | Activity factor | $\theta$ | $\beta$ |
|------------|--------------|--------------|-----------------|----------|---------|
| 1          | 4,237680     | 0,512126     | 0,121           | 0,06     | 0,44    |
| 2          | 6,988320     | 1,000126     | 0,143           | 0,06     | 0,40    |

$\theta$  – transition probability from *Off* stage do *On* state,  $\beta$  – transition probability from *On* stage to *Off* state, *PCR* – Peak Cell Rate, *SCR* – Sustainable Cell Rate.

#### Traffic sources

As the input traffic sources we have used sources with parameters that satisfy to real video sources [2]. Traffic sources we have described by two-state Markov ON-OFF models [3]. This model can be used also for voice traffic sources as well. Parameters of the traffic sources are stated in the table 1. Source no. 1 represents characteristics of film Jurassic Park 1, source no. 2 represents characteristics of film Total Recall.

### 3. SIMULATION RESULTS

#### Buffer Size vs. Admitted Connections

In the following simulations of CAC methods performance we have examined cases in which buffer size of ATM switch was in the range from 2 to 64 kB (circa 40 – 1240 ATM cells). It represents small and middle sized buffer. Dependency between maximum number of accepted connections and buffer size of ATM switch we have examined for three values of required cell loss ratio CLR. In the figures 2–5 we can see achieved results for dependencies between number of accepted connections and buffer size stated in the ATM cells (1 ATM cell = 53 bytes). Size of ATM switch buffer was increased with step of 5 cells. In the graphs for the method based on diffusion approximation (figures 2 and 4), for better visibility, the buffer size is shown only in the range 0-500 (0-250) ATM cells, because further increase of buffer size has no impact on the accepted connections due to upper boundary of accepted connections was yet reached.

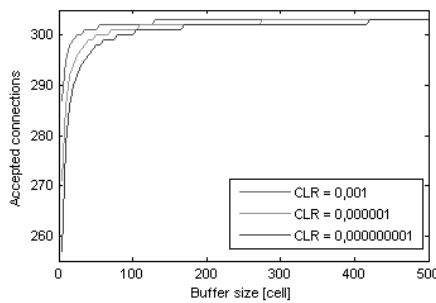


Fig. 2: Dependency between maximum number of accepted connection by diffusion method and buffer size of ATM switch for source no. 1 and three values of required CLR.

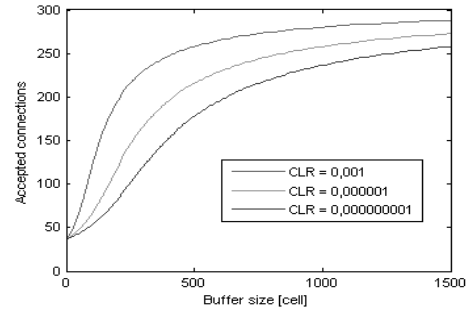


Fig 3: Dependency between maximum number of accepted connection by method of effective bandwidth and buffer size of ATM switch for source no. 1.

We found out that estimations of the diffusion method (figures 2 and 4) in the whole investigated range of buffer size converge to upper boundary of number of accepted connections  $N_{max}$ . The most significant effect of buffer size is in the range of small values, approximately up to 30 ATM cells. This effect is reduced with rising activity factor of the traffic source. From the results it is obvious that method based on diffusion approximation offers excellent bandwidth utilization. But it brings problem in case when some connection violate agreed broadcast cell rate. In this case there need not be enough spare bandwidth to handle increased requirements and link congestion can occur. Considerably different situation is in the case of method based on equivalent bandwidth. In the figures 3 and 5 we can see high relation between number of accepted connections, buffer size and required cell loss ratio. In the case of the lowest buffer size, the estimations of this method approach to the lower boundary of accepted connections  $N_{min}$ . With the rising buffer size the number of accepted connections is gradually increasing, but in the investigated boundaries but it is not approaching the estimations of diffusion method. We can see noticeable lower number of accepted connections compared to diffusion method. Also it is obvious the strict Quality of Service requirements (in this case cell loss ratio) the lower number of accepted connections in whole examined range of buffer size.

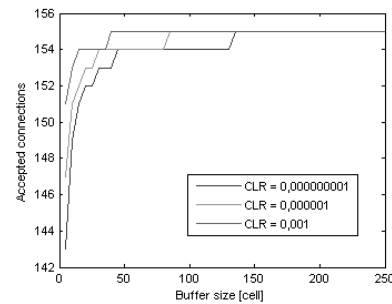


Fig. 4: Dependency between maximum number of accepted connection by diffusion method and buffer size of ATM switch for source no. 2 and three values of required CLR.

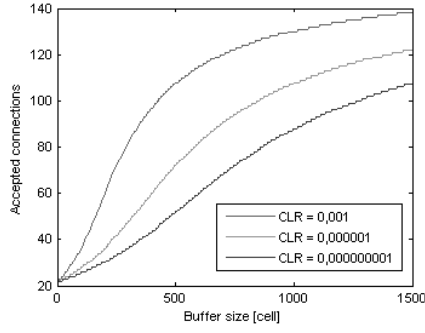


Fig. 5: Dependency between maximum number of accepted connection by method of effective bandwidth and buffer size of ATM switch for source no. 1 and three values of required CLR.

Method based on the effective bandwidth offers significantly worse bandwidth utilization, especially in the low values of buffer size of ATM switch. On the other hand, effective bandwidth method offer better Quality of Service guarantee for individual connections, because if any connection violate agreed traffic parameters, there is enough bandwidth reserve on the transmission link to handle unexpected increase of transmission rate of some connections.

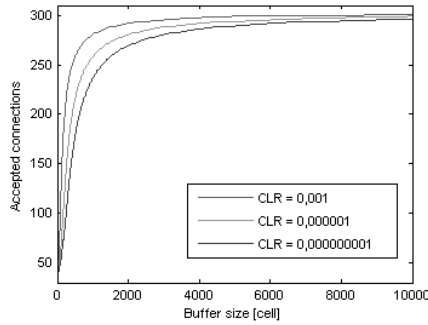


Fig. 6: Maximum number of accepted connections by effective bandwidth method for high values of buffer size (up to 512 kB) for source no. 1.

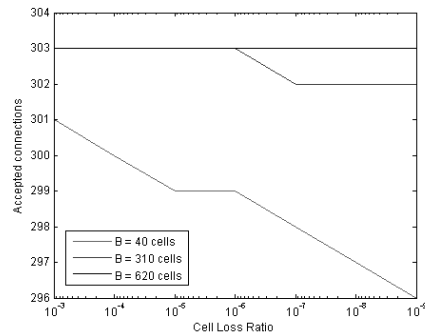


Fig. 7: Maximum number of accepted connections by diffusion method in relation with required cell loss ratio CLR for source no. 1.

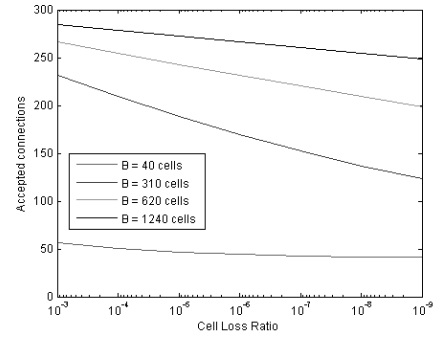


Fig. 8: Maximum number of accepted connections by effective bandwidth method in relation with required cell loss ratio CLR for source no. 1.

The previous figures for effective bandwidth method have shown that the upper boundary of accepted connections was not reached in whole investigated range of buffer size of ATM switch (up to 64 kB, i.e. 1240 ATM cells). In the figure 6 we can see relation between maximum number of accepted connections and buffer size for higher values of the buffer size, approximately up to 512 kB (10000 ATM cells). The results are for traffic source no. 1.

As we can see the effect of required cell loss ratio on the number of accepted connections is minimized at the high values of buffer size. Achieved simulation results confirm the assumption that effective bandwidth method is more conservative in accepting of new connections than method based on the diffusion approximation, but on the other hand it offers higher guarantee of arranged Quality of Service level.

#### Cell Loss Ratio vs. Admitted Connections

Cell loss ratio *CLR* represents parameter that determines reliability of the connection. It is one of the main Quality of Service parameters. Some services, like voice transmission, can accept relative high cell loss ratio (cca  $10^{-3}$ ).

But the majority of modern high-speed broadband services require significantly lower information losses. They typically require cell loss ratio in the range from  $10^{-6}$  to  $10^{-9}$ . In the following simulations we have examined dependencies between admitted connections by both CAC methods and required cell loss ratio. Numbers of accepted connections we have examined for required cell loss ratio from  $10^{-9}$  to  $10^{-3}$ . Simulations we have performed also for various values of buffer size (20, 310, 620 and 1240 ATM cells). Simulation results are graphically presented in the figures no. 7 - 10.

Figures no. 7 and 9 represents achieved simulation results for method based on diffusion approximation. For both traffic sources we have found out only little dependency between accepted connections and required cell loss ratio. In all cases the estimations of diffusion method converge to upper boundary of maximum accepted connections  $N_{\max}$ , or they tightly approaching this boundary with lowering of QoS requirements.

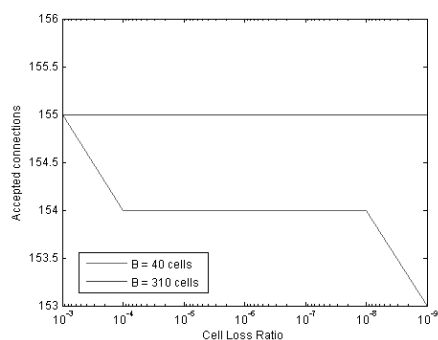


Fig. 9: Maximum number of accepted connections by diffusion method in relation with required cell loss ratio CLR for source no. 2.

Only 3 respectively 2 dependencies are displayed in the graph, because it was found out that in the case of larger buffer size the number of accepted connections is identical with upper boundary  $N_{max}$ . We can see slight decrease of admitted connections for the lowest values of cell loss ratio. In the figures no. 8 and 10 we can see relation between the number of admitted connections and required cell loss ratio for effective bandwidth method. Now we can see the significantly higher dependency between the estimations of accepted connections and required cell loss ratio in comparison with diffusion method. In the case of the lowest value of buffer size (40 ATM cells) the number of accepted connections is closely above the lower boundary of accepted connection  $N_{min}$  for given traffic source. In this case the sensibility of admitted connections to required cell loss ratio is minimal in whole range of examined cell loss ratio. For values of buffer size equal to 310 and 620 ATM cells (16 and 32 kB) we have found out the highest dependencies between the admitted connections and required cell loss ratio. With the rising requirements on cell losses the estimation of maximum accepted connections of equivalent bandwidth method is lowering by tenths of connections. In the case of the highest buffer size (1240 ATM cells) the fall of accepted connections is slightly less than in the case of middle-sized buffers for all examined traffic sources.

Following the achieved results we can say that the effective bandwidth method can be appropriate used in the situations, when we have users that require high guarantee of arranged Quality of Service and the lower effectiveness of bandwidth utilization can be for example compensated by higher cost for users. On the contrary, the use of diffusion approximation based method is appropriate in the situation when we need the better bandwidth utilization, e.g. to accommodate as many connections on the transmission link as possible while considering the higher QoS requirements (cell losses, buffer size of ATM switch). But in this case there is the higher probability of network congestion. This can be for example compensated by lower cost of service for users compared to previous case.

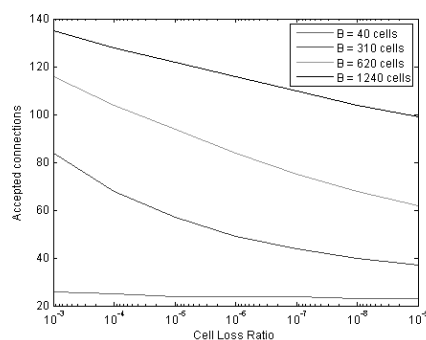


Fig. 10: Maximum number of accepted connections by effective bandwidth method in relation with required cell loss ratio CLR for source no. 2.

#### 4. CONCLUSION

In this paper we have presented exploitation of CAC method simulations for learning of broadband technologies and Quality of Service issues. Students can create traffic model based on measured real voice or video traffic. Consequently they can investigate performance of selected CAC methods for chosen traffic model. Hence, students can practically see impact of given traffic type and CAC method on efficient utilization of network resources.

#### 5. REFERENCES

- [1] Kvačkaj, P., Baroňák, I.: Evaluation of CAC methods used in ATM. In: International Conference Applied Electronics 2005, Pilsen, Czech Republic, September 8-9, 2005, pp. 205-208, ISBN 80-7043-369-8.
- [2] Seeling, P., Reisslein, M., Kulapala, B.: *Network Performance Evaluation Using Frame Size and Quality Traces of Single-Layer and Two-Layer Video: A Tutorial*. In: IEEE Communications Surveys and Tutorials, Vol. 6, No. 2, 2004, pp. 58-78.
- [3] Alberti, A. M. et al.: *Modeling and Simulation of ATM Traffic Management*. In: Proceedings of the 37<sup>th</sup> Annual Symposium on Simulation, April 18 - 22, 2004, IEEE Computer Society, Washington, USA, ISBN 0-7695-2110-X, pp. 273 - 282.
- [4] Ross, M. S.: *Introduction to Probability Models*. Academic Press, 2003, ISBN 0-12-598055-8.
- [5] Tan, S. L., Tham, Ch. K., Ngoh, L. H.: *Connection setup and QoS monitoring in ATM networks*. In: International Journal of Network Management. Vol. 13, No. 3, May 2003, John Wiley&Sons, ISSN 1099-1190, pp. 231-245.
- [6] Chromý, E.: *Optimizing processes in convergent networks*. In: RTT Conference focused on Research in Telecommunication Technology, RTT 2006. Nové Město na Moravě, Czech Republic, September 11-13, 2006, ISBN 80-214-3243-8, pp. 295-299.

## THE AUTHORS



**Matej Kavacký** was born in Nitra, Slovakia, in 1979. He received the engineering degree in telecommunications in 2004 from Faculty of Electrical Engineering and Information Technology of Slovak University of Technology (FEI STU) Bratislava. In 2006 he submitted PhD work “Quality of Service in Broadband Networks”. Nowadays he works as researcher in Department of Telecommunications of FEI STU Bratislava.



**Ivan Baroňák** was born in Žilina, Slovakia, on July 1955. He received the electronic engineering degree from the Slovak Technical University Bratislava in 1980. Since 1981 he has been a lecturer at Department of Telecommunications STU Bratislava. Nowadays he works as an associate professor in Department of Telecommunications of FEI STU Bratislava. Scientifically, professionally and pedagogically he focuses on problems of digital switching systems, ATM, Telecommunication management (TMN), NGN, problem of optimal modeling of private telecommunication networks and services.

## ACKNOWLEDGEMENT

*This work was a part of research activities conducted at Slovak Technical University Bratislava, Faculty of Electrical Engineering and Information Technology, Department of Telecommunications, within the scope of the project VEGA No. 1/3118/06 „Traffic in convergent telecommunication systems and networks“.*



# ASSESSMENT OF VOICE QUALITY UNDER THE CONDITIONS OF EDUCATIONAL INSTITUTIONS

Katarína Kleinová, Peter Fecilák, František Jakab, Ján Bača  
Department of Computers and Informatics,  
Technical University of Košice, Letná 9, 042 00 Košice, Slovakia  
E-mail: {katarina.kleinova, peter.fecilak}@tuke.sk, jakab@elfa.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Nowadays there are used different technical tools and techniques in education that make easier communication among students and teachers or contribute to exchange of information among teachers possibly students. One possible way is the use of VoIP (Voice over IP), but voice transmission itself must comply with given criteria for clear and understandable communication. Progress of VoIP is conditioned by problem solving associated with effective assignment of voice transmission with required transfer parameters (QoS). Means, which can be used for ensuring voice quality in IP networks, are e.g. QoS models. This paper is dedicated to an analysis of parameters that can be used in those models and to new types of codecs that are supported in IP soft phones.

**Keywords:** VoIP, QoS, codec, E-model, MOS, delay, packet loss.

## 1. INTRODUCTION

QoS models are utilized for assessing of VoIP quality and for need of VoIP network planning. Requirements for high-quality VoIP services demand the use of reliable QoS model as early as a proposal of VoIP network. There are various QoS models that differentiate each other in a way of prioritization of VoIP packets, resource reservation or assessment of voice quality.

Voice quality is described with a number of subjective and objective characteristics. It is possible to measure and evaluate the most of these characteristics. However, the most important is how an end user perceives voice quality. [2] Impact of the used codec, packet loss and network delay (or jitter) plays the significant task. On the basis of these parameters, ITU-T G.107 defined the E-model as the passive method of determination of voice quality. [4] This paper is dedicated to an analysis of parameters used in the E-model and to new types of codecs that are supported in IP soft phones.

## 2. CONCEPTION OF E-MODEL

The E-model is found on the assessment of combined effects of different transmission parameters affecting voice quality. According to an impact modeling of parameters as codec, packet loss, delay (or jitter) on voice quality it can be calculated a scalar quantity R-factor. R-factor is a basic output quantity of an analytical form of the E-model. [4], [5]

This R-factor is calculated according to the equation (1) that assumes additive interaction of individual impairments:

$$R = R_0 - I_S - I_D - I_{e-eff} + A \quad (1)$$

Parameter  $R_0$  (2) represents the basic value of signal-to-noise ratio and includes a distortion produced from connected circuit and noise in a room.

$$R_0 = 15 - 1,5(SLR + N_0) \quad (2)$$

The term  $N_0$  is the power addition of different noise sources. [3] Parameter SLR stands for Send Loudness Rating.

Parameter  $I_S$  is a linear distortion, which includes a received level of speech signal and represents an impairment that can arise from voice transmission. The parameter  $I_S$  is the sum of all impairments which may occur simultaneously with the voice transmission.

Parameter  $I_D$  represents impairment caused by delay. Parameter  $I_{e-eff}$  represents impairment produced from a device (codec) and includes impairment caused by packet loss. Under the calculation (3) of this parameter there is also taken parameter  $I_e$  into account that can achieve the values displayed in Tab. 1 for individual codecs.

Tab. 1 Factor  $I_e$  values

| Codec   | Bandwidth [kbps] | $I_e$ |
|---------|------------------|-------|
| G.711   | 64               | 0     |
| G.729   | 8                | 10    |
| G.723.1 | 6,3              | 15    |
| G.723.1 | 5,3              | 19    |

$$I_{e-eff} = I_e + (95 - I_e) \frac{Ppl}{Ppl + Bpl} \quad (3)$$

Parameter  $I_e$  represents Equipment Impairment Factor, parameter  $Bpl$  stands for the Packet-loss Robustness Factor and  $Ppl$  for Random Packet-loss Probability. [6]

Factor *A* (Advantage Factor) is also symbolized an expectation factor and it takes the used devices into consideration. Among factor *A* and the other transmission parameters there is no relation. It can achieve the values shown in Table 2.

Tab. 2 Factor *A* values

| Communication system                                   | Factor <i>A</i> |
|--|-----------------|
| Conventional   | 0               |
| Mobility in a building                                 | 5               |
| Mobility in a geographical area or moving in a vehicle | 10              |
| Access to hard-to-reach locations                      | 20              |

Resulting *R*-factor can assume the values from 0 to 100; acceptable value is in the range from 50 to 100. The value 0 represents very poor quality and the value 100 represents very high quality.

For the assessment of voice quality *R*-factor can be mapped on an estimated MOS (Mean Opinion Score) (4) in the scale 1 – 5

For  $R < 0$   $MOS = 1$

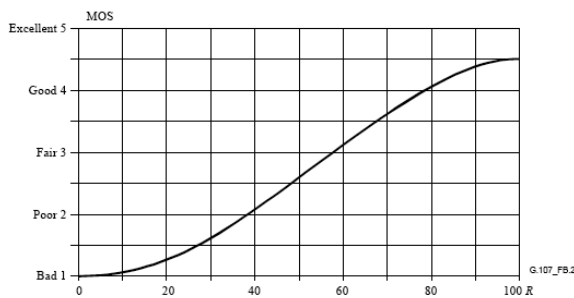
For  $0 < R < 100$

$$MOS = 1 + 0,035R + R(R - 60)(100 - R)7 \cdot 10^{-6}$$

For  $R > 100$   $MOS = 4,5$  (4)

Relation between the estimated MOS and the *R*-factor is depicted in the graph (Fig. 1).

Fig. 1 Relation between the *R*-factor and MOS



### 3. PRIMARY PARAMETERS OF E-MODEL

#### Voice Compression - Codecs

There are various techniques for data compression that are used to decrease in volume of voice data transmitted over packet-switched networks. Type of chosen algorithm has an effect on exploited bandwidth and quality of transmitted voice.

For transmission of voice signal over IP networks, codecs with the highest compression rate are used because IP

header takes an essential part of bandwidth. On the other hand, codecs with a high compression rate produce a deformation of original voice signal.

The most often used codecs are mentioned in Table 1. Except of these codecs, free codecs (open source software) have been discovered more and more, e.g. Speex or GSM.

Tab. 3 Requirements of VoIP for voice transmission parameters

| Code c | Algorithm | Bit rate            | Quality    |
|--------|-----------|---------------------|------------|
| G.711  | PCM       | 64 kbps             | Good       |
| G.723  | MLQ       | 16, 24, 32, 40 kbps | Satisfying |
| G.726  | ADPCM     | 16 kbps             | Good       |
| G.728  | LD-CELP   | 8 kbps              | Satisfying |
| G.729  | CS-ACELP  | 6,3 kbps            | Good       |

#### G.711 codec.

In modern digital telephone networks there is now used PCM (Pulse Code Modulation) codec, standard ITU-T G.711. It is a case of a method for transmission of analog data in a digital and binary form, independently from complexity of analog signal behaviour. Amplitude of the analog signal is scanned in periodic time intervals and then rounded to the closest binary level (quantization). In a receiver a pulse code demodulator converts binary values back to impulses that have the same wave level as those in a modulator. These impulses are in the end restored to original analog behaviours. Bit rate is at the level of 64kbps.

There are two versions of G.711 codec: A-law (used with standard E1) and U-law (used with standard T1). The difference is in the way of analog signal sampling. In either case it is about a logarithmic compression.

The utilization of G.711 codec demonstrates the best voice quality because it uses no compression and so it causes a minimum delay. G.711 codec is supported by a majority of VoIP providers. [6]

#### G.729 codec.

G.729 codec is a CS-ACELP (Conjugate Structure Algebraic Code Excited Linear Predictor) compression algorithm approved by ITU-T. Standard G.729 operates at 8kbps but it can support also 6,4kbps and 11,8kbps. It is used for transmission of voice in IP networks. It processes 16-bit PCM data and produces mathematical approximation of time behaviour. CS-ACELP reads 80 PCM frames and maps them into ten 8-bit code words form the book of codes. Also it offers a noise reduction. [7]

#### One-way network delay

Network delay is a time required to transmission of a packet through IP network. It is measured from the moment when a speaker says a word to voice representation of this word at a listener's side. This delay is named as "mouth-to-ear" or "one-way" delay. Round-trip delay is an addition of two one-way delays that create a phone call.

Requirements of VoIP for one-way delay between end points:

80ms or less – presents high quality,

80ms to 180ms – voice quality is much better than at a standard phone calls and is appropriate to most users,

180ms or above – voice quality can be still acceptable according to user's expectations, type of codecs and suchlike.

ITU-T recommends one-way delay of 150ms (including end points) as a restriction to high voice quality. One-way delay exceeding 250ms can cause a problem of a simultaneous conversation (talk-over), when two persons begin to talk because the delay keep them from realizing that the second person has already begun to talk. [1]

#### Packet loss

Network packet loss gives a proportional or absolute number of packets that was not delivered to a destination. Network packet loss will occur if packets are sent but due to some problems in the network are received with a delay greater than set tolerance or they are not received at all. Among primary resources that produce packet loss belongs:

Bit errors induced by a wiring degrade

Buffer overflow, network congestion

Random degradation of packets

Collisions of packets

Packet loss results in cutting off and omitting of voice, decreases voice clarity. Any packet loss is an undesirable effect and in the design of a network it is important to prevent packet loss with a correct configuration of devices or connected lines. If one packet (10 – 40ms of a call) will be lost, a user does not record this. If more packets will be lost there are deaf positions in a phone call. [1]

Tab. 4 Requirements of VoIP for packet loss

| Voice quality | Packet Loss (%) |
|---------------|-----------------|
| High          | 0 – 0,5         |
| Good          | 0,5 – 1,5       |
| Poor          | 1,5 - more      |

#### 4. ANALYSIS OF PARAMETERS USED IN E-MODEL

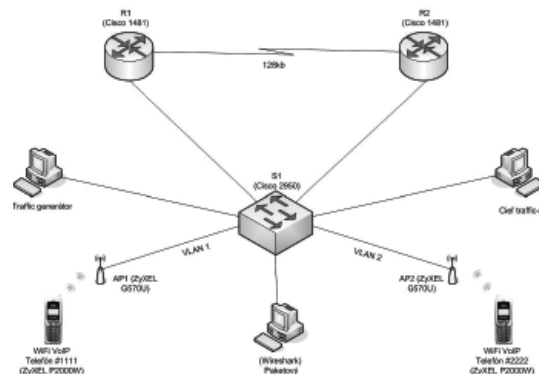
There was recorded and evaluated behaviour of RTP packet flow between phones at the measurements according to connection at Fig. 2.

Running connection (call) was analyzed and then evaluated with R-factor that was subsequently recalculated to MOS

scale. There were realized three types of measurements with the following conditions:

Without additional load and applying of voice quality

With additional load and without applying of voice quality



With additional load and applying of voice quality

Fig. 2 Connection of voice segment

At the measurements an attention was aimed particularly to two parameters affecting the quality of individual calls:

Packet loss

One-way delay

In the first measurement there was generated no additional load and there were transmitted only voice RTP packets. To reach a total one-way delay it is necessary add to the measured delay Codec delay and Packetization delay.

Tab. 5 Delays measured with the use of G.711 codec

| Packetization Delay [ms] | Codec Delay [ms] | Measured delay [ms] | One-way delay [ms] |
|--------------------------|------------------|---------------------|--------------------|
| 20                       | 0,5              | 14,5                | 35                 |

Tab. 6 Delays measured with the use of G.729 codec

| Packetization Delay [ms] | Codec Delay [ms] | Measured delay [ms] | One-way delay [ms] |
|--------------------------|------------------|---------------------|--------------------|
| 25                       | 30               | 7                   | 62                 |

Tab. 7 Calculated values of R-factor and MOS

| Codec | State of network | R     | MOS  |
|-------|------------------|-------|------|
| G.711 | Without load     | 92,13 | 4,39 |
| G.729 | Without load     | 81,48 | 4,08 |

In the second measurement there was running a generator of UDP packets during phone calls that produced simulated congestion of 128kbps serial line between two routers. In relation to low capacity of serial line there was generated load about 100kbps.

Tab. 8 Delays measured with the use of G.711 codec

| Packetization Delay [ms] | Codec Delay [ms] | Measured delay [ms] | One-way delay [ms] |
|--------------------------|------------------|---------------------|--------------------|
| 20                       | 0,5              | 566                 | 586,5              |

Tab. 9 Delays measured with the use of G.729 codec

| Packetization Delay [ms] | Codec Delay [ms] | Measured delay [ms] | One-way delay [ms] |
|--------------------------|------------------|---------------------|--------------------|
| 25                       | 30               | 7                   | 62                 |

Tab. 10 Calculated values of R-factor and MOS

| Codec | State of network | R     | MOS  |
|-------|------------------|-------|------|
| G.711 | With load        | 14,86 | 1,13 |
| G.729 | With load        | 81,48 | 4,08 |

At the realization of the third measurement there was set quality of services on routers, specifically fair-queue. In addition to that there was still produced simulated congestion about 100kbps on serial line between these routers.

Tab. 11 Delays measured with the use of G.711 codec

| Packetization Delay [ms] | Codec Delay [ms] | Measured delay [ms] | One-way delay [ms] |
|--------------------------|------------------|---------------------|--------------------|
| 20                       | 0,5              | 14,5                | 35                 |

Tab. 12 Delays measured with the use of G.729 codec

| Packetization Delay [ms] | Codec Delay [ms] | Measured delay [ms] | One-way delay [ms] |
|--------------------------|------------------|---------------------|--------------------|
| 25                       | 30               | 7                   | 62                 |

Tab. 13 Calculated values of R-factor and MOS

| Codec | State of network  | R     | MOS  |
|-------|-------------------|-------|------|
| G.711 | With load and QoS | 14,86 | 1,13 |
| G.729 | With load and QoS | 81,48 | 4,08 |

## 5. CONCLUSION

E-model is now a very widespread tool for an assessment of combined effects of different transfer parameters affecting voice quality. It was created not only for assessment of voice quality purposes but also for needs of network planning.

Analyzing mentioned parameters and their incorporation into the calculation of the R-factor on the basis of E-model it is possible to define what values of these parameters affecting voice transmission quality are tolerable for calls realized in a suggested data network and that do not meet the requirements of voice.

At realization of the experimental measurements in connected segment it was confirmed a necessity of

implementation of QoS for voice quality preservation, particularly with congestion of line.

From a viewpoint of codec suitability for congested lines or network it is more convenient the usage of G.729 codec which, in spite of congested line between routers and without applying QoS, did not demonstrate such voice quality degradation as G.711 codec.

## 5. REFERENCES

- [1] Avaya IP Voice Quality Network Requirements. Issue 3.0. April 2004. <http://www.avaya.com>.
- [2] Clark, A.: Tech Note: Voice Quality Measurement. 2005. Dostupné na: <http://www.tmcnet.com/tmcnet/articles/2005/>.
- [3] Hardman, D.: Noise and Voice Quality in VoIP Environments. White paper. April 2003. Dostupné na: <http://www.agilent.com>.
- [4] ITU-T Recommendation G.107. The E-Model, a computational model for use in transmission planning. 2003. Dostupné na: <http://www.itu.int/itudoc/itu-t/aap/sg12aap/history/g107/g107.html>.
- [5] ITU-T Recommendation G.108. Application of the E-model: A planning guide. 1999. Dostupné na: <http://www.itu.int/rec/T-REC-G.108/en>.
- [6] ITU-T Recommendation G.711. Pulse Code Modulation (PCM) of Voice Frequencies. Dostupné na: [http://www.vocal.com/data\\_sheets/g711.html](http://www.vocal.com/data_sheets/g711.html).
- [7] ITU-T Recommendation G.729. Dostupné na: <http://www.itu.int/rec/T-REC-G.729/e>

## THE AUTHORS



**Katarína Kleinová** is internal PhD student at Technical University of Košice. Her research activities are related to IP telephony, voice over IP traffic analysis and quality evaluation. She is responsible for development of IP telephony applications as project manager and member of VoIP@lab team at Computer Networks Laboratory. You can contact her at [katarina.kleinova@tuke.sk](mailto:katarina.kleinova@tuke.sk).



**Peter Fecilák** is internal PhD student at Technical University of Košice. His research activities are related to distributed systems, centralized systems, traffic engineering, network topology discovery, network topology visualization, network monitoring and managing. He is responsible for newly developed system for network monitoring and managing called SYNETS and he is member of Computer Networks Laboratory. You can contact him at [Peter.Fecilak@tuke.sk](mailto:Peter.Fecilak@tuke.sk).





**Frantisek Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modelling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology

Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)). You can contact him at [frantisek.jakab@tuke.sk](mailto:frantisek.jakab@tuke.sk).



**Ján Bača** (doc, Ing, CSc), born in 1947, received the Ing (Msc) and CSc (PhD) degrees from the Faculty of Electrical Engineering, Slovak University of Technology, in 1968 and 1982 respectively. Since the 1969 he has been employed at the Technical University in Košice, since 1985 as Associate Professor at the Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics, Technical University in Košice. His current teaching and research interests are oriented towards design and diagnostics of logic circuits, computer nets, CAD systems, formal specifications and decomposition of systems. You can contact him at [jan.baca@tuke.sk](mailto:jan.baca@tuke.sk).





## NGN FOR A NEW INTEGRATED E-LEARNING

Tatiana Kováčiková, Pavel Segeč, Milan Kubina,  
University of Žilina, Faculty of management science and informatics, Department of InfoComm  
networks, Univerzitná 8215/1, 010 26 Žilina, Slovak republic  
Tel.: + 421 41 5134 323, Fax.: + 421 41 5134 312  
e-mail: {Tatiana.Kovacikova, Pavel.Segec, Milan.Kubina}@kis.fri.uniza.sk  
web.: <http://www.kis.fri.uniza.sk>

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The paper provides an overview of the Next Generation Network (NGN) as a paradigm shift enabling ICT to become heavily integrated with information society services. Many current Information Communication Technologies lack interactivity, mobility, personalization, accessibility and multilingualism which are all characteristic for the e-learning users. NGN promises to be multiservice, multiprotocol, multi-access, IP-based networks: secure, reliable and trusted. Hence, using the flexibility of NGN a new integrated e-learning for users can be created.

**Keywords:** NGN, elearning, integrated, Next Generation Network

### 1. INTRODUCTION

In a world where knowledge and information are paramount, European citizens need new skills to adapt to rapidly changing life and work environments and to be able to fully participate in society. Ensuring that everyone can effectively use and benefit from Information and Communications Technology (ICT) in life and work, for accessing information, communicating and learning is now a priority for Europe. E-learning service is being widely deployed into different target environments. However, various possibilities of ICT still haven't been exploited in many e-learning implementations, as they lack interactivity, mobility, personalization, accessibility and multilingualism which are all characteristic for the e-learning users. Next Generation Network (NGN) represents a paradigm shift, where ICT become heavily integrated with information society services. NGN promises to be multiservice, multiprotocol, multi-access, IP-based networks: secure, reliable and trusted. Hence, using the flexibility of NGN a new integrated e-learning for users can be created.

The NGN framework is set by the International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) and ETSI (European Telecommunications Standards Institute), especially its Technical Committee TISPAN (TC TISPAN). Other standardization organizations and fora such as the Internet Engineering Task Force (IETF), 3GPP (Third Generation Partnership Project), 3GPP2, American National Standards Institute (ANSI), CableLabs, MultiService Forum (MSF), and Open Mobile Alliance (OMA) are actively involved in defining NGN standards.

The following sections provide an overview of NGN architecture principles and functions based on the ETSI TC TISPAN specifications as well as the steps in the standardization path towards the full NGN.

### 2. NGN ARCHITECTURE

#### Sub-system approach

TC TISPAN developed a functional architecture [1] consisting of a number of sub-systems and structured in a service layer and an IP (Internet Protocol)-based transport layer. This sub-system oriented architecture enables new subsystems to be added over time to cover new demands and service classes. It also provides the ability to import sub-systems defined by other standardization bodies. Each subsystem is specified as a set of functional entities and related interfaces. Fig. 1 shows the overall NGN functional architecture.

#### NGN Transport Layer

The transport layer provides the IP connectivity for NGN users. The transport layer is composed of a transport control sub-layer on top of transfer functions. The transfer control sub-layer is further divided into the Network Attachment Subsystem (NASS) and the Resource and Admission Control Subsystem (RACS).

The NASS provides registration at the access level and initializes terminal accessing to NGN services [2]. There may be more than one NASS to support multiple access networks.

The RACS provides applications with a mechanism for requesting and reserving resources from the access network [3].

#### NGN Service layer

The NGN service layer comprises:

- Core IP Multimedia Subsystem (IMS)
- PSTN/ISDN emulation subsystem (PES)
- Other multimedia subsystems (e.g., streaming subsystem, content broadcasting subsystem)
- Common components used by several subsystems (e.g., subsystems required for accessing applications,

charging functions, user profile management, security management).

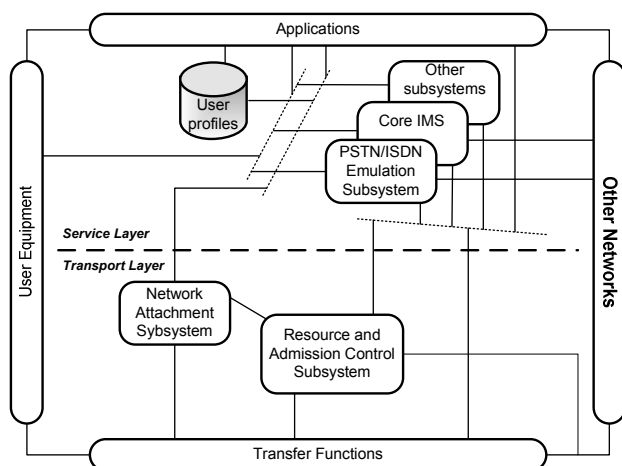


Fig. 1. TISPAN\_NGN Overall Architecture – Concept of Sub-systems.

The core network of NGN Release 1 is required to be based upon the IMS (IP Multimedia Subsystem), as defined in 3GPP Release 6 and 3GPP2 revision A for IP-based multimedia applications. The IMS is IP end-to-end and allows applications and services to be supported seamlessly across all networks. IMS is a framework architecture – a definition of capabilities specified in a set of 3GPP documents that defines components, services and interfaces for NGN. It uses Voice over IP (VoIP) implementation based on a 3GPP standardized implementation of Session Initiation Protocol (SIP), and it runs over the standard Internet Protocol. 3GPP has enhanced the SIP and IP-based protocols (primarily Diameter) to allow for mobility. The TISPAN TC has adopted the IMS and is closely working with 3GPP on any modifications or improvements that may be needed for the NGN [4].

There are three distinct operational layers (or planes) within the IMS architecture: the Application Layer, Control Layer and the Transport Layer (Fig. 2).

The Application Layer contains a number of Application Server (AS) types. These are all SIP entities as expected within the IMS architecture. These servers host and execute services and can operate in a number of SIP functional modes i.e., SIP UA (User Agent), a terminating function; SIP B2BUA (Back-to-Back User Agent) which acts like two back to-back SIP user agents or as a SIP proxy server.

The Control Layer deals with session signalling and comprises a number of distinct functions to process the signalling traffic flow, such as the Call Session Control Functions (CSCF), Home Subscriber Server (HSS), Media Gateway Control Function (MGCF) and Media Resource Function Controller (MRFC). Using protocols such as SIP, Diameter and H.248 MEGACO, the various elements are able to establish subscriber requested services.

The Transport Layer transports the media streams directly between subscribers; and between subscribers and IMS media generating functions, such as the media resource function processor acting as a media announcement server.

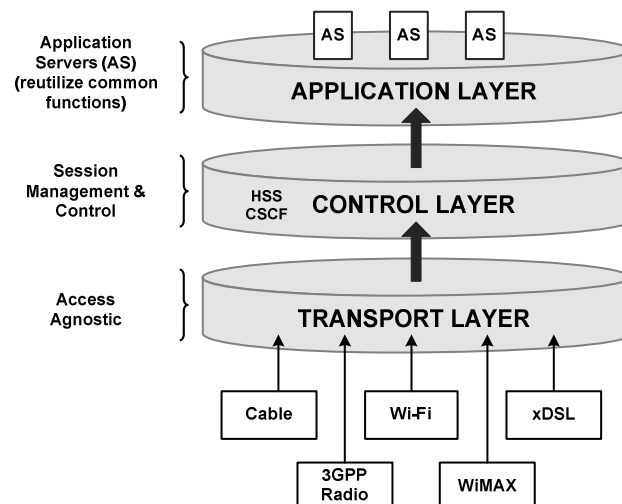


Fig. 2. Three IMS Layers.

The core IMS functions are included in the Call Session Control Function (CSCF) which is a SIP server which processes the IMS signalling traffic in order to control multimedia sessions. There are three types of CSCF:

- Proxy CSCF (P-CSCF): The initial point of contact for signalling traffic in to the IMS.
- Serving CSCF (S-CSCF): Provides the service coordination logic to invoke and orchestrate the application servers needed to deliver the requested service.
- Interrogating CSCF (I-CSCF): A SIP proxy that provides a gateway to other domains, such as other service provider networks.

Until Release 6, specifications for the P-CSCF included the Policy Decision Function (PDF), which stores policies and consults them to make decisions about IP bearer resource allocation requests. The PDF has been separated from the P-CSCF to make it more accessible to WLANs and other access network types. P-CSCFs also generate CDR (Call Detail Record) or billing records that can be consolidated at a Charging Gateway Function (CGF).

The 3GPP IMS has been extended in the TISPAN NGN [4] to support additional access network types, such as xDSL (x - Digital Subscriber Line) and WLAN (Wireless Local Area Network).

The TISPAN extensions of the 3GPP IMS (Fig. 3) take into account the differences between the wireless and wired environments, especially as far as concerns the amount of control needed for the end user device that leads to huge differences in perspectives on control and management. For the both environments, there are also different regulatory constraints, QoS and location definitions, methods and

mechanisms, support requirements for legacy devices as well as many differences in security and network management details.

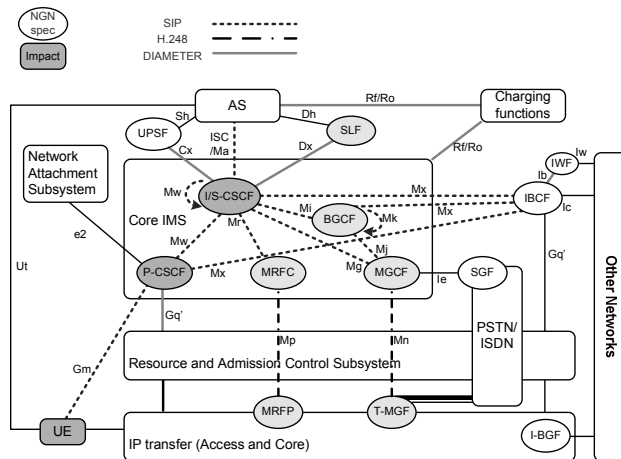


Fig. 3. Core IMS in the TISPAN\_NGN.

PSTN/ISDN Emulation Subsystem (PES) [5] is a subsystem that supports emulation of PSTN/ISDN services, enabling legacy PSTN terminals to access the NGN through Residential, Access and Trunking Gateways.

Streaming Subsystem provides support for RTSP (Real Time Streaming Protocol) -based streaming services to NGN terminals (out of the scope of the TISPAN Release 1).

Content Broadcasting Subsystem enables broadcasting of multimedia content (e.g. movies, TV channels etc.) to NGN subscribers (out of the scope of the TISPAN Release 1).

Common components are those that can be accessed by more than one subsystem. Two types of common components can be identified:

- Components known in 3GPP IMS
- New components defined by TISPAN.

The first group of components has been defined by 3GPP IMS. It includes the following functions:

- Subscription Location Function (SLF) is only needed when multiple HSSs (Home Subscriber Servers) are used. Within TISPAN, it can be accessed by service control subsystems and Application Server Functions to retrieve the identity of the UPSF (User Profile Server Function) containing the service-level user profile of a particular subscriber.
- Application Server Function (ASF) offers value added services and resides either in the user's home network or in a third party location. The third party could be a network or simply a stand-alone AS.
- Interconnection Border Control Function (IBCF) which provides the interconnection with other multimedia sub-systems.
- User Profile Server Function (UPSF) which is, in fact, a subset of the HSS defined by 3GPP. It stores all

relevant information regarding the user, including identification, addressing, numbering, access controls and location information. Unlike HSS, UPSF does not provide HLR/AuC (Home Location Register/Authentication Centre) functionality.

- Charging and Data Collection Functions: As the names suggest, these provide data collection and billing mediation for online and offline charging.

The second group represents either new components that have been defined by TISPAN, or those 3GPP ones that have been modified by TISPAN in the context of NGN:

- Application Server Function (ASF) may provide standalone services or value added services on top of a basic session. For resource control purposes in NGN, the first category of Application Server Functions (ASF Type 1) may interact with the RACS, while the second category (ASF Type 2) relies on the control subsystem that provide the basic session over which the valued added service is built. Examples of Application Server Functions are SIP Application Servers and OSA (Open Service Architecture) Application Servers.
- Inter-working Function (IWF) is a new component that performs the inter-working between protocols used within TISPAN NGN service control subsystems and other IP-based protocols.

Charging and Data Collection Functions include data collection functions and mediation functions to the billing systems (for supporting both on-line and off-line charging) or other management applications that may use the same data.

### 3. TISPAN NGN RELEASES

NGN Release 1, published in December, 2005, provides the first set of implement able NGN specifications that are being used by industry to build the NGN. It incorporates the following capabilities: real-time conversational services, messaging Instant Messaging (IM) and Multimedia Messaging Service (MMS)), and content delivery (e.g., video on demand). Release 1 supports multimedia services with nomadicity/user-controlled roaming based on use of a Network Attachment Subsystem (NASS). NASS supports user nomadicity and roaming with an xDSL access focus. Besides NASS, the main features include the definition of the Core IP Multimedia Subsystem and its relationship to other TISPAN NGN components, Resource and Admission Control Subsystem (RACS), PSTN/ISDN Emulation Subsystem (PES) and PSTN/ISDN Simulation Services (PSS).

In Release 2, focus is done on synchronization of TISPAN NGN specifications with 3GPP, especially the alignment of the timescales and dependencies of TISPAN Release 1 with the work in 3GPP Release 7 on Fixed Broadband IMS (FBI) and the alignment of the timescales of TISPAN Release 2 with the ongoing work in 3GPP Release 8 and Fixed Mobile

Fixed Mobile Convergence (FMC). The objective is to reach a single core solution based on IMS Core signalling technology and multiple access technologies in cooperation with 3GPP. Release 2 architecture issues include new functionalities such as:

- Evolution of RACS including resource control in the core network, end-to-end QoS, optimizing access resource usage according to user subscription profile and service use.
- Evolution of NASS including additional access technologies, e.g., fixed access via xDSL (e.g. ADSL (Asymmetric Digital Subscriber Line), WLAN via xDSL (e.g. IEEE 802.11), WiMAX etc.
- Support for the IPTV (IP Television)
- Online Charging.

#### 4. CONCLUSION

Deployment of the NGN will enable the users to exploit all their needs and requirements in the learning process. They will have the opportunity to educate himself just-in-time for all of his demanding expectations and requests.

On the other hand, NGN based on IMS is also expected to respond to and solve many of the industry's biggest technological challenges, including the lack of interoperability among operators who offer the same services and the inability of operators to take advantage of converged networks. However, implementation of the IMS based NGN should be viewed as a strategy of migration rather than replacement of an entire network. Operators can decide and choose which elements to implement, so the migration to IMS based NGN can be gradual. In other words, IMS based NGN can be viewed as a roadmap for operators that can guide them through an evolution to fully converged networks, services and technologies – a process that is already underway.

#### 5. REFERENCES

- [1] ETSI ES 282 001, “NGN Functional Architecture.”
- [2] ETSI ES 187 004, “NGN Functional Architecture; Network Attachment Sub System (NASS).”
- [3] ETSI ES 187 003, “Resources and Admission Control Sub-system (RACS); Functional Architecture.”
- [4] ETSI ES 282 007, “TISPAN: IP Multimedia Subsystem (IMS): Functional Architecture.”

[5] ETSI ES 187 002, “PSTN/ISDN Emulation Sub-system (PES); Functional Architecture.”

#### THE AUTHORS



**Doc. Ing. Tatiana Kováčiková, PhD.:**

She received her diploma in telecommunication engineering from the University of Transport and Communications (UTC) Žilina in 1984. Since 1990, she has been working in the Department of InfoCom Networks, Faculty of Management Science and Informatics, since 2004 as a senior researcher.

In 1996, she finished her PhD. studies aimed at broadband telecommunication networks and signalling. Her professional research interests include network architectures, signalling protocols, standardization process and technologies for converged fixed and mobile networks.

In October 2004, she was nominated Professor Associated at the University of Žilina in the field of the management and informatics systems.

He has got the SIEMENS award 2003 for leading the research group in the field of IP telephony.

Since 2002, she has been working in the European Telecommunications Standardization Institute (ETSI) as the expert in different Specialist Task Forces (STF) in the area of the NGN.



**Ing. Pavel Segeč, PhD.:**

He received his diploma in the Information and Management Systems from the University of Transport and Communications (UTC) Žilina in 1996 and PhD degree in transport and communication technology at University of Žilina in 2005. He is working

as a teacher at the Department of InfoComm Networks of ZU. In 2002 he received the Jozef Murgas award for year 2001 as the appreciation of his research work and in 2003 he was the team member of the research group that got the Werner von Siemens Excellence Award 2003 for the research in the field of IP telephony.



**Ing. Milan Kubina, PhD.:**

He received his diploma in the Information and Management Systems from the University of Transport and Communications (UTC) Žilina in 1996 and PhD degree in transport and communication technology at University of Žilina in 2004. He is

working as a teacher at the Department of InfoComm Networks of ZU and at the Department of Management of ZU. He worked as IT/ITC manager for the various companies from 1998 to 2006.



## FLASH AND MOBILE SOLUTIONS FOR VIDEO STREAMING PLATFORM

Miroslav Michalko, František Jakab, Miroslav Biñas, Ján Bača  
Computer Networks Laboratory, Department of Computer and Informatics  
Faculty of Electrical Engineering and Informatics, Technical University of Košice  
Letná 9, 042 00 Košice, tel. +421 55 602 2500  
miroslav.michalko@tuke.sk, frantisek.jakab@tuke.sk, miroslav.binas@tuke.sk, jan.baca@tuke.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Development of streaming media changed most of the current web multimedia content delivery into flash streaming solutions for desktop users and 3GPP in mobile environment. This paper deals with implementation of this new streaming solutions into video streaming platform (Videosever) developed by Computer Networks Laboratory at Technical University of Košice. Videosever provides delivery of various educational content for wide public and allows them to share their also their content by automatic audio and video processing into accessible web format. Moreover this solution provides HDTV streaming as multicast and unicast service for clients capable receiving high bandwidth data streams.

**Keywords:** streaming, video-on-demand, platform, mobile, IPTV

### 1. INTRODUCTION

Videosever is provides powerful and easy-accessible platform for sharing of multimedia content for users thanks to intuitive web interface and support of wide number of video formats which are automatically transformed into flash video. Content is not only delivered as whole file like is provided by YouTube (<http://www.youtube.com>) portal but is streamed in optimized data stream. Videosever allows also sharing of audio files and pictures. One of powerful service provided by Videosever is possibility to create multimedia content in supporting environment. After accessing archive, Videosever initiates streaming of video stored in server directly to your computer over the network. Videosever also contains several technologies which supports accessing formats using mobile devices. Implementation of RSS feeds allows simple notification and WAP page provides also short description of last content added into platform. Accessing to video streams is possible by using Helix Streaming solution which streams video in on-demand mode for devices capable received 3GPP content.

Services provided by Videosever streaming platform are preferably targeting school and universities by allowing them to share educational content by simple way. Thanks to open source and widely used technologies behind, platform is easily accessible and there are no special requirements for end users.

### 2. STREAMING TECHNOLOGIES

There are a lot of streaming technologies available at the market. Some of them are huge and complex and provides variety of added services to end user, some are simple and flexible. One of primary keys when selecting streaming technology is supported format(s) and price. Selecting the

proper format means to be successful or not. End users are tired by installing number of codecs and add-ons. Easy accessibility and must have technology for web content made Flash dominant player for most of the current computers. Complex streaming solutions provided by flash creators – company Adobe is commercial and requires higher initial investments. Fortunately, there are some projects in developing phase which offers flash content streaming and covered by GNU licensing policy.

Videosever at the first phase of development was build on proprietary Microsoft technology Windows Media Services included within Windows Server editions. Windows Media Services is powerful and stable platform covering most of the end users by Windows native supported codecs. But this streaming server supports only Windows Media Video and in picture quality compared to other technologies in loosing scores. For this reason future development by using this technology was cancelled.

As vital platform comparable to Windows Media Services is Helix streaming solution. Natively it support only Real Media codecs but thanks to extension provided by Real company it is possible to play some other video formats. Unfortunately full package with support of all codec is not free and makes from Real one of the most expensive solution on the market. Videosever platform uses only open-source Helix streaming server for mobile streaming. Following text will describe in detail key technologies and its implementation within Videosever platform.

#### Helix Streaming Server

Helix streams audio, video, images, animation, text, and other data types to client computers. This newest version of Helix has been designed to keep pace with your multimedia needs as they continue to change.

Helix Server is server software that streams both live and pre-recorded media over a network. The streamed data can originate either on the Internet or within an intranet. The

client receives the media in real time, and without having to wait for clips to be downloaded [1].

Helix Server uses two connections, known as channels, to communicate with clients: one for communication with the client, and one for actual data. The communication channel is known as the control channel, as it is over this line that Helix Server requests and receives passwords and clients send instructions such as fast-forward, pause, and stop.

### Red5

Red5 is a free, open source Flash server that supports streaming and recording audio/video, live stream publishing and Flash remoting [2]. Big advantage of this Java based application is cooperation with FFMPEG software package. Videosever use for flash streaming Red5 as the main streaming technology. Red5 is easy to install and maintain. Unfortunately still lack some important features in compare to Adobe Flash Streaming server.

### VideoLAN VLC

VideoLAN VLC streaming technology allows streaming of video and audio content of multiple formats. VideoLAN is free cross-platform solution released under GNU license. One of the advantages of this technology is powerful command line configuration possibilities and large amount of developers all around the world. VLC is in use for multicast HDTV streaming, configuration is made as extension module into CMS and driven by command line. This module allows changing of IP multicast address, TTL value and video as requested by end user [3].

### FFMPEG

Ffmpeg is a collection of software libraries that can record, convert and stream digital audio and video in numerous formats. It includes libavcodec, an audio/video codec library used by several other projects, and libavformat, an audio/video container mux and demux library. The name of the project comes from the MPEG video standards group, together with "FF" for "fast forward" [4]. After submitting video using portal Upload form ffmpeg is used to automatically convert video into flash format. During converting phase user is allowed to see partial video output of encoded video.

## 3. WEB INTERFACE

If considering to build complex streaming portal there are two possibilities. First, most time consuming one is to make code from scratch. Second, more simple and preferred by many users is to use existing Content Management Systems (CMS) available at the market. The most known are Mambo, Joomla, Drupal, E107 and others. Those systems use PostgreSQL, MySQL or MSSQL databases and script languages and tool such as Oldfusion, PHP, jsp and asp so in global they do not have any special requirements. One of the greatest advantages of web content management systems is their modular structure which allows system to be expanded of required features. The base of web content management systems allow to include different modules developed for actual web CMS.

It took a while to select the best one, there were many criteria considered such as stability, security, modularity, future development and others. Videosever is currently running on CMS Drupal [5].

Drupal is a free modular content management system written in PHP. It has a basic layer, or core, which supports pluggable modules which enable additional behaviors.

The integration between the core and the modules is achieved via a system of hooks, or call-backs, to allow modules to insert functions into Drupal's path of execution. Drupal core provides protection against many of the usual security problems, like SQL injection. Drupal offers many advantages to its users. For its ease installations and configuration and very few requirement of special technical acknowledge it is very popular between administrators. After creation of web site or portal it offers simple and clear navigation trough the site and organization of the content.

One of the Drupal greatest advantages and popular features which does not have any other CMS is taxonomy module. It is a core module, it means, taxonomy module is automatically installed when installing Drupal. The great power of taxonomy module comes from its ability to organize content by type. The taxonomy module can automatically classify new content on-the-fly. The taxonomy module also allows user to define vocabularies or sets of categories which are used to classify content.

## 4. HDTV STREAMING

There are only few streaming technologies available with HDTV streaming capability. Most known are Microsoft Media Services with its own proprietary HDWMV codec, Helix based solution provided by Real, QuickTime and VLC. Two most suitable technologies VLC and Helix are implemented and provide multicast and unicast on-demand streaming. For unicast streaming special module is developed and implemented into IP streaming platform running on CMS Drupal. Screenshot of user web interface for HDTV streaming is shown in Fig. 1.



Fig. 1. Web interface for accessing HDTV content

Due to limitations of multicast streaming content is accessible only within local intranet of Technical University



in Kosice – TUNET. In order not to overload network with unnecessary data stream platform allows also editing TTL value in TCP packet header. After reaching value equal to zero packet is destroyed by any active layer 3 packet device. HDTV video streams are propagated using SAP playlist what makes system more user friendly in compare to use only IP multicast address to remember. For extranet viewers interested in multimedia content there is only on-demand streaming available using specially developed web interface. Due to higher data bandwidth requirements only users with capable connection are ready to access content. Implementation of these streaming technologies into TUNET shows the capabilities of the intranet network and allows sharing knowledge using new multimedia content delivery technologies. HDTV is unfortunately fighting with problems like high bandwidth requirements and high overhead in RTP protocol.

## 5. MOBILE STREAMING

Streaming for mobile devices present numerous challenges, such as how to provide efficient content delivery for various mobile services for different user devices. Thanks to higher data rates such as 3G, multimedia content is simpler to transmit.

Important technology shift is from a vertically integrated to a horizontally layered service environment. A horizontally layered 3G service network seamlessly integrates Internet protocol transport into a mobile service environment with a variety of access networks, opening up many new opportunities for IP-based mobile applications. For example, mobile terminals will be able to access existing Internet content through protocols and markup languages such as WAP and WML that are optimized for wireless application scenarios. The 3G networks will also provide access to support services such as authentication, security, and billing mechanisms as well as mobile-specific services such as mobility management and location-based computing [6].

3GPP and 3GPP2 are the worldwide standards defined by 3<sup>rd</sup> Generation Partnership Project, a group of telecommunication standard bodies, to provide uniform creation and multimedia content delivery for mobile devices. Videosever implemented Helix Streaming server to allow delivery in 3GPP format. Helix Mobile Server is optimized for delivery of all major file formats to any wireless network, including EV-DO, GPRS, UMTS, EDGE, WCDMA, CDMA2000 and 802.11b-WiFi. With the broadest support for mobile delivery standards, including support for live streaming of 3G video (H.263 and H.264) content Helix is perfect solution for Videosever platform. After user selects on-demand streaming for mobile device streaming server on the fly converts video to proper format. Due to low bandwidth in mobile networks there is no problem for server to handle multiple streams simultaneously [6]. Overview of 3GPP streaming client is shown in Fig. 2.

3GPP is based on MPEG4 format packed within AVI or 3GPP container. Most of the current mobile devices are capable to play this format.

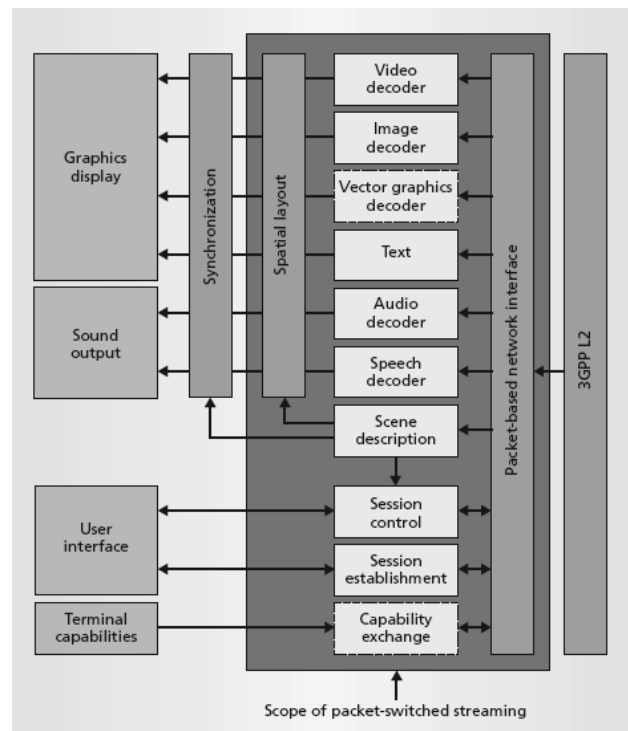


Fig. 2. Overview of 3GPP streaming client [].

There are also other technologies for video content delivery. For TV or IPTV streaming solutions with broadcast delivery method is successor of DVB-T named DVB-H. DVB-H is developed for digital terrestrial television to the specific requirements of handheld, battery-powered receivers. DVB-H can offer a downstream channel at high data rates which can be used as standalone or as an enhancement of mobile telecoms networks which many typical handheld terminals are able to access anyway. Time slicing technology is employed to reduce power consumption for small handheld terminals. IP datagrams are transmitted as data bursts in small time slots. Each burst may contain up to 2 Mbits of data (including parity bits). There are 64 parity bits for each 191 data bits, protected by Reed-Solomon codes. The front end of the receiver switches on only for the time interval when the data burst of a selected service is on air. Within this short period of time a high data rate is received which can be stored in a buffer. This buffer can either store the downloaded applications or playout live streams. The achievable power saving depends on the relation of the on/off-time. If there are approximately ten or more bursted services in a DVB-H stream, the rate of the power saving for the front end could be up to 90%. [7] For future development in mobile streaming 3GPP2 standard will be implemented. The chosen protocols are fully compliant with existing standards. Videosever through its HTTP protocol provides access to static content using TCP connection and upgrade requires only implementation of streaming server with 3GPP2 support. For improving quality an extra proxy server should be considered as an option. Proxy handles problems with continuously changing conditions within providers network environment.

## 6. VIDEOSERVER

Videoserver provides powerful platform for content creating and sharing in supporting environment. After accessing archive, Videoserver initiates streaming of video stored in server directly to your computer over the network. By adding latest offerings of Helix server now we are ready to provide video also in HDTV quality with lower network utilization with application of QoS module. Current development is now focused on content searching and user interactivity in order to make this system more flexible and interesting for students what makes portal different to other portals. Sharing of video materials, web-based curriculums and on-line exams is part of e-learning and blended learning. Implementation of these learning techniques is powerful and effective strategy how to increase quality of education process at schools.

In order to extend platform functionality and to improve quality of offered services following activities are planned in near future:

**Customizability** – next generation services will be oriented directly on user needs. Videoserver will allow creating of user defined playlists supporting various formats of video, audio and picture files. Using simple and user defined web links makes playlist easy to share over the network.

**Mobile streaming** – as rapidly growing segment demands for implementation of new 3GPP2 scenario. To enable interoperability between servers and mobile devices, especially when using MMS standard specifies MPEG4 as an optional file format but this is currently problem. User uploaded videos are converted only into flash video format, additional conversion requires high system resources on server side. The 3GPP streaming standard offers the

possibility of creating presentations in which several media elements such as video, audio, images, and formatted text play at the same time. SMIL, an XML-based presentation language developed by the World Wide Web Consortium, is the glue that combines these different elements to create an interactive multimedia presentation. SMIL is HTML with additional notions of time and temporal behavior. Thus, it can describe a media screen and control the placement of media elements in space and time. The 3GPP streaming client interprets the SMIL scene description and uses it to control the spatial layout and synchronization in the multimedia presentation [6].

**IPTV** – as next logical step. Delivering of content is planned by using of existing streaming scenario based primarily on flash technology. The big problem that IPTV is facing is content. Content is an important tool that IP TV service providers can use to increase the competitiveness of their services and to increase customer spending. Content is the essence of these services; consequently, better content will improve the experience of the viewer and the attractiveness of the service. With so many restrictions on what can be viewed, content choices are extremely limited to viewers. People are watching less television. Broadcasters are concerned that a complacent industry will not push the edge of programming possibilities. The programs – no matter how they are delivered – must provide the viewer with something. According to a new report from Parks Associates - "IPTV: From Quadruple Play to Multiplay" - there will be around 60 million IPTV subscribers around the world by 2011. The number of IPTV subscribers is expected to grow 138% in 2007, to 10.85 million worldwide, compared with 4.56 million in 2006 [8].

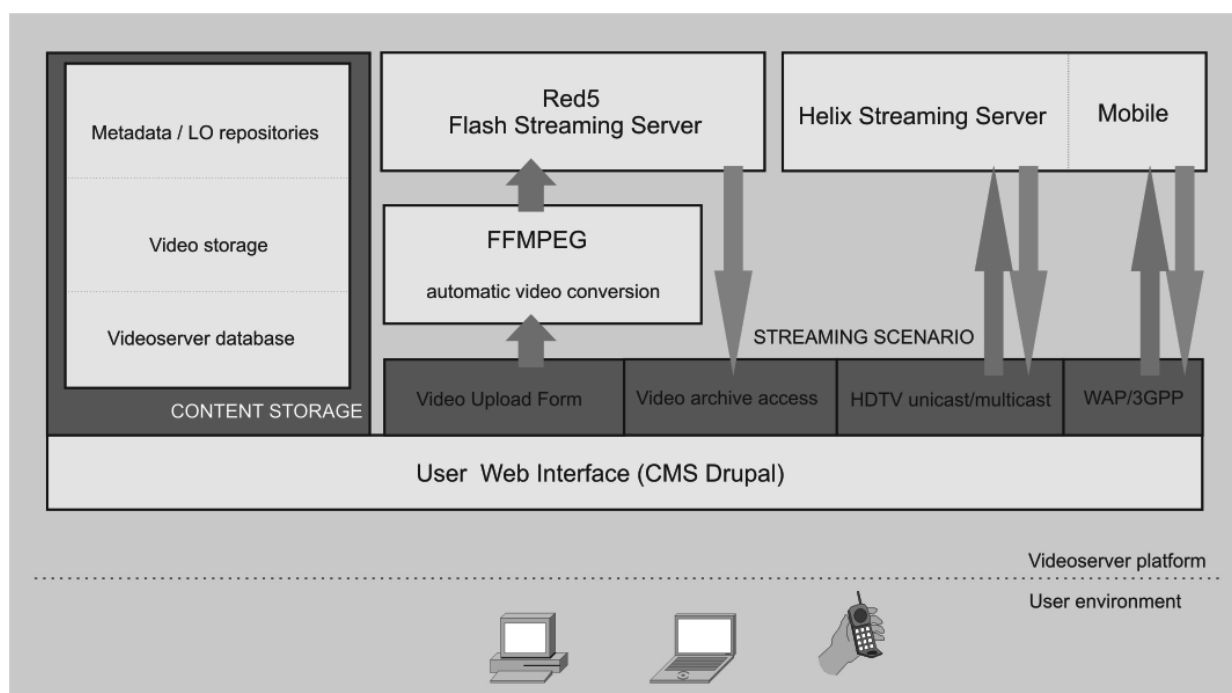


Fig. 3. Videoserver platform streaming scenario.

## 7. CONCLUSIONS

Videoserver platform provides complex service for sharing multimedia content using latest streaming technologies. Implementation of mobile streaming extension is unique in compare to similar web portals. Next development will focus on higher level of user interactivity, streaming adaptability based on continuously changing conditions within providers network environment, distributed access to video content and automatic metadata recognition. There are several forms of emerging content that may be important offerings in the future. Videoserver will focus mostly on interactive content and simple communication user interface but with latest streaming capabilities offering services anytime and everywhere.

Technologies presented in this paper show only few examples of utilization of new streaming and processing technologies connected together in order to provide services with added value. Videoserver is up and ready solution for educational institution for delivering content to online learners.

## 5. REFERENCES

- [1] Helix Community [online], Máj 2007, Dostupné na internete: <<http://www.helixcommunity.org>>
- [2] Red5 - Open Source Flash Server [online], Máj 2007, Dostupné na internete: <<http://osflash.org/red5>>
- [3] VideoLan - Free Software and Open Source video streaming solution [online], Máj 2007, Dostupné na internete: <<http://www.videolan.org>>
- [4] Wikipedia, the free encyclopedia: FFmpeg [online], Apríl 2007, Dostupné na internete: <<http://en.wikipedia.org/wiki/FFmpeg>>
- [5] Official website of Drupal, an open source content management platform [online], Apríl 2007, Dostupné na internete: <<http://www.drupal.org>>
- [6] I. Elsen, F. Hartung, U. Horn, M. Kampmann, L. Peters: Streaming Technology in 3G Mobile Communication Systems [online], September 2001, Dostupné na internete: <<http://www-nt.e-technik.uni-erlangen.de/~hartung/StreamingTechnologyin3GMobileCommunicationSystems.pdf>>

[7] Wikipedia, the free encyclopedia: DVB-H [online], Máj 2007, Dostupné na internete: <http://en.wikipedia.org/wiki/DVB-H>

[8] IPTV Watch portal: DVB-H [online], Máj 2007, Dostupné na internete: <<http://www.iptv-watch.co.uk/10062007-parks-expects-60-million-iptv-subscribers-by-2011.html>>

[9] Kováčiková T., Klimo M.: Architecture and Protocols for NGN, in Next Generations Networks and Beyond, VITEL 2002, International Symposium on Telecommunications, Portorož, Slovenia, May 2002, 8 pp.

## THE AUTHORS



**Miroslav Michalko** is internal PhD student at Technical University of Kosice. his research activities are related to streaming, mobile multimedia technology and web services. He is responsible for Videoserver platform

development as project manager and member of video@lab team at Computer Networks Laboratory.

You can contact him at [miroslav.michalko@tuke.sk](mailto:miroslav.michalko@tuke.sk).



**Frantisek Jakab** was born in 1959. He received the MSc.degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modeling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)).

The paper was partially prepared within the project "Network of virtual laboratory for real system control", No. 3/3121/05, 2005-09-09 2007-12-31 with the support of KEGA.





**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**Tools & Content-oriented Application**





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## CURRENT STATUS OF EVO AND THE PLAN OF THE FUTURE DEVELOPMENT

Rastislav Adamek, Pavel Farkaš, Martin Harčár, Viktor Michalčín, Pavel Murín, Michal Paulíny,  
Faculty of Science, Pavol Jozef Šafárik University in Košice, phone: +421 55 234 6239,  
adamek@vk.upjs.sk, Pavel.Farkas@vrvs.org, harcar@vk.upjs.sk, michalcin@vk.upjs.sk,  
murin@vk.upjs.sk, pauliny@vk.upjs.sk

Philippe Galvez, California Institute of Technology, Pasadena, USA.  
galvez@caltech.edu

**Abstract.** Currently the academic community in Slovakia has at its disposal network SANET videoconference infrastructure that enables the scientists and teachers from Slovakia to communicate with an unlimited number of partners abroad connected to fast internet. All they need is notebook, headset and a web camera. Enabling technology is the product of the California Institute of Technology (Caltech) and the designation of this technology is VRVS (Virtual Rooms Videoconferencing System). Development of VRVS and of the new product EVO (Enabling Virtual Organizations) is shared by the IT experts from Košice pursuant to the Technology Transfer Agreement concluded by and between Caltech and P.J.Šafárik University in Košice. This arrangement is very of benefit for Slovakia as our experts may effectively adapt the user's interface to the needs of diverse users from Slovakia. The requirements of the teacher, researcher or employee of public or government administration differ, just as the work of the scientist in the experimental laboratory differs from the work of the teacher in the class or of the legal consultant sitting in their office. The nature of work should correspond to the working environment which is the EVO interface in our case. EVO product is a new type of manageable videoconference technology in the world internet environment. It is a software product developed on the basis of JAVA platform that communicates also with hardware commercial products (H.323 and SIP clients). The procurement price of EVO videoconference infrastructure is about 10 times lower than that of commercial systems while providing comparable quality of services. With 1600 registered users of VRVS/EVO system Slovakia is placed 6<sup>th</sup> among the countries of the World as far as the absolute number of registered users is concerned. The VRVS/EVO system is used in 139 countries of the world. EVO product is also commercially usable. The paper introduces the current production version of EVO and presents the development activities of the IT team from Košice (EVO transcoder, implementation of the 3D interface, H.264 codec implementation, shared presentation implementation, White-board implementation, voice module implementation, etc.). Transfer of Caltech technology in the environment of the Slovak academic community is financed by the Ministry of Education of the Slovak Republic.

**Keywords:** videoconferencing, videoconference, VRVS, EVO

### 1. INTRODUCTION

#### Videoconferences in national and research networks [1]

Some national networks directly support and provide videoconference service based on one concrete technology, such as NIIF in Hungary [2], with the whole videoconference network based on H.323 technologies managed and monitored from one central node and using H.323 MCU (Multipoint Control Unit) HW equipment for provision of multipoint videoconferences. The disadvantage of H.323 technology is its high price, as well as availability of videoconference rooms that are concentrated in selected centres and institutions. The videoconference system „Access Grid“ in JANET network is secured and functions in similar way in Great Britain [3] which, unlike NIIF uses commercial software technology InSors [4]. „Access Grid“ provides and supports gateway to technologies H.323 and VRVS (Virtual Rooms Videoconferencing System [5]).

This service is managed centrally from one point (UKERNA). In both cases compatibility and interoperability is secured based on use and support of one technology. In other research networks, such as CESNET, FUNET, RENATER [6] not one concrete technology is preferred. The network users receive the list of accessible and recommended videoconference technologies such as VRVS, MBone, MS-Netmeeting, Gnomemeeting, and many commercial systems such as CU-SeeMee, ClickToMeet, H.323 (Polycom, Tandberg, Codian) etc. The technical support is provided on the level of suppliers/operators of these technologies and/or systems.

#### Development of videoconference activities in Slovakia

The most used videoconference technology used by the Slovak academic community is the product of the California Institute of Technology (Caltech) VRVS (Virtual Rooms Videoconferencing System [7]) and EVO (Enabling Virtual

Organization [8]). Since 2003 also a team of IT experts participate in the development of both systems in the Laboratory of Technology Transfer at P.J.Šafárik University in Košice. Good quality internet and minimum videoconference set (web camera, earphones and microphone) are necessary for connection in the system. VRVS and EVO work under the operational systems Microsoft Windows, Linux and OS Mac. Connection in the network of world internet is optimized, the connection breakdowns are automatically restored, the system provides multipoint connection of clients, there is no upper limit on number of participants. VRVS and EVO support connection also with H.323 and SIP clients and have gateway to Access Grid.

#### Videoconference infrastructure on SANET network

- VRVS reflectors ( Ministry of Education of the Slovak Republic, UPJŠ Košice, TU in Zvolen, STU in Bratislava)
- EVO reflectors (Ministry of Education of the Slovak Republic, UPJŠ Košice, University of Žilina, STU in Bratislava)
- VRVS recording servers ( TU in Košice, University of Žilina)
- Archive server ( UPJŠ in Košice)

Infrastructure provides videoconference gateway based on the old product VRVS and automatic recording of the activities implemented through VRVS, videoconference gateway based on the new product EVO, automated recording playback and processing from the archive server based in the elements of immersed virtual reality. Since April 2004 some 613 videoconference activities (total 1947 broadcasting time) were implemented. Archive portal of WEBuniversity [9], contains more than 480 multimedia recordings. Until may 2006 some 1600 participants from Slovakia were registered in VRVS which means sixth position in the World as far as the absolute number of registered VRVS clients are concerned. The most significant international activities related to use of VRVS and EVO with videoconference service provided by our experts were Physics Masterclasses [10] in which 70 European universities participating (out of it 8 from Slovakia). The videoconference activities in the academic sphere in Slovakia are implemented by Virtual Collaboration, a team of more than 120 teachers and scientists of all public universities and some institutes of the Slovak Academy of Sciences (SAV).

## **2. VIDEOCONFERENCE SYSTEM EVO**

Videoconference system EVO is the product of the California Institute of Technology. The development of this system was shared also the IT experts from the Technology Transfer Laboratory of the P.J.Šafárik University in Košice. The Caltech team localized in Pasadena, USA and CERN, Switzerland, are in charge of the development of the core of the EVO system consisting of the communication network

of PANDA servers and the main client KOALA. Caltech manage the full EVO development activities across the all international EVO teams.

The Košice team is responsible for the development of the user software applications and plug-ins used by Koala in contacts with user. It includes the video application ViEVO, EVO transcoder, shared monitor space, Whiteboard, voting module described more closely in the text.

#### Network of PANDA servers

The core of the EVO system consists of the network of servers called PANDA (Fig. 1.) and the client application called Koala. The role of the network of PANDA servers is to assure effective and safe data distribution (video, audio, files, text, ...) among the users. The Panda servers assume the role of the reflectors known from the VRVS system in that they bring in new functions that are based primarily on monitoring of the whole system in the real time by the monitoring system MonALISA[11].

In comparison with VRVS reflectors the network of servers PANDA brings in these new functions and services:

- Data encryption during the data transfer between PANDA - PANDA and PANDA - KOALA.
- Continuous monitoring of the network quality (packet loss, jitter, ...) and connections between Pandas. In case of need the automatic change in the network topology will be made.
- Automatic redirection of the data flow while preserving the most effective data transfer.
- Automatic transmission of messages if the above-limit parameter values are established.

Automatic update to the new version without any impact on the operation of the whole system.

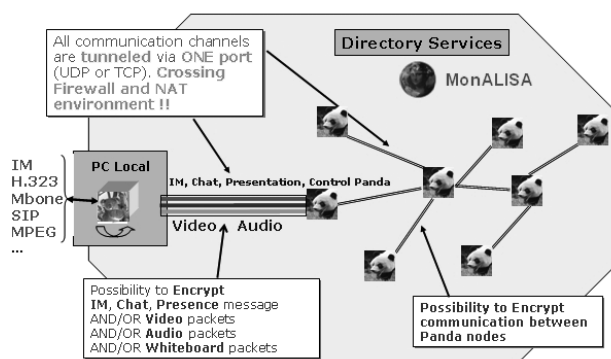


Fig. 1. Network of PANDA servers

#### Client application Koala

System EVO interface is based on the KOALA application which is initiated always upon registration in the system (Fig. 2.). The application is clearly divided in three topics: Meeting Areas, Contact Environment and Community Environment and Chat. The meeting area provides information on communities you are registered in and about



the meetings which are taking place in these communities. Several options are offered to you upon joining the meeting:

- Start of the private chat with the respective participant, sending a file to this participant, addition of this participant in the EVO contacts, start of a private conversation in the meeting (nobody else will hear your private conversation, but you will still be able to follow the meeting and hear everybody in the meeting).
- The participant who reserved the respective meeting will automatically be the moderator of the meeting who will be able to implement some additional activities e.g. deny the audio and video transmission to any meeting participant, exclude any participant from the meeting and to add any participant as a moderator of the meeting.
- Switching on and/or off of the video signal transmission from the camera and video display.
- Switching on and/or off the mike and incoming sound, while incoming and outgoing audio signals are still indicated by the sound indicators.
- Leaving the meeting and going back in the list of the current ongoing meetings in the relevant community.



Fig. 2. Client application Koala

The second part of the Koala application is the Contact Environment where you can get information on the statute of the other users (accessible, absent, etc.) The contacts are divided into two parts “My EVO contacts” (the list of participants created by the user itself) and “My EVO Communities” (the list of all participants connected to the respective community).

The third part is the Chat that displays the chats of individual communities, the chat meeting you are logged in and the private chat (if you have any with a particular participant).

All applications used by EVO system may be initiated from Koala. At the same time Koala offers the information about our computer and on Panda we are connected to.

### 3. USERS APPLICATIONS OF THE EVO SYSTEM

#### Video application ViEVO - users display modes based on the graphic library OpenGL

The first official issue of the EVO system (June 2007) contained the first production version of the video application ViEVO[12], that fully used the graphic library OpenGL for the display. This solution brought more effective display and arrangement of the decoded video signals on the display (PC monitor, projection screen) (Fig. 3.). Use of OpenGL enabled solution of some demanding calculations related to the display directly with graphic hardware thus releasing the CPU means of the computer. In this way continuous change in the size of the displayed video is possible with parallel application of the picture filtration for improvement of its subjective quality. OpenGL library serves primarily for work with 3D graphics enabling attractive graphic simulation of real 3D scenes (arrangement of several monitors, simulation of the participants sitting around the table), as well as more effective use of the display screen while information value of individual video signals is preserved. This first production version of OpenGL ViEVO application contains new solution of video sources arrangement on the basis of their concentration in one common application window controlled by OpenGL. Also basic automatic display modes were implemented– „Selected video sources“, „Speaker“ and „Presentation mode“. The role of these modes is to display automatically and to arrange size and position of selected video sources in the display window depending on priorities and features of the selected display mode. These display modes are for general use for a wide spectrum of possible videoconference scenarios. It is obvious that there are many combinations for arrangement of video sources depending on their priorities (education, recording broadcasting, live transmission of experiments, etc.). One of the future objectives should be the acquisition of ideas and requirements of users from various communities and tailoring development of “specific” modes of display. Obviously this is the feature of the system that would be possible and also necessary to modify and complement continuously.

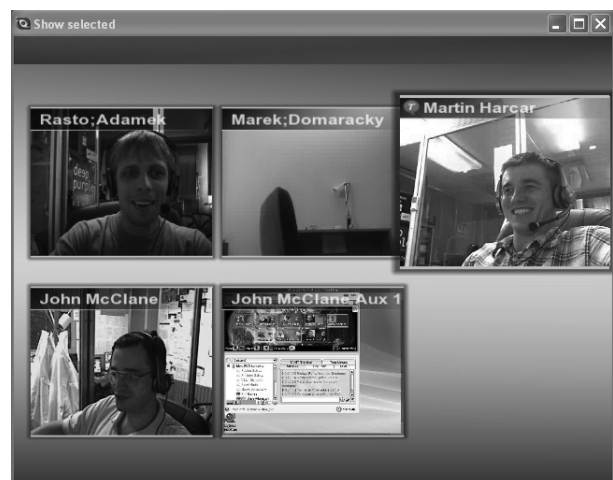


Fig. 3. ViEVO

#### Implementation of the standard videocodec H.264

Currently two standard videocodecs H.261 and H.263 are implemented in the video application ViEVO. H.261 is the basic standard video codec that is supported by all commercial systems so far. Its main disadvantage is the limitation of the maximum definition of the input video signal to CIF (352x288). This disadvantage was remedied in its next version designated as H.263. Moreover the options of more effective use of algorithms of movement estimation and compensation were added, including the entropic coding thus contributing to higher compression as compared with H.261. Video codec H.263 is currently used in the EVO system to share the working screen with high definition 1024x768. As compared with H.263 the standard video codec H.264 provides even better compression of video signals with high definition (HD) and is widely applied in mobile video communication. Its implementation in the EVO system will guarantee effective coding of video signals with HD definition and, on the top of that, will offer an option of connection to mobile networks.

#### Videoconference EVO client for mobile facilities

The predecessor of EVO system was VRVS system that contained the end application (of the client) for the Pocket PC platform developed in 2004/2005. The basic features of this application were:

- standard video codec H.261 support with the option to send static pictures
- audiocodec G.711 ( $\mu$ -law) support
- network solution with network address translation (NAT Network Address Translation)
- full integration in the VRVS system – i.e. the option to sign in any virtual videoconference room and, depending on the performance of the facility, to communicate fully with all participants in the meeting (multipoint videoconference)
- in case of demanding audio and video calculations the library function of IPP (Intel Performance Primitives) optimised for the given type of mobile equipment processor may be used.

In order to meet certain system development priorities the first production version of the EVO system was edited and currently there is a space for development of the EVO client for mobile equipment utilising the experience gained during development of similar application for VRVS. Since in the meantime the calculation and graphic performance of mobile facilities was increased it is possible to consider implementation of more demanding audio and video calculation codecs as well as graphically more attractive user interface.

#### Video-transcoder

Video-transcoder is a console application without a graphic interface. Its task is to transcode video signals (H.261 and H.263) directed to final user on the basis of adjustment of their parameters. The output of video-transcoder is one video signal that can consist of several (4) video signals for detection and identification of the current speaker. In EVO

system the video-transcoder is currently used for transcoding/mixing of four video signals for H.323 clients who may, in the given time, accept only one transcoded video signal. The next objective is the implementation of the video-transcoder in that several input video signals will be transcoded to one with fixed output bit speed, scanning frequency and quality that enables acceptance of video signals at EVO meetings also by users who have narrowband internet connection.

#### Whiteboard

EVOWb is a shared whiteboard client in EVO Collaboration system. EVOWb allows two or more remote participants to collaborate in real time by drawing on a shared whiteboard surface, like there were in one room drawing on a classic whiteboard. In addition to that EVOWb brings possibilities, that are not reachable with classic whiteboard (Fig. 4.).

With the EVOWb, you can:

- Create graphic information by drawing several objects with different color.
- Write text, paste text and import text from a file.
- Import images from a file, from a clipboard, capture and import your screen.
- Move and copy objects with the mouse.
- Use several pages to display content.
- Save (export to a file) the EVOWb contents for future reference.
- Load (import) saved EVOWb pages, so you can prepare everything you want to discuss about before the meeting, then simply import it during a meeting.

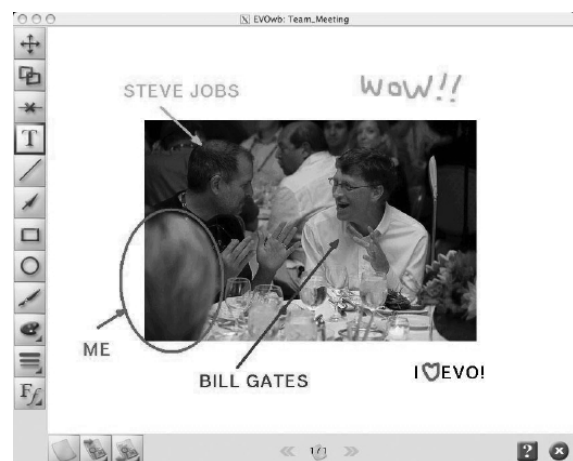


Fig. 4. Whiteboard client EVOWb

#### Local video-recorder

Local video-recorder is a part of the Koala application and as its name indicates it serves for disk recording of the ongoing meeting and the later replay of the recorded meeting (Fig. 5.) The name has to be entered upon recording and the file selected for saving of the recording. The recording options are start, stop, suspend or entry of a sign that we can go to immediately during the replay. For

the replay you have to select the file containing the recording of the meeting that you wish to replay. After that you make selection – local replaying (you alone will see it), or the replay for the meeting. Another option is to go straight to the following or previous sign in the recording (only if recording contains any sign/signs). You can move within the recording using the shifting bar. Video-recorder offers the option of what is to be recorded or replayed. You can select from several options: audio, video, whiteboard, chat or the present users. The combination or the number of selected options depends on the user only.



Fig. 5. Local video-recorder

#### Screen sharing

This application serves for screen sharing and consists of red transparent window that indicates the shared screen surface. The video codec H.263 transmits the screen in the form of the video as it supports big resolution as compared with H.261. The screen is scanned first and then re-coded in the necessary image using video codec. Since the transmission of the screen does not require big image frequency the whole screen can be transmitted with slow internet, too. Only standard video sizes may be transmitted and, therefore, the screen sharing is restricted to three sizes: CIF (352x288), FOURCIF (704x576) a XGA (1024x768) (Fig. 6.).



Fig. 6. Share Part of your Desktop (FOURCIF)

The meeting participants may receive the video from the screen in these sizes only. We say that we share only a “part of the screen”. Of course, nowadays also higher resolutions of the monitor are possible such as XGA, and, therefore the FULL SCREEN mode was developed that scans the screen and using the library functions IPP (Intel Performance Primitives) changes its resolution to the size specified by ourselves and converts it to the final image using video codec. As in case of transmission of an ordinary video we may set the “Bandwidth”, “Image frequency” and the “Quality”. Other function of this application is setting a concrete monitor for sharing (if more than one monitor is attached to the computer). In case of Windows this option supports maximum 10 monitors, with OS Mac maximum 5 monitors are supported and only one monitor is supported by Linux.

#### Voting system

The voting system serves for asking questions all participants in the meeting. It can be used e.g. for distant learning. Online students will be sent test question, answer them and send them back for processing. Further use includes elections or surveys. The questionnaires with several questions and the optional answers can be prepared in advance and saved on the disk. During the meeting (lecture) the questionnaire can be opened and sent out (as a whole or in parts) to other participants in the meeting (lecture). After all answers are prepared and statistically processed the voting for the given issue may take place and the results made public. Secret ballot at each question is also possible.

#### EVO – telephone gateway

The objective is to provide telephone connection to EVO meeting which is under way to those users who are currently not on the internet but wish to take part in the EVO meeting. EVO telephone gateway is POTS/IP equipment that can be installed in the local telephone network (PSTN, VoIP) of any institute or organization and after configuration with the server ASTERIKS the connection of telephone equipment to any EVO meeting is possible.

## 4. PLANNED EVO DEVELOPMENT

In the future further development and improvements of the EVO system are expected. Of course the increased number of servers is also expected depending upon the growth of number of users of this system. In the near future the expert team from Košice should complete the implementation of the OpenGL in the ViEVO, the development of the local video recorder, development of the voting module (for expression of opinions) and creation of the telephone gateway for the EVO system. In the next two years the development of the video conference client for mobile equipment, development of the video-transcoder for wider use and the implementation of the standard video codec H.264 should follow. At the same time the user display modes for ViEVO depending on the need of the users will be developed.

## 5. REFERENCES

- [1] <http://www.terena.org/activities/tf-vvc/F/vc-services-jan2006.html> ... contacts in TERENA
- [2] <http://www.niif.hu/en/vidkonf> videoconference services provider in Hungary ...
- [3] <http://www.ja.net/services/network-services/video/index.html> ... service in Great Britain
- [4] <http://www.insors.com/about/index.htm> ... product information in SORS ...
- [5] <http://www.vrvs.org/Documentation/> ... VRVS documentation in English language ...  
<http://vk.upjs.sk/stranky/technology/videostream/VRVS.pdf> ... in the Slovak language...
- [6] <http://www.cesnet.cz/videokonference> ... in the Czech Republic  
<http://www.csc.fi/english/funet/videotechnology/videoconferencing> ... in Finland  
<http://www.renater.fr/spip.php?rubrique156&lang=en> ... in France
- [7] <http://www.vrvs.org/> ... entry in the VRVS system
- [8] <http://evo.caltech.edu/> ... entry in the EVO system
- [9] <http://vk.upjs.sk> ... virtual services portal of the academic Slovakia  
<http://webuniversity.science.upjs.sk/> ... archive portal
- [10] <http://www.physicsmasterclasses.org/mc.htm> ... Masterclasses...
- [11] Harvey B. Newman, I. C. Legrand, Philippe Galvez, R. Voicu, C. Cirstoiu: Monalisa: A Distributed Monitoring Service Architecture, Computing in High Energy Physics, La Jolla, USA, March 2003, CHEP03
- [12] <http://events.internet2.edu/2005/spring-mm/sessionDetails.cfm?session=1938&event=229>

## THE AUTHORS



**Philippe Galvez** has worked for the California Institute of Technology since April 1995. Philippe is the project manager and chief architect of the VRVS/EVO systems. He manages the entire VRVS/EVO research teams. He is continuously investigating and proposing new research collaborations with other groups in the US and internationally. Philippe is responsible for all major elements of the current and future architectural design as well as many of the policy decisions affecting the VRVS/EVO service offered to the research and education community. He is member of the Internet2 Real-time Communication Advisory Group. You can contact him at [galvez@caltech.edu](mailto:galvez@caltech.edu).



**Rastislav Adamek** is PhD. student and software developer at the Technology Transfer Laboratory at the Faculty of Science of P.J.Šafárik University in Košice. His focus is on development of applications Shared Part of your Desktop. You can contact him at [adamek@vk.upjs.sk](mailto:adamek@vk.upjs.sk).



**Pavel Farkaš** is a scientist and the VRVS/EVO team leader at the Technology Transfer Laboratory, Faculty of Science of P.J.Šafárik University in Košice. His work involves development of video application ViEVO and the user imaging modes based on the graphic library OpenGL. You can contact him at [Pavel.Farkas@vrvs.org](mailto:Pavel.Farkas@vrvs.org).



**Martin Harčár** is a software developer at the Technology Transfer Laboratory at the Faculty of Science of P.J.Šafárik University in Košice. His focus is on development of applications Shared Part of your Desktop. You can contact him at [harcar@vk.upjs.sk](mailto:harcar@vk.upjs.sk).



**Viktor Michalčín** is a scientist at the Technology Transfer Laboratory at the Faculty of Science of P.J.Šafárik University in Košice. His focus is on development on the Video-transcoder application and also he is cooperating on the development of the video application ViEVO. You can contact him at [michalcin@vk.upjs.sk](mailto:michalcin@vk.upjs.sk).



**Pavel Murín** is a scientist oriented on high energy physics, the Head of the Technology Transfer Laboratory at the Faculty of Science of P.J.Šafárik University in Košice. He is the founder of the Virtual Collaboration (1999). Since 2000 he is the chief investigator of all projects which are oriented on VRVS and EVO implementation in the environment of the Slovak academic community. He is a member of the European Particle Physics Outreach Group and is responsible to make sure that Slovakia benefits to the maximum possible extent from the transfer of technologies and know-how of the world research centers of high energy physics. You can contact him at [murin@vk.upjs.sk](mailto:murin@vk.upjs.sk).



**Michal Paulíny** is a researcher worker at the Technology Transfer Laboratory at the Faculty of Science of P.J.Šafárik University in Košice. He works on the development of the whiteboard application EVOwb and also cooperated on the development of the Local Video-recorder application, on the voice system application and on EVO-Telephone Gateway application. You can contact him at [pauliny@vk.upjs.sk](mailto:pauliny@vk.upjs.sk).

# LEARNERS' SUPPORT IN INTELLIGENT TUTORING SYSTEMS



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

Alla Anohina

Riga Technical university, Kalku street 1, Riga, Latvia, LV1658

Tel.: (+371) 7089529, fax: (+371) 7089584, e-mail: alla.anohina@cs.rtu.lv

**Abstract.** The paper describes the approach which improves learners' support in the mode of practical problems solving within intelligent tutoring systems. The approach has been developed on the basis of identification of drawbacks of existing systems. It provides two modes of problem-solving and uses a two-layer model of hints. The kinds of feedback within each problem-solving mode are specified. The algorithms of usage of the model of hints are given. In accordance with the proposed approach the learner solves problems in the mode which is the most appropriate for him/her and receives the most suitable hint. Implementation details of the offered approach in the intelligent tutoring system for the Minimax algorithm are described.

**Keywords:** Intelligent tutoring, problem-solving modes, feedback.

## 1. INTRODUCTION

Nowadays different information and communication technologies provide new opportunities for people to learn by choosing individual learning time, place, amount and pace. Technologies which are integrated into the learning process partially or completely take over a role of the human-teacher. To carry out this role effectively it is important that technology has similar intelligent and adaptive abilities with the human-teacher. In this context it is necessary to note that research is conducted in the field of intelligent tutoring systems for more than three decades. In [1, 2] systems of such kind are characterized as adaptive and intelligent computer-based systems which are based on the theory of learning and cognition, emulate a human teacher and try to provide benefits of one-on-one tutoring. Furthermore, intelligent tutoring systems store three basic kinds of knowledge [3, 4]: domain knowledge, pedagogical knowledge, and knowledge about learners. The types of knowledge determine three main parts of the general system's architecture: the expert module, the pedagogical module, and the student diagnosis module.

Thus, intelligent tutoring systems being based on stored knowledge provide adaptation of the learning process to a particular learner. The analysis of available information sources and developed systems allows to identify several the most widespread basic kinds of adaptation in these systems. Adaptive curriculum sequencing provides the most suitable individually planned sequence of knowledge units and tasks for a current learning session [5]. Adaptive presentation generates the most suitable learning units for a learner from the point of view of their content, detail levels and a kind of presentation and includes adaptive multimedia presentation, adaptive text presentation and adaptation of modality [6]. Adaptive problem solving support is related with adaptive feedback and help when a learner solves practical problems.

Despite of the prevalence of the described kinds of adaptation and thirty-year history in the development of

intelligent tutoring systems adaptive abilities of these systems still are not high enough, particularly regarding modes of practical problems solving and support of a learner in this process. In addition to the analysis given in [1] the following conclusions are made:

- Typically the system gives a learner an immediate feedback after each performed action during problem-solving. In this case research idiosyncrasy of particular learners when learners would like to perform a series of steps, to receive feedback about their correctness and to find what step has led to the incorrect solution is ignored.
- Hints are organized in a range from the most general to the most specific and are given sequentially. Often it demands from a learner to pass through a chain of informativeless hints before he/she receives a hint that is appropriate to his/her knowledge level. It can cause dissatisfaction with the learning process and desire to request subsequent hints without attempts to solve a problem by him/herself.
- Absolutely different situation can be observed in intelligent tutoring systems which simulate natural language dialogue between the system and the learner. In these systems hints are given accordingly to the content of a learner's text-based answer. However, the structure and functional mechanisms of natural language dialogue systems are more complex, because it is necessary to implement not only constituent parts of the general architecture of intelligent tutoring systems, but also some modules for natural language processing.

Thus, it would be usefully to provide two modes of practical problems solving in order to support different learners: a mode in which feedback is given after each performed action, and a mode in which feedback is shown after a series of performed steps. Moreover, mechanisms, which will allow to implement system's individual reactions

for each learner giving such amount of information which will help and at the same time will provide certain cognitive load are necessary.

The paper concentrates on the developed approach which provides greater adaptive abilities of intelligent tutoring systems supporting two modes of problem-solving and using a two-layer model of hints. Thus, the learner solves problems in the mode which is the most appropriate for him/her and receives the most suitable hint. The aforementioned approach is implemented in the intelligent tutoring system for the Minimax algorithm. The initial ideas of the approach are described in [1, 2]. This paper fully states the main conceptions.

The remainder of the paper is organized as follows. Section 2 describes the developed approach in details. Section 3 outlines implementation aspects of the approach in the intelligent tutoring system for the Minimax algorithm. Finally, conclusions are presented, and some directions for future work are specified.

## 2. THE MAIN CONCEPTIONS OF THE APPROACH

Generally, there are two possibilities regarding moments of feedback delivering [1, 2]: immediate feedback after each step or action in problem-solving and feedback after submission of a whole solution of the problem. It is a basis for two modes of problem-solving in the proposed approach. In the *completeness mode* a learner chooses the moments of feedback presentation to check correctness of a series of steps. So, he/she can perform one or more steps solving a problem and then to require checking of the performed steps. The system provides feedback about correctness of his/her previous actions and the learner by him/herself should determine what step has led to the incorrect solution. This mode is similar to reinforcement learning [7] which is widely used in artificial intelligence. In the *step-by-step mode* the system monitors each problem-solving step and gives feedback about its correctness. It is necessary to stress, that the described problem-solving modes can be implemented only if the process of finding a problem solution consists of several steps. Granularity and meaning of a step depend on specificity of a task in a problem domain.

Both modes are further subdivided on the basis of a kind of information given to a learner. There are four variations of the step-by-step mode [1, 2]:

- The learner receives both positive and negative feedback solving a problem. In the case when the learner has performed the correct action he/she is rewarded (receives a positive feedback). If the step was incorrect, criticism (negative feedback) is given to the learner. Moreover, negative feedback can be given in two different forms: only as a text which informs that the action was incorrect, and as a text about the

incorrect step together with a hint about how to improve his/her performance.

- The learner receives only negative feedback. The system does nothing if the learner performs a correct step. In the case of an incorrect action negative feedback also can be given in two different ways described above.

In the completeness mode the learner is not rewarded or criticized for each performed step. Instead of it he/she receives a total estimation of all performed actions. The estimation specifies how far the learner is from his/her goal: the correct solution of a problem. Thus, there are two variations of the completeness mode [1]:

- The learner receives only a total estimation of the performed steps.
- The learner receives a total estimation of the performed steps together with a hint about how to improve his/her performance.

It is obvious, that it is necessary to provide an opportunity to a learner to change the problem-solving mode and a kind of feedback by him/herself, as well as to request a hint in case when he/she receives only a text of negative feedback or a total estimation of the performed steps. Moreover before the learner will start to solve practical problems it is necessary to determine a problem-solving mode and a kind of feedback suitable for him/her. In the simplest case the learner can be suggested to make a choice by him/herself based on the received explanations of the problem-solving modes and the kinds of feedback. In more sophisticated case it is necessary to develop a series of tasks or questions, which analysis will allow to determine the most suitable mode and feedback. Thus, scheme of the problem-solving modes and kinds of feedback is displayed in Figure 1.

In order to support adaptive delivery of hints in both mentioned problem-solving modes a two-layer model of hints has been developed. It consists of a layer of the general hint categories and a layer of hints within these categories. There are three general hint categories:

- Specific hints directly say or show, what should be done, or refer to the step earlier performed by a learner from which it is possible to conclude where a mistake is and how it can be corrected.
- Hints of average informativeness indirectly specify an erroneous action and opportunities to correct it, for example, offering a definition of a concept underlying a mistake.
- General hints are based on information which in an abstract form specifies an erroneous action and high level knowledge are necessary in order to find a place of a mistake and to determine ways of correction.

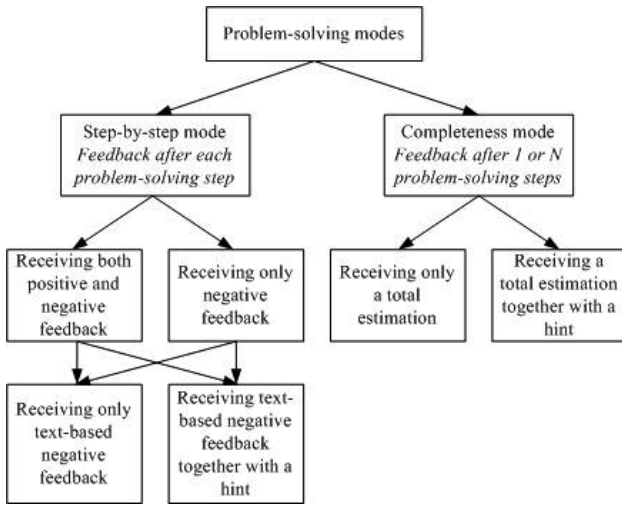


Fig. 1. The problem-solving modes and kinds of feedback for an intelligent tutoring system

Each category contains one or more hints which also are ranged from less informative to more informative.

The offered two-layer model of hints can be described using the set theory. Let  $H$  is a set of all hints for a mistake of a certain type. The set contains from  $1$  up to  $t$  hints:

$$H = \{H_1, H_2, \dots, H_t\}.$$

$C_h$  is a set of the hint categories:

$$C_h = \{C_g, C_{ai}, C_s\},$$

where  $C_g$  is the category of general hints:

$$C_g = \{H_1, H_2, \dots, H_k\},$$

$C_{ai}$  is the category of hints of average informativeness:

$$C_{ai} = \{H_{k+1}, H_{k+2}, \dots, H_p\},$$

and  $C_s$  is the category of specific hints:

$$C_s = \{H_{p+1}, H_{p+2}, \dots, H_t\}.$$

In this case hints in the particular categories are subsets of the set  $H$ :

$$C_g \subset H,$$

$$C_{ai} \subset H,$$

$$C_s \subset H,$$

$$C_g \cap C_{ai} \cap C_s = \emptyset.$$

The model of hints is presented in Figure 2.

The model allows a learner to receive a hint that is the most suitable for him/her. Before a learner starts to solve practical problems testing should be taken with the purpose to determine a general hint category which is suitable for the learner. It is important to note, that the model of hints is based on the assumption, that one or several concepts typically underlie any practical task. A mistake performed by a learner is related to weak knowledge of one of these concepts. It demands to determine a learner's knowledge level of each concept. In the simplest case for usage of the model it is enough to define a knowledge level using three values: low, average and high. The following procedure has been developed for usage of the model in intelligent tutoring systems. If the learner has made a mistake of a certain type for the first time and a knowledge level of a concept underlying the mistake is known then:

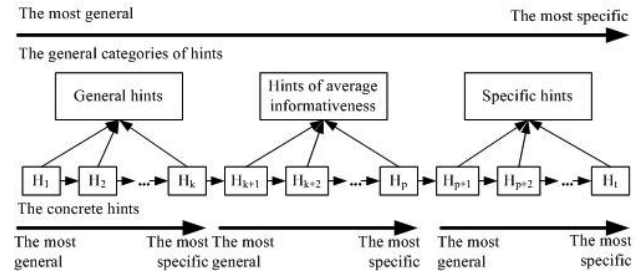


Fig. 2. The two-layer model of hints

- If a value of the knowledge level is low then a category of hints suitable for the learner for this kind of mistakes is the category of specific hints.
- If a value of the knowledge level is average then a category of hints suitable for the learner for this kind of mistakes is the category of hints of average informativeness.
- If a value of the knowledge level is high then a category of hints suitable for the learner for this kind of mistakes is the category of general hints.

Requesting help during problem solving the learner receives an average by number hint from the hint category suitable for him/her. If after receiving a hint the learner is not capable to perform a correct action, repeatedly committing the same mistake, he/she is presented with a subsequent by number hint. The process proceeds while he/she will not reach the last hint for the mistake of a certain kind. Such approach spares the learner from being presented with informativeless hints. Contrary, the learner timely receives a hint providing help and certain cognitive load, therefore, reducing an opportunity of frustration, floundering and loss of interest to learning. The algorithm for delivery of hints is displayed in Figure 3.

Taking in account the fact that several mistakes can characterize the same task, for each of them it is necessary to implement the two-layer model of hints. In case when the learner has reached the last (most specific) hint for a mistake of any type, the system should perform remedial pedagogical actions, for example, to offer the same task with other initial data or to display teaching material which corresponds to the task.

There is a difference between usage of the model of hints in the completeness and in the step-by-step problem-solving modes. In the step-by-step mode the model is applied after each incorrectly performed step or when a learner has requested a hint. In the completeness mode a hint can be given after performance of several steps. The performed steps can be both correct, and incorrect. Moreover incorrectly performed steps can correspond to several mistakes of different types. Therefore before usage of the model of hints it is necessary to identify a type of a mistake, the hint on which will be given to the learner. First of all it is necessary to calculate a number of mistakes of each type. Further it is necessary to choose a type of a mistake which

has the greatest number of incorrectly performed steps, and to give out a hint according to the algorithm described above. In case when several types of mistakes have identical numbers a priority mistake should be chosen. The algorithm of determination of a type of a mistake is displayed in Figure 4.

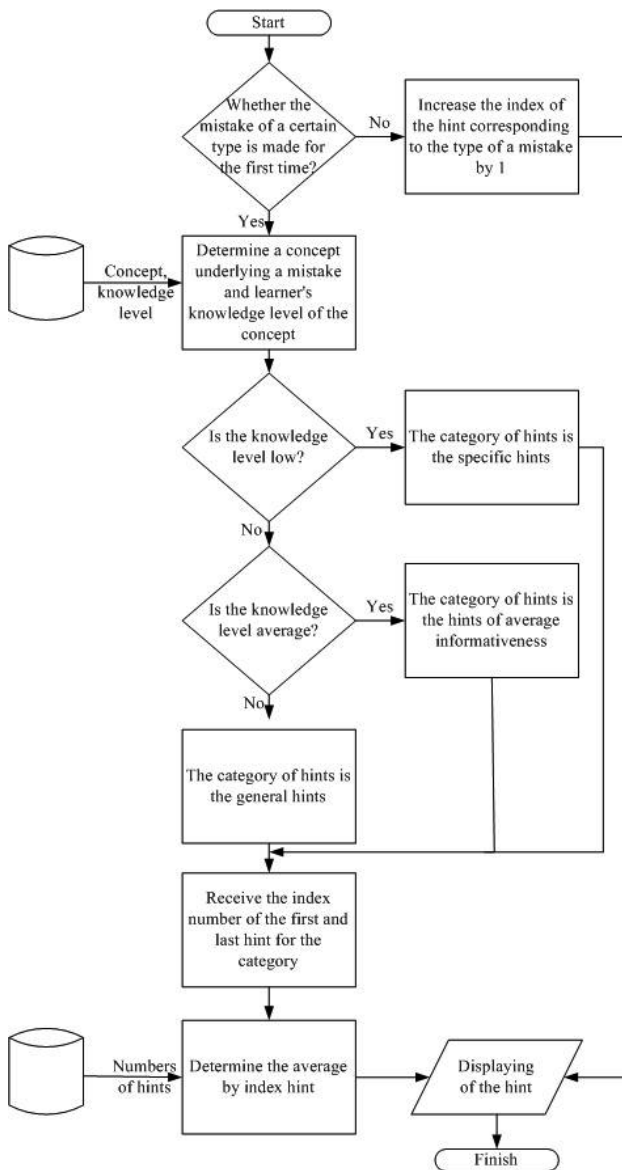


Fig. 3. The algorithm for hints delivery

Thus, the two-layer model of hints demands to store the following information in intelligent tutoring systems: types of mistakes, identification of the task in which the certain mistake is valid, concept underlying a certain type of a mistake, ordinal numbers of the first and the last hint for the general category of hints, ordinal numbers of the first and the last hint for the category of hints of average informativeness, ordinal numbers of the first and the last hint for the category of specific hints, priorities of mistakes within particular tasks and texts of hints.

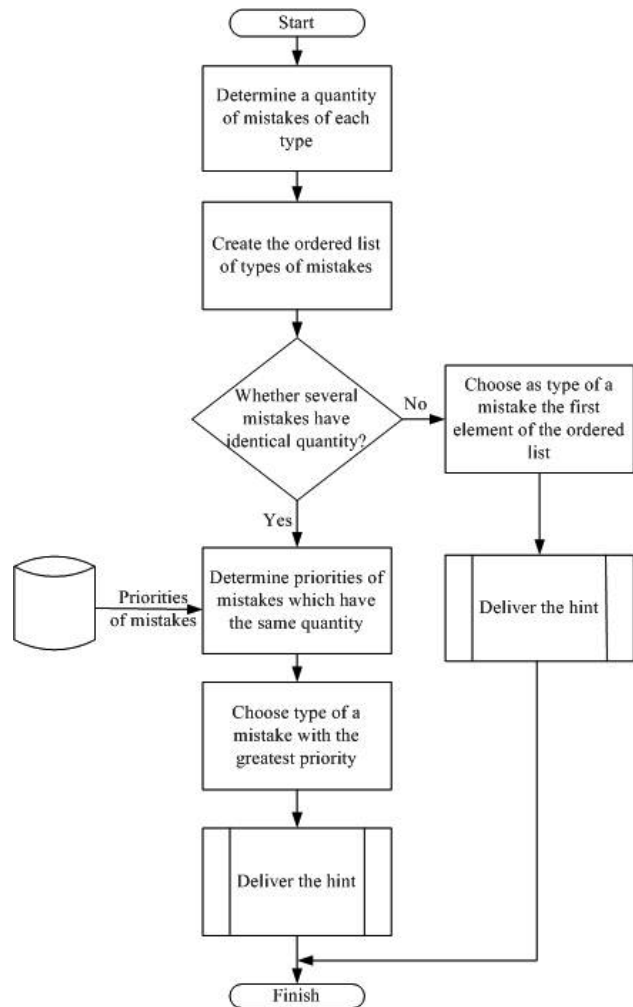


Fig.4. The algorithm for determination of a mistake type

### 3. IMPLEMENTATION DETAILS OF THE APPROACH

The concepts described in Section 2 are implemented in an intelligent tutoring system "MINIMA" which helps to learn the topic "Using heuristics in two-person games" within the learning course "Fundamentals of artificial intelligence" for third year students of bachelor programs at the Faculty of Computer Science and Information Technology of Riga Technical University. The topic is related with the algorithm for implementing two-person games with full information, i.e., the Minimax algorithm [8] (its example is given in [9]). The developed system is an intelligent tutoring system of full functionality which provides knowledge preassessment before the beginning of learning, the mode of theoretical knowledge acquiring, the practical problems solving mode and final assessment of a knowledge level after finishing of learning. Due to the scope of the paper the attention is given only to the practical problems solving mode.

The practical problems solving mode consists from three blocks of tasks: refining of a game tree, propagation of heuristic values and determining of winning paths. The



tasks allow to master the basic skills concerning application of the Minimax algorithm. All tasks consist of a sequence of steps. In the task of game tree refining a step means the removing of one arc from a graph representing a state space of a game. Obtaining a heuristic value for one node of a game tree is a step in the task of propagation of heuristic values. In the task of determining of winning paths adding of one sector to a current path is one step. It allows to provide two modes of practical problems solving (Section 2) in the system.

Before the learner will start to solve practical problems he/she is offered with several questions which allow to identify a learner's knowledge level of each concept underlying the tasks. For each concept there are three questions with different degree of difficulty: simple, average and difficult. The questions are multiple choice questions. Each constituent part of an answer has a definite number of points. The questions have their weights corresponding to the level of difficulty. So, for each concept the learner receives the following score:

$$S_q = \sum_{i=1}^3 q_{wi} * p_i, \quad (1)$$

where  $S_q$ - a total score for a particular concept,  
 $q_{wi}$ - the weight of  $i$ -th question,  
 $p_i$ - learner's received points.

The knowledge level of a particular concept is determined in the following way:

- if  $S_q$  in  $[0...4]$  then the knowledge level is low;
- if  $S_q$  in  $[4...8]$  then the knowledge level is average;
- if  $S_q$  in  $[8...10]$  then the knowledge level is high.

After that the system explains to the learner the problem-solving modes and the kinds of feedback and then offers to make his/her choices without any assistance. However there are three opportunities when the learner can change the mode of practical problems solving and the kind of received feedback:

- If the learner has stopped the previous tutoring episode solving practical problems then before beginning a new tutoring session a report window about tasks performed earlier is shown. In this window the learner can change both the practical problems solving mode and the feedback.
- During the solving of any practical problem the learner can change the kind of feedback within the framework of the mode in which he/she is currently working.
- After completion of the current task a result window is shown in which the learner can change both the practical problems solving mode and the feedback.

In the step-by-step mode the system keeps track of each learner's performed step and delivers him/her reward if the learner has performed a correct action and criticism in case of an incorrect step. In the completeness mode the special button is provided in order to check correctness of a series of performed steps. After the analysis of the learner's solution the learner receives feedback in the form of a total estimation which includes: the number of correctly and incorrectly performed steps after the previous check of the solution and the number of correct and incorrect steps after the current check. In both modes if the learner receives feedback which does not provide an automatic delivery of hints there is a button for hint requesting.

In order to provide usage of the two-layer model of hints, the possible types of mistakes and their priorities were defined for each task. Types of mistakes were determined on the basis of the analysis of course and examination works of third year students of bachelor programs. The two-layer model of hints is maintained for each type of a mistake. Delivery of hints during practical problems solving is carried out on the basis of algorithms described in Section 2.

Any practical task can be completed in two cases: the learner has solved it or the last hint for any type of a mistake has been given. In any case the system checks, which time the learner carries out the given task, whether he/she has made mistakes and has used hints. In the developed system each task can be performed only two times. It is based on the following assumption. If the learner was offered to repeat the task, it means, that he/she has received the last hint for a certain type of a mistake. The last hint includes demonstration of task performance and reading of explanatory material. Thus, after that it will be easy to solve the same task even with other initial data. In the worst case repeated task execution also can be finished with demonstration.

If the learner has completed the task at the first time then the analysis of the solution is the following:

- The learner should perform the task repeatedly in the following cases:
  - If for any type of mistakes the learner's category of hints was specific hints and the learner has made mistakes of the given type, or
  - If for any type of mistakes the learner's category of hints was hints of average informativeness or general hints and the learner has reached the specific category of hints.
- The system gives the learner opportunity to choose between repetition of the same task and execution of the subsequent task in the following cases:
  - If for any type of mistakes the learner's category of hints was the hints of average informativeness and the learner has received more than one hint from this category, or

- If for any type of mistakes the learner's category of hints was general hints and the learner has reached the category of hints of average informativeness.
- The learner passes to the subsequent task in the following cases:
  - If for any type of mistakes the learner's category of hints was the general hints and the category has not been changed, or
  - If for any type of mistakes the learner's category of hints was hints of average informativeness and the learner has received only one hint from this category, or
  - If for any type of mistakes the learner's category of hints was specific hints and the learner has not received hints from this category.

After the made analysis the category of hints is changed for each type of mistakes, reducing a degree of informativeness. Thus the category of the specific hints is replaced by the category of hints of average informativeness and the hints of average informativeness are replaced by the category of general hints.

#### 4. CONCLUSIONS AND FUTURE WORK

The paper describes in details the approach directed to the improvement of adaptive abilities of intelligent tutoring systems in support of a learner in practical problems solving. The approach offers two modes of problem-solving and uses a two-layer model of hints. Therefore, the learner can solve problems in the mode which is the most appropriate for him/her and receive the most suitable hint.

The proposed approach is implemented in the intelligent tutoring system for the Minimax algorithm. At present the system is ready for experimental testing. The main purpose of experimental testing is to check efficiency of the offered approach. After finishing of learning, students will be offered to fill the questionnaire which under the development at the moment.

#### 5. REFERENCES

- [1] Anohina, A.: Advances in Intelligent Tutoring Systems: Problem-solving Modes and Model of Hints. International Journal of Computers, Communication and Control. Vol. II, 2007, No. 1, pp. 48-55
- [2] Anohina, A.: The Problem-solving Modes and a Two-Layer Model of Hints in the Intelligent Tutoring System for Minimax Algorithm. Proceedings of the 1<sup>st</sup> International Conference on Virtual Learning, Bucharest, Romania, October 27-29, 2006, pp. 105-112
- [3] Capuano, N., De Santo, M., Marsella, M., Molinara, M., Salerno, S.: A Multi-Agent Architecture for Intelligent Tutoring. Proceedings of the International Conference on Advances in Infrastructure for Electronic Business, Science, and Education on the Internet SSGRR 2000, L'Aquila, 2000
- [4] Frasson, C., Mengelle, T., Aimeur, E.: Using Pedagogical Agents in a Multi-Strategic Intelligent Tutoring System. Proceedings of the 8<sup>th</sup> World Conference on Artificial Intelligence in Education AI-ED97, Workshop V: Pedagogical Agents, Kobe, Japan, 1997, pp. 40-47
- [5] Brusilovsky, P.: Adaptive and Intelligent Technologies for Web-based Education. Künstliche Intelligenz. Vol. 4, 1991, pp.19-25
- [6] Brusilovsky, P.: Adaptive Hypermedia. User Modeling and User Adapted Interaction. Vol. 11, 2001, pp. 87-101
- [7] Russell, S., Norvig, P.: Artificial Intelligence: A Modern Approach. Prentice Hall. 2003.
- [8] Luger, G. F.: Artificial Intelligence: Structures and Strategies for Complex Problem Solving. Addison Wesley. 2001.
- [9] Anohina, A.: Intelligent Tutoring System for Minimax Algorithm. Scientific Proceedings of Riga Technical University, Computer science, 5th series. Vol. 22, 2005, pp. 122-130.

#### THE AUTHOR



**Alla Anohina:** is an assistant at the Department of System Theory and Design of Riga Technical University in Latvia. Her main research fields are intelligent tutoring systems, computer-assisted assessment systems and artificial intelligence. Now she is finishing her Ph.D. thesis related with the development of the intelligent supporting system for adaptive learning and knowledge assessment. She has participated in several research projects related with the development of knowledge assessment software.

# TRIALOGICAL LEARNING – NEW APPROACH TO EDUCATION



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

František Babič, Jozef Wagner

Centre for Information Technology, Technical University of Košice

+421 55 602 42 20, Frantisek.Babic@tuke.sk, Jozef.Wagner@tuke.sk, www.tuke.sk/fei-cit/

**Abstract.** This paper presents a new integrated project KP-Lab, which started in February 2006 and will take five years. 22 partners from 14 different countries participate on this project. KP-Lab will create new theories, technological platform as well as pedagogical and professional methodologies aimed at facilitating innovative practices of sharing, creating and working with knowledge in education and workplaces. It is a very ambitious project in the area of technology-enhanced learning. The project is based on the idea of trialogical learning that refers to the process where learners are collaboratively developing shared objects of activity (such as conceptual artefacts, practices, products) in systematic fashion.

**Keywords:** Collaboration, Emerging technologies, Knowledge, Metadata

## 1. INTRODUCTION

The present project, Knowledge-Practices Laboratory (KP-Lab) aims at facilitating innovative practices of working with knowledge (knowledge practices) in education and workplaces. KP-Lab presents a unifying view of human cognition based on an assumption that learning is not just individual knowledge acquisition or social interaction, but shared efforts of transforming ideas and social practices. This hypothesis is called knowledge-creation perspective and it is fundamental idea of trialogical learning [1].

## 2. TRIALOGICAL LEARNING

Trialogical learning is an innovative idea in the field of education and learning. Trialogical learning [1] refers to the process where learners are collaboratively developing shared objects of activity (such as conceptual artefacts, practices, products) in systematic fashion. It concentrates on the interaction through these common objects (or artefacts) of activity, not just among people or within one's mind (see Fig. 1).

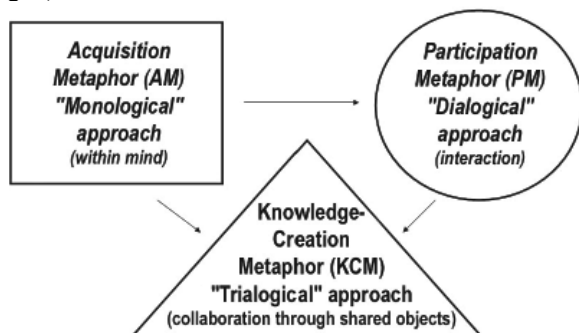


Fig. 1. Three metaphors of learning [1]

We can understand trialogical learning as a generalization of several independent theories and approaches describing the creation of a new knowledge, e.g.:

- Carl Breiter's knowledge building approach which emerged from cognitive studies in the educational context [2];
- Yrjö Engeström's theory of expansive learning based on Activity Theory [3];
- Nonaka and Takeuchi's model of organizational knowledge creation [4].

Activity theory (AT) is a powerful and clarifying descriptive theory focusing on understanding of human activity and work practices. It incorporates notions of intentionality, history, mediation, collaboration and development [5].

AT originated in the former Soviet Union in the 1920's and 1930's as a part of the cultural- historical school of psychology founded by Vygotsky [13]. The theory provides a powerful framework for describing and analyzing collaborative processes. Activity systems are never static but evolve when contradictions emerge between the elements within the activity system

An activity (see Fig. 2) is composed of a subject, and an object, mediated by a tool. A subject is a person or a group engaged in an activity. An object (in the sense of "objective") is held by the subject and motivates the activity, giving it a specific direction. The mediation can occur through the use of many different types of tools, material tools as well as mental tools, including culture, ways of thinking and language. Computers are considered to be special kinds of mediating tools [7].

Transforming the object into an outcome motivates the existence of the activity. An object can be a material thing, less tangible (a plan) or totally intangible (a common idea), as long as it can be shared for manipulation and transformation by the activity participants [6].



Fig. 2. The activity model [5]

The model (Fig. 3) is useful for bringing together a wide range of information about the factors that impact a particular activity. Some of the significant ideas are that:

- In order to achieve our decided outcomes it is necessary to produce certain “objects” which may include such things as knowledge, experiences and actual physical products. Some products may not be physical, e.g., processes or arrangements.
- The human activity is typically mediated by the tools used and artefacts that are considered in relation to the activities, e.g., policy documents, samples, recipes, facilities ...
- The activity is also mediated by the community in which the activity is being carried out. The community may oppose or support the activity; it may facilitate or impede access to resources.
- In addition the community may support or impose rules on the subjects, those persons, groups or organizations that are undertaking the activity or grant them discretion in their activities. There may also be “rules” about the kind of products, knowledge and experiences that can be approved or are acceptable, access to tools and artefacts and who is permitted to do which aspects of the activity...
- To the extent that it is engaged with the community the subject may share responsibility with community for the achievement of the object. This is likely to be realized through some form of division of labour.

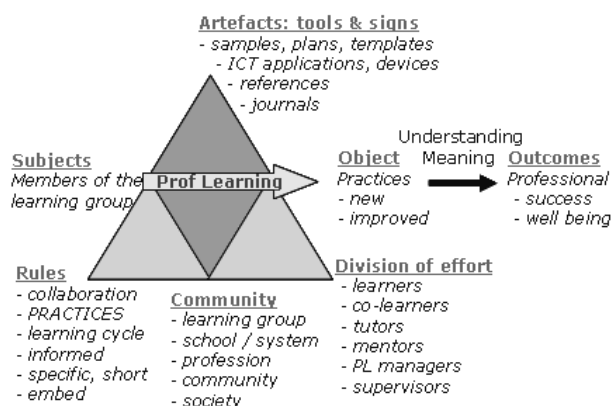


Fig. 3. Professional learning modelled with activity model

### 3. KNOWLEDGE PRACTICES LABORATORY

KP-Lab [8] is an ambitious project that focuses on developing a learning system aimed at facilitating innovative practices of sharing, creating and working with knowledge in education and workplaces.

This integrated Project sponsored European Commission within the "Sixth Framework Programme" will run for 5 years. The first three years will be the R&D phase, while the last two last years will be devoted mainly to finish longitudinal experiments, dissemination activities and exploitation planning.

KP-Lab aims at developing theories, tools, and practical models that enhance deliberate advancement and creation of knowledge as well as transformation of knowledge practices. The essential way of developing the collaborative technologies is a co-evolution process of researchers, technological developers and users.

Therefore, the design principles are the following:

1. Organizing activity around collaborative advancement of knowledge artefacts,
2. "Symmetric knowledge advancement" around authentic problems,
3. Deliberate transformation of knowledge practices,
4. Co-evolution of tools, social practices, and agents.

The multinational consortium integrates expertise from various domains, including pedagogy, psychology and engineering as well as end-users and key representatives from the corporate/business sector to provide authentic environments for research and piloting. The project involves 22 partners from 14 countries, as well as many schools, universities, companies and work places and other prospective end-users.

KP-Lab technology builds on emerging technologies, such as semantic web, real-time multimedia communication, ubiquitous access using wireless devices, and interorganisational computing. There are also non-technological tools as the change laboratory (the idea is to arrange on the shopfloor a room or space in which there is a rich set of instruments for analyzing disturbances and for constructing new models for the work practice).

KP-Lab's interest in methods of co-evolutionary design can be ascribed to theoretical as well as empirical findings and is triggered by the aim to approach knowledge creation processes from an integrative point of view on tools and practices. The main aim of this co-evolutionary design-strategy is to provide a platform for researchers, developers and end users to create a shared understanding of current knowledge practices and to envision, design and evaluate novel applications and methods and thereby contribute to the facilitation of innovative knowledge practices.

The co-evolutionary design cycle (see Fig. 4) is not only relevant from a design but also from a research perspective, as it parallels the process of scientific inquiry whereby the

creation of a shared model can be understood as the formulation of a research hypotheses, which is operationalized during the development and implementation of tools and methods and tested during the field trials.

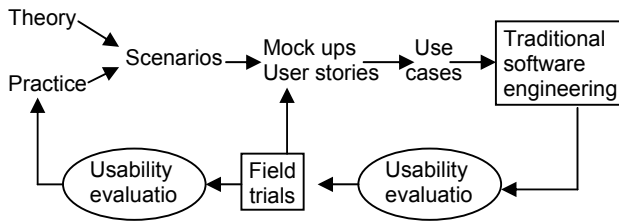


Fig. 4. Integration of theory, practice, and technology [9]

#### 4. KP-LAB PORTAL

One of the main tools that will support the knowledge creation and innovative practices is the KP-Lab portal (see Fig. 5). It consists of several parts. The (KP-Lab) Shared Space is a virtual collaboration space offering facilities for interacting with knowledge artefacts, definition and management of knowledge processes, users and the shared space itself during a trialogical learning or working process. The development of the Shared space is in progress, but the first prototype is available for project trials (see Fig. 6)

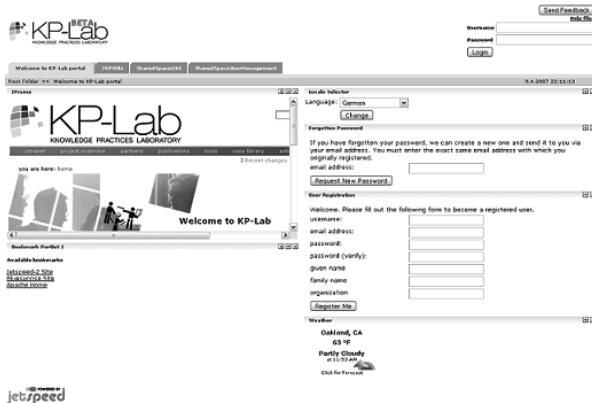


Fig. 5. The user interface of the KP-Lab portal (main screen)

The current version of the Shared Space has been inspired by scenarios on project-based learning as described by pedagogical partners. In the design process the scenarios (which describe the pedagogical design currently in place) have been used to define the functional requirements of the shared space, taking into account the problems with existing tools known so far. As a result the shared space basically supports the scenarios described so far (e.g. students can develop their own project-plan and annotate documents with semantic concepts relevant to the domain of project-management).

The first implementation phase of the KP-Lab portal was finished in February 2007. Valuable data about activities in the KP-Lab portal from the pilot trials will be evaluated

together with possible new requirements specific to trialogical style of learning. Based on these requirements, portal will be extended for the next design-development-testing cycle.

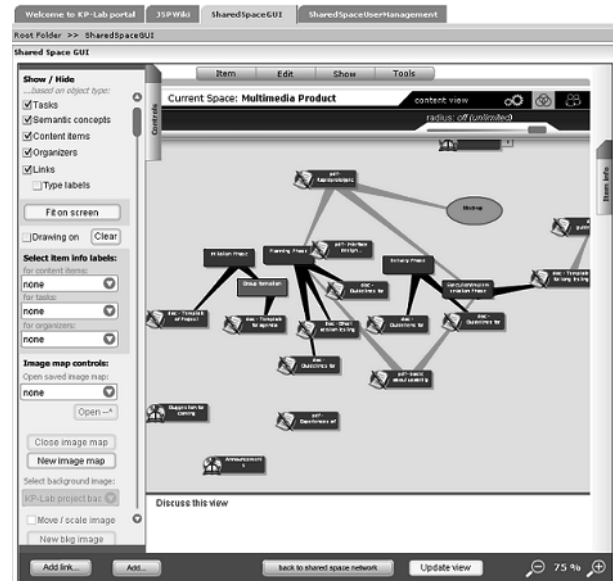


Fig. 6. The KP-Lab Shared Space (pilot course called Multimedia product)

#### 5. KNOWLEDGE PROCESSES TOOL

The KP-Lab team from Technical University in Košice (TUK) is working within the Centre for Information Technologies [10], Faculty of Electrical Engineering and Informatics, cooperating also with the Economical Faculty of the same university. TUK is involved in all technological workpackages, playing as such an important role in the technological aspects of the KP-Lab integrated research activities.

One of the main TUK tasks is the specification, design and implementation of the Knowledge Processes tool (KPT). This tool is integrated into the Shared space and provides a set of functions and interfaces necessary for creation, management, and annotation of knowledge processes composed from various elements (see also screenshot of its graphical user interface in Fig. 7).

Some of the KPT functions are the following [11]:

- Create, view, update and reuse such process elements as Task, Milestone or Deliverable. User can use existing templates or can create a new instance.
- Set-up description of the element – metadata. For example: name, actor, starting and ending dates for a task etc.
- Set-up relationships between process elements. For example: prerequisites mean tasks that need to be completed before actual task will start.
- Execution of a process: User can follow current state of a process by defined timeline.

- Change elements setting on the fly: User can flexibly make changes in description of relevant elements based on her/his user rights.
- Structure of the full process is visualized as Gantt chart (see Fig. 7).



Fig. 7. KPT's graphical user interface (Process view)

## 6. KP-LAB PILOT COURSES

KP-Lab involves design experiments and longitudinal studies in schools, polytechnics, universities, teacher training, and professional organizations. A series of KP-Lab courses will be organized during which students will solve complex problems for real customers whether those are enterprises, public organizations, or research communities. Extended pilots involve scaling up of emerging good practices across large number of students.

Main goal of pilot trials [12] is to test existing and find new innovative knowledge practices through technologies developed within KP-Lab. These courses are held in the several countries (Norway, Dutch, Hungary, Sweden and Israel) by our pedagogical partners. One interesting example is pilot course organized by University in Utrecht (UniC) which is described below [12].

UniC values differences between individuals and prioritizes students' own learning needs. In their pedagogical approach UniC coaches towards the national school exam, thereby not only focusing on knowledge acquisition but also stressing developing competencies, skills and personal development.

The goal of the course is for students to develop and advance a learning object by collaborating in a project team. Necessary conditions for this project in order to involve trialogical learning are:

- students have to collaborate in an intensive manner to create and advance a learning object,
- students work on an authentic project, involving skills, knowledge and competencies comparable to those used by professionals and experts in the work field,
- the project needs to be complex, which means that it has to involve multiple sources of knowledge and is as such challenging and motivating for students to learn from the activities they undertake,
- students have to be encouraged to use and apply their own knowledge and skills during the projects,
- students can exchange and reflect upon each other contributions using a collaborative computer-supported learning environment (i.e., FLE3, KP-Lab portal). Moreover, the learning object students produce should be useful as a tool for later use, either by other students, and/or in actual practice.

Approximately 30 students are participating in this pilot. These students were selected based on their scores on an underachievement list (which was filled in by mentor teachers of the students), which means that these students achieve beneath their learning potential according to the teachers' assessment.

Groups of three or four students will work as project teams throughout the project. The project work consists of several partially overlapping steps, which are described below. Researchers and teachers were present during work sessions and support each other in providing guidance to the student groups.

The pilot is set-up according to a project work model and consists of three main parts:

### Project initiation

During the initial meeting, at the beginning of the project, all students meet with the teachers and researchers. The purpose of the project was explained and students received background information of trialogical learning. Practical issues were also explained, such as when students can work on their project and what the planning was for the coming period. During this introduction meeting students formed teams on the basis of their mutual interest(s) in a topic. When teams were formed and the topics were chosen, students collaborated in their teams to specify and to decide on the product or object they were going to deliver at the end of this project.

### Project planning and execution

After deciding on a topic and a knowledge object, students decided which steps they had to take, what kind of information they needed, what kind of preliminary artefacts they had to create in order to construct their final product, and/or who would be doing what and when. This project plan is an important artefact, since it offers students with a tool to structure and to elaborate on their activities during their project. Students were encouraged to revise their project plan when they did not think it was feasible or when their plans changed, so this artefact formed a constant tool for reflection on students' knowledge practices.

## Delivery

At the end of the project the teams have to deliver a final product to the teachers and, if possible, their client(s). They will present this product during a final meeting with all of the teams, teachers, researchers and clients present. Both clients and teachers will evaluate and provide feedback on the presentation of the object and on the object itself.

The UniC case involves examination of knowledge practices on two interacting levels: a) that of the students engaged in learning activities, and b) that of the innovative knowledge community consisting of project partners who collaborate on the (advancement of the) design of the module which is based on principles of trialogical learning.

## 7. FUTURE WORK

The KP-Lab team from TUK will continue in design and development of various tools supporting trialogical type of education, building mainly on the expertise of the TUK team members in data and text mining. We are designing e.g. a text mining module for support of semi-automatic creation of metadata, as well as a tool for analysis of knowledge practices. As most of the tools are strongly language dependent and KP-Lab is focused on English only, we got another project from Slovak Research and Development Agency (see Acknowledgement) that will enable us to design and develop specific tools in order to support also Slovak language. Moreover, as an educational organization we will also be able to design and test the system within a specific university course as a pilot application.

## 8. REFERENCES

- [1] Hakkarainen, K., Paavola, S.: From monological and dialogical to trialogical approaches to learning. A paper at an international workshop "Guided Construction of Knowledge in Classrooms", February 5-8, 2007, Hebrew University, Jerusalem, 2007
- [2] Bereiter, C., Scardamalia, M.: Surpassing ourselves: An inquiry into the nature and implications of expertise. La Salle, IL: Open Court, 1993.
- [3] Engeström, Y.: Innovative Learning in Work Teams: Analyzing Cycles of Knowledge Creation in Practice. Cambridge, MA: Cambridge University Press, 1999.
- [4] Nonaka, I., Takeuchi, H.: The Knowledge Creating Company. Oxford University Press, New York, 1995
- [5] Nardi, B. A.: 'Activity Theory and Human-Computer Interaction' in Context and Consciousness: Activity Theory and Human Computer Interaction. MIT Press, Cambridge, 1996.
- [6] Kuutti, K.: Activity Theory as a Potential Framework for Human-Computer Interaction Research in Context and Consciousness: Activity Theory and Human Computer Interaction, ed. B. A. Nardi, MIT Press, Cambridge, pp.17-44, 1996.
- [7] Kaptelinin, V.: Computer-Mediated Activity: Functional Organs in Social and Developmental Contexts in Context and Consciousness: Activity Theory and Human Computer Interaction, ed. B. A. Nardi, MIT Press, Cambridge, pp. 45-67.
- [8] KP-Lab project web site. Available on [www.kp-lab.org](http://www.kp-lab.org)
- [9] Richter, Ch., et al.: Guidelines and models on implementing design principles of KP-Lab, application scenarios and best practices. KP-Lab internal deliverable D2.1, August, 2006.
- [10] Centre for Information Technology web site. Available on <http://www.tuke.sk/fei-cit/index-a.html>
- [11] Markannen, H., et. al.: Specification of the shared space for knowledge practices software . KP-Lab internal deliverable D6.1, September, 2006.
- [12] Schrire., S., Sins, P., et al.: A Collective Case Library about pedagogical models and related practices. KP- Lab internal deliverable D9.2, February, 2007.
- [13] Vygotsky, L.S.: Mind in society: The development of higher psychological processes. Harvard University Press, Cambridge, 1978.

## THE AUTHOR(S)



**František Babič:** I am researcher in Centre of Information Technologies, common workplace of Institute of Informatics Slovak Academy of Sciences in Bratislava and Technical University of Košice. My personal web site: <http://www.tuke.sk/fei-cit/babic/index-a.html>



**Jozef Wagner:** I am researcher in Centre of Information Technologies, common workplace of Institute of Informatics Slovak Academy of Sciences in Bratislava and Technical University of Košice.

## ACKNOWLEDGEMENT

*The work presented in this paper has been done within the KP-Lab project, which is supported by European Commission DG INFSO under the IST program, contract No. 27490 and within the RPEU-0011-06 project "Support of Knowledge Creation Processes" supported by the Slovak Research and Development Agency.*

*The KP-Lab Integrated Project is sponsored under the 6th EU Framework Programme for Research and Development. The authors are solely responsible for the content of this article. It does not represent the opinion of the KP-Lab consortium or the European Community, and the European Community is not responsible for any use that might be made of data appearing therein.*







5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## IMPLEMENTATION OF E-LEARNING PLATFORM FOR DISTANCE PRACTICAL EDUCATION IN ELECTRICAL ENGINEERING

Pavol Bauer<sup>1)</sup>, Viliam Fedák<sup>2)</sup>

1) Delft University of Technology, Mekelweg 4, Delft, The Netherlands, p.bauer@tudelft.nl

2) Technical University of Košice, Letná 9, 042 00 Košice, Slovakia, viliam.fedak@tuke.sk

**Abstract.** Virtual and distance laboratories extend the application area of the web. This leads to an openly integrated environment which facilitates the sharing educational material, and also hardware and software resources. This paper investigates distance learning with particular attention to experimental work. The *PEMCWebLab* provides the user with a practical experience in electrical engineering education. It was designed based on leading ideas and had clear targets and offers a complete integrated solution for the education

**Keywords:** Distance education, Education, E-learning, Virtual laboratory

### 1. INTRODUCTION

Distance measurement in electrical engineering systems is used for several reasons [1]. Internet as well as local (LAN) computer network intranet makes it possible to create solutions useful for industry as well as education.

Industrial applications differ from the laboratory in the amount of data transferred, number of connected devices, length of bus (cable length) and number of measured signals.

The possibilities of using distance measurement in laboratory application are: PXI or VXI systems, GPIB interface or Data Acquisition Card. The card consists of several A/D converter coupled with an interface that allows a personal computer to control the actions of the A/D, as well as to capture the digital output information from a conversion.

Solutions used for laboratory applications and described below can use only a limited number of measurement instruments and number of controlled processes. Information transferred is usually simple. The GPIB interface (which is used in presented solution of distance laboratory) can connect max. 15 devices to the bus. The transfer speed is up to 1 MB/s and max length of the cable is 20 m. Therefore industrial solutions are based on different principles.

In the first part of the paper a distance measurement application for educational purposes is described. In the second part monitoring and industrial applications are studied.

### 2. ONLINE DISTANCE LABORATORIES

Online distance laboratories present the latest trend also in education. Therefore, for educational purposes, the hardware experiment should be adapted in such a way that it can also be accessed from the Web. In this way the advances in ICT will be combined with the real world.

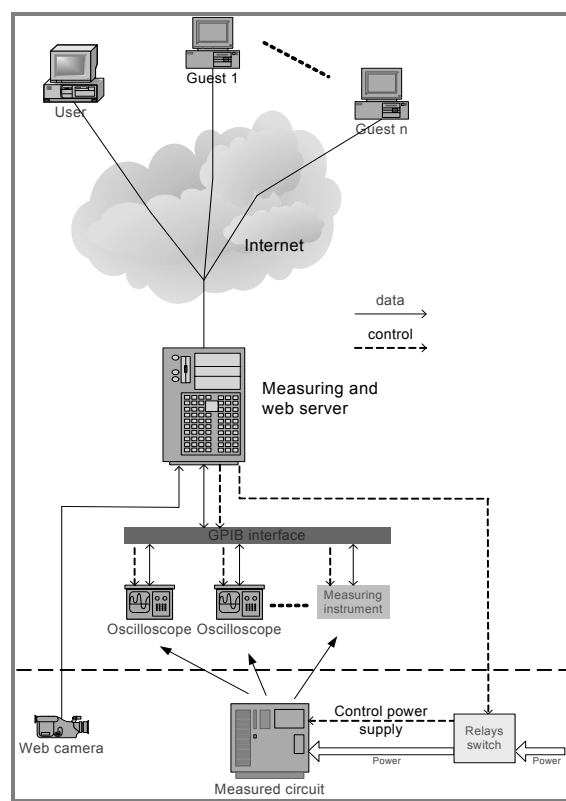


Fig. 1. Principal structure of considered distance laboratory with real experiments

The proposed virtual (distance) laboratory is not a web-based simulation. It is a *real electro-technical experiment* conducted in the laboratory, but it is remotely controlled and monitored by web-based tools. It is even possible to visualize the measuring instrument, the electronic components and many more factors such as lay-out, for example. This facility is useful to fulfill today's requirements for teaching over the Internet.

### 3. DISTANCE LEARNING

To support distance learning we developed a set of remotely controlled real experiments from fields of electrical engineering mainly from Power Electronics and Electrical Drives, so that they create the *PEMCWebLab*.

#### 3.1 Integrated Learning System

The *PEMCWebLab* creates an integrated learning platform. Several learning issues are addressed such as:

- Learning objectives
- Education
- Animation
- Simulation
- Experiment

In the first part the Learning objectives of each experiment are addressed. In the part education a theoretical background of the each individual experiment is given. Interactive animations developed in the previous project are addressed further. The last educational method before experiment is the simulation.

The main function of *PEMCWebLab* is to provide a web-based remote control for designed experiments. The learning process includes several, specially designed, experimental tasks. However, for safety reasons no one will be allowed to perform any experiment until he, or she, has shown adequate knowledge of the experiment. Entering wrong input parameters, due to insufficient knowledge of the experiment, may also lead to improper operation of the experiment. Therefore, a learning routine is designed for learners to gain the prerequisite knowledge which is required before attempting the experiment.

After completion of the online experiment, the learners are given an opportunity to take a simple questionnaire or alternatively to submit their report through the available feedback subsystem for its final evaluation (depending on the requirement enforced by the instructor). All learning procedures are recorded for future reference and analysis.

#### 3.2 Evaluation Subsystem

To use *PEMCWebLab* in order to achieve desired learning effect, the system first has to assess the learners' prerequisite knowledge of experiments. This is done throughout an evaluation subsystem before it permits the learners to access online experiments. Several types of evaluations are used in this system. The simplest method is to use a questionnaire that only contains true or false type questions, single questions, and multiple-choice questions. Instructors may also ask learners to submit simulation results or reports of the simulation tasks via e-mail, and then evaluate the results manually. Another possible method of online evaluation that is currently being considered is a peer review method. An experienced learner who has been trained can be assigned as a *Teaching Assistant* (TA) for that experiment. The TA can talk then to, or correspond with, anyone who requests permission to do that experiment. Once this TA believes that the new learner has adequate knowledge of the experiment, he or she can grant

this learner access to that experiment. In this way the instructor's workload can be reduced.

#### 3.3 Feedback Subsystem

A feedback subsystem plays an important role in improving the performance of the learners and the use of the *PEMCWebLab*. Feedback to learners often includes the evaluation results and suggestions on learning, while feedback to instructors and supervisors often includes problem reports on the *PEMCWebLab* and questions during the learning process. Peer or learner-instructor interactions are both significant in this feedback subsystem. In framework of the *PEMCWebLab* the authors have developed several feedback mechanisms. Feedback to learners may be provided instantly from predefined functions or from an instructor or administrator with a certain time delay. E-mail is one of the easiest ways for learners to communicate with instructors. Discussion forums or online chat rooms also provide different environments for the feedback.

### 4. EXPERIMENT ADMINISTRATION

Every experiment has its own server, because it is located at the different location. Remote users first log onto a main booking server, after which they will be directed to the specific server for actually performing the experiment.

#### 4.1 Experiment Administration

A central booking system is available at the project page *PEMCWebLab.com*. Booking system is provided through Moodle software. Layout of the Moodle pages for all experiments is uniform. This page will contain menu with the following submenus:

##### Submenu:

1. Learning objectives
2. Education
3. Animation
4. Simulation
5. Experiment

All the submenus at the booking system are to be accessed without restriction of number of students. The actual booking is provided in the *submenu Experiment*. The experiments can be booked one week ahead, the length of the offered time window for the experiment varies from 5 to 30 min. Before the experiment becomes available online, it should be tested to verify the correctness of the experiment results as well as the stability of the experimental set-up. The power to some experiment is available 24 hours a day; some experiments are available for safety reasons in the working hours only. An administrator of each experiment can restrict the use if the experiment for his purposes during some days or hours only. Supervisors have to routinely check the status of each experiment to make sure that each of them is functionally correct and is available for use. Several clients can connect to *PEMCWebLab.com* simultaneously. However, Internet bandwidth becomes extremely limited when too many remote users request to

use this system. Several concurrent, remote users are allowed via an Internet connection for each experiment. However, each experiment in the *PEMCWebLab* can be operated only by a single remote user at a time. The system thus considers each experiment as a “resource”, and remote users who wish to operate a specific experiment should first get permission to operate the experiment. Once the resource is in use, other remote users cannot access that resource, because it is then marked as “locked.” All the remote users without access permission can see only the online, real-time video of that experiment.

#### 4.2 Server Site Administration

As already said every experiment has its own server and it is located at the different location. Remote users first logged onto a main booking server, after which they will be directed to the specific server for actually performing the experiment get into the page of the experiment itself.



Fig. 2 Page of an experiment at the institution

### 5. A SET OF EXPERIMENTS IN FRAMEWORK OF THE PEMCWEBLAB

A Leonardo da Vinci EU project titled “*E-learning Distance Interactive Practical Education - EDIPE*” [2] is suggested and approved to create a full set of distance laboratories. Twelve universities with the span across the EU (from the countries: NL, F, D, PL, CZ, SK, HU, RO, GR) are participating in the project.

The expected specific results are:

- Learning objectives for the distance experimental education,
- The guidelines for project oriented measurements with the learning objectives for distance and /or virtual practical education,
- Synthesis oriented experimental measurements,
- Technology and technical documentation for distance practical education and measurements via the Internet,
- Different designed measurements each with its own philosophy.

The outputs from the project will present

- teaching material (in electronic form; guidelines, manuals, documentation in English and other languages),
- distance and virtual laboratories approached via web,
- visualisation and the layout of the measured system and
- the measurement results obtained via Internet.

The following modules are proposed (grouped into sets of modules) in such a way that they cover fundamentals and basic applications of the EE and advance topics including the application as well:

| Groups of subjects – specialisation                     | Modules   |
|---|---|
| <b>1. Fundamentals of Electrical Engineering</b>        | 1.1 Single Phase and Three Phase Rectifier Circuits<br>1.2 DC Circuit Measurements and Resonant AC Circuits   |
| <b>2. Power Electronics</b>                             | 2.3 Power Converters<br>2.4 Power Factor Correction<br>2.5 PWM Modulation<br>2.6 DC-DC Converter for Renewable Energy Sources and Microgrid<br>2.7 Power Quality and Active Filters<br>2.8 Power Quality and/or Electromagnetic Compatibility   |
| <b>3. Electrical Machines</b>                           | 3.1 Basic Electrical Machinery – Synchronous Generator<br>3.2 DC Machines<br>3.3 Basic Electrical Machinery – DC Motor<br>3.4 Basic Electrical Machinery – Asynchronous Motor   |
| <b>4. Electro-Mechanical and Motion Control Systems</b> | 3.1 Basic Elements of Internet based Tele-manipulation<br>3.2 Mechatronics, HIL (Hardware in the Loop) Simulation<br>3.3 High Dynamic Drives - Motion Control<br>3.4 A Automotive Electrical Drive<br>3.5 Complex Control of a Servodrive by a Small Logic Controller<br>3.6 Intelligent Gate Control by a Small Logic Controller (SLC) |

Tab. 1 List of modules with remote controlled experiments in the EDIPE project

## 6. EXAMPLE OF THE WEB AND MEASURING PEMCWEBLAB SERVER

The main part of the system is the web server, which is responsible for all the web services, web pages and the correct functionality of the user interface. The web server also communicates with other applications which can access the other parts such as the measured data.

### 6.1 Measurement Application

Most of the similar applications use LabView [7]. In the case described here the measurement application communicates with measurement instruments via a GPIB interface. This application was written in a Matlab environment and finally compiled / built as an executable application. Matlab has to be installed together with its "Instrument Control Toolbox" to provide communication via the GPIB interface. This toolbox is a general programming interface, controlling all instruments equipped with a GPIB interface.

### 6.2 Control of Power Part

There is an application, programmed in C++ language, which controls the on and off switching of the power supply of the measuring instruments and the measuring board. The data bits of a parallel port are used as a control signal. A built-in remote controller controls the power switches by means of radio waves (see Fig. 3).

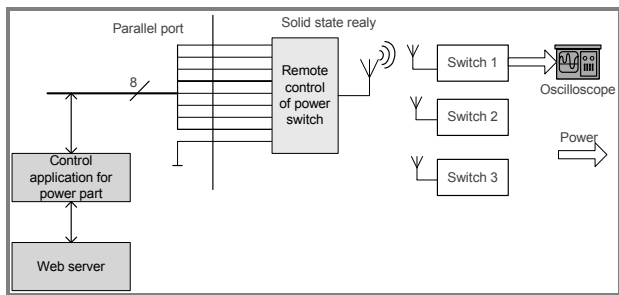


Fig. 3. Principle of power controlling

*Compiler of the source code:* The source-code compiler for the XC866 microcontroller is also included in this system. The usage of the compiler will be explained later. The selected microcontroller is a XC866 from Infineon [8]. This 8-bit microcontroller features a system on chip that has been developed for all kinds of motion control using PWM based schemes. The microcontroller used in this system is commercially available in an evaluation kit. The PC is connected to this starter kit via the communications port, COM1. After the user sends the source code to the microcontroller, it is compiled and translated to a hexadecimal-executable file and then loaded in the microcontroller. The programming language used for the microcontroller is C. Users can use all the available features of the C language and in addition they can also use the special registers as variables.

### 6.3 Software

The main functional part is the connection between the web server and the measuring applications which in turn communicate with the measuring devices themselves. In Fig. 4 (left) a simple state diagram of the web page is shown. The "DelftWebLab page" bubble represents the web page with measured data. From this page the user can run the measuring application (dash line). The two arrows pointing away from the "DelftWebLab page" bubble represent some events which might occur:

- The first event, namely the 'On change settings of the measurement instruments', occurs when some parameters are changed e.g. the vertical scale of the scope, etc.
- The second event occurs periodically, refreshing the web page to show the latest measured data.

On the right side of this figure, there is a block diagram of a measurement cycle. The dashed line represents cooperation between the functionality of the web page and the measuring application. When the measuring application is launched, the program periodically controls the measuring instrument, reads the measured data and stores the measured data to a file.

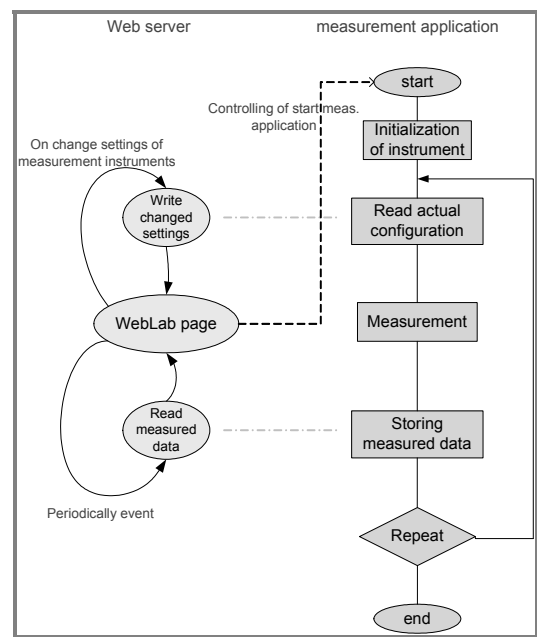


Fig. 4. Cooperation of the web server and a measuring application

## 7. CONCLUSIONS

In this paper, we have introduced basic philosophy and structure of remote controlled laboratory - called the PEMCWebLab. It will collect real remote experiments from various application fields of Electrical Engineering. Altogether 18 different experiments are under development. The course materials and case studies giving a guide to

particular experiments will complement them in a short future. We will also welcome networking with other similar laboratories and interested colleagues abroad.

## 8. REFERENCES

- [1] Ertugrul N.: Towards Virtual Laboratories: a Survey of LabVIEW-based Teaching/ Learning Tools and Future Trends.
- [2] E-learning Distance Interactive Practical Education – EDIPE, Pilot Project of the EU Leonardo da Vinci Vocational Training Programme. Project No CZ/06/B/F/PP-168022, duration 10/2006 - 09/2008, at <http://www.powerweblab.com/>.
- [3] Gillet D., Nguyen Ngoc A.V., RekikY.: Collaborative Web-based Experimentation in Flexible Engineering Education. IEEE Transactions on Education. No. 4 (2005). Vol. 48, p. 696-704.
- [4] Cheng K.W.E, Chan C.L., Cheung N.C, Sutanto D.: "Virtual Laboratory Development for Teaching Power Electronics, Power Elecgnonics and Motion Control Int. Conference, EPE-PEMC 2004 Riga, Latvia.
- [5] Yi Z., Jian-jun J., Chun F.S.: A LabVIEW-based Interactive Virtual Laboratory for Electronic Engineering Education; Int. J. Engng Ed. Vol. 21, No. 1, pp. 94-103, 2005.
- [6] Buckman A.B.: VI-Based Introductory Electrical Engineering Laboratory Course; Int. J. Engng Ed. Vol. 16, No. 3, pp. 212-217, 2000.
- [7] Peek C. S., Crisalle, O.D., Deapraz S., Gillet D.: The Virtual Control Laboratory Paradigm: Architectural Design Requirements and Realization Through a DC-Motor Example; Int. J. Engng Ed. Vol. 21, No. 6, pp. 1134-1147, 2005.
- [8] Fernandez C., Vicente M.A., Jimenez L.M.: Virtual Laboratories for Control Education: a Combined Methodology; Int. J. Engng Ed. Vol. 21, No. 6, pp. 1059-1067, 2005.
- [9] Ertugrul N.: New Era in Engineering Experiments: an Integrated and Interactive Teaching/Learning Approach, and Real-Time Visualisations; Int. J. Engng Ed. Vol. 14, No. 5, pp. 344-355, 1998.
- [10] Agelidis V.G.: A Laboratory-Supported Power Electronics and Related Technologies Undergraduate Curriculum for Aerospace Engineering Students, Int. J. Engng Ed. Vol. 21, No. 6, pp. 1177-1188, 2005.
- [11] Gregson P.H., Little T.A.: Designing Contests for Teaching Electrical Engineering Design; Int. J. Engng Ed. Vol. 14, No. 5, pp. 367-374, 1998.

- [12] Mann H., Ševčenko M.: Learning Dynamics and Control Using Remotely Tutored Simulation and Virtual Experiments. Conference IMCL2006. April 19 -21, 2006 Amman, Jordan.

## THE AUTHORS



**Pavol Bauer** received his Masters in Electrical Engineering at the Technical University of Košice ('85) and Ph.D. from Delft University of Technology ('95). Since 1990 he is with the Delft University of Technology. He has published over 180 journal papers and papers at the international conferences in his field, he holds an international patent and organized several tutorials. He is teaching Power Electronics, Electrical Drives and related subjects. Dr. Bauer is a member of the IEEE, EPE and also member of international steering and scientific committees of numerous international conferences.



**Viliam Fedák** received his Ing. degree in Technical Cybernetics from the Technical University of Košice in 1974 and the Ph.D. degree in Electrical Drives and Traction in 1980. Currently he is Associate Professor at the Dept. of Electrical, Mechatronic and Industrial Eng., TU Košice and Head of Mechatronic System Division there. He is teaching subjects on Electrical Drives, Mechatronic Systems, Dynamical Systems Modelling and Process Identification. He has published over 70 journal papers and conference contributions in field of in motion control by electric drives and in education. In last years he coordinated several EU projects dealing with e-learning, mostly in framework of the Leonardo da Vinci programme but was involved in many other EU projects.

## ACKNOWLEDGEMENT

This work has been performed within the project „*E-learning Distance Interactive Practical Education - EDIPE*“. The project was supported by the European Community within framework of Leonardo da Vinci II programme (project No CZ/06/B/F/PP-168022). The opinions expressed by the authors do not necessarily reflect the position of the European Community, nor does it involve any responsibility on its part.





## COMPLEX ADAPTIVE ON-LINE LEARNING SYSTEM “THEORY OF AUTOMATIC CONTROL”

Yuriy Bezgachnyuk, Leonid Zamikhovskyy, Roman Matviyenko, Larysa Savyuk.  
Ivano-Frankovsk Institute of economy and management “Galitskaya Academy”  
Tel.: +380(342) 772095, Fax: +380 (3422) 65598  
e-mail: [ime@ime.if.ua](mailto:ime@ime.if.ua), [www.imega.edu.ua](http://www.imega.edu.ua)

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The controlled from distance teaching (DT) in the system of technical education has a row of features: complication of informative content, necessity of development of simulation models and trainers for conducting of practical and laboratory employments, conducting of knowledge diagnostics on the basis of mathematical-based algorithms, organization of execution collective projects of the applied setting. For development of the process of teaching bases of fundamental discipline control system Theory of automatic control (TAC) the combined approach of optimum combination of existent programmatic instruments of support was chosen DT and own developments. The system DT TAC included: controlled from distance course (DC) of TAC, site of virtual laboratory practical works in LAB.TAC and students knowledge remote diagnostic system d-tester.

**Keywords:** system, theory, management, content, algorithm, testing, diagnosing, laboratory stand, animation, device, knowledge control.

### 1. INTRODUCTION

In the present time in Ukraine large attention is spared the problems of introduction of modern of informatively-communications technologies (ICT) in higher education. In formation of humanitarian direction the proof tendencies of growth of rates of passing were set to modern computers technologies and use of methods DT.

DT in technical education, because of the special methodological and algorithmic approaches, integrated considerably slower.

Informative content for organization of Web-teaching technical specialties requires a considerable reinforcement mathematical conclusions, multimedia materials, models of simulations, interactive trainers, virtual laboratory stands. Software for development of similar educational materials often is inaccessible educational establishments in a price relation.

Development of the systems of diagnosing of knowledge's of bases of technical disciplines is related to realization of difficult algorithms of testing, such as organization of answers in a free form by built-in formula editors, testing is based on the methods of matrix calculation, multilevel questions which are not included in the standard set of the developed systems DT [1].

It is necessary also to take into account that planning of the effective system DT must be based on a careful analysis and search of modern pedagogical approaches during its organization.

At development of the system DT discipline of TAC bases of social structural pedagogics, which are foundation of Learning Management Systems (LMS) Moodle, were incorporated, to modern textual criticism and two-parameters theory of interpretation Rasch testing results.

Informative maintenance of DT TAC has the developed multimedia support as 3D and Flash-animations, laboratory practical work is built on the basis of the use of virtual mathematical models and recordings devices.

### 2. SYSTEM STRUCTURE

The system is built on principle of adaptive control. On a fig. 1 the flow diagram of the system is represented.

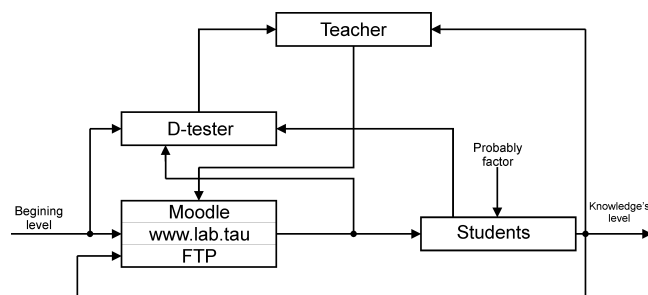


Fig. 1.

In obedience to the modern theory of management connections are synthesized between the participants of educational process. Adaptation of students in the process of mastering of course TAC is provided testing of initial level of knowledge's, intermediate diagnosing and feedbacks between a teacher, students, informative content and system of d-tester.

Results of students teachings are latently structural parameters and depend on complication of information and set the problems, and also from the level of course participant knowledge's.

### 3. THE DISTANCE COURSE OF TAC IN LMS MOODLE

A course is built on the basis of social structural pedagogics which is basis of LMS Moodle and the most strong side of project i. Doudzhyamosa.

The method of creation of DK of TAC is presented on figure 2. A teacher is the moderator of course and executes a role function in a student collective.

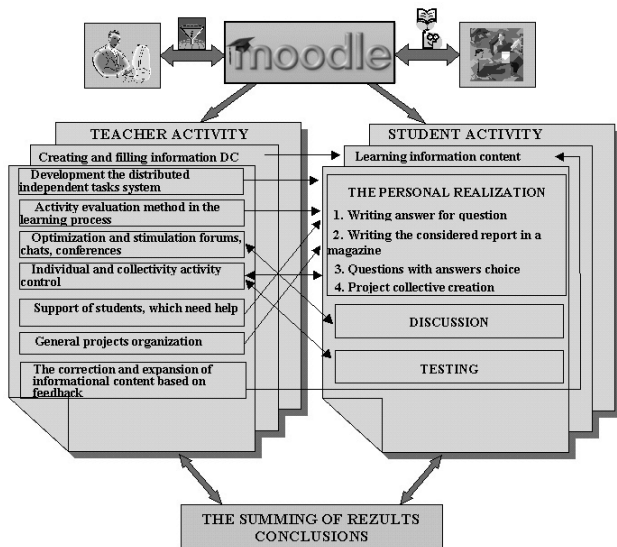


Fig. 2.

Basic functions of teacher: development of card of conceptions (plan) of course, organization of independent work of students, their discussions, and joint projects. A teacher carries responsibility for creation of effective scale of evaluation of results of activity of teaching subjects, support of operative feedback with a student audience and transforming of maintenance of DT, in accordance with the current results of teaching process.

Students must in time execute all tasks of teacher. Teaching results are in direct dependence on their executiveness, efficiency of work and creative initiative.

On fig. 3 the educational page of DT TAC is presented in a SCORM-format. On a page a multimedia resource, which illustrates work of steam Watt engine, is placed.



Fig. 3.

Conclusions: The presented adaptive control teaching system is in the process of forward dynamic development. On the real stage its filling goes informative materials, the library of models of simulations of technological objects and systems broadens on the basis of adequate mathematical models.

In the stage of development and realization there is the module of the adaptive diagnosing of level of knowledges of students on the basis of statistical treatment of results of testing of latently structural analysis and parametrics theory of Rasch methods.

### 4. THE INFORMATIONAL TECHNOLOGIES USING DURING THE LABORATORY EMPLOYMENTS CONCLUDING OF «THEORY OF AUTOMATIC CONTROL ON DISCIPLINE»

Presently there are plenty of modern programmatic facilities of animation presentations during conducting of laboratory employments on technical disciplines. At the design of the difficult systems motion of objects is examined not on a plane, but in space. That is why among basic and the most popular programs for creation of three-dimensional objects it is possible to select the system of 3D Studio MAX.

By this program videos-rollers, which allow students it is better to understand principle of work of the classic automatic control systems, in an evident form present (to represent) motion of executive mechanisms (engines, reducing gears), regulators and other components of the system, are created. On a fig. 4 the three-dimensional model of engine of direct current is shown. Video-roller is also created, which shows work of engine in a cut air-cooled.

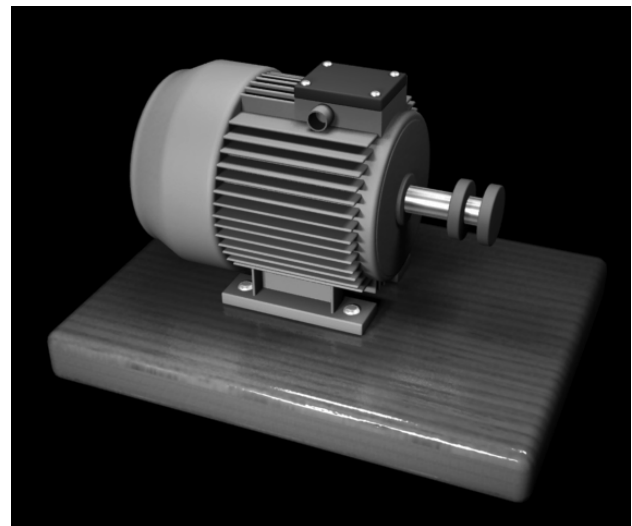


Fig. 4.

Another popular graphic program is Macromedia Flash. The program Flash in essence is multitask: it and illustration program, editor for graphic arts and sound, mean for animation and machine for writing scripts which are incorporated in one program [2]. Its advantage is in that she allows creating interactive laboratory trainers, games.

By Macromedia Flash the row of rollers of animations was created for the study of others that the disciplines «Theory



of automatic control». Process of they is creation very much stand: at first it is necessary to create the row of static pictures, put in order them and create an animation file. On a fig. 5 the last shot of animation roller that demonstrates the order of creation of model for the construction of phase plane of the automatic control system is resulted.

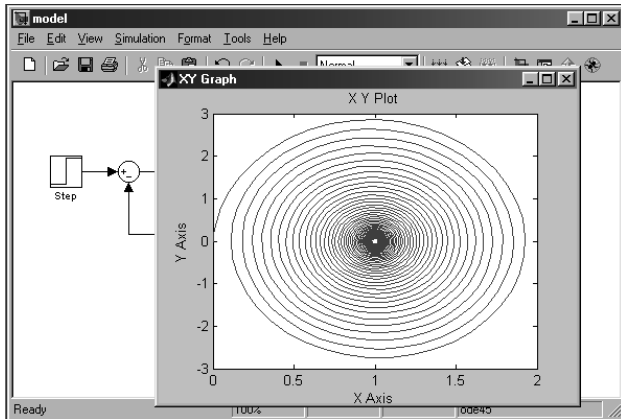


Fig. 5.

Next to Macromedia Flash there is plenty of the small programs for creation and editing of animations (Timer Lock, Advanced Gif Animator). Their advantages are simplicity, high speed and small volume of initial files.

## 5. VIRTUAL LABORATORIES AS INALIENABLE PART OF THE CONTROLLED FROM DISTANCE STUDIES

Virtual laboratories are important part of educational process. A virtual laboratory can be created for the study of certain discipline or section of discipline. She must consist of virtual laboratory stands, each of which must provide a study and practical mastering of lecture material. A purpose of creation of virtual laboratory stands is conducting of research of the phenomena and processes in a situation, near to reality.

Experiments on virtual laboratory stands in essence are researches of theoretical models. Such stands allow in an evident and usual for an experimenter form to represent the results of theoretical calculations.

A laboratory stand is named virtual because from one side a researcher sees him, can by a mouse manage conducting of experiment, to get the results of measuring with some degree of convention. From other side, this stand does not exist physically in nature, his image is created by a computer on the screen and elements execute the functions because in accordance with the program a computer is changed by an image on the screen, creating at a researcher the illusion of participating in the real experiment [3].

The analysis of results of experiments is conducted with the purpose of exposure of dependences between different factors and sizes, which characterize the explored process, object or phenomenon, establishing reasonable following connections between them.

Basic advantages of creation of virtual laboratories:

*cheapness* - a dear equipment is replaced the computer program;

*a compactness* is scaling of equipment of largeness, placing on one computer of plenty of "virtual" equipment;

*speed* is a change duration both too slow and too rapid processes;

*safety* - at a design potentially of dangerous equipment, for example, nuclear a reactor.

Among the products of software of the virtual measuring devices and systems intended for creation it is needed to select the applied package of the graphic programming of LabVIEW 8.0.

LabVIEW, like programming in PASCAL or BASIC, is a programmatic package for development of the application programs. However, unlike the programming languages indicated higher, LabVIEW uses a graphic programming of G (Graphics), intended for creation of the programs in the form of diagrams of flows language. LabVIEW contains the vast libraries of functions and tools, intended for creation of the systems of capture of data and automated control systems. LabVIEW also includes the standard tools of development of the programs, allows to set the points of controls, use computer animation for implementation of the program, to see that information pass through the program, to carry out incremental implementation of the program, for facilitation of development and program debug [3]. A presence in the system of LabVIEW special Simulation Module does her maximally suitable for a design and research of the difficult dynamic systems.

The programs in LabVIEW are named virtual instruments (VI), as the real measuring devices imitate their kind and functioning.

In the environment of LabVIEW 8.0 a stand is created for the calculation of parameters and research of descriptions of sentinels of executive DPS. The frontal panel of stand has three insets (fig. 6-7).

On an inset "Choice of type of engine" in a block "Weekend an user can set information" value of parameters of management (PM) (static moment of loading of PM, moment of inertia of PM, high angular speed and maximal angular acceleration of PM and speed of change of static moment of loading of PM) object in obedience to a requirement specification. In a block the "Technical parameters of DPS" it is possible by a switch "Choice of engine" to carry out the choice of certain engine, thus the values of technical parameters (nominal power, nominal tension, nominal speed of rotation of billow of engine, nominal current of anchor of engine, moment of inertia of anchor, resistance of puttee of anchor, CUA of engine) in the proper fields change automatically. In a block the parameters of "Calculations of DPS" enter parameters: nominal angular speed of engine, nominal moment of engine, optimum gear-ratio of reducing gear, total moment of inertia, inductance of engine, parameters of calculations. Parameters over of transmission function of DPS are brought in a fourth block: amplification of engine factor, amplification of engine factor in relation to loading, electro-mechanics and electromagnetic permanent time of DPS.

On the third inset descriptions" of "Sentinels are resulted curves of acceleration of engine of direct current without loading, with a quiescent and variable load. Comparing the

graphs, draw conclusion, that at the variable loading frequency of rotation of billow of engine is the least, and in default of loading - most frequency is set accordingly.

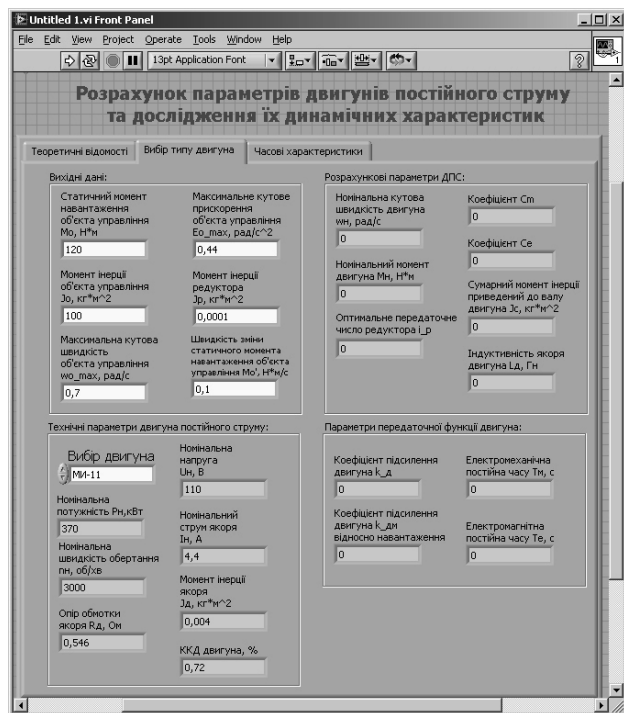


Fig. 6.

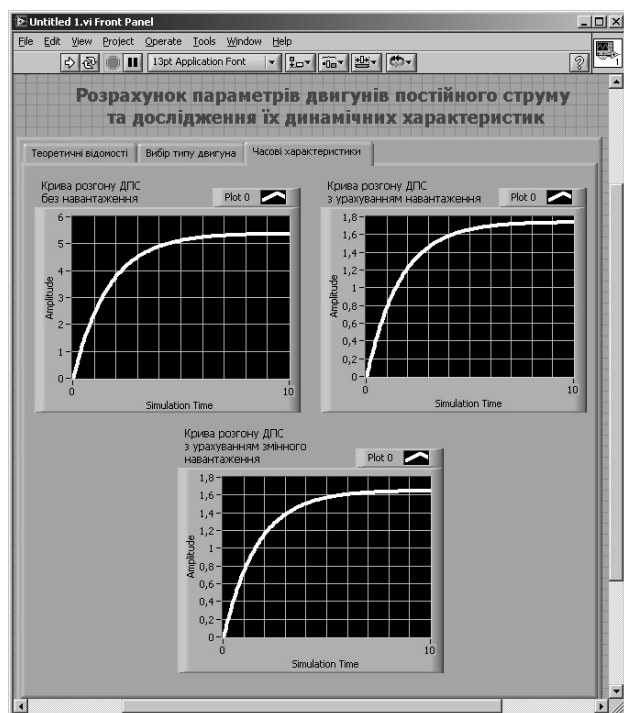


Fig. 7.

Consequently, the programmatic package of LABVIEW allows easily creating virtual devices for research of dynamics of the control and their separate elements systems.

## 6. STUDENTS KNOWLEDGE REMOTE DIAGNOSTIC SYSTEM D-TESTER

D-tester 1.1 is the most powerful system, designed for providing testing in different high schools; it has the all necessary abilities and functionalities for making testing process simpler and faster. This testing system is developed for using in different operation systems and it is based only on the most popular free web-technologies such as Apache web server with PHP + MySQL. D-tester 1.1 has the rich couple of different statistics that make analyzing results faster and easier.

The system consists of two subsystems: administrative subsystem and testing subsystem. The scheme of the system and external links is showed on a fig. 8.

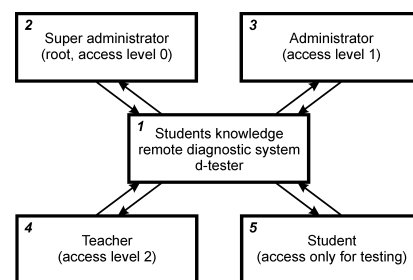


Fig. 8.

The administrative subsystem owns next possibilities:

- creating tests blocks;
- registration new students and groups of students;
- analyzing results of testing;
- active sessions control.

The administrative subsystem consists of 11 modules, scheme of administrative subsystem shown on a fig. 9.

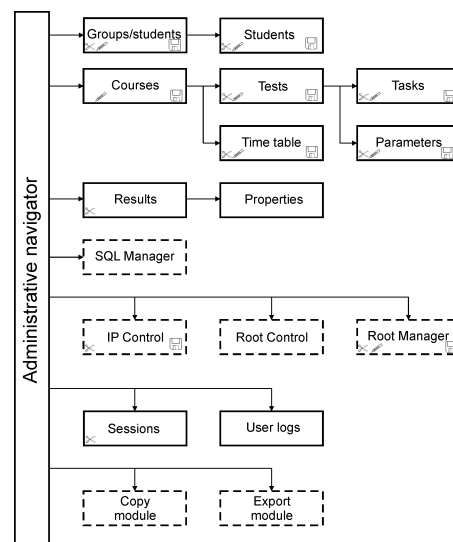


Fig. 9.

Three levels of administrator's privileges are foreseen in the system:

- Zero level – foresees possibility of complete access to all modules, and also direct access to the system database with using the SQL manager module;
  - First level – foresees possibility of complete access to all modules, except for SQL Manager, IP Control, Root Control, Root Manager, Copy module, Export module;
  - Second level – foresees access only to that part of the system, which is certain by a quota. Information about proper quota is kept in a database. A quota consists of identifier of course – unique number of course in a database, and also privileges of access:
  - SB\_READ is revision of information about courses;
  - SB\_WRITE is adding/modification of information about objects;
  - SB\_DELETE is deleting information about courses;
  - RES\_READ is revision of results of passing of test control;
  - RES\_DELETE is deleting of information about the results of passing of testing.
- It should be noted that in this case under a course not only a course but also all is understood subcategories are tests, tasks are related to him.

Description of modules:

- groups/students – management students and group of students information;
- courses – management courses and subcategories tests and tasks;
- results – generating reports about results of testing;
- SQL manager – direct access to system database using SQL queries;
- sessions – active session control functions;
- IP control – functions of LAN computers control;
- user logs – user logging information functions;
- root control – admin logging information functions;
- root manager – management system administrators functions;
- copy module – copy tasks functions;
- export module – export tasks functions.

The system supports the task in the IMS QTI 2.0 standard.

Next types of test tasks now supported:

- simple choice (simple choice text & images);
- multi choice (multi choice text & images);
- short answer;
- numerical;
- alternative (partial of the simple choice question) [4].

The system has a simple and intuitively clear interface projected so, that you can conduct its localization for any language package. Some web pages of administrative subsystem are shown in fig. 10 (start page of administrative subsystem) and fig. 11 (task editor). For registration task you can use some tags of the HTML language. In a next version of the system the TINY\_MCE editor, which considerably will simplify the process of registration of test task, will be used in the task editor.

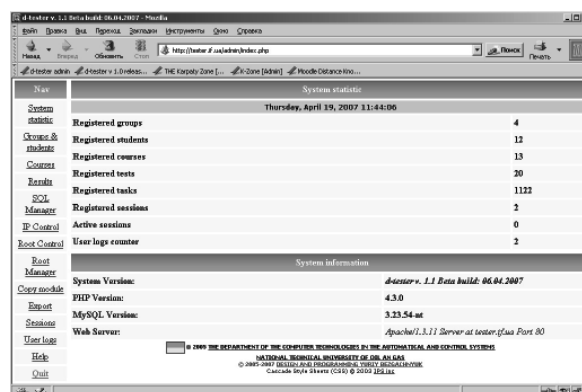


Fig. 10.

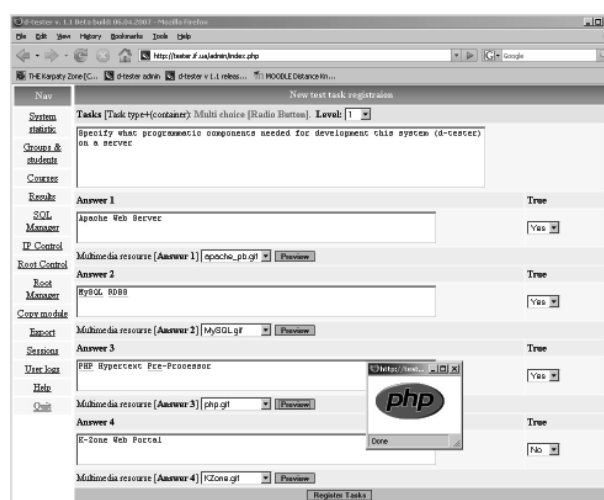


Fig. 11.

One of important functions of the system is possibility of conducting of analysis testing results. A page with report is shown on fig. 12.

| # | Student          | Rate | Quality | Date       | Time     | Time     | ID | Control       |
|---|------------------|------|---------|------------|----------|----------|----|---------------|
| 1 | Bragachyuk Yuriy | 30   | 67%     | 19-04-2007 | 00:01:52 | 13:28:43 | 3  | Parameters... |
| 2 | Lushchik Andrew  | 30   | 67%     | 19-04-2007 | 00:01:05 | 13:30:38 | 4  | Parameters... |
| 3 | Lushchik Vitaly  | 21   | 47%     | 19-04-2007 | 00:00:40 | 13:31:37 | 5  | Parameters... |

Fig. 12.

You can also generating some histograms about the testing results.

The testing subsystem is intended for providing student's test control. It owns next possibilities:

- show testing questions;
- time control;
- checking user answers;
- generate and show result of testing.

User can simply distinguish the type of task, which is offered him. For example: simple choice type of task is shown using radio buttons, multi choice type – check boxes. A page with question (multi choice [images]) is shown on fig. 13.

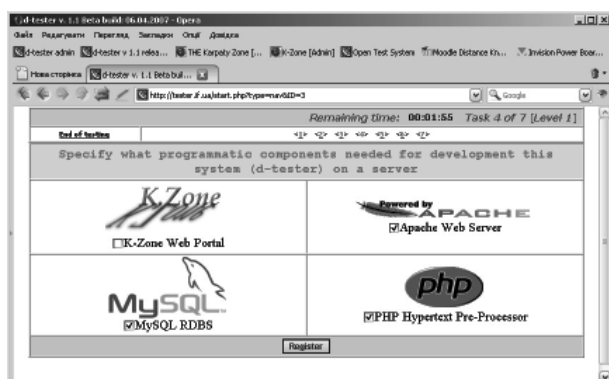


Fig. 13.

Short form of transcription

DT – distance teaching;

DC – distance course;

TAC – the theory of automatic control;

ICT – information – communication technologies;

VI – virtual instruments;

CO – control object

HTML – Hyper Text Markup Language;

PHP – PHP Hyper Text Pre-processor;

SQL – Structured Query Language.

## 7. REFERENCES

- [1] Л.М. Заміховський, Л.О. Сав'юк: Проблеми створення універсальних навчальних оболонок для дистанційного навчання студентів технічних спеціальностей. Східно-Європейський журнал передових технологій. №6/2(18).–Харків. 2005, с.71-77.
- [2] Рейнхардт Г., Дауд С. Macromedia Flash MX 2004. Библия пользователя. - Спб: Диалектика, 2005. - 1312 с.
- [3] Матвієнко Р.М. Програмні продукти для створення віртуальних лабораторій по забезпеченню технічних спеціальностей. Наукові вісті Івано-Франківського ІМЕ "Галицька академія". Івано-Франківськ. - 2005. - Вип. №2(8) . - с.89-93.

[4] Безгачнюк Ю. В.: Система дистанційної перевірки і оцінювання рівня знань студентів d-tester v0.0. Образование и виртуальность – 2006. Сборник научных трудов 10-й международной конференции УАДО. – Харьков-Ялта. – 2006. – Харьков: ХНУРЭ. – 2006. – с. 434-440.

## THE AUTHORS



**Yuriy Bezgachnyuk:** master's degree on the control and automation systems. Certificated learning management systems administrator (Moodle). PHP/MySQL Developer. Developer of the students knowledge remote diagnostic system. Published 5 scientific publications.



**Leonid Zamihovskiy:** Doctor of technical science, professor. Manager by the department of the document knowledges and information activity. Pro-rector from the science. Academic of the Ukrainian Oil-Gas academy. Published more than 300 scientific publications, 50 of them on information technologies.



**Roman Matviyenko:** master's degree on the control and automation systems. Assistant of computer technologies department in the control and automatic systems. LabVIEW developer. Virtual laboratory stands developer. Published 5 scientific publications.



**Larysa Savyuk:** technical science candidate. Manager by the UNESCO department. Certificated Ukrainian Distance Knowledge Association specialist. Certificated learning management systems administrator (Moodle). Published more than 40 scientific publications, 10 of them on information technologies.



## IS LINUX ENOUGH ACCESSIBLE?

Miroslav Biñas, František Jakab, Miroslav Michalko, Alena Galajdová  
Computer Networks Laboratory, Department of Computer and Informatics  
Faculty of Electrical Engineering and Informatics, Technical University of Košice  
Letná 9, 042 00 Košice, tel. +421 55 602 2500  
miroslav.binas@tuke.sk, frantisek.jakab@tuke.sk, miroslav.michalko@tuke.sk, alena.galajdova@tuke.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The computers use a set of standard input and output devices, such as keyboard, mouse, screen and audio speakers. However, these devices are not suitable for everyone. Some users need a specially adapted keyboard, mouse or other input/output devices. On some special cases software can emulate one of these devices, such as sound events displayed on the screen or the numeric keypad used to move the mouse cursor.

This article is focused to the topic of accessibility of the Linux system - the scale of available applications, solutions and it's comparison to the existing Windows applications.

**Keywords:** Software, Ambient intelligence, Accessibility, Linux

### 1. INTRODUCTION

*Computer accessibility* (also known as *Accessible computing*) refers to the accessibility a computer system to all people, regardless of disability or severity of impairment [1]. It is largely a software concern; when software, hardware, or a combination of hardware and software, is used to enable use of a computer by a person with a disability or impairment, this is known as *Assistive Technology*.

There are numerous types of impairment that impact computer use. These include [1] [6]:

- *Cognitive impairments and learning disabilities*, such as dyslexia, ADHD or autism. Abstract and Keywords,
- *Visual impairment* such as low-vision, complete or partial blindness, and color blindness.
- *Hearing impairment* including deafness or hard of hearing.
- *Motor or dexterity impairment* such as paralysis, cerebral palsy, or carpal tunnel syndrome and repetitive strain injury.
- *Age-Related impairments*, which can include all of the signs from previous types.

### 2. LINUX ACCESSIBILITY PROJECTS

As usual in the world of open source, there are several projects focused to solve the accessibility issues at the *Linux* platform. There can be found standalone projects dedicated to special application, communities focused to the whole issues of accessibility and complete distributions for disabled people.

Two of the biggest projects dedicated to the accessibility at the *Linux* platform are also related with the two major desktop environments, the *GNOME* desktop environment and the *KDE* desktop environment: the *GNOME Accessibility Project* [6] and the *KDE Accessibility Project*

[5]. The task of these projects is to integrate several types of applications supporting the accessibility issues directly into desktop environment.

### 3. BETTER DESKTOP

*Linux* is in many ways focused on accessibility and usability of the desktop environment. Mainly, the *GNOME* environment offers an easy to understand desktop for *Linux*. *GNOME's* community of professional and volunteer usability experts have created Free Software's first and only *Human Interface Guidelines*, and all core *GNOME* software is adopting these principles.

*Better Desktop* is a project dedicated to sharing usability data with *Linux* developers [8]. The result of this project is a video repository, which consists over than 200 videos of people using desktop applications such as *Mozilla Firefox*, *Evolution*, *Open Office*, *Banshee*, ... or people dealing with situations such as finding documents and folders, emailing photos, setting up appointments, ... (Fig. 1).

The goal of this project is to make *Linux* easy-to-use and easy-to-learn. The usability tests are made for three main reasons [8]:

1. To find out which parts of a given design work well for the target audience and which parts don't.
2. compare the effectiveness of various designs.
3. To verify that the specific usability goals have been satisfied.

### 4. VISUAL IMPAIRMENT

*Visual impairment* or *vision impairment* is vision loss that constitutes a significant limitation of visual capability [1].



Fig. 1. Female is moving a window to a different desktop

According to [3], the terms *partially sighted*, *low vision*, *legally blind*, and *totally blind* are used in the educational context to describe students with visual impairments. They are defined as follows:

- *Partially sighted* indicates some type of visual problem has resulted in a need for special education;
- *Low vision* generally refers to a severe visual impairment, not necessarily limited to distance vision. Low vision applies to all individuals with sight who are unable to read the newspaper at a normal viewing distance, even with the aid of eyeglasses or contact lenses. They use a combination of vision and other senses to learn, although they may require adaptations in lighting or the size of print, and, sometimes, braille;
- *Legally blind* indicates that a person has less than 20/200 vision in the better eye or a very limited field of vision (20 degrees at its widest point); and
- *Totally blind* students learn via braille or other non-visual media.

There are several assistive technologies for visually impaired users:

- *screen readers*
- *speech synthesizers*
- *screen magnifiers*
- *braille devices*

Their description and availability on the *Linux* platform will be covered in the following sections.

#### Screen readers

A *screen reader* is a software application that attempts to identify and interpret what is being displayed on the screen. This interpretation is then represented to the user with text-to-speech, sound icons, or a braille output [1]. The choice of screen reader depends on many factors, such as platform, type (command line or GUI (Graphical User Interface)) or (in most of the cases) cost (the price of commercial screen readers can be hundreds of US dollars).

There are two types of *screen readers* at the *Linux* platform:

#### 1. command line screen readers

#### 2. GUI screen readers

Command line screen readers have longer history on *Linux* and they are still very popular in the present. The desktop screen readers are related with the desktop environment but it is not essential, because they are running in the background. Because of the *GNOME Accessibility Project* [6] and *KDE Accessibility Project* [5] there is good integration of such applications directly in the desktop environment.

In the *GNOME* desktop environment can be used the *Orca* [13] or *LSR* (Linux Screen Reader) screen readers. The goal of *LSR* is not only to read the screen, but also to create a reusable development platform for building alternative and supplemental user interfaces in support of people with diverse disabilities [11].

The *KDE* desktop environment uses the *KTTS* (KDE Text-to-Speech), what is a subsystem within the *KDE* desktop for conversion of text to audible speech [5]. Unfortunately, *KTTS* is currently under development and aims to become the standard subsystem for all *KDE* applications to provide speech output.

#### Speech synthesizers

Most important part of the screen reader application is *speech synthesizer*, which is responsible for converting normal language text into speech [1]. Speech synthesizers can be a hardware device or a text to speech (TTS) software application. Hardware synthesizers are available for the *Linux* operating system, however, they can be very expensive and must be compatible with the screen reader application in order to function properly [2]. The alternative is to download and install a software synthesizer.

In the *Linux* system, very popular speech synthesizer used in screen readers is *Festival* and as usual in the world of Open Source - it is completely free. The biggest problem in our country could be support for Slovak language, but there are several projects dedicated to this problem such as [9] or [10].

#### Speech magnifiers

A *screen magnifier* is software that interfaces with a computer's graphical output to present enlarged screen content [1]. People using them are able to control what area of the computer screen they want enlarged, and can move that focus to view different areas of the screen.

Screen magnifiers commonly provide several other features for people with particular sight difficulties [1]:

- *Color Inversion*
- *Smoothing*
- *Cursor customisation*
- *Different Magnification Modes*
- *Screen reader*

Users of the *GNOME* desktop environment can use *GNOME Magnification Tool*, which is part of the *Orca* project - free, open source, flexible, extensible, and powerful assistive technology for people with visual

impairments [13]. Users of the *KDE* desktop environment can use *KMagnifier* (Fig. 2), which is part of the *KDE Accessibility Project* [5]. Links to other screen magnifier applications can be found in [2] and [12]. But comparing to other desktop features and commercial software, magnification on *Linux* is slow and poor on features [14]. With the emergence of *XGL* (An *X server* architecture designed to take advantage of modern graphics cards via their *OpenGL* drivers) and *Compiz* (Composing window manager for the *X Window System* that is able to take advantage of *OpenGL* acceleration) there is a great opportunity to take a leap forward here.

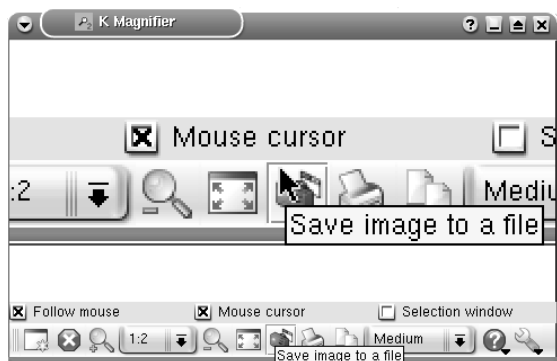


Fig. 2. Magnification tool for *KDE* desktop environment

#### Braille devices

A refreshable *Braille display* (Fig. 3) or *Braille terminal* is an electro-mechanical device for displaying Braille characters using a series of pins to form braille symbols that are constantly updated as the user navigates through the interface, usually by means of raising dots through holes in a flat surface [1] [6]. This devices are normally used by individuals who are totally blind and may be hearing impaired as well. The speech synthesizers are used for the same task as braille devices and blind user may switch between this two systems.

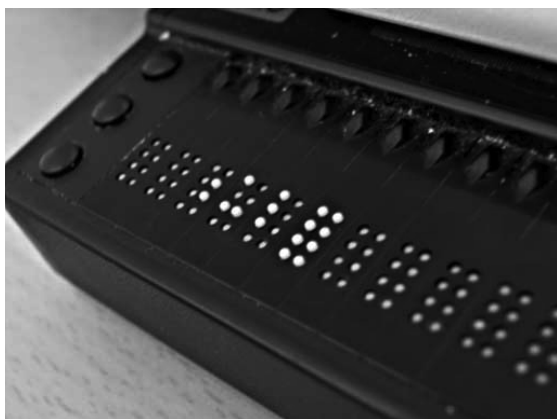


Fig. 3. Refreshable Braille Display

A *braille embosser* is a hardware device for printing a hard copy of a text document in Braille.

*Braille translation software* is required to translate the on-screen text to a Braille format.

Support for braille devices in the *Linux* has also several problems, such as:

- support of accessibility feature during the booting process
- autodetection of braille devices and their configuration
- support of the braille devices in the live distributions
- support of the braille devices during installation of the system
- ...

At the moment *Linux* supports braille devices and provides several solutions for this. One of the most popular solutions running as a background process (daemon) is *BRLTTY*. Other solutions can be found [2] and [12].

#### Desktop environment

Support of assistive technologies in the *Linux* system for visual impaired people is not only in development of new applications, but it is also about the desktop environment itself. Not all of the visual impaired people are completely blind - plenty of them are partially blind. In this case it is important to provide specific tasks to make normal environment accessible for partially impaired people.

One of the tasks is *adjusting the screen's resolution*. Big screen resolution can act for partially blind as not readable, because everything looks very small and hard to read. Change of the screen resolution of the *X server* can be done by hand editing the `/etc/X11/xorg.conf` file or with some GUI tool.

Another problem from this category can be contrast of used theme. There are available several themes providing the high contrast, which can help partially sighted people to better recognize their desktop and look of the applications (Fig. 4) [14].

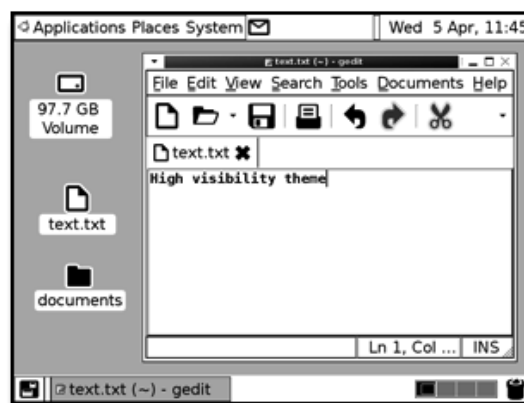


Fig. 4. High contrast theme in *GNOME* desktop environment

## 5. HEARING IMPAIRMENT

*Hearing impairment* is a full (*deafness*) or partial decrease in the ability to detect or understand sounds [1]. According to [4], there are three types of hearing loss:

1. *Conductive hearing losses* are caused by diseases or obstructions in the outer or middle ear. A person with a conductive hearing loss usually is able to use a hearing aid well or can be helped medically or surgically.
2. *Sensorineural hearing losses* result from damage to the delicate sensory hair cells of the inner ear or the nerves which supply it. A person with a sensorineural hearing loss may perceive distorted sounds, sometimes making the successful use of a hearing aid impossible.
3. *A mixed hearing loss* refers to a combination of conductive and sensorineural loss and means that a problem occurs in both the outer or middle and the inner ear.

For users who have hearing impairments the audio output must be conveyed visually on the screen. Most desktops provide visual audio alerts and warnings. In console mode the system can also be configured to provide visual bells [2].

## 6. PHYSICALLY DISABLED

A *physical impairment* affects the ability to move or to coordinate and control movement when performing tasks. A physical impairment may also affect the ability to use or feel certain parts of the body. In the area of the computer accessibility, the physically impaired people have difficulty using a mouse, pointing device, or keyboard [2].

There are several assistive technologies for physically impaired people:

- On-screen keyboard
- Speech recognition,
- Alternative input devices

Their description and support on the *Linux* platform will be covered in following sections.

### On-screen keyboards

An on-screen keyboard, or virtual keyboard, is a graphical computer keyboard that enables people with physical disabilities to use a computer. If a person is not able to push the keys on an ordinary keyboard, he or she can push the keys on a virtual keyboard shown on the screen. This is done by clicking the keys with an ordinary mouse, a headmouse, eyemouse or scanning.

There are several projects available on the *Linux* system dealing with this problem. Some of them provide standard on-screen keyboard with the ability to create their own layouts of the on-screen keyboard look for different types of usage (Fig. 5). Another projects provides completely different ways for entering text, such as *Dasher*.

*Dasher* provides a "zooming interface". User only points where he wants to go, and the display zooms in wherever he points. The world into which is user zooming is painted with letters, so that any point user zooms in corresponds to a piece of text. The more user zooms in, the longer the piece of text user write. User chooses what to write by choosing where to zoom [15].

Other on-screen keyboard applications can be found at [2] and [12].



Fig. 5. Additional layout of the on-screen keyboard

### Speech recognition

*Speech recognition* is the process of converting a speech signal to a sequence of words, by means of an algorithm implemented as a computer program [1]. *Speech recognition* utilities are used by people with mobility impairments. These utilities enable people to control computers with their voice instead of a mouse or keyboard. There two types of *speech recognition* application on the *Linux* system. First type recognizes voice commands based on prepared voice samples (for example *CVoiceControl*). The second type work as a speech dictation, so the user can write his documents using his own voice (for example *Xvoice* based on the *IBM* tool *ViaVoice Dictation for Linux*. Links to speech recognition applications can be found in [2] and [12].

## 7. LINUX DISTRIBUTIONS FOR DISABLED PEOPLE

*Linux distribution* comprising the *Linux* kernel, the non-kernel parts of the *GNU* (Gnu's Not UNIX: A UNIX-compatible operating system developed by the Free Software Foundation) operating system, and assorted other software [1].

Usually, the biggest problem for the becoming *Linux* user is to choose the best distribution, that will fit all of the user's needs. The problem becomes bigger for the disabled people. At the present, there is big range of *Linux* distributions, which are very user friendly and eye candy. But this are not the features disabled person needs.

Some of the distributions deals with the issues of accessibility and usability for disabled people (for example *Ubuntu* distribution truly claims, that it is "*Linux for human beings*"). To avoid this problem, there are also distributions directly focused for disabled people with all the needed applications preinstalled. There can be find two types of such distributions. First type covers distributions for console environment only (for example *Oralux* or *BrlSpeak*). The second covers distributions with *GUI* (for example *Ubuntu*).

## 8. COMPARISON WITH THE PROFESSIONAL APPLICATIONS

The dissability of the impairment people is not the only disadvantage of this people. If they want to use computer, they have to buy special applications for dissabled people. The problem is the fact, the price of such products is very



high. There is always some alternative to the commercial applications from the open source community, but not all of the open source projects have the same features and provide the same quality as the commercial ones.

The table Tab. 1 shows the commercial applications for the *Windows* operating system and their prices. The price was calculated to the course of €1 = 35 Sk.

| Application                 | Type                                | Price |
|-----------------------------|-------------------------------------|-------|
| WinTalker 4.0               | screen reader                       | €440  |
| Jaws 7.0                    | screen reader                       | €1280 |
| Jaws 7.0 with magnifier     | screen reader                       | €1540 |
| Magic 9.0                   | screen magnifier                    | €395  |
| Magic 9.0 Plus              | screen magnifier with voice support | €795  |
| MountFocus Runtime Keyboard | on-screen keyboard                  | €11   |
| WiViK 3                     | on-screen keyboard                  | €225  |

Tab. 1. Commercial applications for OS Windows

## 9. CONCLUSION

This article was dedicated to the topic of accessibility of the *Linux* system for the people with disabilities. The goal was not to introduce some completely new technology, but to make an exploration of available applications and distributions, that will fit the needs of impaired people.

The benefits of open source applications are still in the price, because almost all of them are available for the free. But still - not all of them provide the same quality and same set of features as the commercial ones.

This article is related with the *MonAMI* project which demonstrates, how accessible and useful services can be delivered in mainstream systems and platforms [16].

## 10. REFERENCES

[1] Wikipedia, the free encyclopedia [online] May 2007, available on Internet <http://www.wikipedia.org>

[2] Linux Accessibility HOWTO [online] May 2007, available on Internet <http://tldp.org/HOWTO/Accessibility-HOWTO>

[3] Visual Impairments; A publication of the National Dissemination Center for Children with Disabilities, January 2004 [online] May 2007, available on Internet <http://www.nichcy.org/pubs/factshe/fs13txt.htm>

[4] Deafness and Hearing Loss; A publication of the National Dissemination Center for Children with Disabilities, January 2004 [online] May 2007, available on Internet <http://www.nichcy.org/pubs/factshe/fs3txt.htm>

[5] KDE Accessibility Project [online] May 2007, available on Internet <http://accessibility.kde.org>

[6] GNOME Accessibility Project [online] May 2007, available on Internet <http://developer.gnome.org/projects/gap>

[7] GNOME 2.14 Desktop Accessibility Guide [online] May 2007, available on Internet <http://library.gnome.org/gnome-access-guide/unstable>

[8] Better Desktop [online] May 2007, available on Internet <http://www.betterdesktop.org>

[9] Čáky P., Klimo M., Mihálik I., Mladšík R: *Text-to-Speech for Slovak Language* ISBN 978-3-540-23049-6, 2004

[10] Rusko M.: Department of Speech Analysis and Synthesis [online] May 2007, available on Internet <http://www.ui.savba.sk/speech/dep.htm>

[11] Linux Screen Reader May 2007, available on Internet <http://live.gnome.org/LSR>

[12] Linux/Unix Accessibility Software May 2007, available on Internet <http://larswiki.atrc.utoronto.ca/wiki/LinuxUnixAccessibilitySoftware>

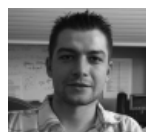
[13] Orca - GNOME Live! May 2007, available on Internet <http://live.gnome.org/Orca>

[14] Ubuntu Accessibility May 2007, available on Internet <https://wiki.ubuntu.com/Accessibility>

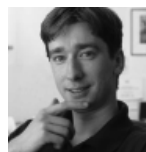
[15] The Dasher Project May 2007, available on Internet <http://www.inference.phy.cam.ac.uk/dasher>

[16] MonAMI - Mainstreaming on Ambient Intelligence May 2007, available on Internet <http://www.monami.info>

## THE AUTHORS



**Miroslav Biñas** is internal PhD student at Technical University of Kosice. his research activities are related distributed systems, videoconferencing technologies, ambient intelligence and to streaming technologies. He is responsible for newly developed archive system for VRVS and EVO videoconferencing systems and he is member of Computer Networks Laboratory. You can contact him at [miroslav.binas@tuke.sk](mailto:miroslav.binas@tuke.sk).



**Miroslav Michalko** is internal PhD student at Technical University of Kosice. his research activities are related to streaming, mobile multimedia technology and web services. He is responsible for Videoserver platform development as project manager and member of [video@lab](mailto:video@lab) team at Computer Networks Laboratory. You can contact him at [miroslav.michalko@tuke.sk](mailto:miroslav.michalko@tuke.sk).



**František Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modelling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak

Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)).

You can contact him at [frantisek.jakab@tuke.sk](mailto:frantisek.jakab@tuke.sk).



**Alena Galajdová** is employed as an assistant professor at the Dep. of Instrumental and Biomedical Engineering at Technical University of Kosice and works also in Access Center at Technical University of Kosice. Her research interests include methods of gait analysis, assistive technology and neural networks.

You can contact her at [alena.galajdova@tuke.sk](mailto:alena.galajdova@tuke.sk).



## WHY IS IT SO DIFFICULT TO PREPARE A PROJECT PROPOSAL FOR EU FP7 COLLABORATIVE RESEARCH PROGRAMME? CAN E-LEARNING HELP?

Zdeněk Brož

Private Consultant, Pod Penzionátem 845, Dobřichovice, Czech Republic

Tel/Fax: +420-257712485, zbroz@quick.cz, <http://web.quick.cz/zbroz/>

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** “To be or not to be a project coordinator” is a question a scientist has to resolve if he/she wants to participate at the EU FP7 Collaborative Research Programme. Such a situation happens for example if his original research idea suits well to the particular call for proposals. However, sometimes, the scientists try to persuade friends or anyone else to serve as a Project Coordinator. They will usually promise to become an ordinary Project Participant, Work Package Leader and/or will assist extensively with the project proposal preparation. I will give some reasons why it is so difficult to write the RTD project proposal and why it is very unpopular to become a project coordinator. Also I will demonstrate the methods and techniques I am using in order to simplify and speed up the project proposal preparation if I were in a position of the consultant or a member of the team preparing the project proposal.

**Keywords:** Applications, Research and development, Resources, Skills, Tools.

### 1. INTRODUCTION

The EU RTD Framework Programmes (FPs) have a rather high rating among the scientists all over the Europe, therefore the position of the coordinator is a privileged one. If newcomers to FPs wish to become coordinators they need information how much time it takes to prepare a cooperative research project proposal and what is the actual coordinator's workload during individual stages of the project running. Of course, that depends very much on the FP7 specific programme, the project type, the number of participants and many other matters. Unfortunately, information derived from experience with domestic grant systems is rather misleading and of no help.

The most of National Contact Points (NCP) from old EU member countries, the project proposal evaluators and also some experienced scientists know in detail the past history of FPs. Of course, there are not too many scientists or research administrators from universities and research organizations that would have a personal experience with more than just one cooperative research project proposal preparation, participation or coordination for each individual FP. It is caused by a low number of the so called opportunity windows (calls for proposals) available during a five or seven year's long life-span of FPs and also because of a rather low rate of success during the evaluation. However, one participation for each FP is enough to become sufficiently informed to understand main changes and challenges available at each new FP. A particularly well informed are the members of the EU FP Programme Committees and experts participating in a preparation of the Work Programmes.

My own experience with European projects dates back to FP4 and namely to the start of FP5 (1999) when the Czech Republic became an associated country to FP5 and I have

started to work as NCP at the Technology Centre ASCR (TC) - the Czech NCP organization.

The FPs has changed very much since that time but there is not enough time to discuss here a complicated structure of the current FP7. Therefore, I will concentrate just on two of the most important instruments of FP7, namely the „Small and Medium ...“ and „Large scale Collaborative Research Projects“. These names have replaced the former titles „Specific Targeted Research Project (STREP)“ and „Integrated Project (IP)“. Of course, the basic „philosophy“ of the Programme Cooperation and its 10 thematic areas (Health, ICT, Transport, Environment etc.) is still the same, but rules, propositions and individual Work Programmes have been modified to a great extent. The important change at the FP7 is the retaining of just one model of the project financing, the Full Cost Model (FC). As usual all changes are a result of the objective „to simplify a project proposal preparation, submission, evaluation, administration, financing and a follow-up“.

Next, I will present information in a chronological way, starting from the call for proposal announcement and ending at proposal deadline, which activity takes usually 3 to 4 months. I will discuss namely the timing of the project proposal preparation because the well known „lack of time“ in preparation is the most frequent cause of the proposal failure during evaluation. I will also mention steps that follow if the proposal is selected for financing. These are the consortium agreement preparation, the contract negotiation, the grant contract agreement signing and the project start-up followed by the kick-off meeting. The main target audience of the paper are potential coordinators of STREPs and IPs, but it can hopefully help to ordinary FP participants to understand what information, when and why are their coordinators asking for.

## 2. PROJECT PROPOSAL

### General

A preparation of the project proposal is a difficult and tedious long-term effort. Its extent can be measured e.g. by numbers of pages recommended for a project composed of 10 Work Packages (WPs) and prepared by a consortium of 15 participants, see Tab. 1. However, the most important advice is „to follow closely the Guide for Applicants” where both the content and structure of the project proposal are precisely defined. The project proposal itself consists of two parts, namely the Forms A and the Part B. The Annex 4 of the Guide is a template of the Part B and it contains very useful recommendations.

### Forms A

All Forms A have to be filled out at the Electronic Project Submission System (EPSS). Form A1 contains a project title, its acronym, keywords, information about the coordinator, a preliminary list of participants and the project abstract with 2000 characters at maximum. Form A2 contains information about the organization and the names of responsible and contact persons. The Form A3.1 contains the budget data of individual project participants and the last Form A3.2 is a budget summary generated automatically by EPSS itself. Each participant has to fill out just Form A2 and in order to access EPSS he/she will use the username and password obtained from a coordinator. The coordinator has: (i) to form a consortium setup and to add, remove or change the order of participants if necessary; (ii) to fill out Forms A1, A3.1; (iii) to fill out some parts of the Form A2 for each participant. The access of the coordinator to EPSS portal is secured by a special username and password.

### Part B

The template for Part B can be downloaded from EPSS in a form of the Rich Text Format (RTF). Its content is the same as given at Annex 4 of the Guide for Applicants (PDF file). Tab. 1 shows a list of content of Part B, consisting of the headlines of chapters, subchapters, tables and charts. The four columns at the right side of Tab. 1 characterize a type of individual content items. Moreover, for a purpose of comparison, there are also introduced the questions that have to be answered by the evaluation experts. You can observe that the wording of questions follows closely the headlines of chapters and sub-chapters of Part B. A more detailed description of the evaluation process is beyond the scope of this paper. I will only add here that STREPs are evaluated by 3 experts, while the Integrated Projects by 5 experts. If the evaluated IP is introduced on the list of projects selected for financing then its coordinator could be invited to Brussels for a special hearing. When the evaluation process is completed all the coordinators will receive from the Commission a two page long Consensus Report that is prepared during the so called consensus meeting by the evaluation experts. It is a general practice that negative answers will come one month sooner than the positive ones.

## 3. GANTT CHART

### A purpose of the Gantt chart at Part B

As follows from Tab. 1 the Gantt chart forms a part of the subchapter 1.3 and represents the timing of WPs and their components (Tasks, Deliverables and Milestones) in a graphical way. Its main objective is to interpret the proposal content in a more understandable way. Moreover, it forms the introductory part for other tables like the List of WPs, WP Descriptions, Deliverables, Milestones, Pert diagram etc.

In general, the scientists are not used to collect data, construct and utilize Gantt charts in their ordinary research practice. The most difficult part of it is to plan the scientific endeavour with duration of 3 or 4 years and a delayed start-up of approx. another 12 months. However, a good quality Gantt chart is a clear message to evaluators indicating good managerial abilities of the coordinator. It helps namely when different proposals have similar scientific or technological qualities and the "non-scientific" indicators (Implementation and Impact) affect the evaluation result very much. In fact, the overall marking of the project proposal is based from the two thirds of the total mark on the content of chapters 2 and 3 of the Part B (see Tab. 1).

### A purpose of the Gantt chart here

The Gantt chart here is both the object of the description and (at the same time) the instrument describing the timing of the project proposal preparation (Fig. 1). The Gantt charts can have different levels of detail and complexity. They can be produced using a special software (e.g. Microsoft Project) or can be prepared as an ordinary Excel sheet and copied into the Word document file, what is the case used here.

At Fig. 1 there are shown three different Gantt charts characterized by different time periods. The first one describes the overall project duration without any detail (WP) introduced at all. The second chart is a timing that starts at the date of the call for proposals and that has two different ends according to the decision of the evaluation committee. The last Gantt chart (C) describes those usual four months available for the project proposal preparation. Those 4 months are divided into 16 weeks and the proposal preparation workload is divided into three distinct stages (WPs). Equally well we could continue further on and to zoom just at the last week, the last day, hour or even at the very last 10 minutes before the deadline. Later on we will present how much time it will take to make some operations like conversion of the Word document to PDF, to upload Part B and submit a project to the EPSS portal.

## 4. PROPOSAL PREPARATION STAGES

### WP1 Preparatory stage

The first Work Package at Fig. 1 is divided into two distinct tasks. The first one (T1.1) incorporates the download of the call document files from the CORDIS portal <http://cordis.europa.eu/>, a search for similar projects at

previous FPs, a search for partners, a search for a policy and other support documents and also a contact with NCPs and/or the Project Officer. The task ends with the Deliverable D1 (see Tab. 2), while the milestone M1 (see Tab. 3) is the first decision point that should provide an answer to the question “to continue or not with the project proposal preparation as a coordinator”. The task T1.1 is a suitable short-term task for PhD students or postdocs. If they prove to be capable they can become the members of the team preparing next steps of the project proposal. In fact, the grant award would affect their life to a very great and positive extent. The content of T2.1 and D2 does not need any further explanation, while the milestone M2 implies a decision whether to use or not a help of an external consultant, when and to what extent. At the end of the first month there should be provided a brief text describing the project idea and a simple WP structure. However, the text should not disclose sensitive information and be ready for an open distribution to anyone.

### WP2 Consortium building stage

The objective of this stage is to prepare and realize a meeting of participants, the activity that needs an exchange of many e-mails with potential project consortium participants. The mailing itself is a time demanding task and a proper strategy should be prepared for it. The text of the first invitation letter could differ according to whom you are mailing it, whether to your scientific friends or to the yet unknown potential participants. If the answer is a positive one, the next letter could contain following items: (i) Memorandum of Understanding or the Non-disclosure agreement, (ii) a request of CV of the organization, research group and scientists - see subchapters 2.2 and 2.3 at Tab. 1, (iii) participant involvement and ask for comments relating the WP structure, (iv) Person Months and budget, (v) WP leadership matter etc. There will be built up gradually (i) “a project core group” composed of the WP Leaders, (ii) alternative lists of the ordinary project participants. Everything mentioned above should be directed to preparation of the meeting of participants organized at the coordinator premises. The meeting should be organized also as an important social event that can help to form an active group of people wishing to prepare a joint project proposal and work together for next several years. You should ask your organization head for a support.

### WP3 Proposal writing stage

This last stage is a self explanatory one using Fig. 1 and tables of Deliverables and Milestones. I would like to stress here the importance of “external evaluation” of Part B by persons “external” to the consortium and sometimes even not involved in the scientific field itself. The consortium partners can also ask their domestic NCPs to read and comment on those “non-scientific” parts of Part B (Chapters 2 and 3). Namely the NCPs are very experienced ones in a given area.

The Gantt chart shown at Fig. 1C describes an optimum case of the project proposal preparation workload distributed evenly to all four months available. The actual

practice is a different one as shown in Fig. 2, taken from an article published in the Czech language [1].

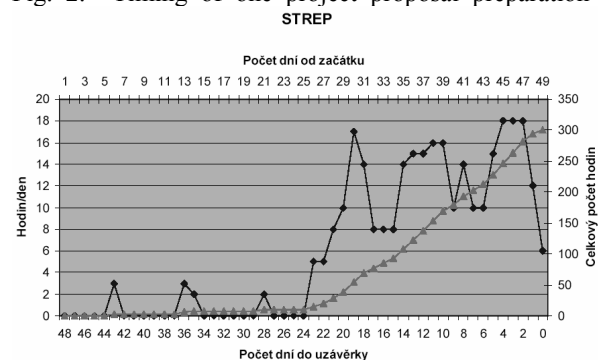
Tab. 2. Deliverables list

|    |     |  |
|----|-----|--|
| D1 | W2  | State-of-the-art   |
| D2 | W4  | Brief description of the project idea suitable for mailing to participants, contacts with NCP and/or Project Officer etc.  |
| D3 | W9  | MoU, CVs, WP leadership, PMs and project cost, a core group build-up, meeting agenda preparation   |
| D4 | W11 | Minutes of the meeting (Consortium setup, draft of the abstract, WP structure, plan of next activities and individual participants involvement, questionnaire for data inputs, Letter of Intent, IPR, Consortium Agreement, "external evaluators" etc. |
| D5 | W13 | Budget preparation and its updates   |
| D6 | W13 | Part B and A3.1 upload to EPSS, the partners and "external evaluators" asked for comments  |
| D7 | W14 | Part B upload to EPSS, partners and "external evaluators" asked for comments   |
| D8 | W16 | Download of all Forms A and Part B from EPSS and mailing the files to participants and to a representative of the own organization   |

Tab. 3. List of milestones

|    |     |   |
|----|-----|---|
| M1 | W2  | Decision to become a coordinator  |
| M2 | W4  | Decision to use an external consultant  |
| M3 | W11 | Confirmation of the coordinator, agreement of plans prepared for proposal preparation |
| M4 | W13 | Approval of the project budget  |
| M5 | W13 | Decision to keep or modify WP structure   |
| M6 | W16 | Final submission of a proposal to EPSS  |

Fig. 2. Timing of one project proposal preparation [1]



Bo the left and right ordinates describe a number of hours per day and the total number of hours spent on the proposal preparation since the beginning of my involvement. The upper x-axis shows number of days since the start and the bottom x-axis shows number of days available till the deadline. The meeting of participants took place at day numbers 19 and 18, while the day number 10 marks a complete change of the logical structure of WP. The partners received Part B for comments 2 days before the deadline. You can see that the proposal preparation was squeezed in three weeks and no time had been available for

comments of “external evaluators”. Instead of that, we had to seek information how much time is necessary to submit a project proposal to the EPT system (the predecessor of EPSS), see Tab. 4.

Tab. 4. Time duration in minutes

| No | Item                                   | Minutes |
|----|--|---------|
| 1  | Registration of a project              | 60      |
| 2  | A3.1 Budget data upload from keyboard  | 60      |
| 3  | Acrobat PDF Maker conversion of Part B | 10      |
| 4  | Acrobat Distiller conversion of Part B | 1       |
| 5  | Part B PDF file upload to EPT          | 1-2     |
| 6  | Final submission of the project to EPT | 1-2     |

## 6. EXCEL FILE AS A TOOL FOR A PROJECT PROPOSAL PREPARATION

The project proposal preparation is a difficult task also because of a continuous inflow and update of a huge amount of data. There are two main sources of data, namely those (i) obtained from participants and (ii) generated during the course of the proposal preparation. All the data have to be transferred to proper and multiple places at Forms A and Part B.

To solve the problem with frequent data updates and their subsequent transfer to multiple places I am using a “centralised system of some data inputs” at the pre-defined sheets of the Excel file. The ordinary Excel sheets are interlinked to those “master ones”. For example, from one data entry there can be updated automatically the other sheets like WP Description tables, List of WPs, the Gantt chart data, Deliverables and Milestones. Using the tools of Excel you can easily regroup Deliverables and Milestones according to their delivery month and then export a resulting table into the document Word. It can be done quickly if you are under the time pressure.

## 7. QUESTIONS WITHOUT ANSWERS

I have three main reasons why to replace the proposed template title “Discussion” by the above “Questions without answers”. They are, namely (i) a lack of space here, (ii) a lack of some answers, (iii) a belief that a reader will try to find the answers by himself. Below I have divided the question into two distinct groups:

A. How many document pages a coordinator has to read before he/she can start with a proposal preparation? How much time is it needed to prepare a project proposal? What is the usual workload distribution among the coordinator, WP Leaders and ordinary participants? How to optimize a composition of the coordinator’s team? How to distribute the proposal preparation workload among the senior scientists and doctorands? What kind of a support can a coordinator expect from the NCP organization? What can

he/she expect from his/her mother organization, e.g. the university or research institute? How is it possible to combine the ordinary duties of a coordinator like teaching with so demanding task of a proposal preparation? Is there available a list of the support measures the coordinator needs? Who can profit the most if you are a coordinator? What should be the organization policy towards the overhead money? How should the organization motivate a scientist to become a coordinator?

B. What are the indicators of a quality of the project proposal? How to describe and treat risks and contingency plans at Part B? What is a suitable mix of CVs and a description of the roles of scientists, research groups and organizations in the project proposal presented at so limited space? What are the indicative figures of EU grant contribution for STREPs and IPs? How to deal with subcontracting and travel costs that are the sensitive project cost items? How to differentiate among the four main project activity types like RTD, Demonstration, Project Management and Other? What are the reasonable figures of Person Months and Project costs of the Management activity? How to proceed with the Consortium agreement preparation? How and when to start to discuss the IPR (Intellectual Property Rights) matters? What to answer if some people are prompted to rate the FP as intentionally difficult, complicated, unfriendly and a hostile one? What questions are missing? Can E-learning help?

## 8. REFERENCES

[1] Brož, Z.: How to write project proposals to EU FP6 – Experience of a private consultant. ECHO- Information about the European research, development and innovations, Vol. 3/2004, pp. 19-20. Publisher: Technology Centre AS CR, printed version ISSN: 1214-7982, on-line version ISSN: 1214-8229 (in the Czech language).

## THE AUTHOR



**Zdeněk Brož, PhD:** Original profession is a research in chemical engineering (www.icpf.cas.cz, 1961-1993); secretary/advisor to the President of the Czech Academy of Sciences (www.cas.cz, 1993-1996); Deputy Director of TC ASCR (www.tc.cz, 1996-2001) involved in SMEs incubation, COST administration, National Contact Point of the EU RTD FPs of ENVI, INCO and INTAS. After the retirement, involved in various activities as the project proposal consultancy, administration and management of European projects, e.g. FP6 IST SSA ATVN-EU-GP Project (www.atvn-eu-gp.pl/) at the Centre for Administration and Operations ASCR, v.v.i. (www.cas.cz, 2005-2006).

Tab. 1. Project proposal structure, content and evaluation questions. Number of pages of a project proposal with 10 WPs and 15 participants.

| Type    | ID   | Title   | RTD  | PMs | Budget  | Timing | Pages  |
|---------|------|---|--|-----|---------|--------|--------|
| Forms A | A1   | Abstract 2000 characters  | ✓  |     |         | ✓      | 1      |
|         | A2   | Participant information (2 Pages per Participant)                                 |  |     |         |        | 30     |
|         | A3.1 | Budget (1 Page per Participant)   |  |     | ✓       |        | 15     |
|         | A3.2 | Budget Summary  |  |     | ✓       |        | 1      |
|         | 1.   | Scientific and/or technical quality, relevant to the topics addressed by the call | Scientific and/or technological excellence   |     |         |        | 20     |
| Part B  | 1.1  | Concept and objectives  | Soundness of concept, and quality of objectives  |     |         |        |        |
|         | 1.2  | Progress beyond the state-of-the-art  | Progress beyond the state-of-the-art   |     |         |        |        |
|         | 1.3  | S/T methodology and associated work plan  | Quality and effectiveness of the S/T methodology and associated work plan  |     |         |        |        |
|         |      | Gantt chart (timing of WPs and their components)                                  | ✓  |     |         | ✓      | 2      |
|         |      | Table 1.3a Work package list  | ✓  | ✓   |         | ✓      | 1      |
|         |      | Table 1.3b Deliverables List  | ✓  |     |         | ✓      | 2      |
|         |      | Table 1.3c WP descriptions (max. 3 Pgs/WP)  | ✓  | ✓   |         | ✓      | 30     |
|         |      | Table 1.3d Summary of staff effort  | ✓  | ✓   |         |        | 1      |
|         |      | Table 1.3e List of milestones   | ✓  |     |         | ✓      | 1      |
|         |      | Diagram Pert or similar   | ✓  |     |         | ✓      | 1      |
|         | 2.   | Implementation  | Quality and efficiency of the implementation and the management  |     |         |        | 26     |
|         | 2.1  | Management structure and procedures   | Appropriateness of the management structure and procedures   |     |         |        |        |
|         | 2.2  | Individual participants   | Quality and relevant experience of the individual participants   |     |         |        |        |
|         | 2.3  | Consortium as a whole   | Quality of the consortium as a whole (including complementarity, balance)  |     |         |        |        |
|         | 2.4  | Resources to be committed   | Appropriateness of the allocation and justification of the resources to be committed (budget, staff, equipment)                    |     |         |        |        |
|         | 3.   | Impact  | Potential impact through the development, dissemination and use of project results   |     |         |        | 10     |
|         | 3.1  | Expected impacts listed in the work programme                                     | Contribution, at the European and/or international level, to the expected impacts listed in the work                               |     |         |        |        |
|         | 3.2  | Dissemination and/or exploitation of project results, and management of           | Appropriateness of measures for the dissemination and/or exploitation of project results, and management of intellectual property. |     |         |        |        |
|         | 4.   | Ethical Issues  | ✓  |     |         |        | 1      |
|         | 5.   | Consideration of gender aspects   | ✓  |     |         |        | 1      |
|         |      | Forms A: Number of pages  |  | 47  | Part B: | 96     | Total: |

Fig. 1. Gantt charts of three different periods of the project life

| A. Timing from START to END (without the Work Packages introduced) |   |      |    |    |    |    |  |  |  |  |  |
|--|---|------|----|----|----|----|--|--|--|--|--|
| ID   | Task  | Year |    |    |    |    |  |  |  |  |  |
|  |   | Y1   | Y2 | Y3 | Y4 | Y5 |  |  |  |  |  |
| 1  | Project proposal preparation, evaluation, consortium agreement, negotiation etc.  |      |    |    |    |    |  |  |  |  |  |
| 2  | Collaborative research project running (a duration of STREP / IP is 2 to 4 years) |      |    |    |    |    |  |  |  |  |  |

| B. Timing from START to KICK-OFF meeting |   |       |    |    |    |    |    |    |     |     |     |     |     |     |     |     |
|--|---|-------|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
| ID                                       | Task                                      | Month |    |    |    |    |    |    |     |     |     |     |     |     |     |     |
|  |   | M1    | M2 | M3 | M4 | M5 | M6 | M7 | M8  | M9  | M10 | M11 | M12 | M13 | M14 | M16 |
| 1  | Project proposal preparation              |       |    |    |    |    |    |    |     |     |     |     |     |     |     |     |
| 2  | Evaluation                                |       |    |    |    |    |    |    |     |     |     |     |     |     |     |     |
| 3  | Decision from the European Commission     |       |    |    |    |    |    |    |     |     |     |     |     |     |     |     |
| 4  | Consortium agreement preparation          |       |    |    |    |    |    |    | NO  | YES |     |     |     |     |     |     |
| 5  | Project negotiation                       |       |    |    |    |    |    |    | ☹   | ☺   |     |     |     |     |     |     |
| 6  | Grant agreement signature by participants |       |    |    |    |    |    |    | END |     |     |     |     |     |     |     |
| 7  | Project Kick-off meeting                  |       |    |    |    |    |    |    |     |     |     |     |     |     |     |     |

| C. Timing from START to DEADLINE of a call for proposals |  |      |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
|--|--|------|------|---|----|----|----|----|----|----|----|----|----|-----|-----|-----|
| ID   | WP/Task  | Who? | Week |   |    |    |    |    |    |    |    |    |    |     |     |     |
|  |  |      | C    | P | W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 | W11 | W16 |
| 1  | WP1 Preparatory stage  | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 2  | T1.1 Information collection                                    | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 3  | T1.2 Project idea and draft of the WP structure                | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 4  | WP2 Consortium building stage                                  | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 5  | T2.1 Communication with participants, set-up of a "core group" | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 6  | T2.2 Meeting of participants preparation and realisation       | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 7  | WP3 Proposal writing stage                                     | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 8  | T3.1 Project registration at EPSS, Forms A1 and A2 filling     | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 9  | T3.2 Project budget, Person Months, Subcontracts etc.          | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 10   | T3.3 Part B Version 1 and A3.1 - 1st submission to EPSS        | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 11   | T3.4 Part B Version 2++, 2nd submission to EPSS                | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |
| 12   | T3.5 Final editing of Part B and submission to EPSS            | ✓    |      |   |    |    |    |    |    |    |    |    |    |     |     |     |

Notes: C = Coordinator, P = Participant, ✓ = a prevailing participation at the WP or Task, D = Deliverable, M = Milestone.





## REMOTE COMMUNICATION WITH MEASUREMENT WORKPLACES

Olga Čičáková<sup>1</sup>, Michal Kubík<sup>2</sup>, Iveta Ondrášová<sup>1</sup>

<sup>1</sup> Department of Measurement, Faculty of Electrical Engineering and Information Technology, Slovak University of Technology, Bratislava, Ilkovičova 3, 812 19, Slovak Republic  
Email: olga.cicakova@stuba.sk, iveta.ondrasova@stuba.sk

<sup>2</sup> Honeywell comp., Brno, Czech Republic  
Email: michalkubik@gmail.com

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The aim of the work was to design and to implement the system, which would cover the most significant aspects of remote control, and to support its next expansion. The system is oriented to communication of proposed communication protocol between individual parts of the system. By using the implemented system several users are allowed to take a part in the remote control process at the same time. The submitted document is focused in the stages of analysis, requirement specification, projection and implementation of the generated system. The verification phase of implementation and evaluation is presented in the paper.

The aim of this report is to show the problems in compilation of the remote measurement workplace and how to deal with them, as well as to project possible solution of such a workplace.

**Keywords:** client, server, remote control

### 1. INTRODUCTION

Nowadays, getting correct information in good time is a big advantage. Besides, by obtaining lower cost and higher quality we are on the best way to belong to the top. In the area of measurement technique the systems for remote communication with measurement workplace give us such an opportunity.

The aim of our work was to implement the system allowing remote control of electricity meter calibration through the computer network. It would also offer other users the possibility to watch the calibration process [1]. The designed system was implemented on existing workplace used for local control of calibration process.

Regarding to specific requirements the control PC was transformed to local client (LC) and server and remote clients (RC) were implemented. Architecture design is on

current and power. They are connected as electricity meters.

- RC1.....RCn – remote clients
- S - server

The main difference between the local and remote control of measurement workplaces is that using local control the operator and measurement workplace are located at the same place in a given time.

On the other hand the remote control allows measurement process control from any remote place. In addition the operator can lay out the measurement that will be carried out in future without his presence – batch processing. In remote control using the „intelligent“ measurement devices is suggested.

The advantage of remote control of measurement workplace is that it allows measurement equipment sharing by several users and measurement process can be simultaneously represented to several users in real time. On the other side, if the remote control is used, higher initial costs and protection costs for protection of data transfer security is needed.

### 2. SUBJECT AND METHODS

In dependence of customer requirements of initial conditions, available measurement devices and the very measurement object, as well as the different topology workplace variation allowing remote control, can be reached.

The workplace topology will look differently if we have at our disposal the devices with LXI standard support [2] (these devices could be connected to computer network on-line), and it will look differently if the devices have GPIB, VXI, PXI... standards support – it is convenient to

The designed system consists of:

- control PC as Local Client (LC) – it controls calibration process, that means providing the communication with individual equipments, screening and keeping obtained results. For connection “control PC-equipments” RS232 bus is used,
- electronic calibration station EKS 05-3 - it consists mainly of device PEM6711 as a signal generator, of relay system for switching the current and voltage ranges of transformers and of other equipments,
- calibration device comparator K2006 - as three-phase digital meter for electric voltage, current and power, of high accuracy class,
- calibrated devices PEM6711 as multipurpose equipments which allow to generate 3-phase harmonic signal and to measure digitally 3-phase voltage,

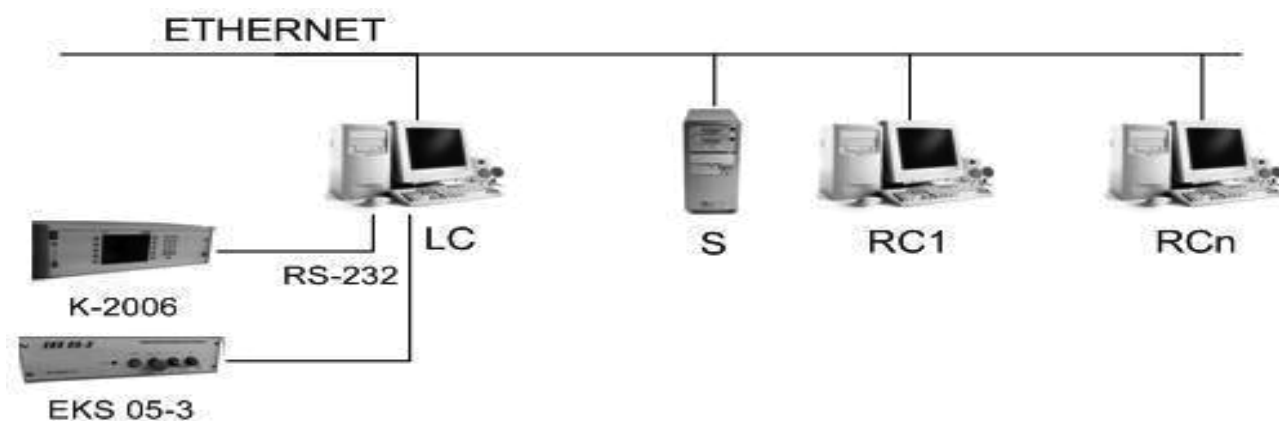


Fig. 1. Architecture network design for remote communication with calibration workplace

connect these devices to computer and then to connect this computer to computer network.

The result topology will be rather complicated if the customer requires the system permitting several users to monitor measurement which is performed momentarily by other user.

In case of sensitive data transfer the increase of security system is useful, e.g. by separating measurement devices from remote computers by server.

However, the computer can:

- save the list of users who have been participating in the measurements,
- save the measurement process (by providing realized measurements, additionally)
- implement a schedule for the control client selection.

After having resolved the physical topology problem of our workplace the selection of useful network protocol is needed. We have some possibilities: TCP, UDP, http, FTP, SMTP [3], in some case commercial protocols, e.g. DataSocket, RDP-Remote Desktop Protocol [4].

Then it is necessary to establish communication protocol, through which the exchange of data reports between individual clients is possible and to define particular types of data reports and their dataflow direction.

The question of security is very complex and the solution on its every single level is needed. From the point of view of workplace topology the separation of measurement devices from remote computers by server is available as mentioned above. On the level of network protocol it is useful to secure transferred data e.g. by protocols SSH, SSL, IpSec, etc.

It is effective to supply the communication protocol e.g. with sum field check.

### 3. RESOLUTION

In the implemented system the requirements on remote communication with measurement workplace are taken in account.

From the view of architecture the workplace for local control was transformed to local client to whom the particular measurement devices were connected. The remote client was designed and implemented.

The designed solution allows measurement process control by control client located on the side of local or remote client. The other clients can monitor the measurement process. Only one local client and several remote clients can exist in a given time. Individual clients are separated from one another through server which operates as firewall. All clients have to identify and authenticate on the server before starting the measurement. Reports are transferred from control client to other clients by server. The block diagram of the workplace for remote communication with measurement workplace is shown in Fig.2.

The communication protocol allowing the exchange of data reports between individual communication entities was designed, too. This protocol is designed as universal – it means that remote communication is enabled but in case of need it is possible to add other types of reports. In every report, except information on the measurement, the fields - type of report, priority, extension, data, CRC code are also included.

Momentary these types of reports are designed and implemented:

- Login, Logout – reports for client identification and authentication.
- Selection of equipments, devices and watched parameters – report used for selection of measured parameters, e.g. active phases of generator, phases of measured device or equipment.
- Range setting – report used when setting the ranges of measured devices.
- Next measurement parameters – report used mainly for measurement workplace control, e.g. start, halt of measurement.
- Allocating control client information – report used for client information of which client will be selected as the control one.
- Answer 1,2 - 2 format types of answer were designed. The main difference between them is that in the first

case with the answer the origin report is also that in the transferred (command which is related to the answer).

- Error – error message about the potential failure, e.g. loss of connection between local client and server.

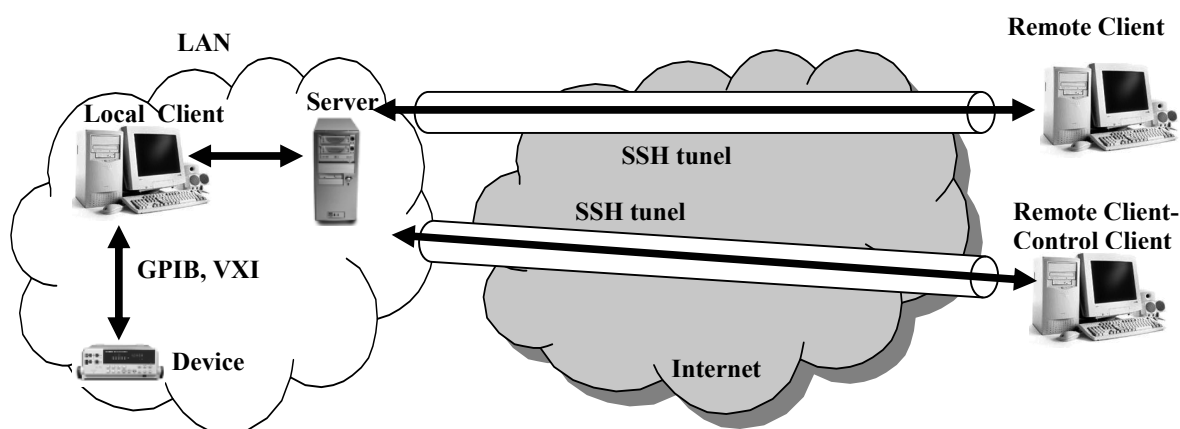


Fig. 2. Block diagram of workplace for remote communication with measurement workplace

For data transfer security the SSH and Isec protocols were used. Additional fault tolerance is reached through CRC field in communication protocol and by separation the clients by server. On the server in case of increased security requirements the implementation of filter for filtering the danger reports is possible.

Designed solution was implemented on the system for digital electrometer calibration. Individual clients and server are implemented as autonomous programs. By reason of simple transportability the communication protocol is implemented in dll library.

#### 4. CONCLUSIONS

As shown above the aim of the work was to implement the workplace allowing remote control of the system for digital electrometer calibration. The intension to make the system as much universal as possible was performed. The implemented solution described above is only the first step in generating the workplace allowing remote control. For full-value use of the implemented workplace the reactions of the system to the next situations are resolved:

- tendency to measurement control by several clients at the same time,
- inaccessibility of local client,
- loss of connection between server and local client in time of measurement process,
- loss of connection between server and remote client in time of measurement process,
- connection of remote client when the measurement is in progress,
- integrity break of accepted data.

Furthermore, in more extended systems and high precision measurements the problem of synchronous impulses distribution is needed to resolve

In the work we started from the workplace for electrometer calibration. This workplace was transformed to local client. By adding the communication protocol library the communication with the server was provided.

As the base for remote client the user interface from the original system was used and the library with communication protocol was added to it, too..

Implemented system allows:

- to perform the measurement from local client. This attribute has remained from the original system,
- to watch the measurement process through LAN and Internet by several remote clients,
- to control the measurement through LAN and Internet by control client,
- to use designed communication protocol,
- to display user reports on the server,
- secure data transfer.

In the future the implemented solution could be extended to other communication channels, e.g. GSM, Bluetooth, etc. In case of error local client operator could be informed immediately.

If the implemented system is applied to other application types new reports in in communication protocol library are necessary.

The results of measurement could be saved on the server so that the users not participating in the measurement process can watch it.

## REFERENCES

- [1] Kubík, M.: Remote Communication with Measurement Workplace, Diploma work FIIT SUT, Bratislava, 2006.
- [2] LAN eXtensions for Instrumentation, [www.lxistandard.org/home](http://www.lxistandard.org/home),
- [3] Halva, T.: Internet Process Making Remote Process Control Easier. Automa, 2004,10 (4):6-7.
- [4] Integrating the Internet into Your Measurement System, DataSocket Technical Overview. [zone.ni.com](http://zone.ni.com).

## THE AUTHORS

**Oľga Čičáková** (Ing.) received her degree of Ing. (1979) in experimental electrophysics from Faculty of Electric Engineering and Information Technology, Slovak University of Technology in Bratislava. From 1991 she is a lecturer at the same faculty, Department of Measurement.

Her current research interest is in efficiency of automation measurement systems.

**Michal Kubík** (Ing.) received his degree of Ing. (2006) in computer systems and networks from Faculty of Informatics and Information Technologies, Slovak University of Technology in Bratislava. He works as system engineer in Honeywell comp., Brno, Czech republic.

**Iveta Ondrášová** (Ing.,PhD.) received her degree of Ing. (1986) in measurement technics from Faculty of Electric Engineering and Information Technology, Slovak University of Technology in Bratislava. She gained the degree PhD. (1992) in evaluation of efficiency of automated measurement systems. She is a lecturer at the same faculty, at Department of Measurement. Her current research interest is in efficiency of automation measurement systems.

## ACKNOWLEDGEMENT

*This work was partially supported by the grant VEGA 1/3101/06.*



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## THE CONCEPT OF DEVELOPING E-LEARNING REPOSITORY – METADATA AND GROUP WORK

<sup>1)</sup> Dariusz Dobrowolski, <sup>2)</sup> Anna Grabowska, <sup>3)</sup> Pascal Lafourcade

<sup>1)</sup> Maria Curie Skłodowska University, Pl. M. Curie Skłodowskiej 5, PL 20-231 Lublin, Poland  
Phone: +48 81 537 62 86 e-mail: [dariusz.dobrowolski@umcs.lublin.pl](mailto:dariusz.dobrowolski@umcs.lublin.pl)

<sup>2)</sup> PRO-MED Co Ltd., Dolne Migowo 16 C, PL 80-282 Gdańsk, Poland, Mobile: +48 601 329 795,  
e-mail: [anka.grabowska@gmail.com](mailto:anka.grabowska@gmail.com)

<sup>3)</sup> ETH Zurich, Haldeneggsteig 4/Weinbergstrasse, CH 8092 Zurich, Switzerland Phone: +41 44 632  
72 72 e-mail: [pascal.lafourcade@inf.ethz.ch](mailto:pascal.lafourcade@inf.ethz.ch)

**Abstract.** This article describes how a build-in mechanism in LMS/LCMS (Learning Management System/Learning Content Management System) and Open Source software are used for creating the content repository in the **CENAR** project (Centrum Edukacji Niestacjonarnej Akademii Rolniczej – in Polish, Distance Education Centre at University of Agriculture – in English). The CENAR project aims at constructing the model of knowledge repository based on the metadata standards. It describes the educational course contents using IMS Learning Object Metadata (LOM) specification. In the article a universal solution in a form of XML document is proposed. It supports development of e-learning materials and implementing them in different LMS/LCMS. In order to filter information content in the XML repository Stack-Based Query Language (SBQL) is used. This is a new object-oriented query language based on Stack-Based Approach (SBA). Finally implementing the results of the **Rural-eGov** (Training SMEs of Rural Areas in using e-Government Services) Leonardo da Vinci project is elaborated.

**Keywords:** metadata, e-learning, Atutor, Moodle, ReloadEditor, SBQL, database

### 1. INTRODUCTION

Development of distant education systems disclosed drawbacks related to creation of educational courses – expenditures of new courses are larger and larger but the effects do not correspond to costs.

The serious problem is the fact of existence of courses in the same subjects and created by various authors enjoying eminent authority but their availability is confined due to the lack of information flow. Creating a mechanism which would facilitate formation of a new course from already existing material and then rendering it accessible for a large group of users is considered on various levels – description, storage and availability. The information describing educational contents in the most cases is based on the IMS specification. In the presented repository project called CENAR, the repository structure represents the IMS LOM standard, metadata description is in the XML format and data storage takes place in the database management system SBQL (Stack-Base Query Language) – the stack-based approach.

### 2. WHY METADATA

The contents must be designed in such a way that it could be used many times and must be so packed that its localization and automatic systematization in the in-coming catalogue publication could be made. One of the approaches to achieve this aim is using metadata. What are metadata?

The metadata themselves are often called the data about data or the information about information. Actually metadata are the structural information which describes, explains and locates data or facilitates recovery, use or management of information source. In Fig. 1 we present an example of metadata, this example shows that the language used for the description of metadata is very simple and intuitive.

```
<metadata>
  <lom>
    <general>
      <title>
        <langstring xml:lang="pl">Weryfikacja
        protokołów kryptograficznych</langstring>
      </title>
      <language>pl</language>
      <language>en</language>
    </general>
    <description>
      <langstring xml:lang="pl"> Weryfikacja
      protokołów kryptograficznych </langstring>
      <langstring xml:lang="en">Verification of
      Cryptographic Protocols </langstring>
    </description>
  </lom>
</metadata>
```

Fig.1 Example of metadata

At present there are many schemas of metadata and sets of elements. Many organizations deal with the frameworks for metadata. These are, among others, Dublin Core (DC). Metadata Encoding and Transmission standard (METS),

metadata Object Description Schema (MODS) or IMS Learning object Metadata (IMS LOM)

### 3. MODEL LOM AND TOOLS FOR EDITING THE METADATA

To create a database of knowledge over the years acceptance of specification and standards ensuring access, exchange and use of educational modules from different producers results from the need:

- To popularise educational contents
- To render contents of both basic materials and complex course accessible
- To ensure portability between educational platforms
- To apply modules many times
- To create on-line training

The above needs are taken into account in the specification Learning Object Metadata (LOM). LOM was elaborated by the organization IEEE Learning Technology Standards Committee (LTSC) and included in the standard IEEE 1484.12.1-2002. The metadata schema is hierarchical and includes over 60 elements, determines their interrelations and types of stored value. These metadata are included in the tuck in list form on which the user can make necessary modifications. The list is divided into nine categories (Fig. 2)

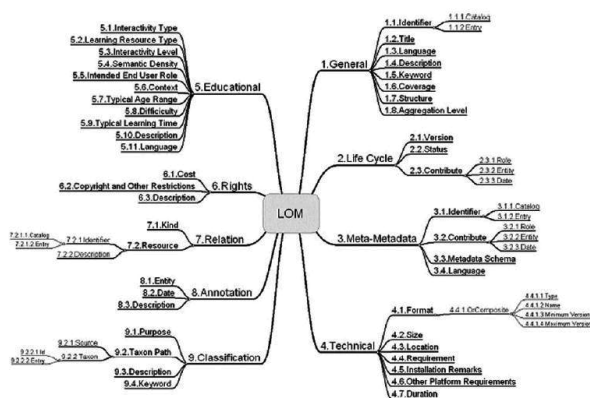


Fig. 2 Specification LOM [1]

### 4. CREATING REPOSITORY FOR EXAMPLE LAFOURCADE'S COURSE

The best way to present the process of repository preparation is a specific example. Pascal Lafourcade from ETH Zurich developed an exemplary course in the Moodle system (Fig. 3). It was the first time he used this system. Only a very short time was necessary for creating his course in this system. Moreover the proposed interface is friendly designed, very intuitive and convivial to use. It allows the author to produce documents in different common formats like PDF, PS, HTML. This experience is a good demonstration of the expansion of Moodle and explain that Moodle is one of the most popular LMS/LCMS systems.

**Information Security**

---

## 1. Verification of Cryptographic Protocols

Exercises introducing the formal verification of cryptographic protocols [html](#), [pdf](#), [ps](#).

## 2. Using an Automatic Verification Tool: Scyther

Exercises introducing the *Scyther* tool for formal verification of cryptographic protocols [html](#), [pdf](#), [ps](#).

Webmaster [pascal.lafourcade@inf.ethz.ch](mailto:pascal.lafourcade@inf.ethz.ch)

Fig.3 Lafourcade's Course

However so far it has not got tools for formation and export of metadata. Therefore the procedure of metadata edition by means of external tool has been presented. For this aim the tool ReloadEditor was applied. ReloadEditor is application of Java, therefore it is not ascribed to a specific operation systems. It can be installed on both platforms Microsoft Windows, Linux or MacOS. The only requirement is to install the package Java Runtime Environment (JRE). Starting the Editor there are formed automatically the files including the basic data:

- imsmanifest.xml – the manifest of contents package including all stored information
- imscp\_v1p1.xsd – the local copy of the content package in the format XMLSchema
- imsmdv1p2p2.sd – the local copy of metadata in the format,
- ims\_xml.xsd – the local copy of the document XMLSchema.

Fig.4 and Fig. 5 presents the example of editor and edition fields. [3]

Fig.4 ReloadEditor - FormView

The system ATutor presents a different approach to export and exchange of educational contents. ATutor is Canadian LMC/LCMS system, not as popular as Moodle, but after getting familiar with it, arousing interest. It has a module structure composed of modules of distant education team work, improvement for the disabled etc. As one of a very few systems ATutor is able to export data according to the

IMS specification. Edition takes place directly in the system, it exports the course edited at the moment (Fig.6).

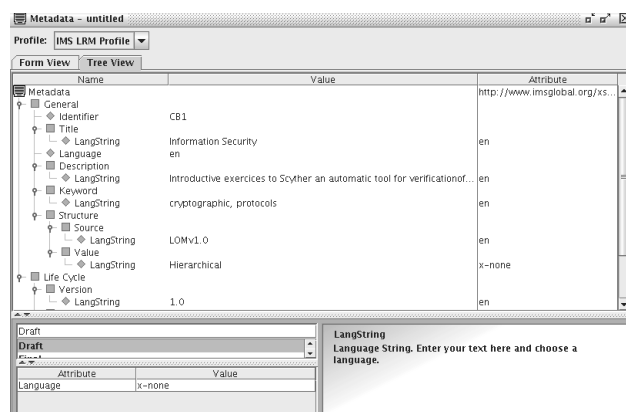


Fig. 5 ReloadEditor - TreeView



Fig.6 Export content with ATutor

As a result of the above procedure we obtain Content Package in the standard form imsmanifest.xml enabling creation of generally accessible database containing all information about existing educational courses (Fig.7).

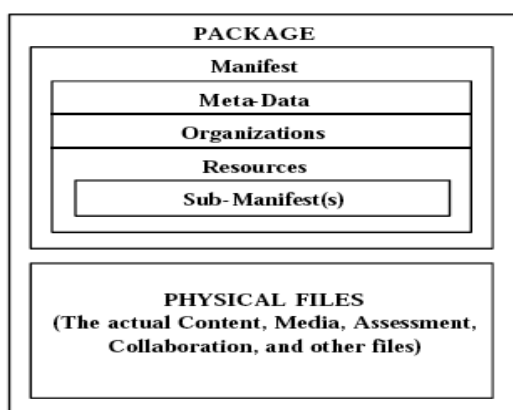


Fig. 7 Content Package concept

In the project the innovative solution in the field of database which is Stack-Base Query Language (SBQL) – the database using Stack-Base Approach (SBA) is applied. It can be successfully used for the repositories XML.

Moreover, this system is friendly for programmers (example shown in Tab. 1) and fast in data exploration.

Tab.1 Comparison of query SQL and SBQL

| JAVA+JDBC+SQL   | PySBQL   |
|---|--|
| <pre> Connection conn; ResultSet R; Statement s; ... s=conn.createQuery(); ... R=s.executeQuery(   "SELECT salary FROM   empl WHERE sname =   'SMITH'"); while (R.next()) {   System.out.println   (R.getString(1)); } </pre> | <pre> print (men where sname == 'SMITH').salary </pre> |

The language SBQL enables creation of the own system of data exchange based on data servers and the system p2p following the example of gnutella, a file sharing network. The approach for repository formation is applied not only for description of education courses themselves but also any information connected with them, the example of which can be Rural-eGov project.

## 5. IMPLEMENTING "RURAL-EGOV" RESULTS WITHIN CENAR PROJECT

The Rural-eGov project aims to focus on and analyse the needs regarding public services support of SMEs in five rural areas of EU member states with different degrees of e-government services deployment and adoption. The specific aims of the Rural-eGov project among other things are:

- to develop a set of proposed training scenarios (based on blended learning strategies for vocational training). These will promote the combination of ICT-based learning (such as digital learning repositories that support virtual communities) with traditional forms of learning (such as seminars and learning groups). Their aim will be to train SMEs from rural areas in understanding and reaping the benefits from e-government services.
- to develop innovative and relevant e-learning content that will support the proposed training scenarios, which will be described and stored (in the form of learning objects) in the Observatory's repository of digital training objects.

The earlier described project CENAR is applied in description of public services within the Rural-eGov project. The model of content description in the form of repository will enable access to government services classified earlier and thus will speed up attainment of information of great interest for specific subject.

## 6. CONCLUSION

The above text is only introduction to the problems presented by the CENAR project whose main aim is rendering the educational contents described by means of metadata accessible. This project is based on the edutella project (project is a multi-staged effort to scope, specify, architect and implement an RDF-based metadata infrastructure for JXTA) and indirectly on JXTA of the firm SUN Microsystems, Inc. Application of different approach to structure of information exchange system and first of all the database ODRA and the language SBQL as a main project may be widely applied.

One of the expecting results will be an e-learning repository metadata build on co-operation between two projects CENAR and Rural-eGov. It is planned that this repository will be used by university students (Lublin, Gdańsk, others) which is an added value for both projects.

## 7. REFERENCES

- [1] IMS Meta-data Best Practice Guide for IEEE 1484.12.1-2002 Standard for Learning Object Metadata
- [2] Lafourcade P. : Example course in LMS Moodle, <http://blanka.moodle.pl/mod/resource/view.php?id=2418>
- [3] Milligan C.: ReloadEditor Introductory Manual. JISC, 2004, 31 pages
- [4] ATutor: Open Source Web-based Learning Content Management System, <http://atutor.ca>
- [5] Lim Kin Chew: Use of XML in eLearning Content Packaging. Synthesis Journal, ITSC, 2001, Section 2
- [6] Subieta K. Theory and Construction of Object-Oriented Query Language. PJIIT – Publishing House, ISBN 83-89244-28-4, 2004, 522 pages (in Polish)
- [7] Leonardo da Vinci Programme “Rural-eGov: Training SMEs of Rural Areas in Using e-Government Services“, EL/06/B/F/PP-148238, <http://rural-egov.eu>
- [8] Dobrowolski D., Grabowska A., Lafourcade P.: Example group work in Moodle: <http://blanka.moodle.pl/course/view.php?id=66>
- [9] Edutella - RDF-based Metadata Infrastructure for P2P Applications, <http://edutella.jxta.org/>

## THE AUTHORS

**Dariusz Dobrowolski:** from 2000 Maria Curie Skłodowska University in Lublin, from 2006 - assistant professor at the Department Put Techniques, Faculty of Engineering of Production, Lublin University of Agriculture, from 2005 – Open PhD procedures in Polish-Japanese Institute of Information Technology

**Anna Grabowska:** assistant professor at Faculty of Civil and Environmental Engineering, Gdańsk University of Technology (GUT), Project Manager at PRO-MED Co Ltd., Head of Autodesk Authorised Training Centre, Head of Distance Education Centre at GUT (1997-2004). Member of: EDEN, PROMETEUS, ProCAx, IFIP, SEA. Member of International Program Committees: ICETA, ITHET, Telematica, ICNEE, CATE, WBE. Experiences in European programmes: TEMPUS, PHARE Multi-country Programme in Distance Education, Socrates (COMENIUS, GRUNDTVIG, MINERVA), Leonardo da Vinci, Research Framework Programme 5, EQUAL, Interreg, ESF.

**Pascal Lafourcade:** Post-doctoral studies at ETH Zurich in the team Information Security of David Basin and assistant at ETH in lecture "Modelling and Simulation" and "Information Security".

## ACKNOWLEDGMENT

The project Leonardo da Vinci “Rural-eGov” has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use, which may be made of the information contained therein





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## DESIGNING AND COMPLETE SPECIAL TASKS WITH AUTOMATIC EVALUATION AND VIDEO PRESENTATION IN E-LEARNING

Radoslav Fasuga, Libor Holub

VŠB Technical University of Ostrava, 17. listopadu 15, Ostrava-Poruba, 708 33, Czech Republic

Phone +420 597 32 4439, e-mails: radoslav.fasuga@vsb.cz, libor.holub@vsb.cz

**Abstract.** This article inquire into methodology of design multimedia video lectures, combination of audio/video records with materials published in presence teaching process. Here are discussed requirements for recording technology and the methodology to making protocol of whole recording process for future elaboration. Article compares methodology of directed lecture versus records in real teaching process with discussion. In additional mastering and synchronization of final records with other teaching elements are described two possible approaches that can be used for this purpose. Here is published a tool designed on VŠB-TU in Ostrava that is able to store schemes and graphs, build their representation in vector graphic format and store their content in structured text form by using XML language that is suitable for future processing. Article describes concrete example of use in course Theory of Data Processing. Here is described approach for authors to design correct model or pattern and complete additional information for automatic evaluation.

**Keywords:** e-learning, special tasks, statistic evaluation

### 1. INTRODUCTION

In this article is published the possibility to design and build special types of questions and their automatic evaluation. Article describes possibility of designing pattern solution, creating an experimental student solution and their comparison. Target of this article is proposing conception that will build in future an universal tool for preparing, visualizing and evaluating large scale of questions especially diagrams, common schemes, physic properties and magnitudes, chemistry formulas, electrical circuits, network diagrams, etc. Similar technological process can be realized for comparing the formulas with their graphical representation. Not in last stage is this solution applicable for deploying the objects into specified work area with possibility of evaluation destination location of the object. Article describes conception for building the tools that can solve these problems: strategy and possibility for storing information about designed schemes, deploying elementary objects with possibility of their connection. Next part describes the way how to store destination schemes with requirements for make future changes and especially the automatic evaluation by using computer. This technology can be used for testing of achieved knowledge, for step-by-step explanation methods by using elementary commented steps.

In the university area is still growing possibility of distance and blended learning. For these students is often unreal to inspect present lectures. Also for this type of study are prepared special study materials. The possibility come to see live lecture is hard to substitutable. With the scope of education activity support and e-learning on VŠB-TUO are on the department of computer science realized records of selected lectures, and they are consequently available for students. It does not go about simulated records in professional background, but it goes about real record of live lecture complemented by used presented materials

(often PowerPoint, HTML documents etc.). Actually teacher can use for materials publishing TabletPC. Final records are modified and synchronized with presented materials. Students can effectively choice the parts of that are in their area of interests. Lectures are used not only for blended learning students but also for presence students that want to know some explanation parts. [1]

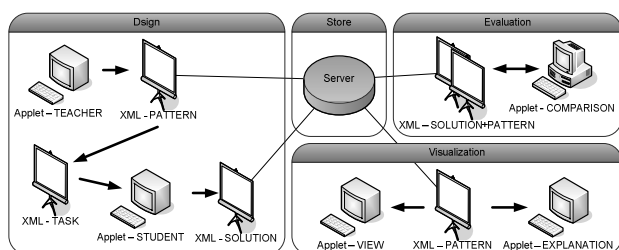
### 2. CONCEPTION OF DESIGN SPECIAL TASK INTERACTIVE APPLICATION

#### 2.1 Application basic scheme

Based on application functions requirements that can allows designing and storing the schemes, is impossible to produce this system with standard internet browser and server based web pages. In this time is one of possible ways for solving this problem to use Macromedia FLASH applications or JAVA language, especially JAVA Applets that guarantee their functionality in different operating systems independents on used browser. Project conception is based on client-server architecture, when the applet is running on client side (user – student, teacher), and server part provides scheme results storing and future manipulation. Evaluation process can be situated on client or server side. With respect to security protection for information abuse is recommended to build evaluation process on server site. By modifying this solution we can receives alternatives with only client application in off-line mode without requirements for connection to server node. This variant is designated for self-study by using CD, DVD. [5]

Solution conception (Picture. 1) is divided into four basic modules. In **design module** are located tools for designing final schemes. These tools use techniques for direct

visualization. The elementary objects available for given scheme are represented by vector graphic and user can manipulate with them (move, rotate, change the size). Among elementary objects is possible to define relation (relationships) that can be labeled, valued, or can be change their graphical representation (type of line, end connection nodes types, etc.). **Store module** is used for storing final schemes in form that can be used for future elaboration or editing. Final scheme can be stored in database or in file organization. **Visualization module** contains two basic approaches. In first row it goes about drawing final scheme. This drawing can be used in future for a problematic explanation or showing the solution in evaluation results. Enlarging the simply visualization method is explanation procedure. Here is whole scheme system represented by list of elementary commented steps. Most important part is **evaluation module** that based on scale of similarity can solve the problem – if the student solution is similar with teacher pattern.



Picture. 1 Solution conception modular scheme

## 2.2 Applets

**Teacher** – tool for constructing pattern solution, input values for evaluation and parameters for problem solving

**Student** – tool for constructing solution, use input parameters from teachers defined pattern to prevent mistakes with different labeling for objects and relationships

**Comparison** – tool for comparing pattern with students solution

**View** – methods for representing final scheme solution in form of picture

**Explanation** – tool used for explanation for concrete task, author can use in pattern solution construction adds - steps with methods for sequential explanation process

## 2.3 XML documents

For storing final structures can be used form of XML documents. All graphical elements, their locations and properties are represented in this structure and consequently they are used for repeated drawing of given scheme, their editing, and comparison.

**Pattern** – this XML document contains complete pattern solution given by teacher

**Solution** – here is stored solution designed by student

**Task (specification)** – this is an extract build form pattern designed by teacher. It contains only labels of elementary objects for preventing problems with students own labels and based on this damage automatic evaluation. For the

abuse security protection this documents does not contains final solution from source pattern

Structure of XML documents:

**Common information** – list of basic attributes about scheme dimension, background, authors and other properties

**Objects** – list of used objects, their location, type, distance tolerance, rotation, scale, labels, values, connection points

**Relationships** – list of relations realized between objects, their labels, valuation, graphical representation (types, lines), ending nodes

**Labels** – contains list of labels for elementary objects and relationships (here can be added “misleading” unused labels), to prevent using different labels for same objects

**Steps** – drawing process of elementary objects and relationships can be divided into elementary steps, for every step are draw or highlight concrete elements in given order with given time or delay, and for every defined steps can be added some commentary

## 2.4 Comparison

With regard to storing method of designed schemes in XML documents form is possible to use several possibilities of an automatic evaluation. Because is not compared final pictures but their structures which this pictures (schemes) represents. Based on this is possible to evaluate difficult schemes and formulas.

**Similarity scale** – this is fundamental method for scheme comparing (pattern vs. solution). Similarity scale can be evaluated absolutely or by percents based on specific criteria (used elements, their valuation etc.) Comparison is realized on used objects in given solution and their mutual connections based on used relationships among objects. Because are compared only objects and their relationships concrete object can have different location in work area but the solution is still the same and correct.

**Distance scale** – next area for evaluation is distance scale. Here is typical example - the task like the map. Into this map we can make correct deploying pointers to concrete elements with their labels or we can situate objects into map. Teacher defines correct location for concrete object with their distance tolerance (because is often impossible to put the object into exact one pixel on the screen). Based on scale of distance we can evaluate it directly (if the pointer or object is in defined area with tolerance) or we can evaluate the value of distance for set of concrete objects.

**Numerical methods** – for the math formulas or difficulty schemes we can use numerical methods. Mathematical formulas we can effectively represent by language MathML based on XML. For comparison of teacher defined pattern and student solution we can use numerical procedures. Defined objects in formula we can transform into executive figure here we can put into the formula values predefined by teacher and next compare final results.

**Other evaluation strategy (simulation)** – Large spectrum of evaluation possibilities can be finding for methods in area of physic, electricity or chemistry tasks. For example is possible to construct an algorithm than will evaluate electrical circuit scheme. Student must design the scheme by using given sources, resistors and serial or parallel connections to receive requested voltage on defined

element. Evaluation can simulate rules for voltage or some other magnitudes in real circuits.

### 3. TYPES OF TASKS BASED ON SCHEME DRAWING CONCEPTION

**Schemes** – in this set fall within large palette of diagrams, UML, ER-Diagram, network or organization diagrams etc. It goes about object distribution, their labels and connections.

**Experiments** – physic, chemistry, electrical and other experiments based on simulation and evaluation progressed events and futures, numerical valuation and the process of realistic conducts.

**Tasks for finding location and layout** – geography and natural science tasks, based on elements identification in given solution, concrete elements labeling, or deploying the elements into work area. It can be used also for simulation of electrical circuit connection, but the method of evaluation is based on object location, but not on relationships among objects.

**Formulas** – representing math, physic, and chemistry formulas and their evaluation, based on methods for comparing structure, or numerical methods with executive calculation.

## 4. PREPARATION FOR PRESENTATION RECORD

### 4.1 Teacher preparation – presenter

Because the recording process is realized in real-live lectures, the teacher preparation is minimal. Yet to come several basic rules that can be respect by the teacher.

**Encompassment of presentation techniques** – is basic condition to guarantee quality of whole record. Every teacher can be introduced with basic rules of guiding presentation and managing discussion. Here is required understandable, comprehensible, and loud interpretation to protect good quality of voice record.

**Encompassment of presented problematic** – teacher must reason out that in record process “all what he say can by use opposite them”. The record can be made with teacher that is expert in presented area with long time practice in presentation to prevent mistakes in explanation, and will be competent to response asked questions.

**Preparing subsidiary materials** – presentation materials can be prepared in same time line in which will be presented to students. Every page of presentation must contain *unique label* that precisely describe their content. Additionally is recommended to make *unique numbers for presentation slides*. This preparation has as the result more faster work in producing final mix and makes easy student orientation in presented material.

**Reducing other presentation techniques** – because the record is often oriented to person of the teacher, and published presentation. Then is not ideal to combine it with additional techniques like the black board, flipchart, practical instruments etc. (When is required to record

experiments, is proposed to use simulated background laboratory out of live record.)

**Respect the properties of recording device** – it is necessary condition to brief the teacher with possibilities of recording technology, restrictions, and final quality of the record. In case when is in use permanently installed cameras is briefed moving possibilities in restricted area. Here is not preferred fast moves, and changes in explanation with orientation to teacher or proposed presentation material. [4]

### 4.2 Cameraman preparation – recorder

In the area of making record was tested usability of permanently installed cameras versus cameras with moving possibility with manual control. For the purpose to make record of live lectures are permanent cameras unusable. It was substituted by one camera and cameraman that control them. This solution brings reduced cost of the technology and human sources. In other side are required cameraman practical experiences in recording process and making protocol for the record.

**Content preparation** – cameraman must be brief with the organization of the lecture. Which way is lead the explanation and the time for discussion, moves of the presenter, which kind of presentation sources are used. As a part of record preparation must be written the lecture progress protocol that is typed parallel with recording process. Based on this protocol is realized final mix. In the protocol is published basic information about course, presenter identification, record made date, and presented lecture (hour). Then continues information about used recording media (longer lectures or high quality records can be stored on more recording media); number or label of presented slide that was showed; action time from the media beginning; localization that publish the target of recording (person, slide, blackboard etc.). In respect to fast progress of the presentation are the notes used semi-occasionally.

**Technical preparation** – is entire part for produced quality and complete record. Cameraman must to have enough amount of high-quality, and prepared (rewind media to begin) recording media. Here are required minimally two full-charged accumulators that respect recording time requirements with minimally 50% reserve for unexpected situation. Strong and stable located tripod land on unmovable ground-sheet. In the area near the camera must be marked discrete zone tat is prohibited for the student. It is the area in the front of camera (objective visor) and in the area of shot-gun microphone to prevent the interference of the record. Then are required prepared protocols about lecture progress and some stationary. Cameramen must be brief about special action in presentation process (delays, brakes etc.); must be gathering up to recording process, and established some signal with presenter for problem situation. [6]

### 4.3 Required technical and software equipment

For the purpose of making records was on VŠB-TUO used following equipment:

**Digital camera CANON MVX 3** – with quality objective and optical picture stabilizer

**Directional stereo microphone CANON DM-50** – located directly on camera chase in Shotgun mode with reduction noise and wind. (Goal of this solution is to situate the camera in the opposite (than the presenter) side of the presentation room, with protecting high quality of audio record without requirements to use radio-microphone, and the presenter is not stressed or otherwise limited.

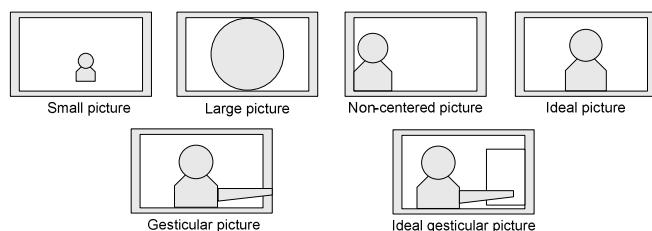
**Iron tripod VANGUARD high 170 cm** – this tripod can be effectively and comfortable use for stander cameraman with good overhead visibility that guarantee good quality with unvalued people standing or other student moves.

**Recording media DV tapes** – for the purpose to make best record was buy standard metallic DV tapes. One set of tapes was used for complete course presentation. On the tape was produced about 15 overwriting records. Tapes was wok with non-reduced functionality and for the next series was used new media.

## 5. MISTAKES IN RECORD BUILDING PROCESS

Common mistakes in recording process are:

**Blurred picture** – that is produced by wrong camera stability or fast moves by cameraman or the presenter (teacher). Cameraman must respect technical possibilities and speed of focus for used camera and based on this parameters make the speed moves (With short contact lost of the recorded object).



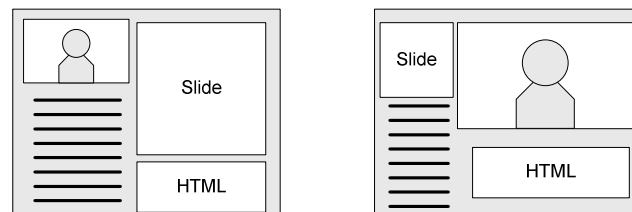
Picture 2.: Record preview

**Wrong size for the recorded area** – Most frequently errors are wrong choice of recording areas (Picture 2.). Cameraman must to catch recorded person in the center of the record, his basic line (head and high part of the torso (shoulders)) must be record completely. Exception is the (hand) gesture record. Gesture must be stored completely, with blackboard, slide, when are there made some important explanation actions. Ideal is to find optimal picture size, and do not change them (different presenter has different moves and require special setting). [3]

## 6. FINAL MIX

With respect to past publishing of recorded materials, and requirements for simply realization is for destination mix used basic program tools of Windows system. For the import of the record into computer is used tool Microsoft MovieMaker (standard Windows XP part). Quality of stored record is based on size of destination record and requirements for the future quality. For the lecture were commonly used stream 500kB/s quality that with standard

size of the presentation 90 minutes with capacity 15 lectures per course can by stored to one DVD disc (4.5GB). When are published slides (Picture 3.) form PPT presentation source or as HTML pages, than can be used the tool Microsoft Producer 2003 (price free enlargement of Microsoft Office 2003 PowerPoint program) that allows to synchronize published videos combined with presentation elements. For the presentations that are based on different data formats RealMedia, PDF documents is used SMIL standard.



Picture 3.: Allocation of final record mix

## 7. CONCLUSION

Actually is on VŠB-TU Ostrava realized experimental tasks that solves elementary parts for previously described problematic and possibilities. Based on proposed conception is prepared the realization of programming system that will commonly solve previously described problems with possibility to insert own objects relationships, attributes, and patterns. Most important part of this system will be the possibility of automatic evaluation for all previously published tasks. [2]

Final compilations of the presentations are available for the student via teaching server. Student can download them or start it directly form the server. This initiative has positive response from blended and also present students. Student requires making some other lectures in this standard. Big turn of these solutions is possibility to generate SCORM 1.2 standard Manifest for given lecture. This final complete (video + presentation content) multimedia element can be integrated into several information and education systems.

## 8. REFERENCES

- [1] Fasuga, R., Holub, L., Šarmanová, J.: Podpora výuky odborných předmětů a jejich aplikace s použitím systému Barborka. In Geometry and Computer Graphics 2004, 25. konference o geometrii a počítačové grafice. Ed. Dr. RNDr. Arnošt Šarman, Ostrava, Czech Republic: VŠB-Technická univerzita Ostrava, 17. listopadu 15, 708 33, Ostrava-Poruba, 2004, 32-37, VŠB-Technická univerzita Ostrava, 17. listopadu 15, 708 33, Ostrava-Poruba, ISBN 80-248-0581-2
- [2] Fasuga, R.: Aplikace inteligentních technologií ve vzdělávání, vývoj a použití výukového systému Barborka, Ostrava: , Faculty of Electrical Engineering and Computer Science, 2004. Ed. Václav Snášel, Schneider Electric, ISBN 80-248-0596-0

[3] Fasuga, R., Holub, L., Šarmanová, J.: Praktické zkušenosti s tvorbou distančních studijních opor v LMS Barborka. In III. Národní konference s mezinárodní účastí Distanční výuka v České republice - Současnost a budoucnost. Ed. J. Lisalová, Z. Freibergová, Praha: Centrum pro studium vysokého školství - NCDiV Národní vzdělávací fond, o.p.s. - Národní informační středisko pro poradenství, 2004, 278-282, Národní centrum distančního vzdělávání, Česká asociace distančního univerzitního vzdělávání, Národní vzdělávací fond, o.p.s., České vysoké učení technické v Praze, ISBN 80-86302-02-4

[4] Holub, L., Fasuga, R., Šarmanová, J.: Návrh a tvorba video záznamů pro výuku, jejich úprava a publikování. Ed. Prof. RNDr. Erika Mechlová, CSc., University of Ostrava: University of Ostrava, 2005, s. 219-223, ISBN 80-7368-081-5

[5] Němec, M., Fasuga, R., Šarmanová, J.: Nástroje pro testování speciálních úloh složitá schémata, grafické úlohy a metody jejich automatického vyhodnocení, Ostrava: , University of Ostrava, 2005. Ed. Prof. RNDr. Erika Mechlová, CSc., ISBN 80-7368-081-5

[6] Holub, L., Fasuga, R., Šarmanová, J.: Inovace výuky odborných předmětů na bázi řízení projektu. In sborník. Ed. P. Sojka, T. Pitner, Masarykova univerzita v Brně: Masarykova univerzita v Brně, 2005, s. 59-64, ISBN 80-210-3699-0

## THE AUTHORS



**Radoslav Fasuga:** Assistant Professor, Department of Computer Science, Faculty of Electrical Engineering and Computer Science, *e-learning, databases, Barborka e-learning system designer, course content designer, intelligent education techniques*



**Libor Holub:** Phd. Student Department of Computer Science, Faculty of Electrical Engineering and Computer Science, *e-learning, Barborka e-learning system designer, LMS administrative specialist and designer, study styles*





## GREENSTONE DIGITAL LIBRARY IMPLEMENTATION WITH FEDORA DIRECTORY SERVER

Alina Frolova

National University of Kyiv-Mohyla Academy, Kiev, Ukraine.

fshodan@gmail.com

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia

September 6-8, 2007

**Abstract.** These notes describe the process of organizing digital repository for students' educational and research activities demands in the UKMA Student Internet Centre by using integrated Open Source software – Greenstone Digital Library and Lightweight Directory Access Protocol (LDAP)..

**Keywords:** Greenstone Digital Library, LDAP, Fedora Directory Server.

### 1. INTRODUCTION

UKMA Student Internet Centre (USIC) is a part of university informational system, which serves to provide students with the possibility of free scientific research and development. Of course, it must have digital repository to store important university data such as books or student research documents, which can be accessed by students or university staff through authentication system. Therefore we suggested to integrate Open Source software – Greenstone Digital Library and LDAP – in order to achieve our aim.

### 2. SOFTWARE SELECTION

Greenstone is a suite of software for building and distributing digital library collections. It provides a new way of organizing information and publishing it on the Internet or on CD-ROM. Greenstone is produced by the New Zealand Digital Library Project at the University of Waikato. It suits us best because of such features (according to MIDESS project, Institute of Programming Systems of NAS of Ukraine and our investigations [1], [2]):

- ability to handle variety of file formats (there are plugins provided for a variety of formats which convert them to Greenstone Archival Format)
- supports OAI-PMH, Z39.50 and/or SRU/SRW, persistent URLs
- support for compound object formats such as METS (multiple file formats can be linked together)
- supports content submission buffer
- support for hierarchical collections with unlimited nesting
- using web-interface for deposit and administration of collections
- multilingual interfaces

NaUKMA is planning to use Greenstone for internal information assets access and management, scholarly communication, education, research (e-journals, e-prints, e-books, data sets, e-learning). Our main goal for now is to give access for unique data such as one copy books that is not available for all students or NaUKMA's professors works. But we can't secure copyrights permissions in order to use all available documents in the digital library, therefore only students or university staff can be given access to digital library.

A built-in access control mechanism of Greenstone allows collections to be restricted to non-authorized users using a password protection scheme. This mechanism is common for both students submitting their works (GLI applet authentication) and reviewers and may be integrated with different external systems such as LDAP, IMAP, Active Directory, etc. Very important function of this integrated system is to create and assign access rules to e-documents to be stored into collections following by author copyright license.

Authentication and authorization system has been already implemented in USIC to grant every user a certain set of facilities [3]:

- log in to any of Linux/Windows workstations inside one of the administrative domains (i.e. USIC terminal room, NaUKMA classrooms (including Windows workstations), Graduate School rooms);
- have an email address and a mailbox;
- be able to create and maintain their own Web pages;
- have up to 500 Mb of disc space for keeping files;
- gain access to the Greenstone digital library;
- use a power-cluster for calculations (using the Sun Grid Engine).

Authentication and authorization system is based on PAM/nsswitch & OpenLDAP libraries (client); Fedora

Directory Server slapd/slurpd (server) and Fedora Directory Server Management Console (configuration/maintenance/backup of the directory).

PAM/nsswitch supports such features:

- OpenLDAP pluggable authentication module;
- multiple authentication/user information schemes.

FedoraDS slapd provides:

- user information exchange over the LDAP protocol;
- user schema customisation capabilities;
- user information through SMB/ActiveDirectory.

FedoraDS slurpd provides users data/schema replication.

### 3. HOW TO INTEGRATE BOTH SOFTWARE

LDAP utilizes the concept of a 'directory', which is convenient for representing user data in our particular case. The directory is implemented in a hierarchical database with a modifiable schema. So, whenever we need to add a new attribute to the user data, we just add this attribute to the schema. Therefore we can easily add new information into users' data concerning Greenstone such as group, for example, administrator, collection builder or just common viewer. The following scheme describes how it should work:

Greenstone has its own database to store information about authorized users. Instead of using it Digital library sends request to LDAP database with USIC authorized users, which gives information whether or not users are able to access or build collections. To organize such a conversation we use our own PERL scripts instead of Greenstone's.

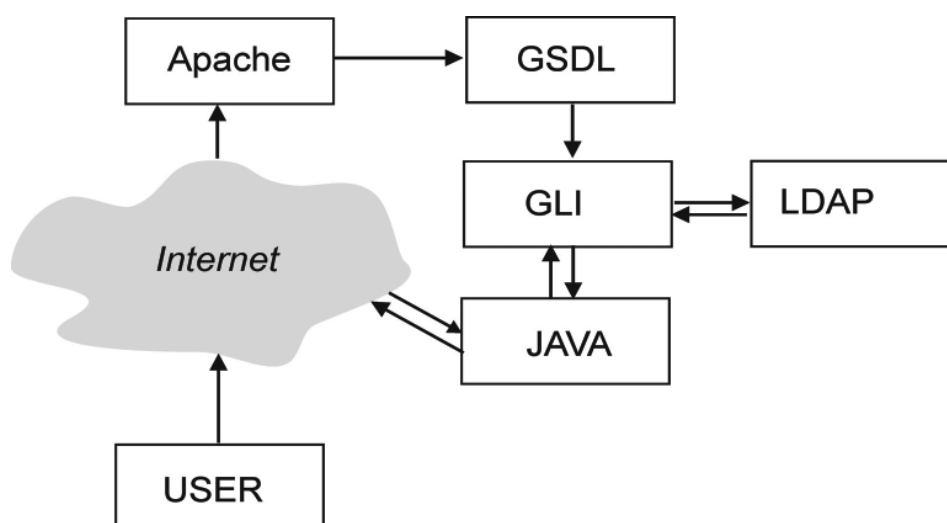


Fig 1. Authentication Process

FedoraDS Management Console is an easy administration/configuration tool.

NFS provides filesystem branches exports & fast access to data through the network.

We have chosen the Lightweight Directory Access Protocol, because it fits the following requirements:

- fast data access (this is critical because of the high network usage rate);
- simplicity (providing the reliability and possibility to fix problems locally);
- flexibility (in order to be able to adapt to the changing circumstances);
- Open Source implementations (to comply with general concepts of USIC functioning);
- the possibility of integration with different services such as mail server, web server and others (see our initial tasks).

### 4. CONCLUSION

Greenstone Digital Library software was compiled on server of USIC and available now for all registered users from local academy's network. The work of librarian staff is underway on create digital collections of important data.

### 5. OUR PLANS

In order to organize proper submitting system we intend to add in our scheme one more part – Reviewer Library staff approvement, which will check student documents, that they try to add. It will be module that we will add to Greenstone, of course, certain people (for example, NaUKMA library staff) will be needed to serve this module.

This feature are also not supported by Greenstone and have to be built by ourselves.



## REFERENCES

- [1] MIDESS: WP 2 – Functional and Technical Requirements Specification  
<http://www.leeds.ac.uk/library/midess>
- [2] Резниченко В.А., Проскудина Г.Ю., Овдей О.М. Создание цифровой библиотеки коллекций периодических изданий на основе Greenstone  
<http://www.elbib.ru/index.phtml?page=elbib/rus/journal/2005/part6/RPO>
- [3] Pylypchuk, A., Zhuravl'ova, O., Golda, R. Open Source LDAP-Based Authentication, Authorization and Service System Creation and Deployment.

## THE AUTHOR

**Alina Frolova**, student of National University of Kyiv-Mohyla Academy, administrative staff of Student Internet Centre (USIC).





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## FLASH IN TEACHING

Jiří Hrbáček  
Pedf MU Brno  
+420 549 49 4563, hrbacek@posta.ped.muni.cz

**Abstract.** Today's distant education and e-learning we can't even imagine without interactive animations, simulations, attractive graphic background or without a possibility of connecting to databases and LMS. The teaching can be dulcified and it's effectiveness increased by using various teaching games.

Even difficult control or measuring systems that communicate with various devices connected to the computer need a good-quality graphics interface, through which the user can intuitively control the systems.

Nowadays there exist distant laboratories that through the internet enable to do different measuring in real time, to watch the process of measuring and behaviour of objects through a camera, to obtain measuring data and to direct or control the distant measuring. Even the necessity of video-chats, chats and other on-line communication channels is not negligible.

This contribution deals with the basic possibilities of creation of SWF files and with less known but useful possibilities of their use.

**Keywords:** flash, interactive, animation, tests, conversion

### 1. INTRODUCTION

We can't even imagine today's distant education and e-learning without interactive animations, simulations, attractive graphic background or without a possibility of connecting to databases and LMS. We can dulcify and increase the effectivity of teaching by using various teaching games.

Even difficult control or measuring systems that communicate with various devices connected to the computer need a good-quality graphics interface, through which the user can intuitively control the systems.

Nowadays there exist distant laboratories that through the internet enable to do different measuring in real time, to watch the process of measuring and behaviour of objects through a camera, to obtain measuring data and to direct or control the distant measuring. Even the necessity of video-chats, chats and other on-line communication channels is not negligible. Today, interactive boards are widely used. They have their own place at elementary and secondary schools and thanks to their interactivity, they are infiltrating very quickly also to universities.

Flash, "is the only format which is able to bring move into SMART Notebook applications" as written in Kyslinger Leo [1] on portal for support of teaching with interactive boards. It can appear, that Flash is a suitable tool only for professional programmers and graphic designers. Indeed, they can do magic with it – starting from local operating applications and ending up with full net versions. However, even less able users and students are able to do great things with Flash. Even ordinary user can create very nice and useful applications. It is possible to do very simple direct conversions of documents to SWF (ShockWave Flash – Flash format) format- similarly as we do it to PDF format.

It is possible to do these conversions without any knowledge of work with Flash. Let's have a look at some ways of creating SWF in dependence on difficulty and necessary knowledge for their creation.

### 2. DIRECT CONVERSION OF DOCUMENTS TO SWF FORMAT

Files SWF are possible to be created easily with the help of Flash Paper program. The Flash Paper program together with Dreamweaver (used for professional design and creation of web applications), HomeSite (editor of HTML code), Fireworks (graphic editor for web a multimedia), Contribute (for actualization of content of web sites for non-professionals) and Flash (world standard for interactive applications on web) is a part of Study 8, which is an accredited software for schools. After installation of FlashPaper, the item FlashPaper is added to print menu.

Moreover, the item FlashPaper is added to menu of Word, Excel, PowerPoint and tool bar tool for easy transfer.

We can see here how the transfer is done by using this tool [2]. Here we can see the file transferred [3].

If there are active references in transferred documents, their activity will be maintained in converted file.

If we make a presentation by using Flash Paper PowerPoint, the sequence of pages is made as if printed.

The other tool for creation of presentation (similar to PowerPoint) is program **OpenOffice Impress** (free off charge as a part of OpenOffice.org package). Creating animations in this program and in PP is very much alike. It is not difficult to learn how to work with it.

It can directly convert created animation to PDF and SWF format, open and work with PowerPoint presentations. It is possible to use it for conversion. There are individual frames without functional animation and active references in converted SWF file. By conversion to SWF we create a

slide show from individual frames as we can see on the picture [4]. By clicking on mouse, we do proceed to the next picture.

There is no need of any special knowledge for realizing the SWF conversions described above.

### 3. CREATING SWF USING ADOBE CAPTIVATE 2

For creation of animations, which show us how to work with various programs on computers we use Captivate. It can create not only presentation animations, but also testing and training animations. It grabs what is happening on a screen.

From the grabbed activities it creates a line of frames that looks like in PowerPoint. We can do many various modifications in it and we can even load it to Flash and arbitrarily modify or reprogram. On the picture [5] you can see the demonstration of work with Captivate.

A very positive aspect of these animations is the size of the final files. The storing technique is very sparing. Only small part of screen that has been changed is stored. But Captivate can do much more things.

Let's have a look how to create SWF with this program.



Fig. 1. Basic menu after Captivate program initialization.

Option window is opened after program initialization. We can record or open new project or create it from a template. If we decide to open or record new project, we can choose to do the following:

With **Software simulation** we can record and create simulations and presentations by scanning screens of computer.

Option **Scenario Simulation** allows us to create presentations (linear-, frame, after frame, or non-linear-frames don't have to be one after the other) similarly as with PowerPoint.

Option **Other** allows creating a blank project, to import PowerPoint to Captivate or create project by downloading fines with frames.

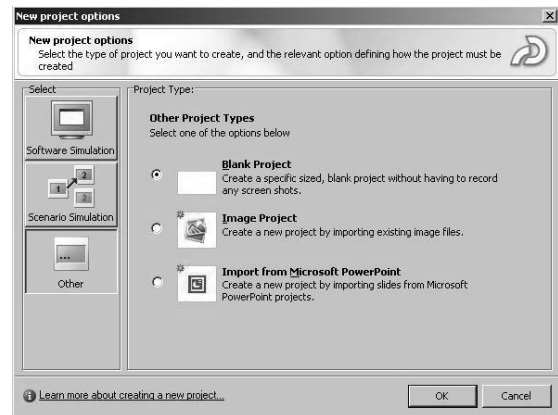
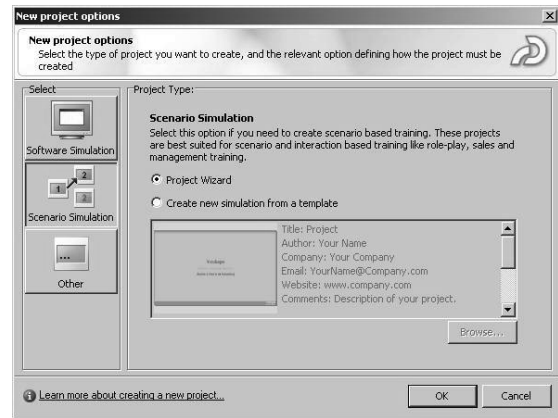


Fig. 2. Project options

Captivate contains also Quiz manager which enables an easy creation of six most common types of tests and their variants.

The result of tests is possible to send on an e-mail address or by the help of standard formats to LMS (Learning Management System) system for e-learning.

It is possible to put SWF files and FLA projects or videos (avi, animated GIF i flv), to individual frames.

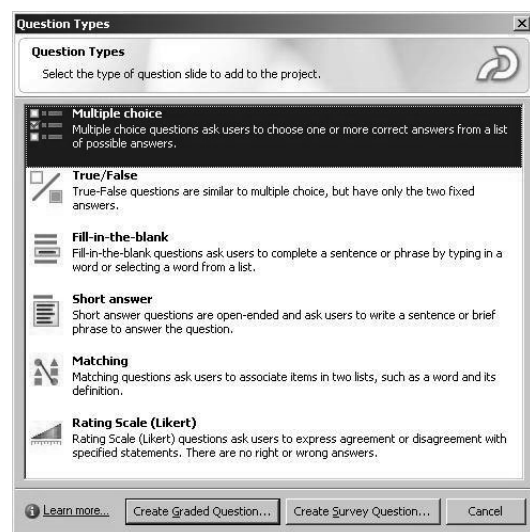


Fig. 3. Selection of test type.

To learn how to work with this program is not very difficult. It is practically as difficult as to work with PowerPoint. I guess it would be appropriate to include teaching of working with this program into a curriculum of IT.

#### 4. CREATION OF APPLICATIONS IN FLASH.

The Flash program is a very powerful tool that can be used by professional programmers and graphic artists, but also non-professionals can learn how to work with it. Many teachers on elementary schools devote their time to teaching Flash. Students of secondary schools can create very nice applications and there is no need to talk about universities. I, myself, teach working with Flash more than a year and a half. The first term is devoted to creation of graphic in Flash; the second term is devoted to basics of programming and to basics of work with Action. The third term is devoted to more advanced techniques of programming, to communication with servers etc. It is necessary to point out that very much depends on a way of teaching. It is needed to motivate students to work in teams. It is important to create a graphic in the way that allows a programmer to absorb knowledge and interactivity.

Surely, some graphic artists will create only animations (animated banners etc.), which will not be programmed anymore. However, it is very few of them. Most of them will create animations and graphic objects for more difficult projects, games and interactive animations. Therefore it is necessary for them to know how the object to which they will later give their own intelligence should look.

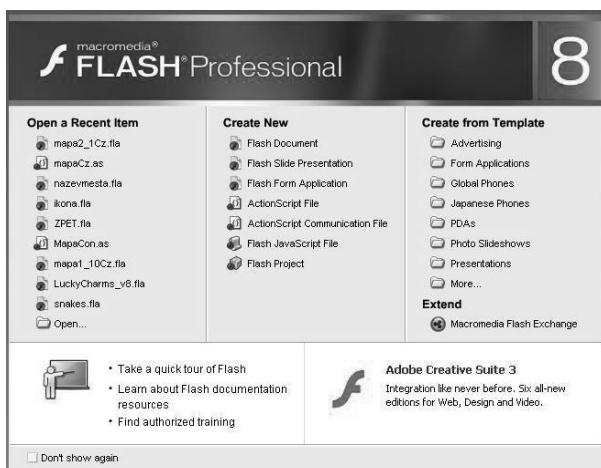


Fig. 4. Basic options after Flash 8 program initialization

There aren't many good programmers and good graphic artists at the same time. This combination is very rare. It is necessary to teach students to create animations of minimum size that will load client computer only minimally. However, we are not going to deal with methodology of teaching and similar things.

How much time do we need to gain knowledge needed for creation of applications in Flash? Approximately in one term (15 classes) and approximately 150 hours of individual work we will be able to learn to create graphic applications.

In approximately the same time, we can learn the basics of programming in Action Script.

Let's have a look at some applications which Flash allows us to create.

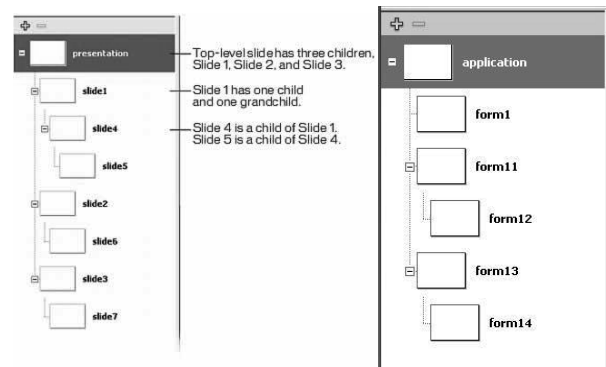


Fig. 5. Structure of document Flash Slide Presentation and Flash Form Application

**Flash Slide Presentation** is designated for creation of presentations similar to PowerPoint.

**Flash Form Application** for form applications like registration form and various forms for work with data, etc.

**Flash document** is a base document of Flash.

These three types differ in inner structure of document. The base of Flash document is scene. For Flash form application and for Flash Presentation structure of screens (forms) is typical. Flash Slide Presentation is used for sequence presentation of screens as slides. Flash Form Application uses screens in function of forms and server for realization of non-linear structures.

There are also many templates in Flash, which we can use, as we need in our applications (advertising, form applications, photo slide show, presentations, quizzes and slide presentation).

#### 5. USE OF SWF IN OTHER APPLICATIONS

If we put Flash presentation into Word, there is no doubt that it won't "move" when we print it. However, if we need to create a good quality interactive electronic support with the help of Word, this is a very good way. And how is it with PowerPoint? Why do we have to put animations into environment that creates animations itself? It is simple. PowerPoint can create simple animations. We cannot give own intelligence to these animations. We need to put for example test in it, which will be able to evaluate results or elaborate the results and send them to database. SWF enables us to do that.

We can input SWF animations into PowerPoint very simply.

We can use program Swiff Point Player for PowerPoint 2000/XP. This is a free program, which creates an *Insert* item in the menu *Flash movie* after installation.

With the help of VisualBasic implemented in MS Office we can input Flash movies into Word, Excel or PowerPoint. Even though it seems to be difficult, it is not. As we can see here[6], it is possible to do it very simply. We can have a look at the result here [7], or download Word document with necessary files here [8].

If we plan to use Flash animations in Word document, it is necessary to have allowed doing macros.

## 6. CONCLUSIONS

In this contribution are shown basic possibilities of creation of SWF files and some other less known but useful ways of use. I believe that this information will become a motivation and a motive for creation of many high quality study supporters.

## 7. REFERENCES

- [1] KYSLINGER, Leo. *Web portal for support of teaching with interactive boards*. [online]. 29.8..2006. 2005 [cit. 2007-06-06]. Accessible at WWW: <<http://www.veskole.cz/?p=article&id=1014>>.
- [2] [Http://boss.ped.muni.cz/Hrbacek/PrDivMat/WrFlPap.htm](http://boss.ped.muni.cz/Hrbacek/PrDivMat/WrFlPap.htm) [online]. 2007 [cit. 2007-06-06]. Accessible at WWW: <<http://boss.ped.muni.cz/Hrbacek/PrDivMat/WrFlPap.htm>>.
- [3] [Http://boss.ped.muni.cz/Hrbacek/PrDivMat/WrFlPap1.htm](http://boss.ped.muni.cz/Hrbacek/PrDivMat/WrFlPap1.htm) [online]. 2006 [cit. 2007-06-06]. Accessible at WWW: <<http://boss.ped.muni.cz/Hrbacek/PrDivMat/WrFlPap1.htm>>.
- [4] [Http://boss.ped.muni.cz/Hrbacek/PrDivMat/létoOpOf.htm](http://boss.ped.muni.cz/Hrbacek/PrDivMat/létoOpOf.htm) [online]. 2006 [cit. 2007-06-06]. Accessible at WWW: <<http://boss.ped.muni.cz/Hrbacek/PrDivMat/létoOpOf.htm>>.
- [5] [Http://boss.ped.muni.cz/Hrbacek/PrDivMat/Captivate.htm](http://boss.ped.muni.cz/Hrbacek/PrDivMat/Captivate.htm) [online]. 2006 [cit. 2007-06-06]. Accessible at WWW: <<http://boss.ped.muni.cz/Hrbacek/PrDivMat/Captivate.htm>>.
- [6] [Http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.htm](http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.htm) [online]. 2006 [cit. 2006-06-06]. Accessible at

WWW:

<<http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.htm>>.

[7]

[Http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.doc](http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.doc) [online]. 2006 [cit. 2006-06-06]. Accessible at

WWW:

<<http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.doc>>.

[8]

[Http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.zip](http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.zip) [online]. 2006 [cit. 2006-06-06]. Accessible at

WWW:

<<http://boss.ped.muni.cz/Hrbacek/PrFIWaPP/FlashWord.zip>>.

## THE AUTHOR

**Jiří Hrbáček:** Studies and courses - FEL ČVUT Prague, field of engineering cybernetics, FTSD – diagnostics of microprocessors, course of use of computer in distant learning, course for authors, tutors a administrators of distant education, extension special needs study, PGS in field of special needs- use of distant study supports in full-time study. Since 1996 he intensively deals with a problem of distant education.



## ACKNOWLEDGEMENT

*I believe that in this contribution you will find interesting inspiration for creating of your own high-quality multimedia study supports.*



## BUILDING QUALITY IN E-LEARNING

Mikuláš Huba and Ľubica Rovánová  
Slovak University of Technology in Bratislava  
Faculty of Electrical Engineering and Information Technology  
Ilkovičova 3, 812 19 Bratislava  
Tel.+421 2 602 91 771, 624; Fax: +421 2 654 11 004,  
Email: mikulas.huba, lubica.rovanova@stuba.sk

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Quality of learning becomes to be frequently discussed topic - not only with respect to the e-learning. Simply, who is today able to organize and deliver learning without computers? The paper analyses some problems of modern education and the quality issues from the point of view of Slovak universities and their institutional evaluation, tries to respond to the arising questions, shows possible improvements and topics for a broader cooperation at the national level.

**Keywords:** e-learning, evaluation, human resource, quality of services.

### 1. INTRODUCTION

At the first glance, the quality of learning started to be one of dominant issues in our learning system. Jointly with the Slovak Rector's Conference the Slovak Ministry of Education commissioned systematic evaluation of all Slovak universities organized in Association of European Universities to be reviewed with respect to their strengths and weaknesses in the area of institutional and quality management and to undergo EUA institutional or follow-up evaluations. EUA evaluations are peer reviews, the members of evaluation teams are mostly rectors, presidents, vice-rectors or vice-presidents or former holders of these positions [5], [6], [7], [8]. So, at least for the top managements of all universities, the term "quality culture" becomes to be quite fashionable last years. It defines the overall attitude of a university which focuses on the concept of "quality" and which, thus, applies to issues like quality assurance, quality assessment, quality improvement etc. It is expected that the growing number of institutional reviews contribute to the promotion of a culture of quality and to the dissemination of examples of effective strategic management among the European universities.

Quality plays a key role in the Bologna Process. In order to establish a European perspective and a European context for quality assurance in higher education the "Standards and Guidelines for Quality Assurance in the European Higher Education Area" have been developed by European Association for Quality Assurance in Higher Education (ENQA) and adopted by the European Ministers in Bergen in May 2005 [5], until the academic year 2005-06 139 universities participated in the Institutional Evaluation Programme offered by the European University Association (EUA) [7], 134 higher education institutions participated in the EU Quality Culture Project (2002 – 2006) [2], etc.

As every country participating in the Bologna Process, also Slovakia is committed to establishing its own national quality assurance system by 2007 according to the above

standards and guidelines. In parallel, EUA actively encourages Slovak universities to implement their own internal quality assurance mechanisms and to develop a quality culture shared among universities throughout Europe.' Conference commissioned to EUA The system evaluation of Slovak higher education commissioned by the Ministry of Education in the Slovak Republic jointly with the Slovak Rectors has began in September 2005, when EUA started to evaluate 23 Slovak universities.

Institutional evaluations consist of a preliminary two-three-day visit, where the evaluation team can familiarise itself with the university, its staff and the context in which it operates. The team may request additional information to clarify issues that came up in its discussion with members of the university. The three-four-day main visit follows a few months later, at the end of which the team provides the rector and his or her invited audience with an oral presentation of its main findings.

In the follow-up procedure there is only one visit and with a smaller team of a chair, another member and a secretary, if possible the same persons who visited the university for the original review. The purpose of the follow-up evaluation is to assist the university to evaluate the progress it has made since the original review: What was the impact of the original review? What use has the university made of the original review report? How far has it been able to address the issues raised in the report? The follow-up review is also an opportunity for the university to take stock of its strategies for managing change in the context of internal and external constraints and opportunities.

In line with the EUA Institutional Evaluation Programme as a whole, the follow-up process is a supportive one. The EUA does not wish to provide Universities with a blueprint for its development; rather the review process is a consultative and supportive one. Each institution is evaluated against its specific aims and objectives and the evaluation is oriented towards offering recommendations

for improvement rather than passing summary judgement or ranking institutions. The evaluation is taking place in the wider context of the Government's strategic objective of placing Slovakia in a favourable position in meeting the Lisbon objectives; the Government's interest in ensuring the successful implementation of the Bologna reforms; the Government's acknowledgement of the need to increase the transparency and the attractiveness of the sector for the public. Under the terms of reference for the project, EUA is evaluating all 23 Slovak universities beginning in September 2005. Each evaluated university receives an individual evaluation report at the end of its evaluation. The institutional evaluations examine organisation and structures for carrying out the main missions of higher education institutions, effectiveness of internal quality processes and their relevance in decision-making and strategic planning; perceived gaps in the internal mechanism processes and frameworks and recommendations for enhancing them.

These key elements are placed within an analysis that takes into account the local, national and international context. In addition, EUA provides a sector report highlighting crosscutting issues and recommendations arising from the institutional evaluations and considering the conditions of research in Slovakia. The project concludes in January-February 2008, when the Slovak Rectors' Conference organises a concluding seminar with the higher education institutions and interested stakeholders to discuss the sector report and come to an agreement about the next steps. Finally, the sector report will be published.

Seven Slovak universities also participated in the "Quality Culture Project" organised by EUA to raise awareness of quality assurance within universities and that it seems to have made good use of the experiences it gained.

## 2. WHAT IT IS "QUALITY" AND HOW IT CAN BE ASSURED?

The notion of quality is strongly relative to the context within which it is used [2]. It can e.g. be understood as:

- fitness for purpose,
- compliance (zero errors),
- customer satisfaction,
- excellence,
- value for money,
- transformation (process of changing the customer),
- enhancement (process of changing the institution),
- control (punitive/rewarding process of quality assurance).

Accordingly to the relativity of the quality definition, different systems can be used for its assurance. While in industry it is usually related to the international standards EN ISO 9001 : 2000, for the academic environment relevant to the Bologna process it was considered as too bureaucratic and new standards have been proposed. The European Higher Education Area (EHEA) with its 40 states

is characterised by its diversity of political systems, higher education systems, socio-cultural and educational traditions, languages, aspirations and expectations. This makes a single monolithic approach to quality, standards and quality assurance in higher education inappropriate [2]. Consonant with the Graz declaration, the standards and guidelines proposed recognise the primacy of national systems of higher education, the importance of institutional and agency autonomy within those national systems, and the particular requirements of different academic subjects.

The system of quality assurance in Slovak higher education is based on internal quality assessment, external evaluation and accreditation. Internal quality assessment lies with the responsibility of each individual institution, while external evaluation is part of the accreditation procedure and is carried out by the Accreditation Commission. No special regulation is available for accreditation of the distance learning, the e-learning, or blended learning courses what has also negative influence on their reputation.

The EUA Institutional Evaluation Programme is based on self-evaluation reports, two on-site visits of an expert team, draft report and final report. The evaluation of Slovak institutions [7] was taking place in the wider context of:

- The Government's strategic objective of placing Slovakia in a favourable position in meeting the Lisbon objectives;
- The Government's interest in ensuring the successful implementation of the Bologna reforms;
- The Government's acknowledgement of the need to increase the transparency and the attractiveness of the sector for the public;
- The intention of this evaluation to support Slovak higher education institutions in their continuing development in order to meet best standards and practices adapted to their specific context.

In a broader context, the evaluation should focus on general standards for quality control published recently by ENQA [5]:

**Policy and procedures for quality assurance:** Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programmes and awards. They should also commit themselves explicitly to the development of a culture which recognises the importance of quality, and quality assurance, in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality. The strategy, policy and procedures should have a formal status and be publicly available. They should also include a role for students and other stakeholders.

**Approval, monitoring and periodic review of programmes and awards:** Institutions should have formal mechanisms for the approval, periodic review and monitoring of their programmes and awards.



**Assessment of students:** Students should be assessed using published criteria, regulations and procedures which are applied consistently.

**Quality assurance of teaching staff:** Institutions should have ways of satisfying themselves that staff involved with the teaching of students are qualified and competent to do so. They should be available to those undertaking external reviews, and commented upon in reports.

**Learning resources and student support:** Institutions should ensure that the resources available for the support of student learning are adequate and appropriate for each programme offered.

**Information systems:** Institutions should ensure that they collect, analyse and use relevant information for the effective management of their programmes of study and other activities.

**Public information:** Institutions should regularly publish up to date, impartial and objective information, both quantitative and qualitative, about the programmes and awards they are offering.

Just at the beginning it should be noted that the evaluation report is strongly based on and wrapped around the Self-Evaluation Report (SER) of a particular university. The report will also indicate the issues the university wishes to discuss with the follow-up team [8]. While the evaluation reports that react on SERs are easily to find on Internet, it is not the case with SERs. So, it is not possible to confront both these documents systematically.

### 3. THE INSTITUTIONAL EVALUATION PROGRAMME: QUALITY FOR WHOM?

In reality "quality" means different things to different observers and interest groups; not all share the same perceptions of priorities for change [3]. Any distance education system incorporates many different elements and processes and the actual degree of importance given to these varying components depends upon which interest group is going to interpret quality [1]. The same is, of course, valid also for any e-learning system.

"The Institutional Evaluation Programme (IEP) serves university leaders as a tool to assist them in their efforts to improve their management and to promote the universities' capacity for change. The EUA expects that the growing number of its institutional reviews contribute to the promotion of a culture of quality among its members, and to the dissemination of examples of effective strategic management among the European universities." [8].

The EUA Institutional Evaluation Programme is not concerned with the assessment of the quality of teaching and research activities; rather, it is concerned with the assessment and the improvement of the existing mechanisms and processes for strategic management and

quality assurance and, in that context, with the assessment and the improvement of the capacity of the universities to adapt to the rapidly developing higher education environment in Europe and in the world [7].

The up-to-now experience with the fully confirms this IEP dedication. This is in strong contrast with the warning formulated in the document Quality Culture in European Universities - A Bottom-Up Approach [2]: "It is clear that grass-roots initiatives in higher education are often more effective than top-down directives. The sense of ownership and engagement that develops through grass-roots involvement is critical to success in higher education. This observation applies to public authorities and also, but to a lesser extent, to higher education leadership: both have to provide the appropriate pre-conditions for quality culture to emerge and develop but they should not impose it by decree or pre-defining it without discussion with the academic community. The aim is to establish a quality culture that encompasses the whole institution in a consistent and integrative manner".

"The management (directors, president, a management group) traditionally measures the quality of training by study completion rates, overall grades, profitability or similar performance indicators. Quality helps to establish a good reputation and image and thus attracts more students to enrol on courses. Quality is one of the key aspects of business competitiveness" [1]. So, it is not to wonder that despite to the proclaimed role of students in the evaluation, the estimated quality is more on what the management regards as appropriate than on the customers' and the students' perceived needs, expectations, and preferences - for all three mentioned universities, quality should bring the title of "research university" that is expected to guarantee higher financing by state. This was, however, promised already long time ago - what is a good reason to look also for more realistic outputs of the whole campaign.

### 4. QUALITY VERSUS E-LEARNING

Just at the beginning it must be mentioned that only in the Follow-Up Report of the ŽU Žilina [8] there was explicitly mentioned role of e-learning in building the quality culture. This might, on the one hand, indicate that the university managements would forget the quality culture initiative similarly fast, as they have forgotten the flexible and e-learning initiative brought by the Lisbon documents, and, on the other hand, it brings a lot of questions related to how they wish to increase and to bring into practice the "institution's capacity for change and improvement that allows it to deal with a fast-changing environment and to respond to evolving needs" [7].

Short fragments of the IERs may indicate a lot: "The review team had the opportunity to realise that there are not any systematic structures and processes for quality assurance and quality culture at the institutional level in the STU" [7]. Or: "We feel that the present long-term plan is not really a

plan at all, but rather a list of desirable outcomes with no indication of how or when they may be achieved” [6].

## 5. PRE-ENTRY COURSES ON MATHEMATICS AND PHYSICS

The evaluation reports have once again remained the old problem of technically oriented universities in Slovakia: all three mentioned universities have problems with the incoming students: “The drop-out rate among first and second year students is worryingly high in many faculties, Economics being an exception. Several reasons were offered to explain this: the poor secondary preparation in mathematics and physics noted above, the inherent difficulty of engineering studies, the ‘parking’ phenomenon whereby some students enter the university for reasons unrelated to the completion of a study course, perhaps even for a relaxing year [6].”

Within the Phare Multi Country Cooperation in Distance Education project, at the Faculty of Electrical Engineering and Information Technology in Bratislava we have developed already in 1996 correspondence courses for the pre-entry preparation of students on Mathematics and Physics. Later, due to the increase penetration of Internet, we have built in also some e-learning features into the courses. These courses are considered as an essential contribution to increasing chance of their graduates to successfully overcome the largest barrier of the first university year and to continue in the study.

From the beginning of the course development we have tried to cooperate with as many Slovak universities and faculties as possible to improve students’ skills and knowledge all over the Slovakia. The course authors and tutors were recruited from many different faculties. We are still ready for an increased national cooperation based on the concept of the regional study centres associated with the particular universities, since, for the particular target group, the distance education is still more effective if appropriately combined with face-to-face activities. Despite to the recommendations given by international experts, we still do not see interest of other faculties and universities to cooperate – they prefer their own courses that cannot withstand advantages of a corporate approach. If they do so with respect to the profit generated by their own pre-entry courses, it is to remind that no acceptable fee for such a course is comparable with the state contribution they could gain for each student if successfully continuing his study.

The traditionally high drop-out rate among the first year students we have also tried to eliminate by splitting the first nominal year of the distance education bachelor study at the Faculty of Electrical Engineering and Information Technology into two calendar years and by reorganising the curricula (introduction of quarters instead of semesters that brings higher frequency of study and receiving feedback). Of course, the first solution – effective pre-entry courses is more effective since it does not prolong the length of study. But, especially for the students working and studying

simultaneously, also this second solution may bring success.

## 6. FRAGMENTATION VERSUS COOPERATION

Both the STU Bratislava and the TU Košice are facing problems of fragmentation. The report in Košice mentioned: “...some important disciplines are fragmented across the faculties. These include mathematics, physics and IT to name three examples. There is a loss of synergies by this fragmentation and a serious loss of both teaching and research potential [6].”

From the e-learning point of view, the situation is yet much worse. With its population of 5 million inhabitants, Slovakia is too small country to build effective e-learning system separately by all 23 universities (today, this number already accedes 30). When the university managements and the international experts point out the not effective use of scarce finances dispersed among not-cooperating faculties, why they do not push forward this principle by supporting an inter-university cooperation that could yet much more increase the synergy and effectiveness of the joint course development and delivery? The would just keep track with the recent development of methodology of learning objects that supports such a philosophy and enables to develop advanced schemes of division of work functioning on the win-win bases. Why do we not copy the success stories of joint learning repositories in Czech Republic, of the Finnish Virtual University, of the Swiss Virtual Campus, and other countries that are world-wide at the top of the development? Together with partners from TU Košice, ŽU Žilina and other Slovak universities, we have applied such national project already in the last round of Tempus projects. That time we have received feedback that it was very nice prepared but too expensive (just small projects were finally accepted). Looking to the advances made in Estonia and other Baltic countries, where they effectively supported development of e-learning at the national level, it still seems to be one of the key steps in establishing delay and fragmentation of the ICT based education and e-learning in Slovakia. Too late to complain, but still not late to manage an improvement!

## 7. STAFF DEVELOPMENT & TRAINING

Just at the beginning of e-learning in Slovakia, the established Phare study centres started with a joint course development and delivery for the staff development – STU Bratislava in cooperation with TU Košice, ŽU Žilina and also other Slovak universities (UMB Banská Bystrica, TU Zvolen, UAD Trenčín) that was also supported by several Tempus projects. Later this cooperation continued under support of the Open Society Fund. After introduction of the ESF projects, it was firstly not clear, how to overcome regional organization of these projects and how to build partnership under the given financial rules. So, our first staff development ESF projects “Preparation to e-learning”, code 13120120011 and “Preparation of the system and

program of the lifelong education of the university employees“, code 13120120023 have been oriented just on cooperation with the universities in Bratislava. After “mastering” the permanently varying nuances of these projects (that really cause a tremendous drawback in supporting education), we started to renew our traditional contacts and cooperation within the mirror-projects “Preparation of University Teachers for Using ICT in the Learning Process” with partners UCM Trnava, SAU Nitra, UMB Banská Bystrica and Elfa - TU Košice (project code 11230220525), or FChPT STU and MtF STU Bratislava (project code 13120120287). Both projects are targeted to the basic computer (ECDL) and e-learning skills and they should deliver about 6000 course modules.

## 8. CONCLUSIONS

From the point of view of e-learning and distance learning, the European focus on quality is strongly welcomed. By its nature they need to be yet more publicly accountable than the traditional face-to-face teaching and excellently prepared to satisfy the student needs and expectations. However, in order to further increase the synergetic effect, the top-down approaches that up to now dominate on particular universities should also be extended to the institutional issues using the synergy at the national level and, at the same time, combined with the bottom-up approaches mobilizing broader staff participation. In our long-term experience in offering staff development courses we feel absence of motivation factors that would stimulate the majority of staff in the individual development and acquiring team work skills that are indispensable both for implementing the philosophy of the learning organization [4] and for spreading the quality culture.

It is to understand that university management wish to have higher authority and stronger mechanisms for the university control. But, the authority is not something that can be given by a decree and the real quality culture can be established only under conditions of appropriate political culture. All these need the well known but sometimes forgotten: “...the capacity for change requires, above all, inspiration. It requires inspired, motivated and determined people. It is extremely important to realise that elements of strategic planning do not themselves change the universities. Changes in universities have to be driven by people: Staff and students and an inspired university leadership making sure that the actions in the action plans are in progress...”

## 5. REFERENCES

[1] Lampikoski, K.: Who Determines Quality in Distance Education? In D. Sewart, ed., *One World Many Voices: Quality in Open and Distance Learning. Selected papers from the 17th World Conference of the International Council for Distance Education*, Birmingham, United Kingdom, June 1995. Vol. 2, pp. 117-20

<http://www1.worldbank.org/disted/Management/Governance/q-02.htm>

[2] Quality Culture in European Universities: A Bottom-Up Approach. Report on the Three Rounds of the Quality Culture Project 2002 – 2006, EUA Publications 2006, [http://www.eua.be/eua/jsp/en/upload/Quality\\_Culture\\_2002\\_2003.1150459570109.pdf](http://www.eua.be/eua/jsp/en/upload/Quality_Culture_2002_2003.1150459570109.pdf) (15.6.2007)

[3] *Schools and Quality*. OECD, Geneve, 1989.

[4] Simmonds, T.: *Implementing and managing flexible learning: Personnel and development*. Pitman Publ., TVU London 1995.

[5] Standards and Guidelines for Quality Assurance in the European Higher Education Area, European Association for Quality Assurance in Higher Education, 2005, Helsinki, [http://www.bologna-bergen2005.no/Docs/00-Main\\_doc/050221\\_ENQA\\_report.pdf](http://www.bologna-bergen2005.no/Docs/00-Main_doc/050221_ENQA_report.pdf) (15.6.2007)

[6] Technical university of Košice, EUA Evaluation Report, June 2006, [http://www.tuke.sk/tu/Aktuality/TU\\_Kosice\\_final\\_report\\_18\\_07\\_06.pdf](http://www.tuke.sk/tu/Aktuality/TU_Kosice_final_report_18_07_06.pdf) (15.6.2007)

[7] Slovak University of Technology in Bratislava, EUA Review Report, March 2007 [http://www.stuba.sk/buxus/docs/stu/uradna\\_tabula/eua\\_report\\_eng.pdf](http://www.stuba.sk/buxus/docs/stu/uradna_tabula/eua_report_eng.pdf) (15.6.2007)

[8] University of Žilina EUA Follow-Up Report, June 2006, [http://www.uniza.sk/document/EUA\\_Zilina\\_18.07.06.pdf](http://www.uniza.sk/document/EUA_Zilina_18.07.06.pdf) (15.6.2007)

## THE AUTHOR(S)



**Mikuláš Huba**, STU Bratislava – initiator and director of the Distance Education Centre (former Phare Local Centre of Distance Education at the STU in Bratislava established in 1996), Founder and director of the non-profit organization Slovenská e-akadémia, n.o.



**Ľubica Rovánová**, STU Bratislava, Faculty of Electrical Engineering and Information Technology, Head of the Department of Languages, Head of the Board of Trustees of the non-profit organization Slovenská e-akadémia, n.o.

## ACKNOWLEDGEMENT

*The paper was partially supported by the ESF Projects “Preparation to e-learning”, code 13120120011, “Preparation of the system and program of the lifelong education of the university employees“, code 13120120023 and by the mirror-projects “Preparation of University Teachers for Using ICT in the Learning Process” codes 11230220525 and 13120120287.*





## INTELLIGENT E-LEARNING SYSTEMS

Peter Kažik, Igor Sivý

Department of Computer and Informatics, Technical University of Košice, Letná 9, 042 00 Košice, Slovakia

kazik.peter@centrum.sk

sivy@elfa.sk

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** E-learning systems are information systems used for educational purposes. It is powerful way for teaching and training people in many areas of human activity. Besides many advantages, these systems have disadvantages in process of education. Main disadvantage is generalization of learners, which means that all learners get the same studying materials and e-learning system do not have tools for satisfy learners individual study needs, like providing of other studying materials or assisting learner with a psychical aid. Intelligent e-learning system might be possible solution for this problem. Intelligent e-learning systems are rather new technology with basic principles identical with e-learning systems, but they also contain so-called intelligent principles for eliminating learners' generalization with individualized access to learners study. This can also make learner's study more effective. There are many ways for implementation of this intelligent principles, selecting from a set of intelligent principles is based on character of studying material, format of study course, etc. This work discusses mainly used principle that is adaptability principle, where system stores information about progress of learner study and make appropriate actions.

**Keywords:** adaptability, student model, optimal path, metadata, e-learning, intelligence

### 1. INTRODUCTION

Problem of education is mostly connected with knowledge-based economy, which has been defined as main factor for development in our community, because only properly trained or skilled persons can mainly support this development. However, quality of knowledge mostly depends on quality of education. At present, new information and communication technologies have enabled development of new learning and teaching environments [1]. Intelligent e-learning systems (IELS), which have basic principles identical with standard e-learning systems (provide education), are examples for this development. Main reason for development of these systems was that standard e-learning system contains disadvantages, like generalization of learners and inability to provide individualized access to learner study. By this disadvantage, all learners get the same studying materials which might be comprehensible for one learner, but might be incomprehensible for other learner.

There are many approaches for these intelligent principles, selection and application of these principles depends for example on type of studying material or format of course. This work will discuss the principle of adaptability. By this principle, IELS store information about learner's study progress in so-called student model and next system action is based on this stored information. IELS also have his own system architecture, which may contain some new modules, which are not present in standard e-learning systems. Its metadata specification for learning object in data repository is also important part of IELS. This specification can increase efficiency of system in searching for alternative materials or changing the structure of learning material (if possible).

### 2. ANALYSIS

#### E-learning Systems

E-learning systems are information systems mostly used for on-line education. It can be:

- General – can serve education in many areas
- Problem-oriented – have supporting tools for studying of a particular subject, study of other subject can be problematic.
- Combination of general and problem-oriented [4].

Problems in this form of education are eliminated with embedded intelligent principles, which convert standard e-learning system into intelligent e-learning system.

#### Development of IELS

Development of IELS consists from several steps:

Analysis of teaching materials and courses, which can be provided in developed system, is the first step. This is followed by selection of the most appropriate intelligent supporting technology. For example, e-learning systems for teaching programming languages must have built-in lexical and syntactic analyzers for a selected language and components for intelligent analysis of student results.

Project of architecture of new system is certainly the next step. New system can be developed, or an existing system may be updated. Nevertheless new architecture must contain new modules for selected intelligent support.

Selection of metadata specification is an important step, which is also based on analysis of teaching materials and courses.

Programming and technical development must be obviously based on outputs of previous steps.

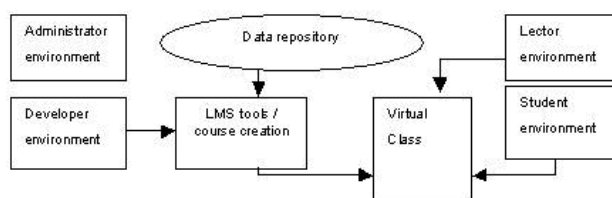


Fig. 1: Architecture of Standard E-learning System

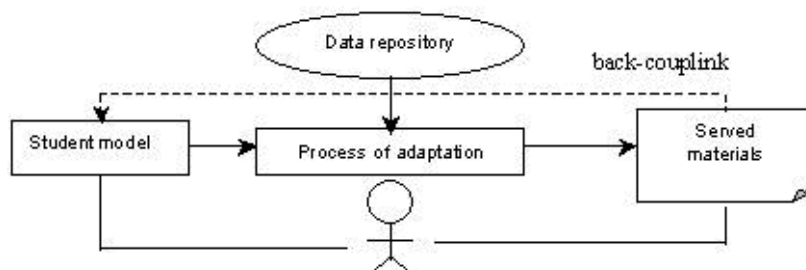


Fig. 2: Principle of Adaptability

### Architecture of Intelligent E-learning System

Important fact for creating architecture for IELS is analysis of architecture of standard e-learning system. This architecture is shown on the Figure 1 and consists from these basic modules:

- LMS tools - contains tools for course creation and can have tools for creating learning objects.
- Virtual class - can simulate standard class known from school. Lector can bind this class with some course and manage users of this class.
- Data Repository - disk space containing learning objects.
- User environments – usually web-browsers for on-line e-learning system.

This architecture is also demonstration of a fact, that standard e-learning system does not have modules (components) for supporting individualized access to learners study.

**Principle of Adaptability.** This principle brings support for individualized access to learner study. It is shown on Fig. 2 and principle can be considered as follows: Information about learner study progress is stored in a student model [6]. This information tells system rules for managing teaching materials from data repository and then learner is provided with these materials. If the materials invoke a change in learner study progress, this information is again stored in student model.

Mostly used technologies based on principle of adaptability are [3]:

- Intelligent tutoring systems
  - Curriculum sequencing (Optimal Path problem)
  - Problem solving support technologies (Intelligent analysis of student solutions, Interactive problem solving support, the example-based problem solving support)

- Adaptive hypermedia systems
- Student model matching

This was only few technologies used in IELS with adaptability support. Theory of IELS is relatively new and is being constantly developed.

After selection of intelligent principle, it is possible to project architecture of IELS. Example of this architecture can be found in the next chapter.

### Metadata Specification

Every teaching object used in system must have its own metadata. Metadata are information about data (learning objects) and they are usually stored in database tables, as it is shown on the Fig. 3. There are many metadata specifications, for example [2]:

- Dublin Core
- Ariadne
- IMS
- IEEE-LOM
- GEM
- Advanced Distributed Learning – SCORM

Some of these specifications can be used as templates for updated metadata specification. For example, [7] is an interesting work, which describes useful so-called ecological approach for specification IEEE-LOM.

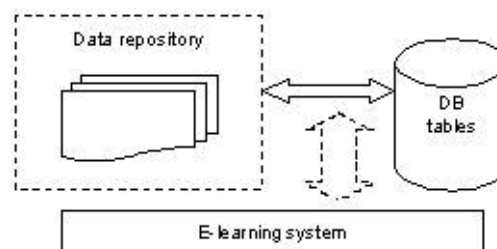


Fig. 3: Use of Metadata

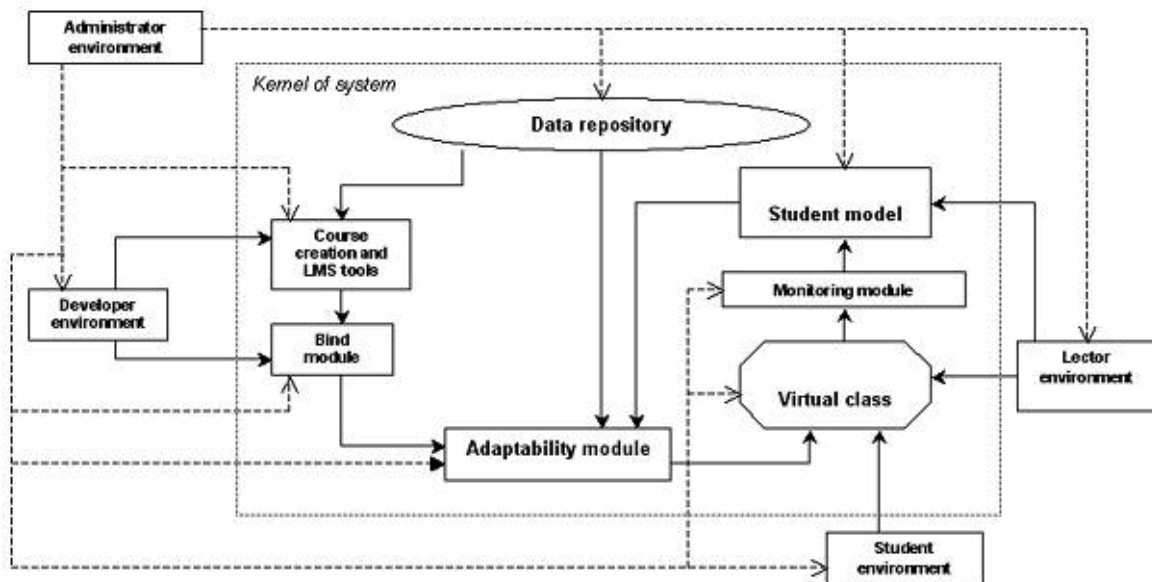


Fig. 4: Architecture of IELS

### 3. SOLUTION AND RESULTS

Principles from this work were tested on existing e-learning system eEduser.

Analysis of courses and teaching material which can be used through this system was the first step. Assignment defines, that eEduser is a general, not problem-oriented e-learning system, which can simulate original form of education known from schools. Simulation of this school education can be accurate by using principle of adaptability: technology of Optimal path.

#### Optimal Path Problem

Skeleton of the problem is based on the rules (binds) between teaching materials. Categorizing of teaching materials in two groups is a start for rule set up:

- Theoretical materials (or objects) – all object that does not evaluate learned knowledge
- Object for knowledge-checking – like tests

Then the rules are:

- *if* some theoretical object was seen/read *then* make other theoretical object/tests accessible
- *if* test for some theoretical object was successfully accomplished *then* make other theoretical object accessible

These rules are defined by a course developer. If a learner fails in a test, system will look up another teaching material and provide it to learner. Example of this can be seen on the next figure:

#### Architecture of IELS

New system architecture must contain new modules using intelligent principle of optimal path. This architecture is shown on Figure 4 and contains the following new modules:

- *Bind module* – a module, in which course developer defines if-then rules. System needs for storing rules the following information: identification of course, identification of learning objects and type of bind.
- *Student model* contains information about learner progress in study. Models are implemented as data records in database tables. For this version of optimal path student model contains information how many times theoretical object was visited from course, calculated balance, which depends on binded tests and information about additive teaching materials, which are served to learner, when he fails in a test.
- *Adaptability module* is a part of source code, which is responsible for managing (control of accessibility) of teaching materials provided to student. This managing depends on information from Bind module and Student model.
- *Monitoring module* is a part of a source code, responsible for storing information in student model.

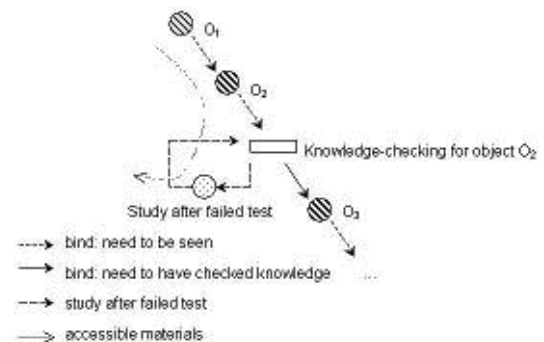


Fig. 5: Example of Optimal Path

### Metadata Specification

Metadata specification is next part in development of IELS. Selected specification is Dublin Core [5]. It is a specification used in libraries with so-called conservative access to objects metadata, but sufficient to applied problem. Basic specification involves 15 elements: title, creator, subject, description, publisher, contributor, date, type, format, identifier, source, language, relation, coverage, rights [4]. This basic specification was updated for some new elements. Final specification elements were categorized in 4 groups:

- *Basic information* (DC\_Basic) contains identification of data record, Title, Description, Source Thema, Keywords, Languages and Version
- *Rights information* (DC\_Rights) contains Price, Creator, Contributor, Publisher, Coverage, basic description of rights, information about starting and ending date (time) of accessibility of data source and information about acceptance of source.
- *Format and Type information* (DC\_Format\_and\_Type) contains basic file name for object (ev. so-called index file), type of source, storing information and some eventually needed information.
- *Relation information* (DC\_Relation) are stored information on relation between individual data sources. It can help system in finding best additive teaching materials to satisfy learner needs.
- *Other information* (DC\_Others) consist from information about Competencies, Knowledge, needed Skills, Prerequisites, Department and History (uses of object).

### Additive Teaching Materials

Searching for alternative and additive data sources would be last solution provided to particular learner, which would be stored in IELS. If student fails in a test, system would get metadata from theoretical object, for which failed test was binded. System then uses these elements for finding similar learning object in data repository. This algorithm is shown on the next figure:

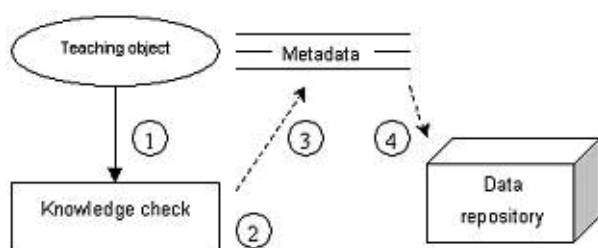


Fig. 6: Searching for Additive Materials

Usable elements are:

- Title – learning object with the same title can probably tell information about same topic, but in understandable way.
- Keywords – classical search algorithm. A certain level of keywords agreement (for example 70%) must be set.

- Source Theme could be alternative to description, but it is shorter.
- Author/Creator – same author can probably create other teaching materials, which cover the same topic. Searching with this element must be combined for example with keyword searching with lower level of agreement, etc.

Information about founded teaching materials would be stored into student model.

## 4. CONCLUSION AND FUTURE WORK

This work is an introduction into theory of IELS. We have founded, that a principle of adaptability is mostly used principle for IELS. There is a set of technologies, which can be used in different IELS. Optimal path was used as selected technology and it was tried to implement it into existing e-learning system. This technology requires rebuild of system architecture and addition of some new modules. Changing of metadata specification can be also useful part of development. This work maps beginning of this technology. In future work, this technology can be combined with technology of intelligent analysis of students result. Then, if a student fails in a test, system will find alternative materials for study only for wrongly answered questions. New metadata specifications and rebuild of system architecture might be required.

## 5. REFERENCES

- [1]. STANKOV, Slavomir - ŽITKO, Branko - GRUBIŠIĆ, Ani: Ontology as a Foundation for Knowledge Evaluation in Intelligent E-learning Systems. 12th International Conference on Artificial Intelligence in Education, Amsterdam, Netherlands, 2005, pp. 81-84
- [2]. SADDIK, A. E. E-Learning Standards: The Dawn Has Broken. School of Information Technology and Engineering, University of Ottawa, Canada, 2001.
- [3]. BRUSILOVSKY, Peter: Adaptive and Intelligent technologies for Web-based Education, Special Issue on Intelligent Systems and Teleteaching.
- [4]. PEYLO, Christoph – THELEN, Tobias – ROLLINGER, Claus – GUST, Helmar: A web-based intelligent educational system for PROLOG, Osnabrück 2000, Institute for Semantic Information Processing – University of Osnabrück.
- [5]. Dublin Core Metadata Element Set, Version 1.1 <http://dublincore.org/documents/dces/>
- [6]. BUREŠ, Miroslav - JELÍNEK, Ivan: Formální popis adaptivního webového systému, Praha 2004, Odborná skupina Webing, katedra počítačů ČVUT FEL
- [7]. BROOKS, Christoper - McCALLA, Gordon - WINTER, Mike: Flexible Learning Object Metadata, 2005, 12th International Conference on Artificial Intelligence in Education, Amsterdam, the Netherlands, pp. 1 - 8



## THE AUTHORS

**Peter Kažík:** born in 1982, has successfully graduated on the high school Stredná priemyselná škola elektrotechnická in Košice, in year 2001 and completed his university studies by taking a state examination in the study field of Computers and Informatics on Technical University of Košice in year 2007. His hobbies are computers, book reading, psychology (passive) and nature.

**Igor Sivý:** born in 1960, received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 1988. He works as an assistant professor at the Dept. of Computers and Informatics, Technical University of Košice. His research interests include operating systems, e-learning systems and intelligent tutoring systems.





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## REMOTE ACCESS TO SENSORS ON BASIS OF DISTRIBUTED INFORMATION MEASUREMENT AND CONTROL SYSTEM FOR SUPPORT OF RESEARCH AND EDUCATIONAL PROCESS

Sergey A. Kiprushkin<sup>1</sup>, Sergey Yu. Kurskov<sup>2</sup>, and Eugene S. Sukharev<sup>3</sup>

Department of Physics and Engineering, Petrozavodsk State University, Lenin Str., 33  
185910 Petrozavodsk, Russia

Telephone: +7 8142 711 025, fax: +7 8142 711 000

E-mails: <sup>1</sup>skipr@dfе3300.karelia.ru, <sup>2</sup>kurskov@psu.karelia.ru, <sup>3</sup>eugene-mobile@yandex.ru  
<http://dfе3300.karelia.ru>

**Abstract.** The development of the distributed information measurement and control system for optical spectral research of particle beam and plasma objects and the execution of laboratory works on Physics and Engineering Department of Petrozavodsk State University are described. The access to physical equipment is realized through the equipment servers (CAMAC, GPIB et al.) and the communication server, which integrates the equipment servers into uniform information system. In this work, the designed by the authors network interface is discussed. The interface provides the connection of measuring and executive devices to the distributed information measurement and control system via Ethernet. This interface allows controlling of experimental parameters by use of digital devices, monitoring of experiment parameters by polling of analog and digital sensors. The device firmware is written in assembler language and includes libraries for Ethernet-, IP-, TCP- и UDP-packets forming.

**Keywords:** Infrastructure, Information and Communication Technology, Internet access, Hardware, Software

### 1. INTRODUCTION

Up-to-date systems of experiment automation are recently built on modules of software-controlled devices or digital measurement hardware, connected to interface bus. In all cases, hardware is connected to computer with interface device.

Integration of distributed system with remote sensors is more efficient, when the network interface used. It can be built on network chip and microcontroller. By using Ethernet interface, it is possible to connect different digital and analog devices, and the connection with servers will be based on TCP/IP networks.

The goal of this work is to develop a network interface for connecting remote sensors and execution units to distributed information measurement and control system for physical experiments.

### 2. DISTRIBUTED INFORMATION MEASUREMENT AND CONTROL SYSTEM

The distributed system (Fig. 1) is based on client/server technology and works in the nets on basis of TCP/IP protocol stack [1–4].

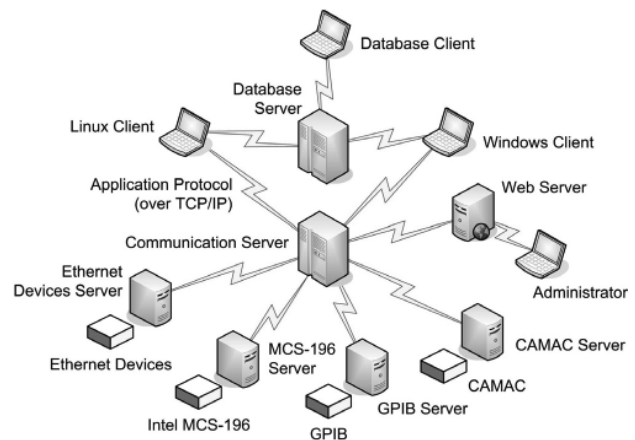


Fig. 1. The scheme of the distributed information measurement and control system

The system provides the remote access to information and hardware resources of automation equipped working places. The equipment servers (CAMAC server, GPIB server, the server of access to the MCS-196 microcontrollers, the server of Ethernet devices, the server of access at GDS-840C digital oscilloscope, and others) provide the access to physical equipment. The communication server integrates the whole distributed systems. Its functions are: communication with user, system monitoring, security, and proper distribution of resources in multiuser mode.

The distributed information measurement and control system is based on the modular approach implemented both in the structure and in the software. Clients and equipment servers are built into the system according to the unified rules and interact on a unified protocol by the principles of open systems. Note that an open system is a system that implements open specifications or standards for interfaces, services and formats in order to provide software portability with minimal changes in a wide range of systems (mobility) as well as interaction with other applications on local or remote systems (interoperability) and users (user mobility) [5]. In particular, distributed systems are based on OSE/RM model that describes systems by client/server architecture.

The experiment process is determined and conducted by client software running on a client computer. It is necessary to emphasize, that the managing experiment software are operated not on the remote computer (as when using Web technologies) [6 – 8], but on the user one, connected to the system via global network.

This system also implies the supervisor (the administrator) mode. The administrator access to the communication server is carried out with the help of a standard browser and a Web server. The Web server – communication server interaction is implemented with the help of servlet. Servlets are extension modules of Web servers with Java support. In the present work the servlet is used for the network exchange organization with the communication server according to the system protocol and the dynamic generation of HTML pages.

The administrator connects to the communication server as a usual client but with the password in the “data” field; the length of the password is set in the “key” field. The password having been checked, the supervisor is receives the zero CID. A few additional functions are available for the supervisor: the client information review, the used resources review, the client registration and disconnection, and resource release [9].

The database is based on database management system Oracle9i. The software was developed using Model View Controller architecture, which separates application data from graphical presentation components and input processing logic. The following graphical presentations were implemented: measurement of radiation spectra of beam and plasma objects, excitation function for non-elastic collisions of heavy particles and analysis of data acquired in preceding experiments. The graphical clients have the following functionality of the interaction with the database: browsing information on experiments of a certain type, searching for data with various criteria, and inserting the information about preceding experiments.

The communication server, the equipment servers, and the client software are implemented as Java applications. The data exchange between them is based on TCP stream sockets provided by java.net package, which is included

into Java API standard package. The methods of using the input-output ports for the access to the interface controllers are written in C programming language.

### 3. ETHERNET INTERFACE

There are many specialized processors (network chips) designed for communication over networks. But it is necessary to create a central command unit, which will communicate with devices and control the network chip. This unit can be built on microcontroller.

Choosing network chip, it is necessary to take into account the physical environment and the required transmission rate of data. For communicating over 10 Mbps network, based on twisted pair, Realtek RTL8019AS processor was selected. This chip is compatible with ISA personal computer interface by timings, data and address signals.

By emulating ISA bus with microcontroller, it is possible to gain proper network chip functioning. Atmel AVR microcontrollers are good choice to implement this idea. They perform each instruction per one clock period, so their performance is 16 MIPS for 16 MHz clock rate. This performance is enough for ISA emulation.

Atmel ATmega8535 was used in the described device. It has 8-channel 10-bit ADC, 8 Kb Flash ROM, 512 b EEPROM, 512 b RAM, pulse-width modulator and analog comparator.

The main logic of the device functioning is described below. When the device is turned on, microcontroller firmware program is initiated. By sending the RESETDRV signal, the network chip is resetting. Then microcontroller configures the network chip. Configuration can be made in accordance to the desired aim of operation: e.g. reading data from measurement device and sending these data to specified network address.

The operation modes are:

- Control of the experiment execution through digital or analog devices (relays, step motors, gas injectors, etc.);
- Control of some parameters by polling analog and digital sensors (pressure, temperature, and optical sensors, atom beam sensor, etc.);
- Notify of parameter value, registering by measurement device.

### 4. SOFTWARE

It is possible to present information flow as follows. Analog value is converted into binary code by ADC. This very value must be received “on the other end of wire” for

placing into database. The result is put into TCP packet. TCP protocol provides the reliable transmission of the messages between remote application processes. Then the IP datagram is formed from TCP packet (the level of the internetworking) and is sent to the bottom level – a network interface level.

Protocols of this level must provide the integration into global network: TCP/IP network must have a facility of the integration into any other networks, which doesn't depend on internal technology of data communication in these networks. Hence, this level is impossible to define once and for all. An interface facility must be designed for every communication technology. IP-frames to Ethernet encapsulation protocol pertains to such interface facility.

Encapsulation of IP-package into Ethernet-frames is described in RFC1042. Then Ethernet-frame is sent via communication media.

The other side receives the frame and performs the re-conversion by correspondent server software. Processing of the frames encapsulation does not take much processor time in personal computer. However, microcontroller has smaller speed and less memory. That is why it is very important to solve this task by means of optimized algorithm and assembler language.

Set of the program modules and the sequence of the transmission of the frame, received from remote device by personal computer, are shown on Fig. 2.

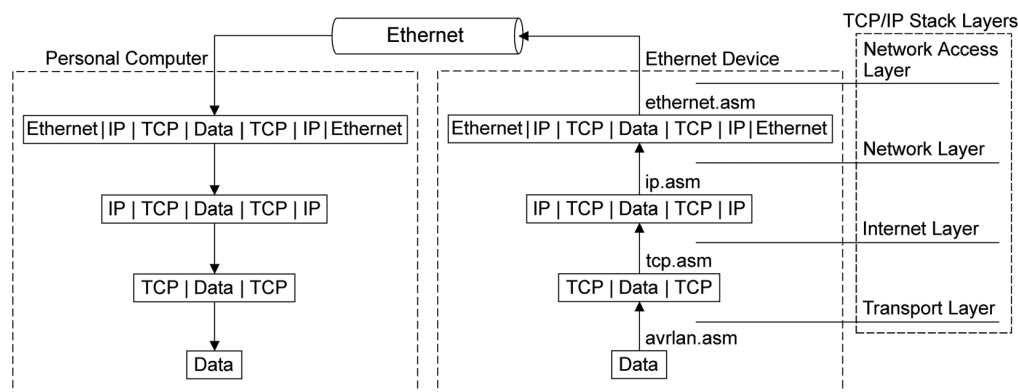


Fig. 2. Set of the program modules and sequence of the transmission of the frame, received from remote device by PC

It is possible to use complete 3rd-party libraries and functions for TCP/IP implementation, because the software requires standard interactions only. These libraries are presented in all up-to-date programming environments (Java, .NET, Visual C++, Delphi, LabVIEW, etc.).

There is a question that needs to be answered by a developer of software: what level of TCP/IP stack must be implemented. This choice depends on software, used in personal computer, dataflow and processing speed of microcontroller, as well as requirements of reliability of information delivery.

The more preferred way is to use the lowest possible level of TCP/IP stack, sending data in Ethernet-, or IP-frames.

E.g. measured values of remote temperature sensor can be packed into Ethernet frames directly if qualification of the developer is sufficient to use the Ethernet level. But if the LabVIEW used, then you need to use all modules for package framing (from ethernet.asm to tcp.asm) on microcontroller side. Using the Java language for writing client applications also superimposes the restriction: when TCP-socket is used, you need to use the tcp.asm library in microcontroller. If you use UDP (unreliable delivery protocol), you must encapsulate messages with udp.asm

library. This library works at transport level of TCP/IP stack that obliges to use as well as all underlayed protocols.

Firmware, designed for the described device, is written on assembler language and includes Ethernet-, IP-, TCP- and UDP-package libraries.

The described device can be used in other networks, based on other protocols, but in this case it is necessary to develop the libraries for generation of correspondent frames.

Internet does not give any warranty for time of package delivery. This reason limits the use of the device in system that imposes hard time restrictions of information delivery. This feature can be eliminated by using a special network, used for undertaking the physical experiment only.

## 5. CONCLUSION

Ethernet interface device and corresponding software were developed and created. It implements access to remote sensor and digital device of the laboratory complex, used for scientific experiments in the field of optical spectroscopy and distant education on Physics and Engineering Department of Petrozavodsk State University.

This interface helps to increase the variety of devices, which can be connected to distributed information measurement and control system without using the computer and software-operated module electronics, as well as different instrument interface like GPIB.

## REFERENCES

- [1] Gavrilov S. E., Kiprushkin S. A., Kurskov S. Yu.: Distributed information system with remote access to physical equipment. Proceedings of the International Conference on Computer, Communication and Control Technologies: CCCT '03 and The 9th International Conference on Information Systems Analysis and Synthesis: ISAS '03, Orlando, 2003.
- [2] Kiprushkin S. A., Korolev N. A., Kurskov S. Yu.: Data security in the distributed information measurement system. Proceedings of the 8th World Multi-Conference on Systemics, Cybernetics and Informatics: SCI 2004. Orlando, 2004, Vol. 1, pp. 13-16.
- [3] Kiprushkin S. A., Korolev N. A., Kurskov S. Yu.: Sharing of Instrument Resources on the Basis of Distributed Information Measurement System. Proceedings of the Second IASTED International Multi-Conference on Automation, Control, and Information Technology – Automation, Control, and Applications: ACIT-ACA 2005. Novosibirsk, ACTA Press, 2005, pp. 170-175.
- [4] Kiprushkin S., Korolev N., Kurskov S., Nosovich N.: Distributed Information Measurement System for Support of Research and Education in Optical Spectroscopy. Proceedings of the Third International Conference “Information Research, Applications and Education”: i.TECH 2005. Sofia, FOI-COMMERCE, 2005, pp. 171-179.
- [5] Isaac James et al.: Open Systems Handbook. IEEE Standards Press, 1994.
- [6] Barrie J. M., Presti D. E.: The World Wide Web as Instructional Tool. Science, V. 274, 1996.
- [7] Зимин А. М., Аверченко В. А., Лабзов С. Ю. и др.: Лабораторный практикум по спектральной диагностике плазмы с удаленным доступом через Интернет. Информационные технологии, No. 3, 2002, сс. 37–42 (In Russian).
- [8] Зимин А. М., Букеткин Б. В., Почуев А. П. и др., Учебная Интернет-лаборатория “Испытания материалов”. Информационные технологии. No. 10, 2006, сс. 58-65. (In Russian).

[9] Kiprushkin S. A., Kurskov S. Yu., Nosovich N. G.: Administration of distributed information measurement system. Proceedings of the 9th World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI 2005. Orlando, 2005.

## THE AUTHORS



**Sergey Albertovich Kiprushkin:** Senior lecturer of the Department of Physics and Engineering of Petrozavodsk State University (Russia), has 94 publications. His research interests include net technologies, operating systems, electronic document management.



**Sergey Yurievich Kurskov:** Associate Professor (PhD) of the Department of Physics and Engineering of Petrozavodsk State University (Russia), has 139 publications. His research interests include distributed information measurement and control systems, physics of atomic collisions, automation of spectroscopic research.



**Eugene Sergeevich Sukharev:** Lecturer, PhD student of the Department of Physics and Engineering of Petrozavodsk State University (Russia), has 15 publications. His research interests include microprocessor-based hardware, net technologies, automation of spectroscopic research, and development of software using Java-technologies.

## ACKNOWLEDGMENTS

We would like to express our gratitude to the laboratories' Head I. P. Shibaev for support of this work as well as postgraduate student N. A. Korolev and students A. V. Mandychev, M. A. Gvozd, V. G. Mullamekhametov, and D. V. Korolev.

The research described in this publication was made possible in part by Award No. RUX0-000013-PZ-06 of the U.S. Civilian Research & Development Foundation (CRDF) and of the Ministry of Education and Science of Russian Federation.



## SYSTEMIC E-LEARNING SOLUTION OF AC MACHINES EXPLANATION BASED ON PHASOR THEORY

Michal Kostelný, Viliam Fedák

Technical University of Košice, Department of Electrical, Mechatronic and Industrial Engineering,  
Letná 9, 042 00 Košice, Slovak Republic

+421/55/602 2278, fax: +421/55/63 301 15, Michal.Kostelny@tuke.sk, Viliam.Fedak@tuke.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The contribution presents a systematic approach to e-learning modules design dealing with theory of electrical machines. Explanation is based on phasor theory that is applied to a unified principle going out of a constant supply voltage and load current. The survey presentation has been chosen from several developed-learning modules of AC machines: Transformers, Asynchronous Machines and Synchronous Machines. In the applications there are shown multifunctional screens with interactive graphs. The modules are used in the full time, part-time and distance study programmes at various faculties of the Technical University of Košice (the Faculty of Electrical Engineering and Informatics, the Faculty of Mechanical Eng., and the Faculty „FBERG“).

**Keywords:** E-learning, Interactive learning, AC Machines, Phasor diagram

### 1. INTRODUCTION

Within the scope of the Leonardo da Vinci II project INETELE “Interactive and Unified E-based Education and Training in Electrical Engineering” [1] there were developed basic modules for the branch of study “Electrical Drives”. Except of solutions developed there also other classical approaches are known, and form various known solutions let’s mention [2].

In framework of the project [1] in the subgroup Electrical Machines several authors’ teams have developed modules of AC [3] and DC machines, but on a different system basis. Only the approach in the module Transformers [4] respects the principles of phasor theory. In case of AC electrical machines it starts from the generalised theory and vectors transformations. AC machines theory starts from theory of electromagnetic field that is described by Maxwell equations. The phasor theory based on their principle describes the AC electrical machines exactly by voltage and current equations. On basis of the phasor theory the next two modules on AC machines were developed and the paper presents a generalised approach to the AC machines explanation using the phasor theory.

Considering a wide spectrum of students at TU Košice studying the electrical machines as a compulsory subject (Faculty of Electrical Engineering and Informatics - FEI), but also in framework of the subject Electrical Engineering at the Faculties of Mechanical Engineering (SjF), Metallurgical Eng. (HF) and BERG, there is necessary to apply a united approach to the basic subject. At present we can assume that the majority of the students outside of the FEI have studied the fundamentals of physics and mathematics but they have minimal information about electrical engineering fundamentals.

### 2. PROBLEM TEORETICAL BACKGROUND

The voltage and current equations of input and output circuits of AC electrical machines are based on principle of a equivalent circuit that presents the whole electromagnetic circuit. They can be expressed by:

1. differential equations for instantaneous values,
2. phasor equations.

The series-parallel AC circuits creating the equivalent circuit (T-network impedance diagram) come out from constant values of resistances and inductances of electrical circuits, for harmonic supply with frequency  $f_1 = 50$  Hz. The values of resistances and impedances are taken from a catalogue or they can be estimated by measurement.

On basis of phasor diagrams the phasor theory for AC circuits of AC machines enables calculation of current values at loading that in the following enables calculation of power and torque of rotating electrical machines.

### 3. SYSTEMIC E – LEARNING SOLUTION BY INTERACTIVE GRAPHS

The solution based on phasor theory enables to apply a unified principle to see visualisation in interactive graphs. It considers a methodological procedure for AC circuit solution at development of voltage and current diagrams. This approach leads to a direct applicability in calculations for various loads.

The principles are applied for all AC electrical machines in no-load operation, short-circuit operation and at loading.

The equivalent circuits are based on a common principle with the following properties.

1. they are created by substitute elements enabling direct calculation and
2. a uniform designation of equivalent circuit elements,
3. in which so called consumer principle (concerning orientation of the current  $i_2$ ) is applied, and
4. in electrical equivalent circuits there are marked instantaneous values of currents and voltages.

The phasor diagrams are characterised as follows:

1. the grid system has the real axis aligned with the vertical axis,
2. the supply voltage phasor  $\mathbf{U}_1$  lies in the positive axis,
3. the load current phasor  $\mathbf{I}_1$  is shifted from the voltage phasor by the phase shift  $\varphi_1$ , respectively to the current  $\mathbf{I}_{10}$  by the phase shift  $\varphi_{10}$ ,
4. the voltage diagram is created by real voltage drops in the corresponding parts of the equivalent circuit,
5. the magnetic flux  $\Phi_\mu$  is perpendicular to the induced voltage  $\mathbf{U}_{11}$  and is in phase with magnetising current  $\mathbf{I}_{1\mu}$ ,
6. the current diagram presents a solution for all circuit load currents,
7. all phasor diagrams respect the physical principle.

Methodology of phasor diagram solution is based on so called synthetic principle. The procedure of solution for the loaded asynchronous motor is shown in Fig. 1.

It consists of four graphic sequential steps:

- 1) The solution starts from the supply voltage – the phasor  $\mathbf{U}_1$  and no-load run current  $\mathbf{I}_{10}$  and the current at load  $\mathbf{I}_1$  having the corresponding phases  $\varphi_{10}$  and  $\varphi_1$  respectively (Fig. 1a).
- 2) From solution of the voltage diagram for the input (stator) circuit one obtains induced voltage  $\mathbf{U}_{11}$ , that creates the overall machine magnetic flux  $\Phi_\mu$

$$\mathbf{U}_1 = R_1 \mathbf{I}_1 + j X_{1\sigma} \mathbf{I}_1 + \mathbf{U}_{11} \quad (1)$$

For all AC machines there is valid (as a postulate) that  $\mathbf{U}_{11} \perp \Phi_\mu$ , (see Fig. 1b).

- 3) The current diagram is solved according to the current equation

$$\mathbf{I}_{10} = \mathbf{I}_1 + \mathbf{I}_2' = \mathbf{I}_{1\mu} + \mathbf{I}_{1Fe} \quad (2)$$

where it was considered that the magnetic flux  $\Phi_\mu$  is in the phase with magnetising current  $\mathbf{I}_{1\mu}$  (Fig. 1c).

- 4) For the output (rotor) voltage circuit, the phasor diagram can be finished from the voltage circuit equation

$$0 = R_2' s \mathbf{I}_2' + j X_{2\sigma}' \mathbf{I}_2' + \mathbf{U}_{11} \quad (3)$$

The phasor diagram of a three-phase core-type transformer in Fig. 3a presents an example of the described systemic application. Immediately from it there can be derived a system of voltage and flux equations.

At solution of three-phase transformers interconnection the phasor diagrams present an unambiguous connection of the transformer windings. Development of a particular connection is realised by so called synthetic principle. By such a method one can analytically follow the connection at both sides of the transformer.

The AC rotating machines – asynchronous machines and synchronous machines are resolved by interactive graphs that present a three-parameter application in the e-learning module: the equivalent circuit, phasor equations and phasor diagram are observed simultaneously in one screen. That explains easily relatively complicated phasor diagrams for synchronous machines, esp. in case of a salient-pole synchronous machine.

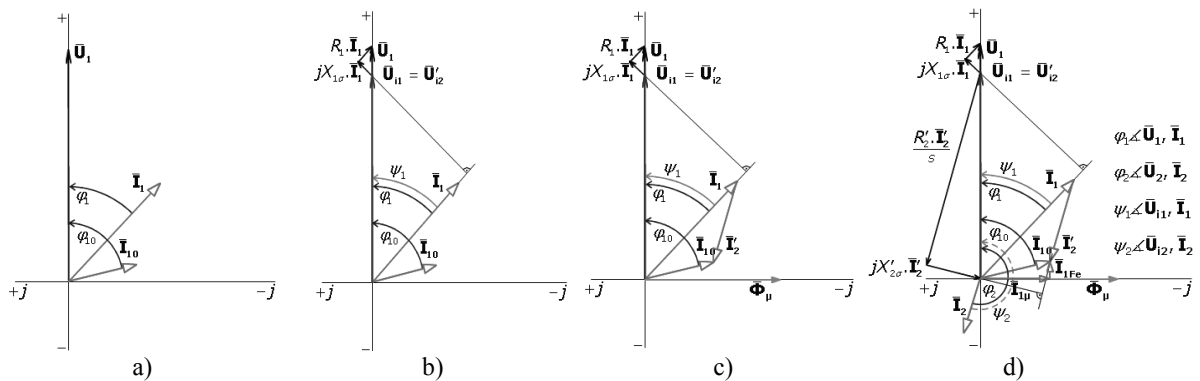


Fig. 1 Principle of a phasor diagram development for an AC electrical machine:

- a) Initial state – defining the voltage phasor position in the real axis and assigning load currents  $\mathbf{I}_1$  and  $\mathbf{I}_{10}$
- b) Voltage diagram of input (stator) circuit (1)
- c) Current diagram (2)
- d) Voltage diagram of output (rotor) circuit (3)



#### 4. INTERACTIVE GRAPHS APPLICATION FOR AC ELECTRICAL MACHINES

The concrete representations are displayed in chosen primary screens of the e-learning modules for each particular machine. Fig. 2 shows an interactive graph that is developed selectively by voltage and current diagram of a transformer at the load.

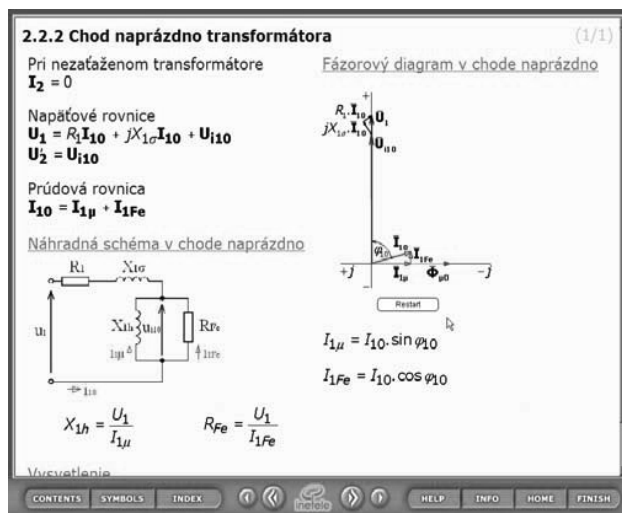


Fig. 2 No-load operation of the transformer (the screen from the module with control buttons)

Fig. 3 shows relationships at no-load operation of the transformer.

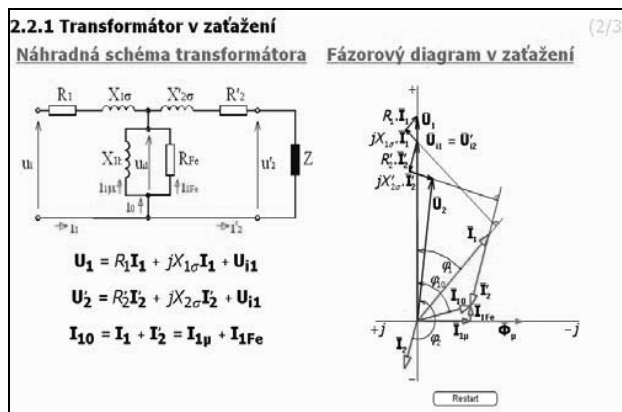


Fig. 3 Loaded transformer

A complete exceptional application of the interactive procedure in solution of magnetic fluxes and voltages for a star connected three-phase core transformer is shown in Fig.4.

Demonstration of a three-phase transformer connection based on windings connection at input and output sides is depicted in Fig. 5.

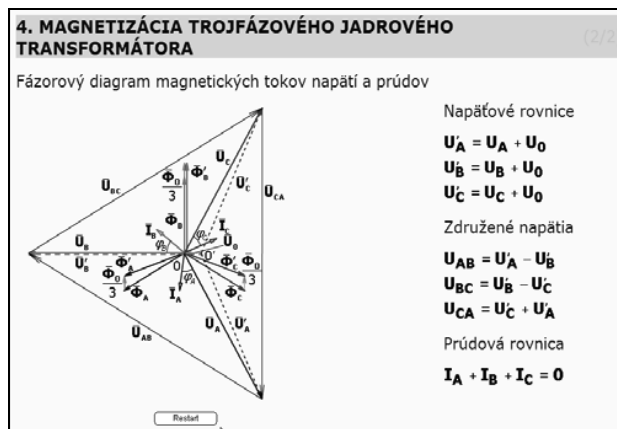


Fig. 4 Three-phase loaded transformer

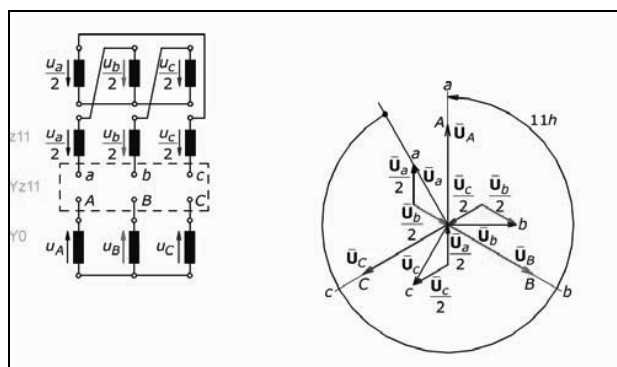


Fig. 5 Three-phase transformer connection Yz 11

Application of the phasor theory in asynchronous machines is presented in interactive graph that can be observed simultaneously in the equivalent circuit and in the voltage and current equations (Fig. 6).

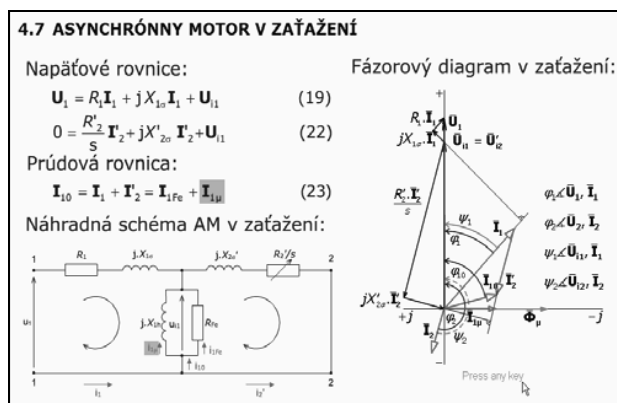


Fig. 6 Asynchronous motor at loading

A combined interactive graph showing position of the stator current phasor against to the position of the voltage phasor for particular synchronous motor loads is shown in Fig. 7.

The phasor diagrams of the synchronous nonsalient-pole generator in Fig. 8 and of the synchronous salient-pole generator in Fig. 9 document the explicitness of AC machines phasor theory systemic solution.

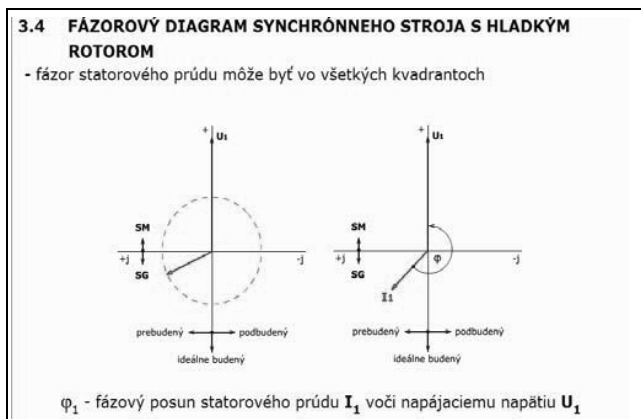


Fig. 7 Synchronous machine states

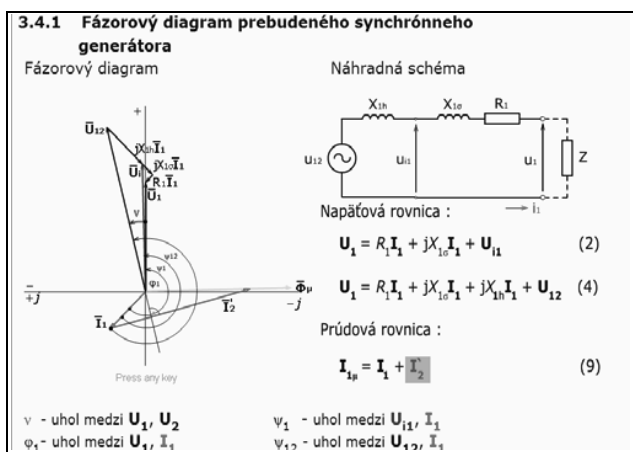


Fig. 8 A synchronous nonsalient-pole synchronous generator at loading

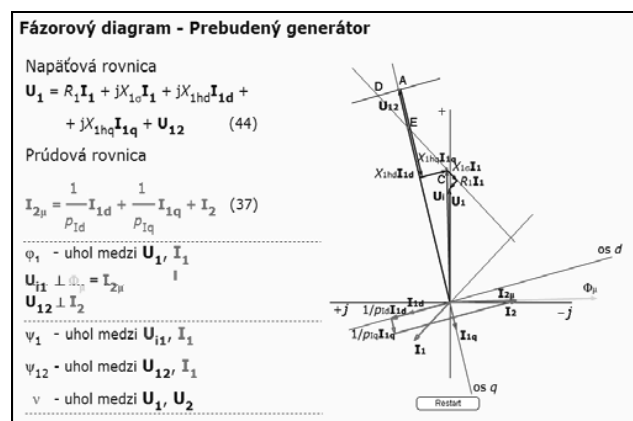


Fig. 9 A salient-pole synchronous generator at loading

The following example serves as a demonstration of applying phasor theory in the uniform system – determination of nominal exciting current for a synchronous generator (Fig. 10) based on the machine measurement at the short-circuit and idle operation.

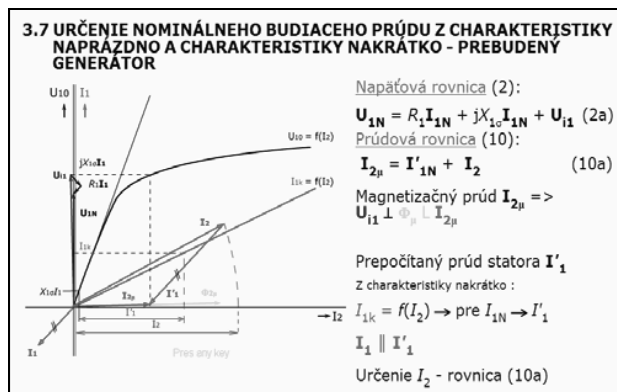


Fig. 10 Determination of a nominal exciting current

## 5. CONCLUSIONS

E-learning form of education in specialised subjects of BSc. courses should be based on uniform principles. Methodologically it has to interlock basic subjects.

The described method based on the phasor theory applied for the AC machines enables to obtain by e-learning tool an unprecedented comprehensibility and a direct, noncomplex way to applications at particular calculations. The study efficiency is increased by verification in framework of laboratory measurements.

The module “DC Machines” prepared in framework of the project [1] differs from standard procedures of solution that are common in AC machines. The next works will deal with development of the module on DC machines by the same methodology like is shown in the paper.

## REFERENCES

- [1] Interactive and Unified E-Based Education and Training in Electrical Engineering”, INETELE. Project No CZ/02/B/F/PP/134009, Leonardo da Vinci programme, www.tuke.sk/inetele.
- [2] em.ucv.ro/eLEE/EN/realisations/CircuitsElectriques/
- [3] Bobon, A. – Kudla, J. – R. Miksiewicz, R: E-Learning Based Teaching of Alternating Current Electrical Machines. ICEE 2005 – Int. Conf. on Eng. Education., Gliwice, 2005. icee2005.ia.polsl.gliwice.pl/.
- [4] Kostelný, M. – Fedák, V. – Kaňuch, J.: Interactive e-Learning Module on Transformers. Int. Symposium on Electr. Machinery, ISEM 2005, Prague, 2005. (in Slovak).
- [5] Fedák, V. – Kostelný, M. – Kaňuch, J.: Interactive e-Learning Tool for Electrical Machines. 4th Int. Conf. on Emerging Telecommunications Technologies and Applications, ICETA 2005, Košice, 2005, pp. 263 – 266.
- [6] Kostelný, M. – Fedák, V. – Kaňuch, J. – Slovenčák, E.: Interactive e-Learning Module „AC Machines – Synchronous Machines“. Int. Symposium on Electric Machinery, ISEM 2006, Prague, 2006. (in Slovak).

Acknowledgement: The authors wish to thank the Slovak Scientific Grant Agency for its support of the project Efficient utilization of renewable energy sources using modern power electronics converters. VEGA (Scientific Grant Agency) project No 1/2177/05.



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## ICPOINT – INTERACTIVE NIGHT SKY OBSERVATION

Alena Kovárová, Michal Dobiš, Vladimír Hlaváček, Linh Xuan Hoang, Michal Jajcaj, Dušan Lamoš  
Faculty of Informatics and Information Technologies Slovak University of Technology in Bratislava  
tel.: +421 2 602 91 548, fax: +421 2 654 20 587, web: [www.fiit.stuba.sk](http://www.fiit.stuba.sk),  
[kovarova@fiit.stuba.sk](mailto:kovarova@fiit.stuba.sk), [netrollers@gmail.com](mailto:netrollers@gmail.com)

**Abstract.** The interaction with computer in multimedia applications is usually achieved by standard computer devices like a keyboard and a mouse. In this paper, we present icPoint system, which proposes a different control method that brings undiscovered learning possibilities to the world of education. It uses a laser pointer mounted on user's head, a reflection from a glass and a webcam to pinpoint a part of the sky. Based on known calculations of sky object movements, the application can determine selected objects and offers the multimedia information about them. Combined with collaborative means to add and edit data, the system provides a new comfortable way of the sky exploring. It enables anyone to learn from everyone about new scientific information as well as local names, myths or legends specific to his/her culture.

**Keywords:** Interactive learning, Applications, Collaboration, Multimedia, Research and Development

### 1. INTRODUCTION

Stars, planets, galaxies – this all fascinates people of all ages. Nowadays, it is easy to find a lot of information about them or to get a picture of current sky at any place on the Earth. However, it is still very difficult to get orientated in all of the shining points over our heads.

The icPoint system enables amateur astronomers to gather information about any sky point observed by him/her at the moment. This is done as simply as possible – a laser pointer mounted on user's head emits light that is reflected by a glass plate and captured by a web camera. We designed a system that calculates the direction of the user's sight, and due to that determines the star, the user is looking at.

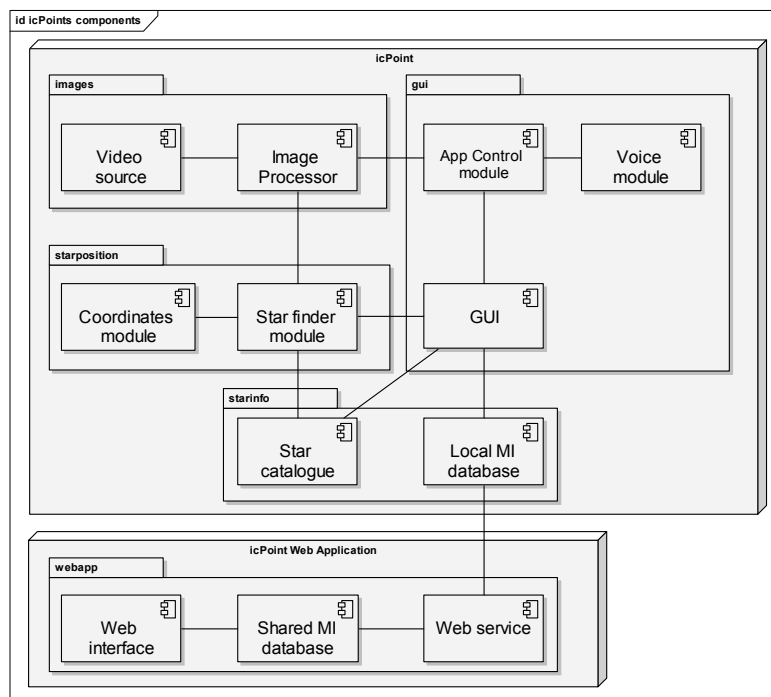


Fig. 1. System Overview

As we realized that every single culture in the history of human kind has or had its own myths, legends and many interesting stories about sky objects, we have decided to enable everyone to edit the multimedia data source. Therefore icPoint may offer mystical and historical information besides all the scientific data assigned to planets, stars and constellations.

Moreover, icPoint took the challenge of controlling the computer without any hand movement. It uses a laser pointer as a new way to move mouse cursor in cooperation with speech recognition for advanced commands.

## 2. SYSTEM OVERVIEW

The purpose of the system icPoint (oronym of “I see point”) is to give people easy way to learn about the objects they can see in the night sky. The best way to get correct information about the particular sky object is to point it and let a system to tell us. Our project comes out with a new idea of determining the object observed by user, using a laser pointer, a web camera and image processing.

icPoint consists of server and the main application (see Fig. 1.). The role of the server is to provide data source made in form of collaborative encyclopaedia. The main application, situated on the astronomer’s laptop, contains packages for application control and sky objects calculations. Moreover it contains a local database, which is responsible for storing information from server part of application.

The system is built on .NET technologies. Main application is programmed in C# with graphical user interface made in form of Windows Presentation Foundation. We use MS Access and XML as local databases. Server part of application is created using ASP.NET. Communication between server and client is based on web services.

## 3. MAIN APPLICATION

The system uses a web camera to get current picture of a computer display or a glass with reflections of laser pointer mounted on user’s head (see Figure 2). The laptop application provides methods for finding sky objects and a human-computer interface including the multimedia information presentation.

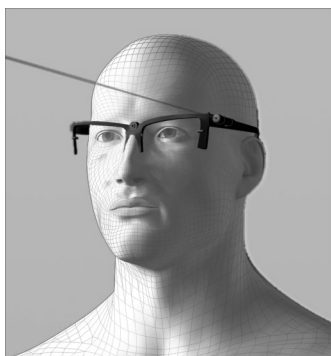


Fig. 2. Laser pointer on the user's head

### Finding the direction

Maybe the most important thing in the icPoint system is the procedure used to find the direction of user’s sight. Since we need to get orientated in the sky, direct recognition of constellations might seem to be the simplest way. However, the problem is that common cameras are unable to see any star in the sky. When pointing current web camera to the sky, we get just black pictures. Therefore, we looked for another method to find a description of the “line of sight” in the 3D world.

Definition of points and direction calculation. As the linear algebra says, we need to know two different points to define a line, or one point and 2 angles alternatively. The angles, named in astronomical community as azimuth (horizontal angle towards north) and altitude (vertical angle above horizon) together with user’s geographical location, are the data needed for the sky object searching. However these are hard to recognize using common computer peripherals. icPoint comes with method based on devices available in common household.

We decided to mount a laser pointer on the user’s head giving it the approximately the same direction as the direction of the user’s sight. This enables the user to point the laser beam at the desired target simply by turning his head. This serves as an approximation of his/her current sight angle. The first point for our calculations appears on a plane of projection, where the light emulated by the pointer falls (Fig. 3. point L). The projection plane should be any plain and transparent material such as glass. The approximation mentioned above might seem very unlikely while human does not have to look just straightforward, but this is not the case. It becomes quite exact due to the fact that in our routine user selects a star simply by pointing at the object on the projection plane with the laser beam.

It is slightly complicated to figure out where the second point (the user’s eye) is. We can not take its position as static while everyone moves his/her head frequently and the position of the eye is changing. However, thanks to the positioning of the laser pointer close to the eye, we can just look for this source of light. In this case we used feature of all common laser pointers - they emulates not just the one-directional light as real laser might do. A big portion of the emulated light stays non-directional, so there appears another point on the plane of projection as its natural reflection (Fig. 3. point R). Here, as expected, the light ray angle of incidence equals angle of its reflection, so we are able to calculate the real position in the 3D world.

Figure 3 shows a simplified schema of the method. Since we are pointing at sky objects, the geographical position accuracy within a meter is not necessary and parallel lines provide sufficient accuracy. Therefore this method needs just to calculate the azimuth and altitude angles.

In a fairly complicated schema with both planes – projection one and the camera view – and all the angles of rotation displayed, plenty of triangles and some parallel

lines can be found. After a little bit of trigonometry, the resulting formulas are as follows:

$$azimuth = \arctan\left(\frac{cl}{cu}\right) \quad (1)$$

$$altitude = \arctan\left(\frac{1}{\sqrt{cl^2 + cu^2}}\right) \quad (2)$$

where inputs are calculated using formulas:

$$cl = 2 \times \tan\left(\arctan\left(\frac{Rx - \frac{w}{2}}{h1}\right) + yRotat\right) - \tan\left(\arctan\left(\frac{Lx - \frac{w}{2}}{h1}\right) + yRotat\right) \quad (3)$$

$$h1 = \frac{w}{2 \times \tan\left(\frac{ha}{2}\right)} \quad (4)$$

Formula used to calculate  $cu$  is similar to one needed for  $cl$ . The difference is only in the meaning of the inputs. Here  $w$  is the width of image from camera (height for  $cu$ ),  $ha$  stands for the maximal horizontal angle of camera view (vertical for  $cu$ ),  $yRotat$  is angle the camera is rotated over y-axis (x-axis for  $cu$ ) and finally  $Rx$  and  $Lx$  are positions of reflected (white) and laser (red) points as found in the camera picture

(x-location for  $cl$ , y for  $cu$ ). As we can see, the equations do not depend on the distance from the glass, while we assume the distances from glass to user's eye and from glass to the camera is equal.

**Finding the points.** All the parameters needed to calculate azimuth and altitude are static for entire observation time except the coordinates of the lighting points emulated by the laser pointer. *icPoint* searches them in pictures from camera. Since there might be some interference from a surroundings, some areas in the picture might be colored the same as the searched points. Examples of such sources are street lighting and the Moon. Therefore we decided not to search colors in the picture. Instead of that, the system compares current image to the background one, which is updated once upon a time. This means, we used known algorithms common for motion detection to do the job [4]. Thus, we enabled user to set threshold as the minimal change of one pixel to mark it as changed, and a minimal count of pixels in continuous area of marked pixels to filter the noise up. The searched points are found in the middle of those areas.

#### Finding sky objects

Application has to calculate, which objects are visible in designated area of the night sky. Calculations are based on conversions between coordinate systems in *Coordinates* module and data from object catalogues in *Star catalogue* module.

We need three basic coordinate systems to designate the position of object on celestial sphere. Each of them uses a different fundamental plane and two coordinates for position. Horizontal coordinate system is based on local horizon. It uses azimuth and altitude and depends on observer's position on the Earth and time. Position in this coordinate system is calculated in *Image processor* module.

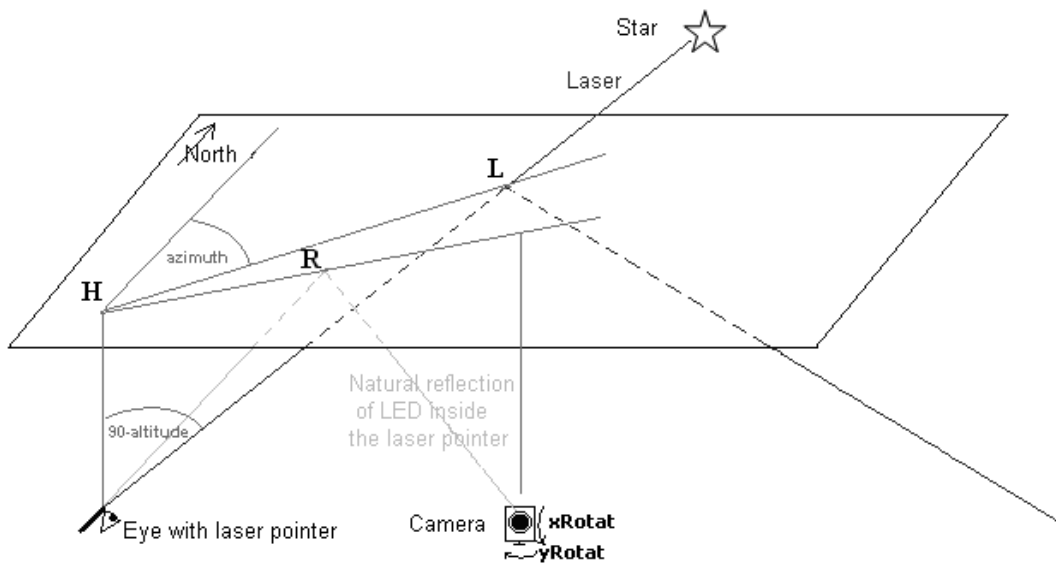


Fig. 3. Simplified schema of star pointing reflections in the plane of projection

Equatorial coordinate system is based on Earth's equator, or better, to its projection to celestial sphere called celestial equator. The first coordinate used in this system is Right ascension of the object; it is the angle between object and vernal equinox point (it is a point where sun crosses celestial equator on March equinox) around the celestial equator. Second coordinate is declination, which is the height of the object above the celestial equator. Coordinates in this system depend very little on observer's time or position on the earth's surface (there are effects of nutation and precession). Therefore this coordinate system is used for position of stars and other non Solar system objects.

Third coordinate system uses ecliptic as its fundamental plane. Ecliptic is a projection of Earth's orbit around the Sun to the celestial sphere. The first coordinate is ecliptic longitude, measured around ecliptic from vernal equinox to object. Second coordinate is ecliptic latitude, which is the height of the object above the ecliptic. This coordinate system is used for objects in Solar system – planets, moons etc. More information about coordinate systems and conversions between them can be found in literature [2], [5].

Scientific data in *Star catalogue* module came from public astronomical catalogues [6]. Currently system uses Hipparcos catalogue which is based on data gathered by Hipparcos satellite during the years 1989 to 1993. The same catalogue is used by Stellarium software [7]. Catalogue is filtered to contain only visible stars (under +6 magnitude) to speed up searching for stars in designated area of the sky.

Equations for calculating position of visible planets originated in the book *Astronomical Algorithms for Calculators* [5]. To achieve the best performance, positions of only five visible planets and Earth's Moon are calculated (Mercury, Venus, Mars, Jupiter, Saturn). System calculates their coordinates in ecliptical coordinate system and then converts these to equatorial coordinate system.

*Star finder* module is responsible for conversion of horizontal coordinates originated in *Image processor* module and searching multiple catalogues for visible objects in the specified area of the sky. It is also responsible for creating catalogue instances and provides access to them for other modules. Each catalogue implementation in *Star catalogue* module is capable of searching for visible objects near specified coordinates in equatorial coordinate system.

We are planning to add more catalogues and to extend the amount of information contained in current ones in the future.

#### Application control

The purpose of the system is to allow easy and comfortable sky exploration. This means, that the user usually lies on his back looking upwards. Thus, it would not be wise to pursue him/her to control our application using a keyboard or a mouse. Therefore we enhanced the human-computer interface with laser pointer mouse cursor control and speech software.

Laser pointer as a mouse First of all, we needed to replace the mouse. Since we have a laser pointer, we decided to use it to pinpoint the position on computer display, the mouse cursor should move to. To make this possible, the system needs to find the position of the display in an image from camera. The icPoint system changes the colors of entire screen at the start-up so there is a large quadrangular changed area when comparing earlier image from camera to the current one. We used distance function to determine the 4 edges of it: they are found as positions of pixels having the maximum distance from the center of the area (from all the pixels on the border of it) whereas none of 3 pixels stay on the same line.

When having the position of the screen, the system excludes it from comparing foreground to background image as used for user's sight direction detection (see section 3.1). For the purpose of finding a point from laser pointer on the screen, the searching for pixels coloured similar to the laser color (mostly red colour) appears to be the best solution while we can control which colours are used by the application graphical user interface. The relative position of the mouse cursor, which is determined by the position of the laser point in the camera image, is calculated as follows:

$$cursor = \left( \frac{c}{c+d}, \frac{a}{a+b} \right) \quad (5)$$

where inputs  $a, b, c, d$  are distances of the found point from top, down, left and right border of tetragon, given in coordinates of image from camera.

Speech recognition Having the new mouse control, we needed to enable also a comfortable realization of advanced commands. Nowadays, many software developers find it useful to enhance their applications with voice recognition (e.g. MS Windows Vista, Opera). So did we.

Our first idea was to develop own speech recognition system based on analyzing captured voice using Fast Fourier Transform algorithm [1]. Advantage of this would be more adaptive system of recognition and every user could define own set of commands to control application. Unfortunately, this solution used a lot of system resources, which were needed more by image processing algorithms. Finally, we decided to use Microsoft's SAPI engine to allow voice control and also for speech synthesis. Users are still able to select any of English words to control application features.

## 4. SERVER

As already mentioned, the icPoint application is capable of identifying sky objects by determining, which object is pointed by the user. But this is just a small part of the system's functionality. Based on the selected sky object, the system is able to produce a simulated image of the corresponding part of the night sky. It also provides

additional multimedia content, stored in a local database to provide further data expansion.

There are various types of possible multimedia content, for example scientific information about stellar objects, planetary 3D images, but also historical background information (e.g. the discovery of a planet, the history of its name, ancient tales, etc.). An interesting idea might be the possibility to collect stories and tales about stellar objects coming from various cultures of the world. We realize that nobody knows everything, so we decided to enable anyone to add text and multimedia content bound to a sky object sharing it with other users of the system. The known concept to solve this problem uses collaborative encyclopaedia situated on Internet such as wiki [3].

Our goal is to build an icPoint community where all members can collect information, which they found interesting and submit it to the icPoint wiki. The submitted content is not limited to the types listed above, but can also contain videos from space probes, images and videos from telescopes. This wide range of possibilities is accessible via the icPoint main application, but also using a web interface called the icPointWiki web portal.

## 5. CONCLUSIONS

In our project we focused on a new and undiscovered application of human-computer interaction using a laser pointer and image processing. Its goal is to allow star and space object recognition using compact IP or web camera and a laptop, thus everyone can learn about the night sky easily. Because of unconventional usage of the product, much effort was dedicated to bring alternative ways of interaction with computer. We have proposed new way of mouse cursor control in combination with voice recognition.

In addition user can read or listen to information about sky objects stored on local computer and get new through our web service. Information can be added and modified by users in collaborative encyclopaedia on Internet.

## 6. REFERENCES

- [1] Brigham, E.: Fast Fourier Transform and Its Applications. Prentice-Hall, Inc., Upper Saddle River, NJ, 1988.
- [2] Hajduk, A., et. al.: Encyklopédia astronómie. Obzor, Bratislava, 1987.
- [3] Leuf Bo., Cunningham W.: The Wiki way: quick collaboration on the Web, Addison-Wesley Longman Publishing Co., Inc., Boston, MA, 2001.
- [4] OpenCV Library. Intel Corporation, 2006, <http://www.intel.com/technology/computing/opencv/index.htm>
- [5] Pokorný, Z.: Astronomické algoritmy pro kalkulátory. Hvězdárna a planetárium hl. m. Prahy, Praha, 1988.

[6] Public Astronomical Catalogues and Lists. Strasbourg astronomical Data Center, 2007. <ftp://cdsarc.u-strasbg.fr/pub/catalogs/>

[7] Stellarium homepage. 2006 <http://www.stellarium.org/>

## 7. AUTHORS



**Alena Kovárová:** Doctoral degree student at Institute of Applied Informatics FIIT STU. Interested in e-learning and interactive multimedia.  
Role in the project: Project supervisor.



**Michal Dobiš:** Master degree student of Software engineering at FIIT STU. Interested in digital image processing and .NET technologies.  
Role in the project: Project leader, image recognition packages and GUI developer



**Vladimír Hlaváček** Master degree student of Software engineering at FIIT STU. Interested in Java and web technologies.  
Role in the project: sky objects calculations and project portal developer



**Linh Xuan Hoang:** Master degree student of Software engineering at FIIT STU. Interested in .NET technologies  
Role in the project: database developer



**Michal Jajcaj:** Master degree student of Software engineering at FIIT STU. Interested in .NET, multimedia and web technologies  
Role in the project: voice recognition and web services developer.



**Dušan Lamoš:** Master degree student of Software engineering at FIIT STU. Interested in computer graphics and design.  
Role in the project: responsible for project documentation, graphic design and GUI.

## ACKNOWLEDGEMENT

This work was partially supported by the \*\*\* under the contract No. \*\*\*







## DISTANCE COURSE “TUTOR’S PRACTICE”

Vladimir Kukharenko, Nina Syrotenko  
National Technical University  
“Kharkiv Polytechnic Institute” (NTU “KhPI”)  
21, Frunze str., Kharkiv, 61002 Ukraine  
ph. +38(057) 7076613, (057) 7076382  
e-mail: kvn@kpi.kharkov.ua <http://dl.kpi.kharkov.ua> <http://dl.kharkiv.edu>

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Distance course “Tutor’s Practice” has been developed on basis of carrying on distance courses, which have been developed by employees of Research Laboratory of Distance Education. This distance course is oriented on teachers who are able to use e-mail, search information in Internet, make the simplest web pages and have a distance course (it could be not their own one). This article shows the necessity and importance of a special course for future distance courses tutor because of new education and learning conditions and an increasing role of self-learning students’ activity and inner motivation as a main condition for high-quality knowledge and competence.

**Keywords:** Distance education, Learning technology, Tutoring

### 1. INTRODUCTION

Research Laboratory of Distance Education (RLDE), National Technical University “Kharkiv Polytechnic Institute” (NTU “KhPI”) has been carrying out distance e-learning since 1999. Both our and western academics [1] experience shows that for providing high learning quality, which can be at least not worse than in traditional form, both student and tutor should be trained. For example, before the beginning of a distance learning process, tutor has to support a students training working in it not less than twenty hours. Also we know that usually students need permanent technical and methodical advises. Besides somebody usually needs current consultations on using the virtual learning environment etc.

We also know that the requirement of a self-learning activity as a main condition of a high-quality personal results lays on the teachers and tutors new liabilities linked not only with technical difficulties and questions but also and especially with pedagogical and psychological peculiarities of distance learning process.

Distance course “Tutor’s Practice” has been developed on the basis of carrying on distance courses such as “Practical Distance Learning Course”, “Pedagogy Fundamentals”, “Basics of Internet”, “Web-design technologies”, which have been developed by RLDE’s employees. The manual [2] can help all persons who wants to know more about this subject because it gathered a whole experience of RLDE’s working up to that time.

The course has been worked up in a virtual learning environment “Web-Class KhPI” that has been created in RLDE in 2001 and since that time was continually used in its works up and permanently modernized. The course “Tutor’s Practice” is oriented on teachers who knows at least general features of distance learning technologies and may be something about distinguishing features of this form and have their own distance courses for carrying out learning process holding. You can find more about learning process organization details in a manual [2].

### 2. ABOUT THE COURSE’S AIM

#### The beginning

The course was tested in September 2003. Twenty teachers of Regional Institutes (Lviv, Odesa, Dnipropetrovsk, Kharkiv) of National Academy of Public Administration by President of Ukraine studied in it. After the course had been carried out the pilot learning on Program of increasing state servants skills was carried out. After that, since November and February, two groups (there were fifteen persons in each of them) had been learning every year. They all are teachers of NTU “KhPI” and other universities of Ukraine.

The main course aim is to prepare a teacher as a tutor for a distance learning process. During his self-learning work with the course the teacher masters to escort the learning, learned to choose communication means working with a concrete students’ group; makes all necessary spade-work for successful start of learning process. Besides that he thinks about and proposes his own rating system of student’s activity assessment that could on his mind help students to form and support an own inner motivation in active learning. The future tutor takes part in discussions, chats and learns to organize them, plans the details of own future leading activity for small learning student groups of own course.

The distance course is, on the whole, oriented on teachers who are able to use e-mail, search information in Internet, make the simplest web pages and have a distance course (it could be not their own one).

Successful passing the course meant not only fulfilling course activity planned but also carrying out the pilot learning with tutor’s help and trying to create himself the learning means that could be needed or useful for the activity process.

#### The course organization

The distance course lasts during six weeks. Student spends in average 6–8 hours for the fulfilling his problems, works up weekly the new information and communicates with other students and tutor.

Such components may be distinguished in the course:

- choice of communication means,
- preparation of a distance course for learning process,
- projecting some useful methodical means for supporting the learning activity,
- the means of students' activity testing,
- organization of group collaboration (discussions, chats, including the peculiarities of work in small groups).

Corresponding theory is given for each component, but the main thing is the preparation of one's own course for learning process with detailed discussions, chats and testing in small groups. On the stage of preparation a teacher already demonstrates his or her ability to moderate discussions and chats.

### 3. LESSONS PLAN

#### Lesson 1 Communication with e-mail.

Getting practical skills of work with e-mail, mailing list, forum and built-in into virtual learning environment course mail [4].

One of the main aims in distance learning is to organize communication into groups. For these purposes e-mail, mailing list, built-in course mail and forum are used. On the very first day he or she (the future tutors) should make sure that all of them work, and working with them makes no problem for the learners.

Mailing list is the most operative communication mean among learning participants. Our aim is to get acquainted, to find our future partners on common activity. All further learning process much depends on how this stage will pass. If the most of learners have their working e-mail, then mailing list will be used regularly as a main and useful communication mean. In opposite case it is more effective to use built-in course mail and forum. This question is discussed in Chat-Introduction.

#### Lesson 2 Planning activities and rating assessment of students' activity.

Considering purposes and aims of the distance course, planning student's activity and developing the system of student's activity assessment.

During the planning process of activity we propose to have in one's mind the possibility of the usage of special questionnaires with self-active questions (SAQ) about the subjects of learning material. Our experience shows us that such mean helps students to understand information much deeper and supports an interest in learning activity. All these SAQ must have so called "open" prescribing that can't let the students to find the answers directly in a learning text. They on the contrary must look through and consider the whole necessary learning material for creating their own answers accordingly with their own analysis and interpretation of problems.

In practice tasks there weekly, uniform learner's activity should be planning and their amount in hours should be evaluated. Course annotation and purposes of the course learning must be given in the plan.

Rating assessment lets consider in detail and to range all the details of knowledge and skills being controlled. Rating assessment should be planned and mailing list should be made in the practice.

#### Lesson 3 Preparation of the instructions and informational materials for the course.

Developing invitations to the distance learning, describing teaching technology, instructions for work in the virtual learning environment, recommendations on using e-mail, mailing list, forum, built-in course mail.

Tutor's activity during the carrying out distance learning process should be planned and course introduction should be made in the practice. The course introduction has all information needed for a person to get interested in proposed opportunities and to define his or her wish of studying in the course. All positions should be given in a friendly form. They also should be directed on trust formation.

#### Lesson 4 Discussions organization and their moderating.

Considering types of discussions, developing a scenario and preparation for a discussion, analysis of a discussion moderating [5,6].

Developing informational materials for a discussion, discussion moderating and its analysis are the important problems of tutor. Every learner should be a moderator and an expert in his or her own discussion, and also be a participant in other learners' discussions of the course "Tutor's Practice". A discussion should be desirably a thematic one, connected with thematic of his or her own distance course.

Also the teaching tutor must show his learners the different possible kinds of discussions or their complexes, because every proposed learning form doesn't become the constant, invariable and, of course, uninteresting form. It is such situation any tutor can't let himself assume.

#### Lesson 5 Organization of small groups work.

Some features of small groups organization and carrying out their learning process are analyzed.

The learners prepare an essay with analysis of their activity in small groups (in pairs) during their work with the distance course.

Such small groups (2-4 members) are very interesting because there is no reason to appear a no formal leader. Therefore the group can work in collaborating without any discomfort. The group activity can be shown as such sequence of actions: a common acquaintance with a subject of problems – together analysis of an useful activity content – carrying out own part of problem by every member of group (with constant self-consulting between the group members and a guiding tutor).

Then all the members analyze their propositions, choose the best one and propose it to the discussion with other groups. In such methodic we get not only individual and small group activity in collaboration but there is also the common activity of all the learners who are working up on that problem. This organization form gives someone many different situations in order to obtain the right decision.

#### Lesson 6 Thematic chat moderating.

Developing a scenario of thematic chat moderating, preparation of informational materials, totalization of chat. Rating system of student's activity assessment is used in the course. The course tutor can follow visiting of a definite learner and get generalized information about it. On the course assimilation a learner spends from 5 to 40 hours. Duration of work in Internet per one session comes up from 10 to 50 minutes.

Sixty five teachers from different Ukrainian towns and cities (Sevastopol, Kharkiv, Lviv, Vinnytsya, Chernivtsi, Kyiv, Berdyansk, Odesa, Dnipropetrovsk, Cherkasy, Ivano-Frankivsk, Mykolaiv) and Estonia (Sillamj e) took part in the course.

With support of a program IATP, fund IREX, the distance course "Tutor's Practice" has been moved to the virtual learning environment MOODLE and the distance learning was carried out for teachers of Ukraine.

### **4. AN OPINION OF ONE OF THE COURSE "TUTOR'S PRACTICE LEARNERS"**

#### 1. The course aims and results expected.

I think that all about the course Introduction, where all this is mentioned, everything is of high level indeed. The aims are understandable and achievable as a whole. I think I've got even more than I expected after the course finishing.

#### 2. Motivation.

It's great that all the material is exactly structuring, it's easy to find a chapter needed. Illustrations always help to read text from the screen. I also liked the questions for individual comprehension. They increase an effect from reading the material.

#### 3. Interaction.

Students' *interaction* in the course was permanently encouraged with tasks connected to the analysis of colleagues' work and further work adjustment. I think that at least one more chat or thematic forum wouldn't hamper. In this way we can also use and analyze the different cases of work in small groups.

#### 4. The course content.

During the course I didn't notice any divergence between the aims and information. My main motivation was, certainly, to know something new and wish to get points. As for general course content, I liked thematic plan the most. Thematic is well-selected: we started from simple things and reached the most complicated gradually. May be there was not enough variety in kinds of work (there could be a test or something).

#### 5. Presenting information.

Presenting information is quite comfortable, the navigation and text intervals are understandable (paragraph indention is not enough in electronic document, there should be an interval).

#### 6. Feedback.

Feedback had been observed during the all period: operative assessment, reaction on answers with elements of analysis. The learners (though not very often) communicated with each other, gave comments and advices.

#### 7. Control and management.

Control of activity was rather operative, the rating was updated at least two times per week. Not so often but I faced evaluation of gained experience during communication with students.

And, certainly, connection with future activity is very straight. I think I'll overlook my course materials in January, adding and editing those elements, which I've developed on learning results (Introduction, chat materials and discussions).

#### 8. Learning process management.

There is fullness of information, additional articles there. For example, an article on testing in a course proved to be rather useful for me. Unfortunately, this theme wasn't considered separately. But still there is a necessity to have it, so the additional information was pretty interesting.

#### 9. Help to students.

Any distance course can be hardly imagined without help to students. Certainly, there was help. These are remarks in mailing list. If something was not clear to me, I always addressed to the tutor and got an answer how to solve a problem.

### **5. CONCLUSIONS**

A distance course "The tutor's practice" permits to decide a problem of preparing a teachers to carrying out the distance learning process. This position defines itself with its practical direction and with adding references on the necessary theories of education.

### **6. REFERENCES**

- [1] McPherson Maggie, Nunes Miguel Baptista. The Role of Tutors as a Integral Part of Online Learning Support. - European Journal of Open and Distance Learning. - 2004.
- [2] Kukhareno, V.M., Rybalko, O.V., Syrotenko, N.G. Dystantsijne navchannya: Umovy zastosuvannya. Dystantsijnyj kurs (Distance Learning: Conditions of use. Distance Course) Manual / Edited by V.M. Kukhareno, Kharkiv: "Torsing". 2002. 3rd issue – p. 320.
- [3] Kukhareno, V.M., Syrotenko, N.G., Molodykh, G.S. etc. Dystantsijnyj navchalnyj protses (Distance Learning Process). /Edited by Bykov V.U. and Kukhareno V.M. – Kyiv: Millennium. 2005, p. 288.

[4] Salmon Gilly. E-Moderating. The Key to Teaching and Learning Online. London, 2002

[5] Meyer Katrina A. Evaluating Online Discussion: Four Different Frame of Analyse. - The Journal of Asynchronous Learning Networks, V. 8, Issue 2. – 2004. p.100-114.

[6] Kasy Deborah K., Albertelli Guy, Bauer W., Kasy E., Theoennessen M. Influence of Non-moderated and Moderated Discussion Sites on Student Success. - The Journal of Asynchronous Learning Networks, V. 7, Issue 1. – 2003.

## THE AUTHORS



Kukhareno Volodymyr N., professor, Dr. of science, head of Research Lab of Distance Education National Technical University “Krakiv Polytechnic Institute”, member of EDEN. Has more than 80 publications in direction of distance learning.



Syrotenko Nina G.: has an experience for 13 years as a mechanical engineer- constructor, more than 30 years of scientific teaching and practical work as a lecturer and methodological organizer in the questions of a high technical school development. Has more than 80 published works in directions of creative and engineering thinking, the questions of high school learning process optimisation etc.



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

Nicolas Martel  
NM MANAGEMENT s.r.o.; Košická 37, 82109 Bratislava, Slovakia  
tel/fax: +421 2 6225 0742; nmartel@nmmanagement.com

Abstract: eduklik.com aims to be a commercial provider of online training content. It will be the opportunity for small and medium enterprises throughout Slovakia to have access to training on many subjects for a price and convenience that is not yet known to them.

Keywords: Interactive, commercial, trainings, online

## 1. INTRODUCTION

NM MANAGEMENT was created in 2005 with the goal of making possible the meeting of experienced managers, mainly from abroad, with local dynamic managers of Slovak small and medium sized companies.

Today, it proposes training programs for all sales levels in companies in Slovakia and also has developed consulting activities in order to help companies understand where to find untapped business opportunities.

Since the beginning of NM MANAGEMENT, Nicolas Martel, the founder of the company has noticed what were the main barriers that come in between overactive managers and training sessions: time.

The time factor is also visible when it comes to training team members who have difficulties making it to the planned trainings.

The money factor is also strong in education issues as travel expenses add up to the existing price of the trainings.

And finally, there are many private citizens who have no access to any professional education because they cannot afford anything.

## 2. GENERAL PRINCIPLES

### Target and objectives

eduklik aims to propose online trainings for small and medium companies in the Slovak Republic. Its online format is designed to counter the usual barriers that come between training and this type of entrepreneurs.

### What will be found on eduklik

eduklik will store on its servers a catalog that we wish to be as large as possible of different types of presentations that will display on demand on customer's computers. The presentations will include small videos, quizzes and attendance sheets. The presentations will be programmed for this particular type of display and will be downloadable for viewing after having been selected by customers

according to the type of training. Programs will be formatted to last 45 minutes maximum.

### Content and contributions

As a starting point, the contributions will be strongly oriented towards delivering the usual trainings proposed in NM MANAGEMENT's catalog: this will include personal efficiency programs such as "Time Management" or "Personal Efficiency skills", sales skills trainings such as "Searching for new customers", "Commercial calling skills" and management trainings. It is not forbidden to imagine accepting content from other contributors through a system that should be determined at that time.

### Pay-per-view payment system

Trainings available on eduklik.com will be on sale. Operators have chosen to opt for a pay-per-view system. Even if this choice is more costly in accounting monitoring, eduklik wishes to propose its visitors a very flexible system that considers its customers as responsible buyers. This system also allows the price to be friendly since it is only linked to one product and not an unlimited access. The pay per view system means that the content is not downloadable. Products can be paid by Credit Cards or the other online banking systems such as VUB Platby or TatraPay..

### Technology

The trainings will be programmed in "Flash format" that will be displayed twice in a way similar to the "streaming" technology for videos. For each purchase, customers will be allowed one or two viewings. The internet site hosting the programs will be standard HTML content and is already branded. Any computer may be eligible for displaying eduklik trainings. The issue will be the swiftness of the internet connection.

### Key success factors

There is of course no technical revolution in eduklik. The success of this venture will rely mainly on the quality of the trainings available, the visibility of the site, the easiness to operate (and the acceptable downloading times), the adequate pricing policy, and of course the acceptance of the customer base to try this new type of training.

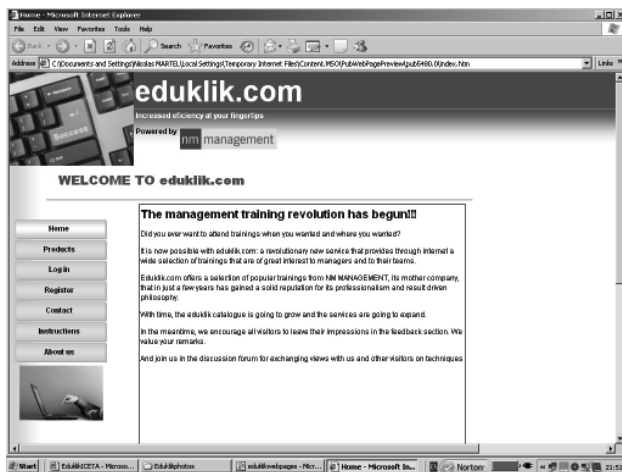
## NM MANAGEMENT philosophy

It should also be said that NM MANAGEMENT has satisfied its customers through a very informal relationship and an exercise based approach. It is clear that it is not possible to reproduce precisely the trainings on the internet. However, the operators of eduklik will put a special emphasis on trying to reproduce the spirit of the trainings. The contact with the customer must be informal, inviting, interactive and highly illustrated such as NM MANAGEMENT trainings are.

## 3. OPERATIONS

### Website

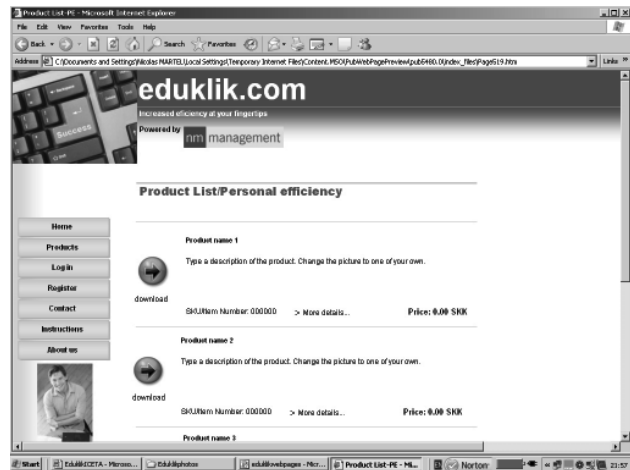
The website will be [www.eduklik.com](http://www.eduklik.com) just as the name of the project. The site will be programmed in HTML and aims at being downloadable very fast by all type of internet connections, even the slower ones. The site shows that it is “powered by NM MANAGEMENT”, its genitor.



The visitor will find on the main gate the following functions: access to products (the trainings), a login (mandatory because of the payment aspect of eduklik), the opportunity to register (for first-time users and visitors agreeing to provide more information about themselves for eduklik marketing purposes in exchange for other advantages), an interactive user guide (very close to the trainings that will be available), and of course the usual pages such as information on the site operators and contact information.

### Selecting products

Participants will view the trainings available by searching through a root menu that will include at its start three categories: sales skills, team management, and personal efficiency. As the content will grow, it will probably be necessary to include a small search engine or an index of everything that is available. By clicking on the desired family of products, the visitor will view the list of available products fitting the description:



The links to downloading the product should be easily accessible, and the a description of the product and its benefits should also be easily viewable in order to allow people to get a more precise vision of what benefits the training can have for them. In certain cases, a small preview may be adapted for potential customers to pass the watching phase and actively decide to purchase the product. We are talking marketing on such issues, and there is no doubt that a strong marketing will be needed to make the internet site procure the willingness to buy.

### Purchase

At the time of filling in this document, all options have not yet been thought completely through. But it is highly likely that eduklik will propose two types of payment: credit card payment, and payment through online banking systems that are quite safe. VUB Platby, TatraPay and SporoPay will be available purchasing methods. eduklik operators wish that the purchase leads to the immediate possible delivery of training products with no delay.



#### Registration and login data

There are many good reasons for eduklik operators to try to gain a maximum level of information from its users. There are also a numerous amount of reasons that will lead eduklik to be discrete at the beginning. One of them being that we wish to show that we value our customer's privacy and that there is not much to fear with working with us. This means that apart from the basic accounting details that will be needed in order to officialize the business transaction, eduklik will not ask for any other information. On the contrary, eduklik will try to obtain the information by adding value to "premium users" who choose to receive a newsletter and to be listed on the marketing lists.

#### Viewing the trainings and monitoring results

After having been downloaded, the customer will view, hear and participate. A voice will read out the written slides (transformed in flash from MS Powerpoint), and videos will illustrate scenes (in flv format). eduklik will also propose quizzes. The software used will allow links to SCORM or AICC e-learning management systems that could be implemented in the future for corporate customers

### **4. BENEFITS FOR INDIVIDUAL USERS**

#### More opportunities for training

As previously said, training for small and medium sized companies face barriers that are time and money. Managers find it difficult to invest the time in training. A large number of managers also feel that many trainings are not worth the investment and the hassles of travelling. eduklik will make gaining skills easier.

#### Easy and cost efficient for many programs.

And it is true that initiations and trainings that revolve strongly around methodology issues or pure content can be deployed in a very different way today. The customer can train where he wants and when he wants at costs that are significantly lower than attending distant classes. eduklik will also modify the way training is provided. By choosing formats of maximum 45 minutes, eduklik will help the customers gain their skills on a more long term approach.

#### A strong liberty for users

Because of its accessibility and its lower cost, eduklik can appeal to employees who wish to benefit from trainings that their company does not provide yet or has provided but not at a satisfactory level. The opportunity for all to have the opportunity to be trained on what they want is not revolutionary, but was difficult to do because it usually involved one or two days out of the office or costs that were a bit too high for individuals...and of course with no guarantee of success in the end.

#### An access to a permanent and long term partner

eduklik is not designed to be static. Its operators will permanently work on updating programs, adding new ones, and proposing more services. It is also planned to have the possibility of registering data should the customer choose to in order to create a profile.

### **5. BENEFITS FOR CORPORATE USERS**

#### Technical or corporate culture training available anytime

Companies may choose eduklik as a tool for managing their own training programs. For example, it will be possible to use eduklik as storage for their own technical trainings or other programs they wish to make accessible for their teams. It will now be possible for them to train one employee at a time as soon as that employee enters the company without having to organize sessions a long time after the entry of the team members.

#### A team trained on the newest skills

By choosing to store and adapt its programs on eduklik, many small and medium companies will have the opportunity to have better trained teams. The teams will be more efficient and better prepared for business challenges. eduklik will provide small companies to have a real training strategy that suits their needs and is adapted to their way of functioning

### **6. OTHER BENEFITS AND DEVELOPMENTS**

#### More social programs available at more locations

One of the problems of the social programs is of course the fact of having to gather a certain number of people in a limited number of places and with a limited number of trainers. With eduklik, programs can be kept online and always available, the only need being an internet served classroom.

#### Opportunities for more technical trainings

It will be possible to propose larger groups of people access to a first level of technical trainings. And this in fields where specialists are rare. Because of the durability of the programs and the permanent access, it will be easier to involve trainers and contributors from the private sector, and at high levels of competence. A development example would be a sales school in which it would be possible to organize at a low cost for students the creation of a school that they could attend to in a virtual classroom but with first rate trainers and programs.

#### Live events

eduklik will make it possible to organize live or semi-live events with managers from around the world giving their views on specific issues. Without leaving their office, small and medium sized companies will have the opportunity to see, and to discuss with chosen contributors through eduklik and to gain inspiration for their own companies. Some events can be semi-live, and contain a Q and A part at the end. In short, eduklik makes knowledge, impressions, advice and consultancy closer to the users.

#### International website

eduklik may be available in other languages. eduklik and its mother company NM MANAGEMENT will make Slovakia a provider or service platform of trainings that can be dispatched to other Central European countries that have the same corporate structure as Slovakia.

## **7. A VIEW IN THE FUTURE: THE MEETING POINT OF SMALL AND MEDIUM SIZED COMPANIES.**

eduklik is powered by NM MANAGEMENT and will as a start propose selected programs from NM MANAGEMENT. In the future however, eduklik will welcome other contributors as long as their programs are aimed at delivering business knowledge to small and medium businesses in Slovakia or elsewhere. By this we mean that the numerous tax and accounting laws, labour codes, and other regulations could benefit from a small training available on eduklik. By being available and updated, it would be the opportunity to give a hand through the internet to small and medium sized companies who have to struggle in a complex world with little time.

To go beyond that level, it is even possible to imagine proposing on eduklik a number of information services on how to gain new markets, where to find partners abroad for business ventures and others...

eduklik aims at making knowledge easily accessible, for companies with the will to invest in people and to grow.

## **THE AUTHOR**



**Nicolas MARTEL**

After having graduated from HEC Business School in Paris in 1991, Nicolas worked for French carmaker PEUGEOT during fourteen years. He held several sales and marketing positions in dealerships, introduced E-commerce tools and managed the price/product policy of the brand in France.

As PEUGEOT SLOVAKIA was founded in 2001, Nicolas was chosen to be its first commercial manager with the mission to build a completely new team. In 2005, Nicolas created NM MANAGEMENT, a sales consulting and training firm, in Slovakia where he still lives today..





# E-LEARNING IN THE EDUCATION OF OPTICAL COMMUNICATION SYSTEMS

Markéta Mazálková

*Communication and Information Systems Department, University of Defence*

*Marketa.Mazalkova@unob.cz*

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** This work involves possibilities of e-learning utilization as a support for education of communication and information systems department. This article deals with new form of education. This kind of education – e-learning is new at the University of Defence. There are mentioned the differences between classic type of education and e-learning. It is concentrated on positives and negatives in e-learning utilization as a support of education and e-learning utilization at University of Defence. The paper deals with Learning Management System called Barborka, which is determined for on-line courses (subjects) creation. The new module (e-learning course) - Optical communication systems is developing and it is creating as a full-tutor on-line course. Some knowledge is necessary for successful e-learning implementation into the new module creation and education. These knowledge went from on-line curs – Nettrainers, which was very helpful, more information about knowledge from this course are included in this paper too [1], [2], [3].

## 1. INTRODUCTION

E-learning is a new form of education. It is well used at universities and at lifelong learning institutes. It should be used not only for distant learning students and for great numbers of students, but it is proper to use it as a support of education. There are fields of knowledge and research, where the rapid progressions are and we needed to change studying materials very often. E-learning implementing as a support of education is in the beginning at University of Defence. We have on-line course only for studying of English language. This is used by students or by people interested in English language, who would like to extend their knowledge in English.

At the beginning, there is a big problem – we really need someone, who is able to create and tutor on-line course. It is not only about creation and tutor the course, it is necessary to find the right form of e-learning [4]. If we have the whole team for on-line course creation, we are winners, but we often have to solve the problem with course creation [5]. We need someone for servicing Learning Management System, making animations, advertise this course and etc.

## 2. ADVANTAGE AND DISADVANTAGE OF E-LEARNING

- Financial advantage: saving in transfer, accommodation and other travelling expenses, saving in classroom rentals, lectors, materials printing ...
- Time advantage: saving time in transfer, organization of training, possibility of choice pudding time for education and another advantages associated with internet education.
- Possibility of made-to-measure course.
- Junction formal and autonomic access to training, multimedia utilization, collection enhancement

- Making groups of specialists of same sight, discussion in discussion forum
- E-learning is not geographical restricted.
- Teachers have to learn how to teach in e-learning course.
- It is necessary to have all learning text in digital form.
- Teachers do not know the faces of students (only names or nicknames).

## 3. THE NETTRAINES ON-LINE COURSE

The Net-trainers on-line course is European on-line course about e-learning. It was developed within a Leonardo da Vinci project granted by European Union. [6] It is very proper for future tutors and for person creating on-line courses. We (three persons from Communication an Information Systems Department and two persons form Centre of Language Preparation) were students of the pilot course Net-trainers.

There were above 30 persons in the Net-trainers course. We were divided into five groups. It was very interesting to communicate and co-operate with not known people. Our study activities were focused on co-operation into groups at the beginning – the team-works. And in the end, there were activities where we learn how to help each other, how to evaluate each other, about comparison of our on-line courses which are preparing on different departments and different branches of interest. We can make a comparison of each other in group or in course. It helps me a lot – opinions and experiences of my group's partners.

We have learn a lot about e-learning (how to create on-line course, how to tutor it, how to solve problems during preparation, how to propagate our own e-learning course). And for the future, it was very helpful to try the role “how to be a student of on-line course”. I know the position of student on myself.

I think this course was very helpful for me. I must admit I have any knowledge about e-learning, when I started to study this course and at the end of Net-trainers course, I am able to create and tutor my own e-learning course.

The seminars about e-learning and advices of colleagues who have more experiences with e-learning are very helpful too and I try to be in contact with colleagues and solve some problems with on-line course creation.

#### **4. LMS BARBORKA**

There is Learning Management System (LMS) Barborka at University of Defence; it is implemented in education system. This LMS should support creation of “electronic subjects”. LMS Barborka is produced by University of Mining in Ostrava and it is serviced by this institution too. Each of the teachers at our university is able to look for LMS and to try it.

The authors may create the module lessons after lessons. We have a chance of choice between sequential access (student has to study the first lesson and after the finish of the first lesson, he can start the second lesson and then next lessons – lesson by lesson), or full access (it depend on student, which of the lesson he can study first). It is only up to us, what we think that is better for our course. So we have to consider well, which type of access we will choose.

The LMS Barborka is very helpful for creating modules with full supporting utilization of others sets (not only study materials in the text form). The education may be supported by animation sets, audio-visual sets or graphics sets. It is very easy to put texts, pictures, tables or equations into the modules that we are creating in this LMS.

The LMS Barborka makes possible the tests and auto tests formation and there are possibilities of choice between automatic evaluation and evaluation by tutor. These tests and auto tests can be used in all lessons of the e-learning course and in the final examination in the end of the course. Another advantage is the possibility of own test for all students. How can prepare an individual test? We can put the number of test's questions and the system can generate the tests for each students.

There is the place for study group discussion, for communication between tutor and students and for communication between students of the e-learning course in the LMS. It is helpful for solving study problems. Some study activities can be submitted as a group activity and students need the place for communication. It should be compare with chat. Tutor can help students with learning or shown the right way with problems solving. Individual study activity can be support with the discussion forum too. The students of distant study have no place for contact each other, so they can solve the problems with others in discussion forum.

Student is able to find out the place of interest by the key words in content of the course and in notification of each module.

#### **5. E-LEARNING AND EDUCATION AT THE DEPARTMENT OF COMMUNICATION AND INFORMATION SYSTEMS**

The e-learning have been used only for education in English language at University of Defence. There are preparing some new modules, in the future – new subjects can be created as e-learning courses. So, the study can be more available for students. What department should start with e-learning? It is our department – Communication and Information Systems Department.

The one of the new e-learning course will be Optical Communication Systems. This e-learning course can be studied not only in communication and information systems study-programme. This e-learning course can be studied by students interesting about optical communications too. Some knowledge from math and physical science are supported. The course Optical Communication Systems is dependent on basic knowledge from math and physical. There is lack of time for teaching math and physics.

At the beginning of the e-learning course creation, firstly we have to set for who the subject is, what are the aims of the course and how to evaluate the course. We do not know the technological equipment of the students. They need computer with internet connection and some browsers too. Next, we have to decide what is better for our course – synchronous or asynchronous education.

We should to transfer study materials into digital form, but it is not necessary. It is better to find some digital library with the same theme. It should be impossible to find the electronic library, so we have to find few internet sources – digital magazines, papers, research works and etc. These sources are helpful for students to find more information about problems of interests and it can be helpful for study activities or next study. The information from well find internet source is necessary for research and future study activities, nowadays. Internet sources are endless in searching helpful information.

It is important to find more details about type of learning. What is the best way how to learn something? It depends on the individual person. But there are some basic types of learning: visual, audio or audio-visual. We can do little research about how to interpret learning for students. But there are lots of sources about this research in web pages. It can be helpful to use multimedia, animation and simulation, which make students to be active in learning process. We use different media support for different modules – it depends on contents.

What are contents of Optical Communication Systems? There are differences between radio and optical communication systems and the explication of these differences; basic knowledge about optical components, that are used in optical communication systems and other optical systems. This basic knowledge will be used in practical demonstration in laboratory exercise. This exercise will be placed in optical laboratory at our department. More information will be given about optical waveguides, optical-

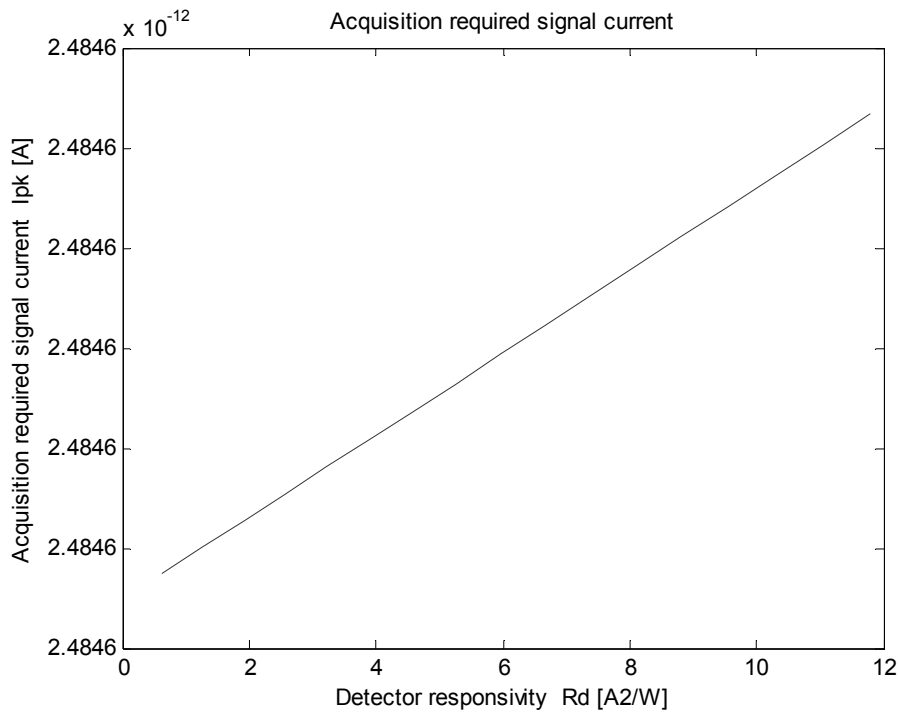


Figure 1 Required signal current dependent on detector responsivity for acquisition link

cable systems and optical communication systems with air transferring, the positives and negatives of these systems.

## 6. OPTICAL COMMUNICATION SYSTEMS

Optical communication systems are developing and innovating for every day. It is a new field in research. There are much unknown things. The changes in this department go from develop and innovation of optoelectronics (it is necessary part of optical communication system). The radio-frequency systems are supply with optical communication systems. This modernization is connected with claims on higher data rates and lower errors. The new development and new systems can be better import into e-learning education then into classical type of education. We can incorporate new things into created e-learning course.

The problem with creating the subject (e-learning course) in this field of research or area is the absence of acceptable source. There is no digital library and we have to look for internet source and check up these sources.

Another condition of availability is the right degree of skill with using of internet-source. This course (Optical Communication Systems) is for students who are interesting in optics and optical communication. The knowledge from math and physics are necessary. The other important thing is English language, because most of the papers and internet sources in this area are in English. That is why we suppose theoretical and practical knowledge in math and physics. We do not suppose knowledge in optics or optical communication.

The course is divided into ten-lesson course. The practical part of this course – the laboratory exercise is aimed for practical using of theoretical knowledge from this course. This laboratory exercise is placed because of two reasons. The first is face to face meeting in the course (it goes from Net-trainers on-line course). The second is to shown how to use theoretical knowledge into practice exercise.

We can although use graphical outputs from computer programmes or from some simulation programmes, when we can not use practical exercises in laboratory. The graphical outputs from Matlab programme are shown in figure 1 and figure 2.

These graphical outputs will be use in one of the lessons – the lesson about laser satellite communication. During the lesson, students can show how to analyse and optimized some parameters of very difficult equations. How to make analysis and optimization easier and how to use the program for optimization and analysis for subsystems and hold communication systems. It is the best way to use e-learning for this subject, because student should see the optimization by changing values of parameters. It is not a problem to install the program on their computer and keep in touch the optimization process. The interaction is very important during the on-line course. We can create own model for our students and update study materials.

It is possible to insert materials form interesting area of students in the module and adapt course for students and their area of interesting. Some experience from previous on-line course should be adapted in course too.

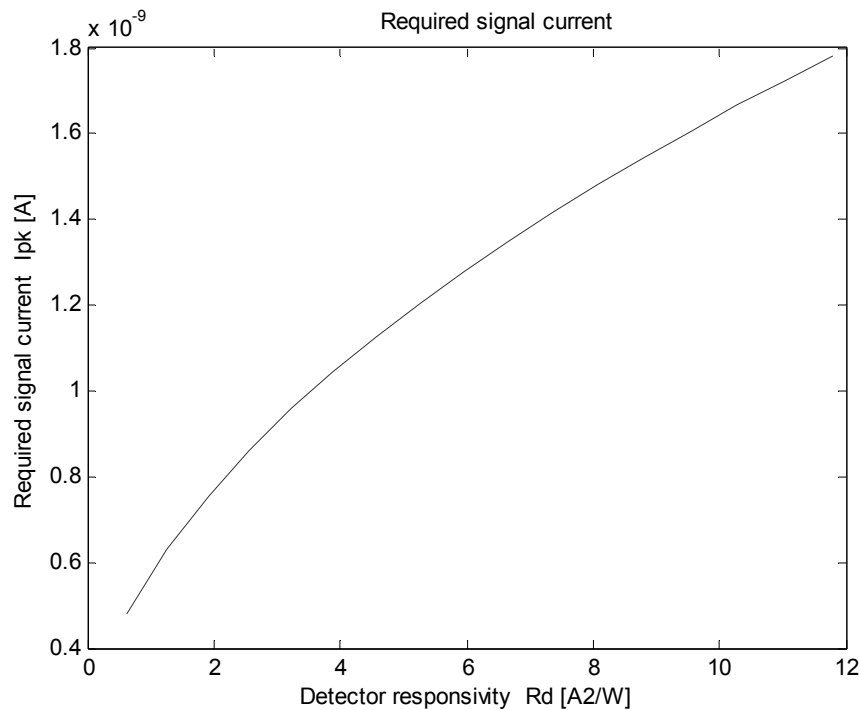


Figure 2 Required signal current dependent on detector responsivity for communication-track link iteration

Students go through course module after module (sequential access). It is necessary to do study activity and fill in the test in the end of each module. When all study activity from previous module is done, then the next module can begin. The study activities are different in each of modules – tests, auto tests, group activity, single activity, work in pairs, there, students may used the discussion forum.

The materials for study are not only in text form, there are lot of pictures and audio-visual support with practical demonstration. The audio-visual support will be used in module before practical exercise, it will be for identification of optical apparatus and instruments and it is helpful for labour protection.

This course called Optical Communication Systems will be prepared for students in January 2008. It will be tested in September 2007.

## 7. CONTRIBUTIONS OF E-LEARNING

- Financial advantage, time independent and individual study
- Student has a choice a time and speed of learning
- Student may repeat lessons
- Each of students is evaluate by the same rules. There is a feedback between student and tutor.

## 8. SUMMARY

The project about e-learning module creation has started in special research. There has been an idea – creation e-learning courses. It has been because we have needed to create new modules from our department.

When we have to create new modules it does not depend if we create subject as a classical type of education or we create e-learning course.

## 9. REFERENCES

- [1] Net-trainers Course [online]. [cit. 2006-05-13]. URL: <http://www.nettrainers-training.org/en/extranet.asp?p=1-1>
- [2] Vejvodová, J.: *Metodická příručka pro autory on-line kurzů*. Západočeská univerzita v Plzni, Plzeň, 2005.
- [3] Vejvodová, J.: *Metodická příručka pro tutorý on-line kurzů*. Západočeská univerzita v Plzni, Plzeň, 2005.
- [4] Coufalíková, A., Hrubý, M., Mazálková, M.: *Nettrainers-the first impression*. ICTE 2006. Rožnov pod Radhoštěm, 2006.
- [5] Hrubý, M., Coufalíková, A., Mazálková, M.: *European On-Line Courses- A Step to Closer Co-operation in Education*, Virtual University, Bratislava 2006.
- [6] Vejvodová, J.: *Challenges of European Net-trainers: A Transnational Online Course*, Online Educa Berlin 2006.



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## THE LEARNING PORTAL FOR IMPROVING THE E-LEARNING ENVIRONMENT

Hiroshi NAKANO<sup>1,2,3)</sup>, Toshihiro KITA<sup>1,2,3)</sup>, Kenichi SUGITANI<sup>1,3,4)</sup>, Junko NEMOTO<sup>2,3)</sup>,  
Shiro KITAMURA<sup>2,3)</sup>, Katsuaki SUZUKI<sup>2,3)</sup>, Ryuichi MATSUBA<sup>3,2)</sup>, Masahiro MIGITA<sup>1,2)</sup>,  
Yasuo MUSASHI<sup>1,4)</sup>, Norio IRIGUCHI<sup>1,2,4)</sup>, Tsuyoshi USAGAWA<sup>1,2,4)</sup>

<sup>1)</sup> Center for Multimedia and Information Technologies,

<sup>2)</sup> Instructional Systems Program, Graduate School of Social and Cultural Sciences,

<sup>3)</sup> Institute for e-Learning Development,

<sup>4)</sup> Department of Electrical and Computer Science, Graduate School of Natural Science,  
Kumamoto University, 2-39-1 Kurokami, Kumamoto, 860-8555 Japan

E-mail: nakano@cc.kumamoto-u.ac.jp

**Abstract.** The learning management system (LMS) is the most popular e-learning system, which normally provides course centered managements and is rather weak at learner centered managements. The LMS normally does not manage school register and imported automatically or even manually from the school information system. Several excellent open-source LMSs are now available as the Sakai and the Moodle, and therefore, it becomes necessary to support not only one LMS. In changing situations, it is very important to improve the e-learning environment by connecting related systems and adding supplemental functions. We tried to solve these problems by constructing the learning portal with the single sign-on environment. This paper shows the implantation of the learning portal by cooperating with several e-learning systems and by adding learner centered functions.

**Keywords:** E-learning, Portal, Learning management system, Distance education, Single sign-on

### 1. INTRODUCTION

As information technology based higher education becomes increasingly common, and many courses use e-learning systems. The learning management system (LMS) is the most popular e-learning system and there so many commercial and non-commercial LMSs, especially, excellent open-source LMSs are recently available as the Sakai [1] and the Moodle [2]. Commercial LMSs already have so enough history that they are stable and have many functions.

The LMSs normally provide course centered managements and they are relatively weak in learner centered managements. The online portfolio systems are remarked to compensate this weak point by cooperating with a LMS as the Open Source Portfolio Initiative [3]. It is however not so easy to connect to any existing LMSs.

The school information systems (SISs) have been used for longer years than LMSs, and they manage mainly school registers. Usual LMSs import or synchronise the data of courses and registered courses for each student automatically or even manually from the SIS. It is not so easy to support several LMSs connecting to the SIS of the university.

Several excellent open-source LMSs are now available as Moodle and sakai project, and university therefore should support not only one LMS but also several kinds of LMSs or provide some standard interface (I think that there are no complete standard interfaces yet.). In changing situations, it is very important to improve the e-learning environment by connecting the related systems and adding supplements. We

tried to solve these problems by implementing the learning portal with the single sign-on environment.

The Kumamoto university portal started since 2006 and it provides customizable portal environment and supports single sign-on. In the same time, Instructional Systems Program, Graduate School of Social and Cultural Sciences was established in our university. The school educate the e-learning professionals by e-learning, and students can finish without face-to-face courses. The learning portal started for the e-learning school based on the university portal.

### 2. THE UNIVERSITY PORTAL

We started the Kumamoto University Portal from the beginning of the 2006 school year, and it is not specialized for learning but for general use; administration, school information, and so on.

The portal is implemented based on uPortal [4] which is a free, sharable portal under development by institutions of higher-education using Java, XML, JSP and J2EE and is developed by JA-SIG. The uPortal supports the portlet (JSR-168) [5]. Portlets are pluggable user interface components for a portal and are useful to add functions to uPortal. We therefore add some functions to provide appropriate information and functions for each role, position, department, and so on, for all members of university (10,000 students and 1,000 staffs).

One of the most important functions is providing links to web services which are available for the login user and can

be accessed without any more authentications; the single sign-on as shown in Fig. 1. The single sign-on service is implemented based on the CAS (Central Authentication Service) [6] which is an open-source authentication system originally created by Yale University and became a JA-SIG project in 2004. The university-wide LDAP is used as authentic data source for the CAS, users therefore can login wireless LAN, PCs for IT classrooms (1,300 PCs over the university with exactly the same usability), emails etc. with the same user ID and password as CAS.

The uPortal supports the CAS by itself and some other web server applications were modified or adapted to support the CAS for convenience; our university's original SIS named SOSEKI, WebCT Campus Edition 4 (WebCT CE4), WebCT Campus Edition 6 (WebCT CE6), Moodle [2], the library system (original), the university scheduler, the Computer Assisted Language Learning (CALL) systems, the network and application registration system (original) have supported the CAS within 2006. The CAS provides many libraries of clients for Java, .Net, PHP, Perl, Apache, uPortal, and others, and it is therefore not difficult to adapt existing web applications with their programming source codes. Even if some commercial systems do not open their source codes, there are some possibilities to adapt by developing adapters or connectors. We developed some applications for adapting the CAS, for example, we made adapters using the portlets for WebCT CE4 and CE6 [7].

### 3. THE LEARNING PORTAL

#### New program for e-learning professionals

In 2006, Kumamoto University established new master program; Instructional Systems Program, Graduate School of Social and Cultural Sciences. This is the first and innovative program in Japan which cultivates e-learning professionals by e-learning. Students are learning the fields of instructional designs, information technologies, intellectual properties and instructional managements mainly by asynchronous on-line education using LMSs, SIS, and the learning portal. Actually more than ninety percents of students are living far from Kumamoto city (more than fifty

percents nearby Tokyo) and are learning through the Internet. Almost all of the students have already been active in employment and many of them are concerning to the industrial trainings or higher educations. The school is therefore very suitable for developing new and reformist e-learning systems and contents, and we started developing the learning portal just since its establishment.

The learning portal aims to help students to learn in the comfortable and efficient learning environments over the Internet. We try to connect several e-learning systems as LMSs and SIS, and to add some functions into the portal to compensate existing systems. Specially, learner centered functions are emphasized, because LMSs generally provide course centered managements and SIS normally treat only school registers and the results of credits.

#### Outline of Construction

The learning portal is constructed by adding functions to the university portal, and is placed before entering e-learning courses as shown in Fig. 2, where the learning portal is named as GSIS (Graduate School of Instructional Systems) Portal. In the program, students use WebCT CE6 as the main LMS and Moodle for exercises as contents creators, as instructors and as administrators. Each student has his or her own Moodle system on university site. We also provide VOD (Video On Demand) server, video conference system, and some original web applications (on-line computer programming exercise [8], file manager for VOD server and so on.) for the program.

#### Implementation and development

The learning portal is built on the university portal based on the uPortal which has extensive functions as a Channel and a portlet. The Channel works only within the uPortal, however, the portlet is a pluggable user interface component with interoperability between different web portals enabled by the Java Portlet Specification (JSR168) [5]. The uPortal is a web portal and of course can show other servers' web pages as inline frames or as proxies. We developed additional pages to the university portal as external web pages and portlets using Java and JSP programming with portlet APIs which allow accessing the portal's database including login user

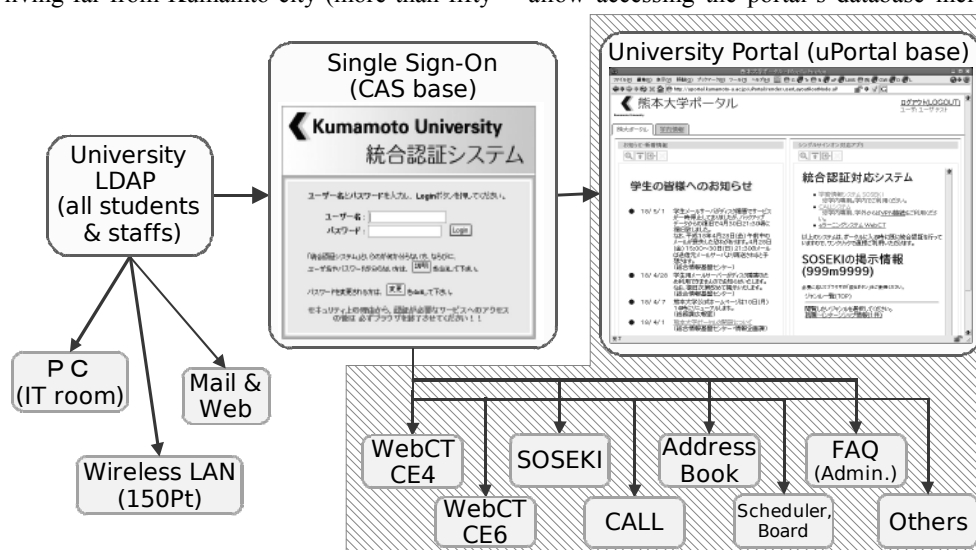


Fig. 1. The Kumamoto university portal and the single sign-on system with several web applications.

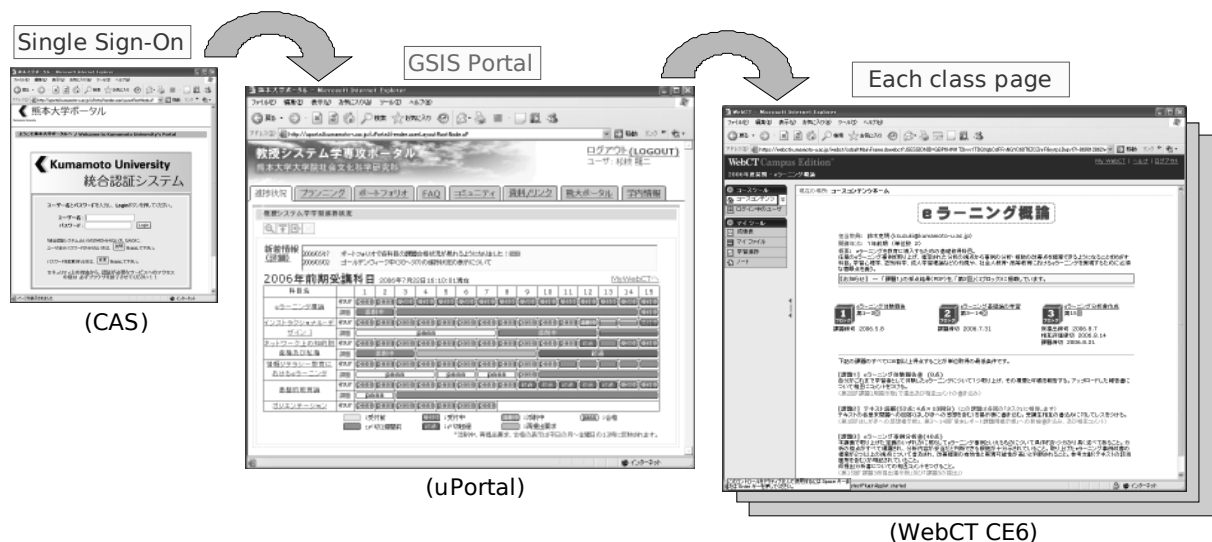


Fig. 2. The learning portal for distance education.

information. We developed the CAS adapter using the portlet for WebCT CE6 [7] in order to realize single sign-on from the learning portal to the main LMS.

#### The pages for learners (student)

The learning portal compensates learner centered functions lacked in LMSs, and followings pages were developed and provided to all users; not only students, but also instructors (professors) and administrators.

- **Visualizing the state of learning progress:** Each course has fifteen modules, and each module has a task to prove studies, and several modules are grouped to a block with subject to check achievement. The top page of the learning portal shown in Fig. 2 indicates states of all tasks and subjects as in/out of date, passed, requiring resubmission, etc. for each course. Each task, subject and course is directly linked to the corresponding place on LMS by single sign-on. The page is developed by the portlet.
- **Designing own curriculum:** All courses dependencies are shown as a chart where students can design their own curriculums by selecting or deselecting allowable courses, and the total units is calculated in real time. The page is written by html with Javascript.
- **Portfolio:** The competencies are listed with their required subjects. Each competency requires several subjects from several courses, and each subject is shown as a course icon indicating the particular subject explained by hovering a mouse cursor. The icon color changes when the corresponding subject is passed. The page is developed by the portlet.
- **Community Salon:** There are introductions of all professors with vide clips, web pages and email addresses etc., and also all students introduce themselves by web pages created as exercises in an introductory course before starting program. The page has a direct link to the discussion board and the chat function on LMS by single sign-on. The page consists mixture of the portlet, html and the embed video streaming.
- **FAQ, related documents and LINKs:** These pages are for convenience and are written in html.

#### The pages for instructors (professors)

For instructors (professors), following pages are modified or added to the learners (students) page.

- **Visualizing the state of learning progress in the course (added):** It is similar to the “Visualizing the state of learning progress” for learners. The listing type is only different and it makes a table of the learners’ state of the course members, where the instructor can notice easily who has a problem. The page is developed by the portlet.
- **Visualizing the state of learning progress (modified):** It is modified to add a learner selection function in order to check the learner’s total state including other courses.
- **Portfolio (modified):** It is also modified to add a learner selection function in the same reason.

#### The pages for administrators

For administrators, following new pages are added to the instructors (professors) page.

- **Managing the course information:** The administrators can make a new course and can modify course information including the tasks and the subjects with this page. The page is developed by the portlet.
- **Managing the learners and instructors information:** The administrators can add more information to the portal with this page. The fundamental user information is managed on the uPortal and CAS (referring LDAP), and the page can manage additional information required in the program. The page is developed by the portlet.
- **Managing the learning states:** Some learning states of the learners can be changed automatically by reflecting the other data, although, this page provide more flexible treatments. The page is developed by the portlet.

Developing the interactive pages for the administrator is not so easy and requires rather heavy programming by the portlet in spite of only for a few administrators use. We think that this is the biggest problem in development, and we are trying to solve the problem for applying customizable and remote database accessible applications such as the OpenOffice.org Base [9].

#### Practical use more than a year

The learning portal has been used in the instructional systems master program since April 2006. There are more than thirty fulltime students and twenty part-time students, and almost all students are learning through the Internet. We have already done more than twelve pure online courses by more than ten instructors. Three instructors are the specialists of the instructional design and concentrate e-learning courses, and others have not only online courses but also many face-to-face courses. In every course, the professor rolls as an instructor, although, does not fully roll as a contents designer, because all of the contents outline have already been designed depending on the total curriculum by using the instructional design. Following the outline, some contents are fully written by the instructors (professors), and some others are written by contents creators ordered by professors. The system has not been simple yet, however, we are reviewing contents every month before serving them to students at the meeting of the related members. As we are developing the learning portal by ourselves, we can fix bugs, revise, improve and modify in nearly real time, however it is not easy to stop the portal because some students are using it in twenty four hours. We should realize a mission-critical system and support.

#### **4. CONCLUSION**

We developed the university portal for all students, professors and staffs based on the uPortal, the CAS and the original tools for connecting several university-wide systems since 2006. The learning portal has been developed based on the university portal for the distance e-learning program mainly implemented by the portlet. The learning portal compensates the weak points of LMS and provide learner centered functions as visualizing the state of learning progress, designing own curriculum, portfolio and so on. The learning portal has been practically and successfully used for more than a year.

#### **5. REFERENCES**

- [1] Sakai: online Collaboration and Learning Environment  
<http://www.sakaiproject.org/>
- [2] Moodle: course management system  
<http://moodle.org/>
- [3] Open Source Portfolio Initiative  
<http://www.osportfolio.org/>
- [4] uPortal: open-source portal for higher-education  
<http://www.uportal.org/>
- [5] JSR 168: Portlet Specification,  
<http://www.jcp.org/en/jsr/detail?id=168>
- [6] CAS: open-source central authentication service  
<http://www.ja-sig.org/products/cas/>
- [7] H. Nakano, T. Kita, K. Sugitani, R. Matsuba, M. Migita, Y. Musashi, N. Iriguchi, S. Kitamura, J. Nemoto, K. Tsuji, M. Shimamoto, T. Kida and T. Usagawa, "Single Sign-On forWebCT CE4 / CE6 implemented by Servlet

and Portlet with CAS", WebCT user conference (in Japan), No. 4, pp.1-6 (2006).

- [8] H. Nakano, T. Kita and K. Sugitani, "Online ActionScript Training Tool Powerd by MTASC", IPSJ SIG Technical Reports, No. 5 (2007).

- [9] OpenOffice.org Base: It can create and modify tables, forms, queries, and reports on many remote database systems.

<http://www.openoffice.org/product/base.html>

#### **ACKNOWLEDGEMENT**

*Major part of this work is supported by the "Good Practice - Distinctive Educational Activity" program from the Ministry of Education, Culture, Sports, Science and Technology by the IT literacy education granted in 2004*





## ONLINE SUPPORT FOR ASSESSMENT OF STUDENT KNOWLEDGE

Ľuboš Odráška, Katarína Žáková  
Faculty of Electrical Engineering and Information Technology  
Slovak University of Technology  
Ilkovičova 3, 812 19 Bratislava, Slovakia  
E-mail: lubos.odraska@gmail.com, katarina.zakova@stuba.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** In the paper the new developed system for student knowledge assessment is presented. The system is available via Internet and it can serve for self-testing but also for examining purposes. The test questions can be of various types including multiple-choice questions, matching items, short answer questions and simple questions. The system integrates a possibility to interchange test questions with other LMS systems, e.g. Moodle.

**Keywords:** knowledge assesment, self-testing, multiple-choice questions, matching items, short answer questions, simple questions, LMS system

### 1. INTRODUCTION

As it is generally known, knowledge assessment is inseparable part of the education process. To get the most valuable results from every learning activity the assessment has to be done:

- before the activity (pre/test) to establish entry behavior;
- during the activity (formative assessment) to produce feedback that student needs in order to improve performance and to stimulate motivation;
- after the activity (summative assessment) to determine the student's final standard of performance.

The assessment is often accomplished on regular basis to provide information about the actual knowledge level of students. The main purpose is to assess student progress at an appropriate level at significant stages of a learning program. Following results tutor can ensure students are succeeding, or at least coping, with the topic and to offer additional support should it be needed.

Continuous assessment combines the purpose of pre/test and formative and summative assessment. The strengths of a continuous assessment include [1]:

- acting as a check on the quality of the instruction or training;
- adopting assessments of varying length from brief tasks to major assignments;
- enabling to test all parts of learning program in depth;
- having frequency and timing adjusted according to the results;
- providing constructive and usable feedback to the learners;
- taking place at times when remedial action can still be taken;
- testing groups of sub/skills before testing the competence as a whole;
- using various types of test to avoid repetition of style.

Tests are powerful educational tools that have at least four functions [3]. First, tests help evaluate students and assess whether they are learning what it is expected to learn. Second, well-designed tests serve to motivate and help students structure their academic efforts. Students study in ways that reflect how they think they will be tested. If they expect an exam focused on facts, they will memorize details; if they expect a test that will require problem solving or integrating knowledge, they will work toward understanding and applying information. Third, tests can help teacher understand how successfully he or she is presenting the material. Finally, tests can reinforce learning by providing students with indicators of what topics or skills they have not yet mastered and should concentrate on. Usually, our aim is to prepare objective tests where the mark achieved by the student does not depend on the person who performs the marking. An objective test requires the student to select or input a correct answer from a predetermined set of alternatives. Herein lays both the major strength and weakness of objective testing. Some of objective tests can be administrated and evaluated by computers. In that case it is possible to talk about computer-aided assessment. It offers a convenient way for delivery of objective tests and for the assessment process as well. The main advantage of computer aided assessment consists in its objectivity and speed. Student can have results immediately after he or she accomplishes the test.

### 2. QUESTION TYPES

We oriented to four basic types of test questions: multiple choice questions, short answers, matching items and simple questions. In following we try to describe each type in more details.

#### Multiple choice questions

A "multiple choice question" (MCQ) is a question in which student is asked to select the correct answer from a given list of possible alternatives. Tests with multiple-choice questions are probably the most commonly used objective

tests. There is a right answer, and no student input other than ticking the preferred answer is required. They are often chosen because they are the quickest way of testing large student groups. Short well-constructed MCQ tests can be very appropriate for allowing students to gain formative feedback quickly.

A multiple choice question consists of a stem (the text of the question) followed by a short list of possible answers, which contains the one correct answer, the key, and several - usually three - incorrect answers known as distracters. There are far more complicated forms of MCQ, some of which can be baffling to students.

Our effort was to eliminate a possibility that students only try to guess the right answer. Therefore, each question can have an arbitrary number of answers whereby the number of correct answers can vary and students do not know it. It can even happen that student receives a question with all correct or all incorrect answers.

It is to note that the presented system enables to use images both in question and answers as well.

Fig. 1. Multiple choice question

Each question is characterized by the number of points that student gets after he or she indicates all correct answers to the question and doesn't choose any of distracters. Correct answers and distracters are multiplied by the predefined coefficients determining difficulty of the answers (Fig.1). The coefficients can also be set in such a way that students get negative points for their incorrect answers. This approach forces students to tick only those answers where they are completely sure with the written statement. It is quite possible for good students to be less successful in MCQ tests because they can see ambiguities in the distracters which less able students are not able to see [5].

#### Matching items

Questions with matching items are usually presented as two columns of information, and students have to match an item from one column with its correct counterpart from the other column. Matching questions are particularly good at assessing a student's understanding of relationships. Matching questions are in reality a variation of the multiple-choice format. If we find out that we are writing multiple-choice questions that share the same answer choices, we may consider grouping the questions into a matching item.

As it can be seen in Fig.2, items in one of two columns can be fixed and student must match only answers from the second column. It is done using a select box.

Fig. 2. Matching items

#### Short answer questions, examples

Short answer questions require that student has to supply the correct answer rather than identify it or choose it. The probability that the student will guess the correct answer is very low. However, the short answer response questions can be difficult to phrase in such a way that only a single correct answer is possible. In addition, if the marking is done by computers, spelling errors may disadvantage students who know the right answer. A little bit better situation is in the case where the numerical result is expected.

We tried to combine short answer boxes with select boxes to have possibility to prepare more complex questions. We call them examples (Fig.3). It is the most complicated part from the whole test. By means of special XML tags it is possible to create mathematical expressions that include items for putting integers `<result_int>`, float numbers `<result_float>`, strings `<result_string>` or select boxes `<result_select>`. Each of these tags enables to predefine correct answers. In addition, each of new tags can be characterized by the following properties that format the created item:

- name (for the result),
- size – it determines length of the text box or number of rows in the select box
- round – it serves for rounding float numbers
- options – it enables to list items in select box

- selected – it determines the predefined item in select box

In similar way as it was already at multiple-choice questions it is possible to define coefficients determining difficulty of the answers. Moreover, the test administrator can also specify whether more attention should be given to textboxes or to select boxes in the answer.

Fig. 3. Example definition

### Simple questions

Simple questions are the only part of the developed test system that cannot be evaluated by computer. It requires manual marking. In spite of this fact we decided to include it into the whole system because student should know to demonstrate that he or she is able to formulate his own conclusions. In the free given answer it is possible to explain the problem, to point out its weak and strong features, to show similarities and differences between two or more things.

From the point of test administrator it is necessary to define the question and the maximal number of points for answer. If it is required the question can be illustrated by the suitable picture.

The definition of the simple question is shown in Fig.4.

Fig. 4. Simple question

### Test management

The whole test can consist from all types here explained questions. In Fig.5 it is possible to set the test properties. The test can run in 2 modes: self-testing and examining

mode. Both modes can be time limited. For example, it can be set that the self-testing period will be one week and immediately after students can be tested for examining purposes. Of course, the test can run without such constraints. The test administrator can set if the test in examining mode can run only once or it can be also repeated. It is also possible to set the length of the test. In that case during the whole test student can see how many minutes he or she has until the test will be concluded.

The test administrator can also specify global test coefficients for determining relation between correct and incorrect answers. If global parameters are set here, parameters determined in question definitions have no influence.

Test questions can be evaluated in two ways. For incorrect answers students can receive zero points or negative points. Both approaches have their advantages and disadvantages.

As it was already said the test can be defined using all types of questions. It means, in one test we can have multiple-choice questions, matching items, examples and simple questions, too. Because of better orientation all questions are divided into several groups defined by test administrator. Before the test running teacher or test administrator has to determine questions that he or she prefers to include in the test. Then it is necessary to specify number of questions in the test and how many answers for multiple choice questions should be used. For example, it is possible to define, that the displayed test will contain 4 multiple choice questions, 2 matching items and 3 short answers. Following the selected questions, the test is randomly generated. The probability that two students will have exactly the same test is very low.

After the student accomplishes the test, he or she can immediately see results of those questions that are assessed by computer. Only simple questions have to be evaluated by the teacher and therefore this assessment is available later. According to the test setting student can see only achieved number of points or also answers to questions. In this case he or she can compare own responses with the correct ones. It helps to the improvement of the gained knowledge.

The advantage of the system is that teacher can always see all answers of the student and therefore it can be easily found where the weak points of students are and what is necessary to repeat more or to explain once again.

Fig. 5. Test definition

Fig. 6. IP table definition

The next interesting feature of the system consists in the fact that it is possible to limit the access of students to the here introduced assessment system. The test administrator can define rules to specify IP addresses of computers that are allowed to run a test or IP addresses of computers where it is forbidden. All rules are automatically joined using the logical operation “and”. After the student try to login to the system, IP address of his or her computer is immediately checked and according to the defined table of access rights the student access is authorized or not. In this way we can avoid in order those students that are running the test in examining mode could do it at some other place that is the official testing room.

### 3. EXPORT AND IMPORT OF TEST QUESTIONS

Since, in present time there exist several learning management systems that support student testing it is important to ensure interchangeability of test questions among them. From this reason we also tried to support this requirement.

The introduced system enables to export and import questions e.g. to LMS Moodle or IMS. For this purpose it is possible to use one of the following standardized formats: GIFT, Aiken, Moodle XML, IMS QTI.

#### Aiken

The Aiken is a very simple format. However, it can be used only for export and import of multiple-choice questions. The external text file has a very clear human-readable format. The disadvantage is that questions cannot include figures and they can have only one correct answer.

#### GIFT

GIFT is the most comprehensive format available for importing/exporting test questions from a text file. It

supports multiple-choice, true-false, short answer, matching and numerical questions. Various question types can be mixed in a single text file. Neither this format does not support pictures in the test.

#### Moodle XML

This specific format was developed for the exchange of test questions with the LMS system Moodle. It supports all types of questions. The format is straightforward and is best demonstrated by exporting a category in the Moodle XML format. The XML format is capable of importing image files. The disadvantage could be the size of the generated file since all questions including pictures are exported into a single file.

#### IMS QTI

IMS QTI format is the most complicated format that enables export and import of all types of test questions including pictures. The complete description of the standard IMS QTI (version 2.0) format can be found in [6]. Information about questions is divided into several files. One file contains basic information about the test question and a reference to the XML file where all other details and answers can be found. If the question includes a picture the detailed XML file offers the reference to the file where the picture is saved.

It is to note that export to IMS QTI format generates a group of files within a single 'zip' file.

### 4. ADDITIONAL SETTINGS AND OPTIONS

#### Multi-language support

The created system can work in several language environments. In present time it includes Slovak and English but the next language mutation can be easily add. It is sufficient to translate menu items and all text variables that can be visible to user. The translation is saved in the separate file that is incorporated in the program structure. The language is automatically added among all other languages and user can choose the most appropriate one for him or her. However, this language choice influences only the program environment. The test questions have to be translated independently by the course tutor.

#### Graphical Layout

Our aim was to enable administrator a simple modification of the system graphical layout in order the presented testing capabilities could be included in various web sites. Therefore we prepared two basic orientation of menu (vertical and horizontal) and we also predefined several color sets for the whole graphical environment of the system. In this way the administrator has possibility to choose the most appropriate graphical layout to his or her web page.

#### Multi-subject support

One installation of the introduced system can support simultaneous testing from several subjects. In one moment we can test students from knowledge about Internet, Mathematics, Chemistry or Literature. Administrator has to define to student his or her subjects and then, student can

see all tests that are available for him/her in the specific time.

If it is required, students tested in one subject can be divided in several groups. It facilitates tutor to check results of own students.

#### Statistics

The included statistics enables to illustrate the achieved results of students in the transparent (graphical or tabular) way. After the test tutor can very easily find out who received the maximal and minimal mark; how many points corresponded to this assessment; how many students would receive the assessment A, B, C, D, E or F; what was the most critical question in the test and also what question was the easiest for students.

The statistics can be accomplished for the selected test or for all tests in one subject.

### 5. CONCLUSIONS

In the paper we introduced the student knowledge assessment system that we developed. It enables to prepare tests with various questions. On the other side it is to say that it is only an environment that can be used. The objective assessment depends on questions that are given to pass to students. They should reflect our expectations. As it was mentioned in [4] many students will learn whatever is necessary to get the grades they desire. If we base our tests on memorizing details, students will focus on memorizing facts. If tests stress the synthesis and evaluation of information, students will be motivated to practice those skills when they study.

Finally, we should realize that some students take the short test purely to find out how they are going.

### 6. ACKNOWLEDGMENT

The work has been supported by ESF Project JPD BA3, No. 13120120287, ESF project SOP IZ, No. 11230220525 and by Slovak Grant Agency, Grant KEGA No. 3/3121/05. This support is very gratefully acknowledged.

### 7. REFERENCES

- [1] Glanville R.: *Implementing and Managing Flexible Learning – Assessment Systems*, Pitman Publishing, 1995.
- [2] Isaacs, G.: *Multiple Choice Testing*, HERDSA Green Guide No 16, 1994.
- [3] Davis, B. G.: *Quizzes, tests, and exams*. University of California, Berkeley. From Teaching Tips on Honolulu community College, University of Hawaii (<http://honolulu.hawaii.edu/intranet/>).
- [4] McKeachie, W. J.: *Teaching Tips*. (8th ed.) Lexington, Mass.: Heath, 1986.
- [5] Teaching & Learning Homepage, Centre for the Advancement of Learning and Teaching (CALT), University of Tasmania (<http://www.utas.edu.au/>)
- [6] IMS Global learning consortium: IMS Question & Test Interoperability Specification (<http://www.imsglobal.org>).
- [7] Moodle: Importing format specification.

### THE AUTHOR(S)

Ing. **Ľuboš Odrážka** finished his at the Faculty of Electrical Engineering and Information Technology, Slovak University of Technology in Bratislava. His diploma thesis was dedicated to the design of Internet based online system for student assessment.

Ing. **Katarína Žáková**, PhD graduated from the Slovak University of Technology in Technical Cybernetics in 1991. Since 1991 she is with the Faculty of Electrical Engineering and Information Technology, Slovak University of Technology in Bratislava. Her current research activities are connected with computer aided control design; Internet based interactive education and e-learning.





## PROGRAMMING IN OS WINDOWS – INTERACTIVE E-LEARNING SYSTEM

Viktor Krajnyík, Igor Sivý

Department of Computer and Informatics, Technical University of Košice, Letná 9, 042 00 Košice, Slovakia

krajnyik.viktor@gmail.com

sivy@elfa.sk

*5<sup>th</sup> Int. Conference on*

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** This paper deals with analysis and design of interactive e-learning system for the topic of programming in operating system Microsoft Windows. In particular, it focuses on system services of this operating system, e.g. working with processes or threads, inter-process communication, process synchronization or file management. System consists of two parts: educational materials and web interface. Educational materials contain except theory also visual animations and exemplar programs created in C# programming language. Interaction between this language and Win32 API is realized through P/Invoke. The web interface based on technology Ajax allows administration of students, educational group management and educational material management. Students have access to developed materials. Complex e-learning system is result of this work. Thereinafter individual modules of the system are described.

**Keywords:** e-learning systems, e-learning, programming, operating system, Windows, Win32 API

### 1. INTRODUCTION

These days we can witness fast development in scientific and technical disciplines. New development enhances knowledge and brings more stress on students who are required to assess and acquire much broader range of information.

Continuous progress in field of information technologies give rise to basic changes in fields of learning and teaching, which are not capable to react flexibly on all aspects of progress. Typing and redacting new books is time-consuming and expensive and in spite of great effort of authors we may still find several mistakes in publications.

Fast technical progress in information and communication technologies has brought new and wide possibilities also in areas of education. Modern way of teaching using computer technologies, which is called e-learning (e-learning system) [1], brings many advantages.

Possibility for continues charges in content of the system is main advantage of e-learning system. Standard education expects that all or most of students perceive equally quickly and lector's comment is sufficient for them. E-learning system removes all these limitations. Students go through educational course with their own speed, they have possibility to return to individual chapters and with a help of pictures and animations they learn more perfectly given problem.

### 2. GOALS

The goal of this work is to design an interactive e-learning system, particularly for the topic "Programming in OS Windows" [2].

The system should contain a module for administration of groups, or students, module for adding new chapters and educational materials into course and module for modification already existing texts. Individual chapters will contain theory, animations and demo programs, using which students can better understand the issue of programming in Windows. At the end of every chapter students will have an opportunity to examine their acquired knowledge in a test. The system will be based on client-server architecture.

### 3. ANALYSIS

On Fig. 1 we can see an illustration of the system architecture. We can see relation between modules of study group administration and student administration, which is performed by program. Information about study groups and students are saved into database. Educational materials and XML files containing tests are stored in file system.

System will be used by two user groups: instructors (administrators) and students, while instructors will have access to study group administration (virtual classes) and student administration. Moreover they will be able to create and remove chapters from course, even they will have possibility to create and edit content of individual chapters. Students have access to developed materials.

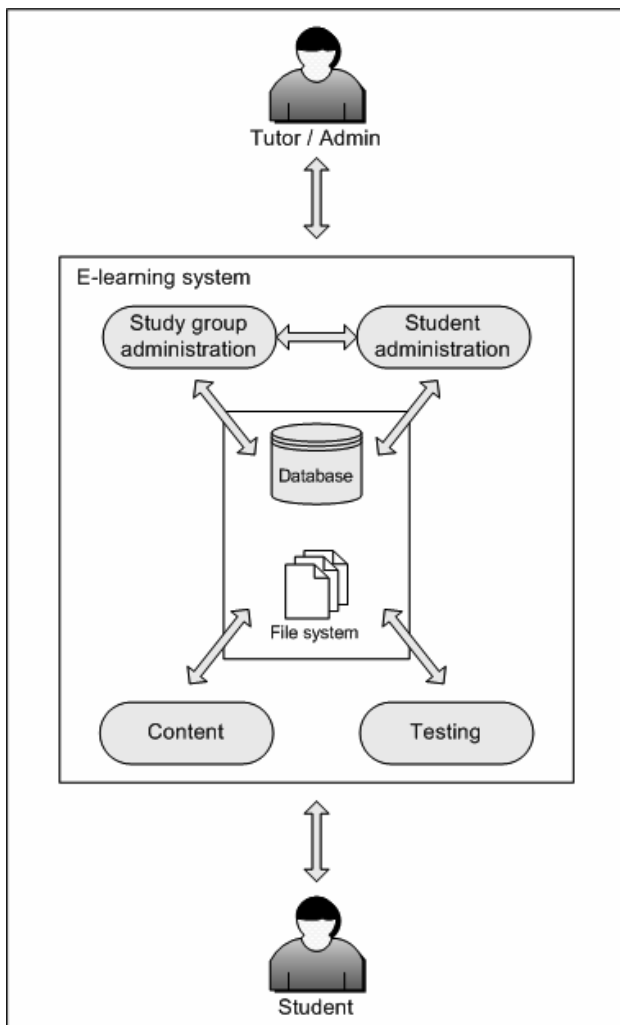


Fig. 1. Architecture of Designed e-learning System

System consists of these modules:

1. Study Group Administration
  - Instructors have possibility to create new study groups.
  - Allow or block registration for students into selected group.
2. Student administration
  - Registration is allowed for students only in case, if study group exists.
  - Student after her/his successful registration is able to access the system only after instructor's confirmation.
3. Knowledge Testing
  - A module for testing knowledge is an important part of system.
  - In general, tests should be saved into database or in file. In this case we have selected the second alternative, which means tests are saved into XML file.
  - A test with several questions which are randomly selected exists for each chapter.
  - After test evaluation, correct and incorrect answers are displayed.

#### 4. Content Files

- As noted previously, system will be used for students for better understanding of issue of programming in Microsoft Windows [2].
- Texts also contain Flash animations, which more accurately, in contrast to standard text, illustrate the given topic.
- Exemplars programs are for free use and are ready for download and try out. The programs might be developed in several programming languages, e.g. C, C++, C#, Visual Basic. NET, etc. Advantages of languages C and C++ are that, that also Win32 API is written in these languages, accordingly exemplar programs are easily to be developed. Language C# is the second alternative. However it is necessary to find convenient translation [3–5] declaration Win32 API functions into this language. An advantage of language C# is that nowadays it is very popular among students.
- Instructors can hierarchical organize content files in chapters and subheads.

#### 4. SOLUTION AND RESULT

Web server Apache, database server MySQL, scripting language PHP5 and markup language XHTML 1.0 were selected for realization. All of them are fully supported by OS Microsoft Windows and by all of Unix system platforms.

System uses technology AJAX [6–9] (Asynchronous JavaScript and XML), that is web development technique for creating interactive web applications. The intent is to make web pages feel more responsive by exchanging small amounts of data with the server behind the scenes, so that entire web page does not have to be reloaded each time user requests a change.

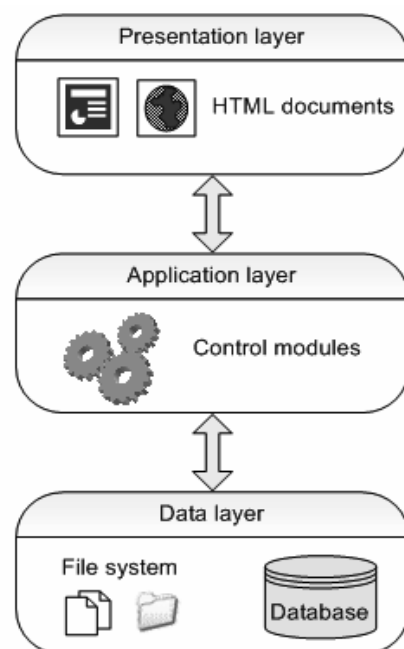


Fig. 2. Three-ply Model of the System



On uppermost level system based on classic three-ply model, whose layers and their connections we can see on Fig. 2.

Data layer is lowest layer and includes database and file system necessary for data and file storage. Application layer is over this layer and it involves application logic of the entire system, e.g. user registration or test checking. This is the layer, which manages communication between presentation and data layers. The presentation layer is uppermost layer and it introduces visual part of the system.

Data like number of group and information are stored about study group. Following information is stored about students: name, surname, login, password, number of group into, that he/she is registered and information about, if registration has already been confirmed by lector.

Instructors have possibility to add new chapters into course, remove chapters from course and create and edit content of individual chapters through web interface. For on-line creating and editing used open source HTML editor, that allows adding pictures and animations into text.

Nowadays it is very popular to use XML (eXtensible Markup Language) language for data description; therefore it was selected as format textual file for saving questions and answers of tests.

At test execution, questions are randomly selected; they are organized and displayed as a form. After the test is evaluated, green or red stars will be given for correct or incorrect answers. Question is considered to be right, if only all right answers were marked (see Fig. 3.).

**X 1. Procesy sú jednoznačne identifikované pomocou čísla:**

- \* ☐ PIN
- \* ☐ PID

**X 2. Každý proces po jeho vytvorení obsahuje:**

- \* ☐ jedno vlákno
- \* ☐ dve vlákna
- \* ☐ tri vlákna
- \* ☐ jedno vlákno, ktoré sa nazýva primárne vlákno

**✓ 3. Čo je to PCB?**

- \* ☐ riadiaci blok procesu
- \* ☐ kontrola stavu procesu

**X 4. Označte správne tvrdenia:**

- \* ☐ proces je jednotka vo vnútri vlákna
- \* ☐ procesy môžu vytvárať ďalšie procesy
- \* ☐ vlákno je jednotka vo vnútri procesu

**✓ 5. Proces je:**

- \* ☐ program v štádiu vykonávania
- \* ☐ pasívna jednotka
- \* ☐ aktívna jednotka

Fig. 3. Checked Test

Exemplar programs are created in C# programming language, whereby access of this language into Win32 API is realized through P/Invoke (Platform Invoke) [3–5].

Example for rewriting declaration of Win32 API functions into C# language is as followed:

Declaration of function *SendMessage* in Win32 API:

```
LRESULT SendMessage(HWND hWnd, UINT Msg,
                    WPARAM wParam,
                    LPARAM lParam);
```

Declaration of function *SendMessage* in C# language:

```
[DllImport("user32.dll")]
public static extern int SendMessage(
    IntPtr hWnd,
    UInt32 Msg,
    IntPtr wParam,
    IntPtr lParam);
```

Content consists of the following chapters:

1. Win32 API - Common information about this application programming interface. Functions and data types, which provides Windows for programmers.
  - Win32 API and .NET - described techniques how to use Win32 API functions in C# language are in this subhead.
2. Processes - Definition of the process, process management in OS Windows. Students can learn working with process - create, start, stop and terminate them.
3. Threads - This chapter deals with work with threads.
4. Inter-process communication – this chapter describes in greater detail communication facilities, that allow communication between processes are described and comprised in this chapter. individual facilities, e.g. shared memory, pipe, mail-slot and communication by messages.
5. Process synchronization - This part deals in general with synchronization objects. Its subheads describe practices, how it is possible to synchronize interaction between process by semaphore, mutex and event.
6. File system - functions for working with file system are presented in this chapter.
7. Memory management - Last chapter deals with work with memory: how to read from and write into this.

## 5. CONCLUSION

Information and telecommunication technologies bring new and wide possibilities for education process. Above all, distance and online educations come as the greatest challenge of today. The goal of this work was development of an e-learning system that should serve especially for informative purposes. From this reason, security of system is (such as saving IP addresses into database on student log on, block multi log on the same student etc.) not dealt with.

The result of this work is a complex e-learning system, which can be implemented as an independent system, or as a module of already existing system. This e-learning system is an open system, which allows addition of new chapters

and educational materials into course. Moreover, it may be used to support teaching e.g. in Operating systems subject.

In the future it is possible to extend this system with course management, which will allow the addition of new trainings or courses.

## REFERENCES

- [1] Kontis e-learning, part 1, 2, 3 [online], 2007-2-19, Available on internet: [http://kontis.sk/uvod\\_proc.asp?menu=elearning&submenu=proc](http://kontis.sk/uvod_proc.asp?menu=elearning&submenu=proc) (part 1), [http://kontis.sk/uvod\\_coje.asp?menu=elearning&submenu=coje](http://kontis.sk/uvod_coje.asp?menu=elearning&submenu=coje) (part 2), [http://kontis.sk/uvod\\_prinos.asp?menu=elearning&submenu=prinos](http://kontis.sk/uvod_prinos.asp?menu=elearning&submenu=prinos) (part 3)
- [2] Development Guides: Windows API, [online], 2006-10-11, Available on internet: <http://msdn2.microsoft.com/en-s/library/aa383750.aspx>
- [3] P/Invoke, [online], 2006-10-11, Available on internet: <http://pinvoke.net/>
- [4] Mueller, J. P.: .NET Framework Solutions - In Search of the Lost Win32 API; Sybex, 2002, ISBN 0-7821-4134-X, pp. 6-43.
- [5] Roman, S.: Win32 API Programming with Visual Basic, Fourth Edition; O'Reilly, 1999, ISBN 1-56592-631-5, pp. 139-237.

[6] AJAX: Getting Started, [online], 2007-3-6, Available on internet:

[http://developer.mozilla.org/en/docs/AJAX:Getting\\_Started](http://developer.mozilla.org/en/docs/AJAX:Getting_Started)

[7] Ajax Tutorial, [online], 2007-3-6, Available on internet: <http://www.xul.fr/en-xml-ajax.html>

[8] Perry, B.W.: Ajax Hacks; O'Reilly, 2006, ISBN 0-596-10169-4, pp. 8-22.

[9] Zakas, N.C., McPeak, J., Fawcett, J.: Professional Ajax; Wiley, 2006, ISBN 0-471-77778-1, pp. 36-48.

## THE AUTHORS

### **Viktor Krajnýk:**

#### Education:

2002-2007 Faculty of Electrical Engineering and Informatics, Technical University of Košice  
1998-2002 Grammar school in Kráľovský Chlmec

#### Employment history:

April 1<sup>st</sup> 2006 - May 31<sup>st</sup> 2007 GNT Systems, s.r.o., programmer in Visual Basic.NET  
Additional work experiences particularly in school projects.

**Igor Sivý:** was born in 1960. He received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 1988. He works as an assistant professor at the Dept. of Computers and Informatics, Technical University of Košice. His research interests include operating systems, e-learning systems and intelligent tutoring systems.



## LEARNING MANAGEMENT SYSTEM “AGAPA” AS AN INSTRUMENT FOR BUILDING OF INFORMATION-EDUCATIONAL AREA

Andrii Striuk

Kyryvyi Rih Technical University; XXII Partz'yizd st., 11, room 219, Kyryvyi Rih, 50027, Ukraine;  
+380674996795, andrey\_stryuk@mail.ru,  
<http://op.ktu.edu.ua:8080/webpage.php?name=Andrey%20Stryuk>

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The paper deals with a comprehensive approach to educational process support both at universities and enterprises. The “Agapa” LMS makes it possible to create a complex information-educational area. The “Repository” module as an instrument for data accumulation is the basis of that area. The results of the “Agapa” LMS application at the universities and enterprises are shown.

**Keywords:** distance education, Learning Management System, repository, information-educational area.

### 1. INTRODUCTION

High dynamics of development of modern science and technology, and also the rigid requirements of labour markets, generate problems of specialist training, both at the university and enterprise levels. Educational institutions have a great demand for technologies which would allow them to keep up with modern rates of knowledge accumulation.

This problem can be solved by the development and introduction of a program complex which allows them

- to create structured storehouses of data;
- to support traditional and remote educational processes;
- to create a communication network inside the organization (high school or the enterprise);
- to supervise and control the educational process.

Integration of all these functions in one software product creates the prerequisite for construction of a complex information-educational area inside an enterprise or university. The learning management system (LMS) “Agapa” (<http://www.agapa.com.ua>) is such a product.

### 2. HISTORY OF «AGAPA» LMS WORKING OUT

The work on the «Agapa» learning management system began, when the “AV-Consulting” company (<http://www.av-comp.com.ua/>) faced the problem of operative personnel training and retraining. The company’s basic objective is developing of information technologies. Therefore the company required highly effective tools for gathering and structurizing of new information, and also the creation and development of training courses based on this information. Numerous structural divisions and their remoteness from each other had required the use of distance learning and educational process control systems. It had also been necessary to create a multilevel communication environment both inside the enterprise and beyond its bounds to support its work with partners and clients.

The studies of existing software products have shown that none of them solve all the problems. Leading experts in various areas, including psychologists, teachers and engineers, took part in the creation of software that could meet the requirements both of educational institutions and enterprises.

It has taken more than two years to develop a software product named «Agapa» LMS. As a result we have developed a system which includes the educational complex, communication environment and information control system. At the beginning of 2005 the system was tested and introduced in the “AV-Consulting” company, and at the end of 2005 the system was applied in Kyryvyi Rih Technical University to create the University Educational Portal (<http://op.ktu.edu.ua>). Initial results have shown a high system effectiveness both in professional training at the enterprise, and for comprehensive educational process support in a higher educational institution. The system’s effectiveness is achieved by the creation of the complex information-educational area at its base which combines knowledge and experience of every staff member in a powerful intellectual potential of the organization.

### 3. STRUCTURE OF INFORMATION-EDUCATIONAL AREA OF AN EDUCATIONAL INSTITUTION

The structure of the information-educational area created on the basis of «Agapa» LMS is shown on fig. 1.

According to its functions the information-educational area can be divided into the following components:

- the common information area (consists of the modules operating the common information for the institution, e.g. news, messages, etc.);
- individual information area (an information field for each user of the system);
- educational information area (the training and educational process control modules).

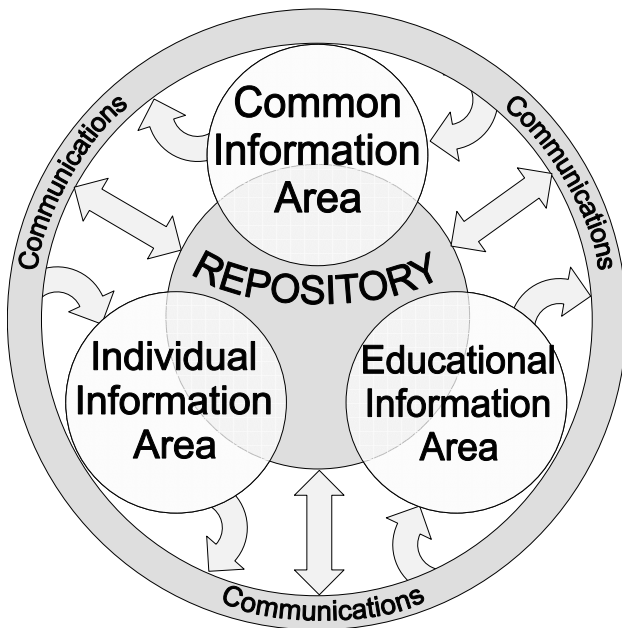


Fig. 1. The common structure of information-educational area of an educational institution

The base of information module is designed for structured accumulation of various data, objects and their management and is called the "Repository". The repository is a universal module and its objects can be used both for construction of the common information area and for support of individual and educational areas.

System integrity is provided by the multilevel system of communications which accomplishes an effective information interchange inside the whole information-educational area.

#### 4. COMMON INFORMATION AREA STRUCTURE

The common information area (fig. 2) is based on the modules which are generally a part of content management systems.

The "Messages" module makes it possible to utilize the lists of the brief information reports which contain important announcements for users.

The "News" module operates a newsfeed, allowing the structure of news in categories, allocates headings, the brief and full text of news, and contains tools for automatic newsfeed to subscribers and for the exchange of news between various portals.

The modules which make it possible to create general image and file collections also belong to the common information area. These collections can be applied by any user to construct the pages of individual, educational or common information areas.

Group structures which also are parts of the common information area, are used to display a hierarchical structure of the organization – a university or enterprise.

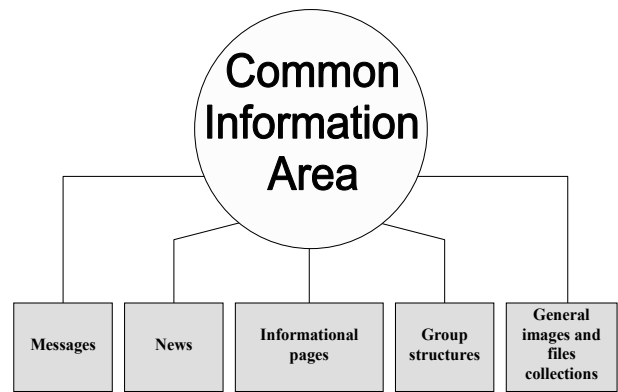


Fig. 2. Structure of the common information area

The system allows the flexible accommodation of the modules and controls the conditions of their display in order to easily adapt its appearance for specific conditions of «Agapa» LMS application. There is also the ability to create any quantity of additional information pages such as filling the common information area.

#### 5. USER'S INDIVIDUAL INFORMATION AREA STRUCTURE

Each user registered in the system has at their disposal the modules allowing them to create their own individual information areas (fig. 3) which are a basis for communication interaction with other users of the system.

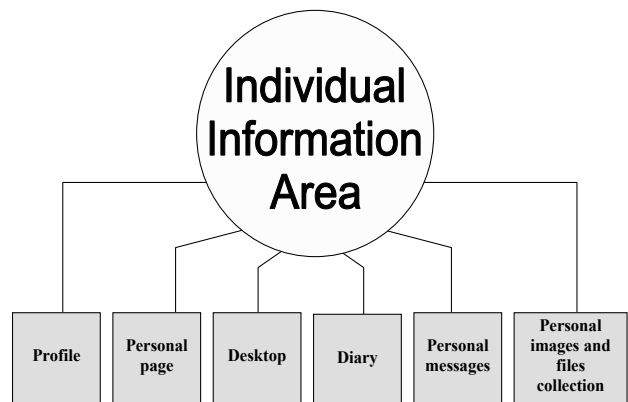


Fig. 3. Structure of individual information area

The user's profile is created from his or her personal data entered at registration. The user then gets an opportunity to create his or her personal page which is the user's visit card in the system. The user can also adjust the "Desktop" inside the system, making it more convenient to perform daily tasks. Also at the user's disposal there is a "Diary" which allows the user to make notes, and a "Scheduler" which reminds the user of important events. The «Personal messages» module represents a powerful mailing system which supports dialogue inside the system. Every user can create his or her own collection similar to the common collection of images and files, but these files and images

will be accessible only to the user. The user can use these objects in his or her personal pages, messages, training courses, etc.

The application of the "Agapa" LMS at the Technical University has shown the huge potential of personal pages and the other individual area elements in increasing student motivation and providing an individual approach to each of them.

## 6. EDUCATIONAL INFORMATION AREA STRUCTURE

The most important component of the information-educational area is the set of modules, which allows training and the operation of the educational process. These modules comprise a separate educational information area (fig. 4).

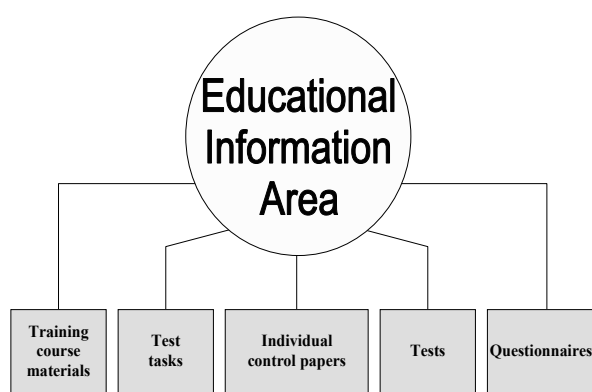


Fig. 4. Educational information area structure

Training course materials are the base of the aforementioned area. The course module has a powerful set of devices to create and manage the structure of educational sections, and also their contents.

A powerful test subsystem provides control of a student's progress. It is possible to allocate within it a module for the creation of test tasks and a module for test formation on their basis. The "Individual control papers" module provides supervision of the student's practical skills. In some cases the teacher can use questionnaires as well. However, questioning can have a universal character and can be used not only in knowledge control but also for other purposes.

The educational process monitoring can be carried out at any level by means of a special module. The teacher or the manager may receive a detailed report on any user or group of users for a certain period, having included in this report only those kinds of activities in which he or she is interested at the moment.

## 7. REPOSITORY

Accumulation of various information objects and their management is carried out by means of the "Repository" special module (fig. 5).

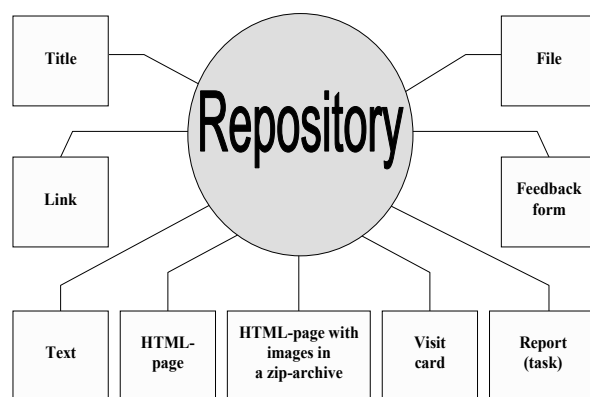


Fig. 5. Repository objects

The following objects can be installed in the repository:

- Titles (discriminating separate structural branches from others, but not bearing in itself additional information, except the name of these branches);
- Links (simple links to other pages inside the system or on the Internet);
- The simple text (contains the text information, probably manual html-formatting of the text);
- HTML-Page (the attached external html-page);
- HTML-Page with images in a zip-archive (the attached external archive containing html-page and images used in it. When the object is addressed, the archive will be unpacked, and contents of html-page will be displayed);
- The Visit Card (the form with the information on this or that person);
- The Report (the form for automatic reporting on various kinds of works);
- The Feedback Form (the form for operative transfer of messages to the administration);
- The File (any file e.g. MS WORD document, presentation, video clip, etc.)

Each of these objects can be used to form information blocks in the common, individual and educational areas. Thus, the repository is the base for the construction of each of them.

An ability for the flexible distribution of access rights to separate sections, branches or objects of the repository is of great importance as it allows each system user to contribute in the construction of the information-educational area without risk of breaking its integrity or damaging the work of other users.

## 8. CONCLUSION

The «Agapa» learning management system is constantly developing; new modules are being added and the capabilities of already existing ones are being extended. Thus everything is being done to fulfill any demand of a user and to make the system more convenient and functional. Operational experience has shown, that «Agapa» LMS already perfectly copes with its primary goal i.e. the creation of the complex information-educational

area. For example, within the parameters of this area Kryvyi Rih Technical University has acquired:

- A qualitative interactive web-site;
- A system of comprehensive support for the traditional educational process;
- A system for the organization of distance learning;
- A communication network which is connected with various university departments;
- An accounting and storage system for methodical literature, research papers etc.

"AV-Consulting" company and other enterprises which have introduced «Agapa» LMS, also have received a set of devices for quality training of employees and the evaluation of their qualification.

Gradual expansion of «Agapa» LMS among the enterprises and universities of Ukraine has created conditions for the construction of a uniform information-educational area which would become a basis for the closer cooperation of various higher educational institutions and companies. There is no doubt that such cooperation can enrich all participants. The first step has already been made.

## 9. REFERENCES

- [1] Kukharenko V. M., Rybalko O. V., Syrotynko N. G. Distantniyne navchannya: Umovy zastosuvannya. Distantniyni kurs: Navchal'nyi posibnyk (Distance education: conditions of application. Distance course: a manual), 3-e vid./Za red. V. M. Kukharenko – Kharkiv: NTU «KhPI», «Torsing», 2002.
- [2] Distantniyni navchal'nyi protses: Navchal'nyi posibnyk (Distance educational process: a manual)/ Za red.. V. Yu. Bikova ta V. M. Kukharenka – K.: Milenium, 2005.
- [3] Sistema distantniynogo navchannya «Agapa». Kerivnitstvo koristuvacha. Chastina persha: koristuvach-student (System of distance education «Agapa». A manual. Part one: user-student). – Kryvyi Rih, 2006.
- [4] Sistema distantniynogo navchannya «Agapa». Kerivnitstvo koristuvacha. Chastina druga: moderator-vikladach. (System of distance education «Agapa». A manual. Part two: moderator-tutor) – Kryvyi Rih, 2006.
- [5] Stryuk A. M. Dosvid pidvyshchennya yakosti navchal'noho protsesu za dopomohoyu zasobiv

distantniynogo navchannya. (The experience of quality improvement of educational process with the help of distance education equipment) // Rozvitok naukovikh doslidzhen' '2006: Materiali drugoi mizhnarodnoi naukovo-praktichnoi konferentsii, m. Poltava, 27-29 listopada 2006 r.: - Poltava: Vid-vo «InterGrafika, 2006. – T.8. – S. 56-60.

[6] Stryuk A. M. Organizatsiya samostiinoi roboty studentiv za dopomohoyu osvitynoho portalu universytetu. (The organisation of students' independent work with the help of the university's educational portal) // Problemy pidgotovky fakhivtsiv z napryamu «Inzhenerna mekhanika», Materialy mizhvuzivskoi naukovo-metodichnoi konferentsii, Kryvyi Rih: Vydavnychii tsentr KTU, 2006. – S. 12-15.

[7] Stryuk A. M. Formuvannya yedynoho informatsiinoho prostoru universytetu yak instrument pidvyshchennya yakosti navchannya (The formation of a unified information area of the university as an instrument of quality improvement of education) // Informatsiyni tekhnologii v naukovikh doslidzhennyakh i navchal'nomu protsesi: Materialy II Mizhnar. nauk.-prakt. konf., m. Lugans'k, 14-16 listop. 2006 r., T.2. - Lugans'k, 2006. - S. 148-154.

## THE AUTHOR



**Andrii Striuk:** the senior lecturer at Kryvyi Rih Technical University and the methodologist at the distance education laboratory of the university. He is the author of a number of research papers on development and application of distance education technologies at universities and

enterprises.

## ACKNOWLEDGEMENTS

*I would like to thank my colleagues from the Distance Education Laboratory, Kryvyi Rih Technical University, and also the staff of "AV-Consulting" company who provided me with the necessary data and helped me to carry out the research.*

# SYSTEM OF DISTANCE EDUCATION AT SUMY STATE UNIVERSITY



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

Anatoliy Vasylyev, Tetiana Lavrik, Vladimir Lyubchak  
Sumy State University (SSU), 2, Rimskego-Korsakova Street, Sumy, 40007, Ukraine  
+380 (542) 33-00-24, rector@sumdu.edu.ua, metodist@dl.sumdu.edu.ua, lub@sumdu.edu.ua  
<http://www.sumdu.edu.ua>, <http://dl.sumdu.edu.ua>

**Abstract.** Development and introduction of distance education in educational system is one of the actual tendencies of society informatization process. Authors describe experience of introducing distance education in Sumy State University and characteristics of own tools used to organize learning activities of student in distance education form – system of distance education.

**Keywords:** distance education, distance course, system of distance education

## 1. INTRODUCTION

Following modern world tendencies Ukraine works out and realizes a number of state programmes directed to informational development of educational sphere. In the system of Higher School informatization processes become apparent in active development and introduction of distance education.

Scientific and methodical work carried out in the institutions of higher education contributes to formation of distance education in Ukraine. Such establishments can be distinguished among them: Kyiv Shevchenko National University, National Technical University of Ukraine “Kyiv Polytechnic Institute”, National Technical University “Kharkov Polytechnic Institute”, Sumy State University, Kharkov National University of Radio Electronics, Khmelnytsky National University, National Academy of State Government by the President of Ukraine.

There are different interpretations of the term “distance education” in home and foreign scientific and methodical literature. Using the notion of “distant education”, the authors of the article are guided by the following definition by Doctor of pedagogical science E.S. Polat (laboratory of distance education the Institute of the Contents and Methods of the Education of Russian Academy of Education): “The distance education – is interaction between a teacher and a student, and students with each other which reflects all peculiarities of educational process (aims, content, methods, forms of organization, educational means) and which is realized with the help of specific means of internet-technologies or other means that prove interactivity” [1]. Specific features of distance education are marked out from this term. They are physical remoteness of the subjects of educational process and use in the educational process of informational technologies that must be taken into consideration during introduction of distance education.

Practices of introduction of distance education in SSU and in others Ukrainian institutions of higher education shows that still a number of problems exist nowadays. The director of Methodology and Information Technologies of Education Institute of The Academy of Pedagogical Sciences of Ukraine, Doctor of technical sciences, professor V.Bukov marked out in his work main actual research

tendencies of distance professional education problems and divided them into five groups: psychological and pedagogical, computer-technological, administrative-organizational, financial and economic, juridical [2].

In the given article the authors present the system of distance education Salamstein worked out in SSU.

## 2. PROGRAMME AND METHODOLOGICAL SOLUTION OF DISTANCE EDUCATION REALIZATION IN SSU

Since 2002 distance education introduction programme for professional training for Bachelor’s degree in the following directions “Enterprise Economy” and “Applied mathematics” and “Engineering mechanics” has been started.

Experimental programme hypothesis: computer training aids use in the university educational process ensures educational activity results increasing of students that have no possibility to attend university regularly and also of day department and distant students under such circumstances:

- education organization as accomplished psychological and pedagogical process;
- distribution of all kinds of activity of the higher educational institute students on reproductive, heuristic and creative;
- automation with the help of computer environment of reproductive and partially heuristic educational activity kinds and also in case of need possibility of activity results self correction by students;
- creation for teachers time reserve for organization and realization of cognitive students activity of heuristic and creative kinds.

Experimental programme aim: to prove theoretically, implement didactic projection, to realize with the help of software and experimentally put on test the whole complex of computerized distance courses that provides educational service quality for people who can’t attend institution of higher education regularly; it would render assistance to individualisation of cognitive activity of day time and distant students.

Experimental programme tasks:

- to define more exactly pedagogical technology of distance education with computer aid that directed on students cognitive activity individualization and activation for university discipline of natural and mathematical cycle,
- to work out the whole complex of distance courses with computer aid for educational programmes of bachelors training on direction “Economics and business undertaking”, “Applied mathematics”, “Engineering mechanics”,
- taking into consideration in-class studies number reduction in distance form of education, provide with the help of computer aid operative, purposeful interaction of teachers and students which have no opportunity to attend university regularly;
- to check experimentally effectiveness of worked-out distance courses complex for cognitive activity individualisation and cognitive activity increasing of students;
- to realize with the help of software “Electronic dean’s office” for management of distant students activity;
- to investigate possibilities to use methodical materials on electronic media for educational process quality increasing on day and distant departments.

Experimental programme is intended to be introduced by stages till 2011.

Theoretical studies and analysis of functional capabilities by existing systems for distance education were the first step to realize the program of distance education introduction at the university [3-6]. Experience accumulated since 2002 allowed to work out our own system of distance education using our resources.

#### Characteristic of distance education system Salamstein

System of distance education (SDE) Salamstein is a system of educational process control and it allows to organize active academic and cognitive students’ activity giving them opportunity to devise their own educational trajectory. Academic and cognitive activity control means in SDE Salamstein are ways of educational material rendering and educational tasks definition.

Specific feature of SDE Salamstein is its multifunctionality, which provide:

- creation of distance educational courses and practical tasks of different kind (tests, simulators, interactive demonstrational and laboratory works, business games);
- organisation of students academic activity (from stage of registration in the system till completion of educational programme study);
- organization of tutor’s work on distance course working out and supporting ;
- clear distribution of user groups functional capabilities (administrator, teaching assistant, programmer, tutor, student, guest);
- built-in electronic message system with possibility of messages copy sending on e-mail;
- different educational programmes and groups forming, using united educational material database.

System of distance education has programme and methodical constituent. Such main modules are marked out in the programme constituent: registration module, module “profile”, control module, course devising module, course

teaching and class organization module, course learning tools.

Registration module. Registration module allows to organize independent users’ registration in the system. For the registration the user must indicate: last name, first name, login, personal e-mail. The user should activate his account. Data for account activation is sent on e-mail, which user has pointed. The system itself generates a password; the user doesn’t chose it himself. Generated password is sent to user’s e-mail for registration. The system doesn’t store passwords in open type, that’s why if the user loses his access password a new one is generated.

After registration the user enters personal biographical particulars. Some part of this information may be accessible for shared review. The user defined fields available for shared review himself.

Module “user profile”. Module “user profile” contains such functional submodules:

1. list of modules that are available to particular user;
2. personal information (entering information about oneself, password changing);
3. list of users with whom the user can contact;
4. internal message system.

Internal message system serves for asynchronous communication between the system Salamstein users. Internal message system interface is similar to well-known mail programmes. Let’s mark out its main features:

- messages receiving and storing in virtual directories (inbox, sent, trash)
- messages creation and sending;
- one enclosure in the message is allowed;
- theme, date and author sort of user’s messages.

Class organization module. Class organization module or module “training class” allows to realize particular educational discipline learning and students and teachers interaction while its study. A training class is a structural union of such elements: particular educational materials version in discipline, users (class participants) roles list, discipline study schedule (well-ordered tasks, rules and its due dates list).

Module “training class” includes such functional submodules:

1. Class title page contains course goals and objectives, study algorithm, course study terms, type of final control, instructions on final control.
2. Information about class participants (student, tutor, teacher).
3. Lecture material review.
4. Means of practical tasks fulfilment.
5. Means of fulfilled tasks results review.
6. News and announcements.
7. Web-recourses references on training course themes.
8. Means of educational materials discussing.

The server part of these tools is a Web-application elaborated with open-source software. Interactive simulations and virtual multimedia models use modern Web-technologies, such as Java, Shockwave Flash, VRML (<http://dl.sumdu.edu.ua/demo/>).

SDE capabilities for users. Worked out system of distance education has a number of functional capabilities for a tutor, a teaching assistant, a programmer and a student. Clear definition of rights and duties of different users give an



opportunity to join each user to one of the groups: an administrator, a creator (programmer), a teaching assistant, a tutor, a student, a guest (<http://dl.sumdu.edu.ua/news/2006-12-13.shtml>).

Such main possibilities are singled out for a tutor supporting student distance educational process: giving students results reports, text editing and improvement, putting announcements for educational group, time schedule forming for given discipline, communication with students with the help of internal message system. A teaching assistant apart from these functions has possibility to review detail statistics of students' and teachers' attendance statistics.

### **3. STUDENT EDUCATIONAL ACTIVITY ORGANISATION IN THE SYSTEM OF DISTANCE EDUCATION**

Methodical constituent contain more than 120 distance courses for the time being. A distance educational course is a set of lecture materials, test tasks, simulations, electronic reports, multimedia virtual models that appear in collaboration of tutors, coders and methodologists.

The whole basic material is given in the lecture block of the distance course; it allows to save time on searching for academic books and to pay attention to others kinds of work. But it doesn't mean that a student shouldn't use additional printed or electronic literature in the distance education process.

Tests reflect all dominant positions of lectures material and appear to be an important element in the process of cognitive activity of the student on perception, comprehension, memorization of educational material. Its main aim is organisation of purposeful comprehension of the main theoretical positions, rather than checks of their mastering. Tests perform educational function as well as correction one. For realization of the correction functions to student is given several attempts of the test passing, as well as possibility of the purposeful address to theories (hyperlinks on lecture material are given to student). Thus while working with tests student can choose his own educational trajectory, according to which he works with lecture material and tests blocks.

Simulators – is an interactive computer model, which realizes the algorithm of the standard problem solution. We shall point out the following advantage of the simulator use:

- 1) skills shaping and habits acquiring while performing the practical tasks;
- 2) student gets the speeded signal about correct (incorrect) action, which according to theory opposed to Anohin P.K. apherentation stimulates further search activity;
- 3) contributing the element of newness of educational process organization in educational activity that promotes the cognitive activity activations;
- 4) possibility to correct the mistakes on one's own;
- 5) individual rate(speed) of the tasks performing.

In simulator student gets orientation on problem solution that is realized in the form of instructions on the action that should be done, there are also additional questions which can help. Simulator structure provides also possibility to get consultations of the teacher on separate action and step of

the solution. At this point are realized simulators, which correspond to the standard calculation problem and account to the student under successful performing automatically. The other type of simulator corresponds to analytical and creative problem and such simulators require teacher checking.

Multimedia virtual works are peculiar computer models, which are similar to traditional practical or laboratory studies. At that, the student is given all condition for virtual reflections of the processes, which take place in the real world. Multimedia virtual works give not only information, but allow also to form the skills and habits. At the same time during work checking of theoretical material mastering is fulfilled.

Multimedia virtual works consist of several parts:

- 1) summary of theoretical material, required for carrying out of the educational study;
- 2) educational study of the certain phenomena, process, device etc;
- 3) analysis of received experimental results.

Possibility of returning to theoretical part of material and redoing of the work is also excellent feature of the multimedia virtual works.

Distant students educational activity means that a student has computerized work place and access to Internet.

Student get individual password to SDE educational courses that is provided according to curriculum.

During academic year student continues to work with given educational materials, keeping to timetable. Timetable is given to student with the purpose to help him to organize his educational activity. All tests, simulator and others tasks passing results are stores in the database and always available to student as well as to teacher. Successful passing of all given tasks is condition of admission to final check-up (credit, credit with mark, examination) that take place in the university.

Student during academic year communicates with teachers and methodologist with the help of e-mail.

Set of examinations take place twice a year. Winter set of examinations means final test passing on the base of distant education base station as well as credits and rating passing in distant form.

During summer set of examinations if student has access he sits for examinations and credits with marks before teacher personally.

For every distance course the following aspects are defined:

- 1) a group of students who learn it; 2) a tutor supporting this course; 3) a teaching assistant that cooperates with a tutor.

### **4. CONCLUSIONS**

As practice shows during work with system appear necessities in working out of new functions. As the system is being developed by programmers in the Laboratory of distance education, it makes possible to improve and develop it constantly at the expense of our own recourses. At the same time the theoretical study of the adaptive system of distance education control with the intellect elements is carried out by the branch of UNESCO chair "New Information Technologies in Education" under the direction of Prof. Krasnopoyasovsky A.S.

Presented system of distance education now is realised in SSU for distance educational form. It is planned to apply the system for students of other educational forms in future.

## 5. REFERENCES

- [1] Дистанционное обучение: теория и практика // В.И. Гриценко, С.П. Кудрявцева, В.В. Колос, Е.В. Веренич. – К.: Наукова думка, 2004. – 375 с.
- [2] Биков В.Ю. Структура актуальных напрямів (тематик) досліджень проблем дистанційної професійної освіти // Вісник Академії дистанційної освіти, 2003. - №1. - С. 22-26.
- [3] N.N. Lugovoy A system for offline support of distance courses // Information Technologies Management and Society: The 3rd International Conference Information Technologies and Management. - Riga, 2005. - p. 66.
- [4] A. Piven, E. Kупenko Preparation of university teachers for creation of distance courses // Internet - Education -

Science - 2004. Proceedings of the Fourth International Conference. - Vinnytsia: UNIVERSUM, 2004. - p. 176-178.

[5] V. Lyubchak, O. Silka, M. Slipushko Virtual Multimedia complex as an addition to traditional physics laboratory experiment // Information technologies at school: The 2nd International Conference "Informatics in Secondary Schools: Evolution and Perspectives". – Vilnius, 2006. – p. 263-269

[6] V. Lyubchak, N. Mulina, O. Sobaeva Active learning implementation in the regional distance learning // Second International Conference on Multimedia and Information & Communication Technologies in Education (m-ICTE 2003). - Badajoz, 2003.

## THE AUTHOR(S)

1. Anatoliy V. Vasylyev, Professor, Ph.D. (Technical sciences), Rector
2. Tetiana V. Lavrik, department of distance education
3. Vladimir V. Lyubchak, Professor, Ph.D., Vice-rector



## WEB BASED AUTHORIZING/TEACHING TOOL FOR E-LEARNING WITH USE OF 3D USER INTERFACE

prof. Ing. Liberios Vokorokos, PhD., Ing. Branislav Madoš,  
Department of Computers and Informatics, Technical University of Košice,  
Letná 9, 041 20 Košice, Slovak Republic.  
E-mail: [Liberios.Vokorokos@tuke.sk](mailto:Liberios.Vokorokos@tuke.sk), [Branislav.Mados@tuke.sk](mailto:Branislav.Mados@tuke.sk)

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract:** This article deals with the work in progress on Internet/Web based authoring/teaching tool for e-learning with use of visual 3D user interface in authoring/teaching tool and distributable learning objects (DLO). The emphasis is on the possibility of collaborative work in the phase of creation of knowledge base and innovative structure of visual 3D user interface as well as communication and socialization opportunities for students. Knowledge base comprises of taxonomical units definitions, relations between units and multimedia represented by pictures and diagrams, video and audio files. Authoring tool is aimed to manage work of groups of authors on knowledge base and to allow interactions between authors and students. The article introduces the idea, implementation details of this Internet/Web based tool, learning content management system of the tool and developed visual 3D user interface.

**Keywords:** Authoring tool, Collaboration, E-learning

### 1. INTRODUCTION

The alternative choices for classroom learning are evolving over the decades. With distance learning in form of corresponding courses in which printed materials were used in the beginning, through the radio and television courses in the past into new, more interactive and effective form which combines use of computers and telecommunications in our presence. Today, not only easy delivery of learning materials is possible, but also interactive, two-way capabilities of audio and video conferencing can be used.

The development of the internet and easy accessibility of internet network with popularity of World Wide Web is powering the use of e-learning in education. E-learning represents opportunity to expand access to education beyond schools and universities and allows cost-effective distribution of education to the broad audience. Corporations are able to educate employees without travelling, lost of productivity and other expenses. There are possibilities to deliver learning materials to previously unreachable students, in different geographical and cultural environments and in the previously unreachable forms.

The content of learning object is, however, in many cases, copying the structure and content of paper based teaching material, adding multimedia represented by video and audio content, but lacks interactivity. There is drop of students from courses and many educators feel that this measure is unacceptable and can be overcome by interactivity Anido et al. [3] and socialization of students which was investigated by Ozturk and Mutlu [4]. The interactivity and socialisation in the World Wide Web environment can be understood as an interchange of messages and communication in various forms.

Authoring/teaching tool introduced in this paper is addressing this problem. It is specialised tool for collaborative work on definitions of taxonomical units in encyclopaedic approach. It disposes with interface for students and it allows students not only to study but also to participate on creation of learning materials. Authoring/teaching tool allows teacher-teacher, teacher-student and also student-student interactions through the various communication forms like posting of comments, discussion boards, chat, mailing lists and others.

Virtual 3D user interface is developed in this project to allow interactively navigate through the content.

### 2. GENERAL CONCEPT

In the centre of the scope is effort to build platform for collaborative work on the definitions of taxonomical units in encyclopaedic approach with strong emphasize in implementation of relations between those taxonomical units.

Formal description of relations between taxonomical units is the base for creation of visual representation in virtual 3D space, which is also used as a visual user interface of authoring/teaching tool. Visual 3D user interface is also main navigation system of the tool. It allows to navigate interactively through the knowledge base and to see additional information represented in textual, pictorial, audio and video form.

The strong emphasize is also on the collaboration of authors in the phase of definitions of taxonomical units creation and students in the phase of study of this teaching material. Students are also able to communicate with authors and to comment definitions and relationships and

participate in this way to the process of iterative content creation.

Architecture of this authoring/teaching tool is designed in terms of the KEGA project No.: 3/4203/06 on the Department of Computers and Informatics, Technical University of Košice.

### 3. IMPLEMENTATION DETAILS

Three layers architecture is used in this authoring/teaching tool. Common base of knowledge represented by definitions of taxonomical units and relations between them is stored in database and additional multimedia files are stored in repository. Separate application and presentation layer for administrators and content authors on the one side and students of learning content on the other side is used. (Fig. 1).

Implementation of this authoring/teaching tool is using Apache server. At the backend is used MySQL database and JAVA and PHP is used in application layer. SQL query language is used to access stored information. Presentation level is HTML based, with use of CSS.

Client/Server architecture allows to access authoring/teaching tool via internet with use of the web browser. Student's interface allows creation of distributable learning objects, in which the knowledge base is stored with use of XML.

Author's user interface allows WYSIWYG browsing and editing of knowledge base, while student's interface does not allow making changes of knowledge base.

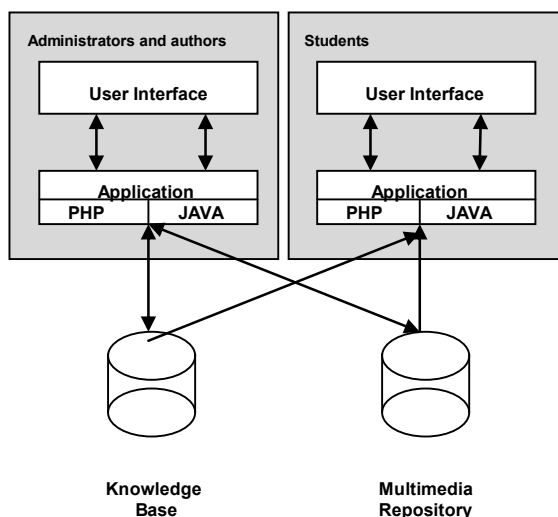


Fig. 1. Structure of authoring/teaching tool

### 4. USER LEVELS

Users of this authoring/teaching tool are divided into four levels according to their tasks and competences:

- Administrators – the role of administrators is to maintain application and users accounts and assign privileges.
- Authors – the role of authors is to create definitions of taxonomical units. Authors are in the role of commentators only, to the taxonomical units created by another authors, and do not have privileges to change definitions, relations and another related content. Authors are allowed to use all integrated communication tools.
- Students – users in the role of students are allowed to study published content without ability to change of the content, but are allowed to comment and to use all integrated communication tools to communicate with other students and also teachers.
- Guests – not registered users are in the role of guests and have restricted access to the system. They are allowed to study published content, but they are not allowed to comment it. Guests do not have access to integrated communication tools.

### 5. CONTENT MANAGEMENT SYSTEM

The Content Management System (CMS) of this authoring/teaching tool allows to create content by authorised authors only. In the relation to the taxonomical unit only one author is allowed and can change the content and is responsible for textual definition of this unit and definition of relations to other units and other related content. Other authors and students are only in the role of commentators and can comment the content but cannot change it. CMS has main functions:

- Login for authorised administrators and authors and also for students they are registered and have access to integrated communication tools and can comment content.
- Administration section for maintenance of users accounts, roles and privileges, with administrators, contributors, commentators roles on the authors side and students accounts on the other side. Administrative section is accessible only by users in the role of administrators.
- Tools allowing to create, edit and delete content are accessible only to author of respective taxonomical unit.

- Tool for allowing/disallowing visibility of definition of taxonomical unit and related content. The tool is accessible only by the author of the taxonomical unit and related content which visibility is considered.
- Tools for maintenance of comments and other communication capabilities. Tools are accessible by administrators and authors.

## 6. COMMUNICATION CAPABILITIES

Very important part of the system architecture is a set of tools for interaction and communication between users of the system. It consists of several communication tools:

- Posting of comments is the basic possibility how users of the system can annotate the work of another authors. Comments are bind to the taxonomical units and are very important in the process of content creation. Comments can be posted as publicly visible or private, visible only to author of the respective taxonomical unit definition and related content.
- Discussion boards and chat are the opportunities for users of the system to meet each other and to talk about the topics related with published content. There is a great opportunity for socialisation of students. Public and private communication is allowed.
- Mailing lists are established for possibility to send messages to all users, all authors or groups of authors, by administrators and authors of the content.

## 7. VISUAL 3D USER INTERFACE

The main part of layout of the authoring/teaching tool and distributable learning object is in this project designed interactive visual 3D user interface which consists of:

- **Text representations of taxonomical units** distributed in 3 layers.
  - Central layer displays central taxonomical unit and other units with synonym, congenial taxonomical unit and others relations.
  - Upper layer displays one or more parental or superior taxonomical units, with close relation to the central unit.
  - Lower layer displays one or more daughter taxonomical units with close relation to central unit.
- **Relations between taxonomical units** are represented

by vectors binding units in the same and different layers, with use of different colors for diverse relation types.

To allow interactivity and to ensure the best usability of the tool and understandability of displayed visual information delivered by 3D user interface, user is allowed to:

- Switch on and off visibility of upper and lower layer to enhance visibility of taxonomical units and their relations in central layer.
- Change interactively central taxonomical unit by click on another displayed taxonomical unit. Visual interface displays this taxonomical unit as a central unit and displays related units in their actual roles in all layers. (Fig. 2.).
- Change the point of view to see displayed information in different perspectives.
- Zoom in and out to customize number of displayed terms presented in one view and in all layers.

Visual user interface of authoring/teaching tool is designed in terms of the KEGA project No.: 3/4203/06 on the Department of Computer and Informatics, Technical University of Košice.

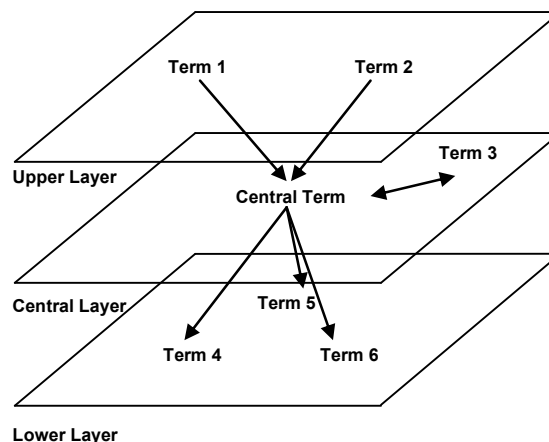


Fig. 2. Representation of terms in three layers of 3D space with represented relations of terms.

To enhance usability of user visual interface the full text search is implemented with possibilities to:

- Search with use of keywords as searching criteria for finding taxonomical unit.

- Search with use of keywords and additional criteria, for example relations type to another taxonomical unit, to find all taxonomical units with defined relation.
- Search with use of keywords within comments, discussion boards, and chats.

## 8. CONCLUSION

This article is a brief description of the work on authoring/teaching tool, which is useful not only for e-learning purpose but also for collaborative work of teams on definitions of taxonomical units with stress on exact, comprehensive and consistent definitions and use of taxonomical units in working groups.

In the future development of this authoring/teaching tool, the stress will be laid to enhance communication possibilities between users and in the phase of iterations of testing and improving find the suitable graphical representation of taxonomical units and their relations, with aim to find balance between amount of displayed information and its easy comprehensibility.

---

Supported by KEGA project No. 3/4203/06

## REFERENCES

- [1.] Vokorokos, L.: Digital Computers Principles, Typotex 2004. Budapest, 232 pages. ISBN 9639548 09X.
- [2.] Vokorokos, L., Látka, O., Chovanec, M., Kleinová, A.: Secure connection of database systems to the applications made by a standard MVC. In: SAMI 2006 : 4<sup>th</sup> Slovakian-Hungarian Joint Symposium on Applied Machine Intelligence : Herľany, January 20-21, 2006. Budapest : Budapest Tech, 2006. pp. 311-318. ISBN 963-7154-44-2.
- [3] Anido, L., Llamas, M., Fernandez, J. M.: Internet-based learning by doing. IEEE Transactions on Education, 44(2), 2001.
- [4] Ozturk, M. C., Mutlu, E. M.: An investigation of social interactivity in computer mediated communication. In 4th International Symposium Communication in the Millennium. CIM, 2005.
- [5] Elvheim., M: Supporting group work in distance education. In The Third International Conference on Extreme Programming and Flexible Processes in Software Engineering (XP2002), pages 204–205, 2002.
- [6] Khalifa, M., Lam, R.: Web-based learning: Effects on learning process and outcome. IEEE Transactions on Education, 45(2):350–356, 2002.
- [7] Mehlenbacher, M., Miller, C. R., Covington, D., Larsen, J. S.: Active and interactive learning online: A comparison of web-based and conventional writing classes. IEEE Transactions on Professional Communication, 43(2):166– 184, 2000.
- [8] Mori, T., Sato, T, Matsunaga, S.: The Development of Web-based Authoring System for Web Teaching Materials, Technical report of IEICE ET 2004-83(2004-12):61-66
- [9] Casade, G., Magnani, M.: Assesment Strategies of an Intelligent Learning Management System, International Conference on Simulation and Multimedia in Engineering Education, Orlando, Florida, January 19 - 23,2003

## THE AUTHORS

**Liberios Vokorokos**, (prof., Ing., PhD.) was born on 17.11.1966 in Greece. In 1991 he graduated (MSc.) with honours at the Department of Computers and Informatics of the Faculty of Electrical Engineering and Informatics at Technical University in Košice. He defended his PhD. in the field of programming device and systems in 2000; his thesis title was "Diagnosis of compound systems using the Data Flow applications". He was appointed professor for Computers Science and Informatics in 2005. Since 1995 he is working as an educationist at the Department of Computers and Informatics. His scientific research is focusing on parallel computers of the Data Flow type. In addition to this, he also investigates the questions related to the diagnostics of complex systems. Currently he is a member of the State Examination Committee in the field Computing engineering and Informatics. His other professional interests include the membership on the Advisory Committee for Informatization at the faculty and Advisory Board for the Development and Informatization at Technical University of Košice.

**Branislav Madoš** (Ing.) was born on 20.5.1976. In 2006 he graduated (MSc.) with honours at the Department of Computers and Informatics of the Faculty of Electrical Engineering and Informatics at Technical University in Košice. Since 2006 he is PhD. student at the Department of Computers and Informatics of the Faculty of Electrical Engineering and Informatics at Technical University in Košice and his scientific research is focused on effective interfaces in e-learning systems.



**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**New Roles of the Instructor & Learner**







## PEDAGOGICAL DIAGNOSTICS WITH USE OF COMPUTER TECHNOLOGIES

Lyudmyla Bilousova, Oleksandr Kolgatin, Larisa Kolgatina  
The Kharkiv National Pedagogical University named after G.S.Skovoroda, Informatics Chair,  
Artema Street, 29,  
Kharkiv-61002, Ukraine,  
E-mail: lib215@list.ru, kolgatin@ukr.net

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The technology of the automated pedagogical diagnostics is analysed. The testing strategy and marking algorithm is proposed. The software "Expert 3.04", based on suggested methods, is designed. The methods of administration of the database of the test tasks are proposed. Some tests on the mathematical topics are worked out with use of "Expert 3.04". The approbation of these tests in the educational process of the Kharkiv National Pedagogical University is carried out.

**Keywords:** E-learning, Diagnostics, Test.

### 1. INTRODACTION

Pedagogical diagnostics is the integral part of E-learning courses and realises a feedback that help the automated adaptive tutoring system, teacher and pupil to choice the most effective strategy of learning. Computer technologies give us possibility to organise the qualitative pedagogical diagnostics at new level. One of the most effective methods of the pedagogical diagnostics is testing.

Traditionally [2], [1], test data are processing to rank examinees according their educational achievements. Rating approach to test results interpretation is useful for professional selection of examinees, selection of pupils for bestowal. The modern theory of pedagogical measurement consider the test as a system of increasing difficulty tasks [3] that is the basis for design of the adaptive test systems such as "Teletesting" [4]. "Computerised adaptive testing dynamically selects items based on cumulative responses, to optimize estimates of trait, for example, degree of agreement or ability level of each examinee (Wainer & Dorans, 2000)" [5].

Modern automated systems, which can be qualified as expert systems, are capable to supply comprehensive algorithms of testing and analysis of the test results. However, the rating approach is not useful for the aims of the pedagogical diagnostics. It doesn't give necessary information for choice the strategy of learning in adaptive tutoring systems. It is not so important that a pupil know the matter better then others, it's more important – "what exactly this pupil know. In our opinion, the criterion orientated tests will be more useful for this purpose.

The unconditional value of testing is also its informative abilities. However, in practice the large part of the test information often isn't used. Testing with use of computers should allow a teacher to obtain the summary characteristics of knowledge and skills of the pupils' group in a whole and to use this information for correction of the own methods of teaching. A wide field of the scientific work is connected

with a study of such algorithms. So the **aim of our paper** is to design methods of the pedagogical diagnostics, which can be used in E-learning courses and are satisfying such demands:

- different forms of the intellectual activities of an examinee are attracting in process of testing;
- the automated system of the pedagogical diagnostics ensures its diagnostic abilities at wide differences of the examinees' mastering;
- processing of the test results provides maximum information for examinee and teacher to correct the strategy of E-learning.

### 2. OBJECTIVES

The **first stage** of an organisation of any pedagogical diagnostics is a construction of an idealised pedagogical model that is allocation of basic elements of knowledge and skills, as well as establishment of a level of its mastering.

The **second stage** represents creation of system of tasks, which cover all elements of knowledge and skills and all levels of their mastering.

We can't design test as a system of test tasks of uniform difficulty, in spite of recommendation of the classic test theory. Such approach was giving the best tests for discrimination of examinees into several groups. The test with uniform tasks has low validity for examinees with bad mastering, because of guessing answers. Validity of such test is also low for examinees with very good mastering for lack of attention. So it is certainly necessary to include tasks of different difficulty to the test.

How to design a test task of advanced difficulty? What is difficulty? Why some tasks are not solving the most of examinees?

We can't use tasks of the reproductive level as the tasks of advanced difficulty. There aren't difficult facts and easy

facts. Our educational process should be organised to provide steady knowledge of all compulsory facts. If the most of examinees don't know some compulsory facts, it means, that we should correct our teaching. We are against using tasks, which correspond to facts, which are fragmentary studied and which are not basic for the topic being tested. Therefore, all tasks, which correspond to the reproductive knowledge, must have uniform difficulty.

Some can increase the difficulty of task by combining several operations in this task. Such approach leads to increasing of influence of lack of attention on the results of the test, to necessity of using weight coefficients and to decreasing of the accuracy of measuring by the test. We are also against using tasks, which correspond to facts, which are fragmentary studied and don't form basis of topic being tested.

In our opinion, the task of advanced difficulty should be connected with using of more difficult, not reproductive kinds of the intellectual activities: executing of standard or non-standard algorithm, carrying of knowledge, etc.

Full and high-qualitative pedagogical diagnostics should be built on the system of test tasks of all levels: reproductive and productive. By analogy with levels of educational achievements, which are standardised by the Ukrainian Ministry of Education and Science [6] we propose such levels of the test tasks:

1 - Initial level - it is the very simple tasks, which assume the reproductive character of the student activities, mainly distinguishing. The difficulty index of these tasks is about 1, the most of the examined students execute these tasks correctly.

2 - Minimum level - it is the tasks, which assume the reproductive activities, these tasks cover all basic facts and unary skills according to curriculum. A database of the tasks of this level is designed the most naturally. According to the Ukrainian standards [6], the student can continue education, if he (she) knows not less than 50% of compulsory facts, which are determined by curriculum. So, by linear estimation, average index of difficulty must be near 75% for the reproductive tasks.

3 - Sufficient level - these tasks assume the examinee applies his knowledge and skills for solving problems in standard situation.

4 - high level - these tasks are practical problems, which assume executing of new algorithm, carrying of knowledge into new, non-standard situation, etc. These tasks lose problem nature, if the method of its solving was explained in the process of learning. Therefore, the database of the tasks of the level 4 requires continuous analysis and modernisation.

We propose the vector processing of the test results: separate calculation of the score for tasks of every level. It

allows to avoid the use of the artificial weight coefficients and to provide the comprehensive algorithm of adaptive strategy of testing and marking. We also propose the separate processing of the results for the test tasks according the elements of knowledge and skills.

Using computer for organisation of testing allows to analyse the examinee's results directly in process of testing and to suggest to the examinee the tasks, which mostly correspond to his (her) level of educational achievements. Such approach is often named as adaptive testing.

### 3. MODEL AND ALGORITHM

A choice of the tasks' level for start of testing is an important question of the adaptive strategy. Testing is usually started from the simplest tasks. Such approach promotes to decreasing of psychological discomfort and creates the atmosphere of competition, the feeling of growth according to complication of the tasks. Taking this consideration into account, we propose to start testing just from tasks of the level 2, which are the simplest for the examinees, which will obtain positive mark.

There is additional argument to choose the level 2 as the start level of testing. The test tasks of the level 2 reflect the compulsory facts of the study topic; these tasks can't be excluded from the test process. It is not worth while to start test from the tasks of the level 3, because productive and, especially, creative tasks are based on sufficiently wide spectrum of knowledge, and it is not always possible to detect, which exactly element of curriculum is not mastered by examinee. The tasks of the level 1 are oriented for students, whose mastering is not satisfactory, so there is no need to suggest these tasks to all examinees. Our testing strategy and algorithm of marking are presented on the fig. 1.

Here are some comments to fig. 1. The testing starts with the tasks of the level 2. Examinee solves the compulsory minimum of the tasks on the level 2, automated system calculates  $S_2$  - his (her) score on the level 2 and estimates the error of the score. If accuracy is enough, the automated system chooses a mark or increases the level of the tasks, which are being suggested to examinee. Otherwise, the tasks of the level 2 are being suggested to the examinee until the accuracy become satisfactory. It should be underlined that accuracy depends not only on the number of tasks, but it depends on the individual test score [7]. The necessary accuracy is also conditioned by the differences between the test score and the key points for decision about a rise of a level or a choice of a mark.

Testing on the levels 3, 4 and 1 is carried out by analogy with level 2 with scores  $S_3$ ,  $S_4$  and  $S_1$  accordingly.

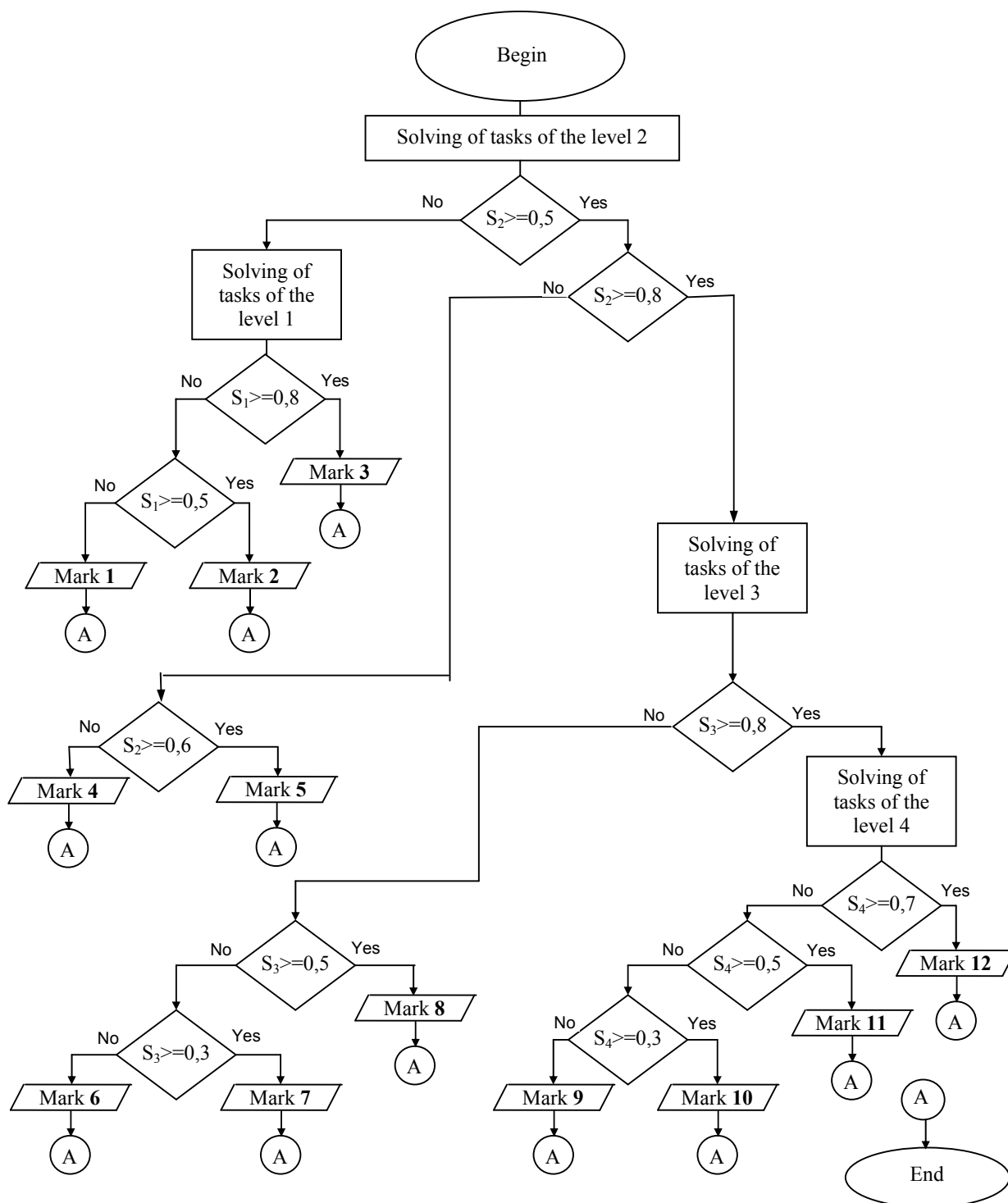


Fig. 1. The marking algorithm

Such algorithm of testing improves accordance between the level of tasks being suggested and the level of examinee's mastering. Influence of a lack of attention on the test mark for the examinees with an excellent mastering is decreased. The examinees with bad mastering solve easy tasks, which correspond to the most important parts of the educational matter. The psychological discomfort, connected with constantly incorrect answers, is excluded, but such easy tasks give possibility to determine the structure of the knowledge and skills on topics and discriminate examinees,

who has not mastered the compulsory minimum according to curriculum.

In any case the result of the pedagogical diagnostics will be more careful in comparison to testing without special selection of tasks.

### 3. SOFTWARE

The computer support of offered technology is provided with information system "Expert 3.04" designed by us as a distributed database in the MicrosoftAccess97 environment. The important advantage of our information system in our opinion is a modular principle of its construction, which allows the author of the test tasks (probably, with the help of the programmer) to create and to add to the database new forms of the test tasks. The central database of information system is the database of the test tasks. The test tasks are grouped by topics for convenience of viewing. The elements of an educational matter are picked out in each topic. To each element the author provides the comment for the student, who has not mastered this matter. Some blocks of the test tasks of a different level of difficulty are offered to verify of student's mastering in each element of an educational matter. The author specifies for the every block the test tasks' level (0-4), a weight factor and maximum time of exposition of one task. All tasks of the block should be of one type, that is, the identical dialogue form. The student will be offered one or several questions from each block by a casual choice in a process of testing. Quantity of blocks of the test tasks and filling of these blocks are determined by required quality of diagnostics.

The database, which contains the information on the answers of each examinee on each question, is formed by results of testing. This database includes such fields: the code of the test task, the correctness of the given answer, level of the test task, probability of casual guessing of a correct answer, time of solving of the task. The additional service information, for example, time and date of testing, examinee's mark etc. is also being stored.

The examinee receives by results of testing (fig. 2) the diagnostic data on each element of knowledge, chart, which reconstructs structure of his (her) knowledge, recommendations for independent work. The author receives the statistical analysis of the index of difficulty of the test task, its index of discrimination, factor of correlation of score for the test task with total result for all tasks of the test. The diagram of dependence of average difficulty of the test task from the examinee's total result gives very useful additional information (fig. 3). The author has an opportunity to generate inquiry by means of Access environment and to pass the data for the further analysis in spreadsheets.

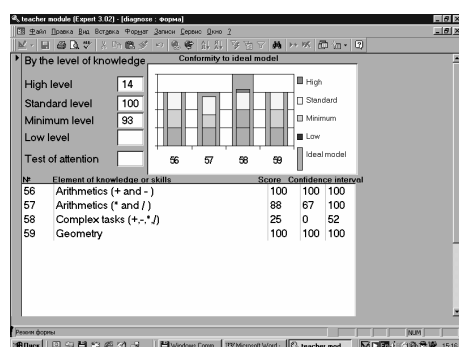


Fig. 2. Information for examinee about the structure of his (her) educational achievements

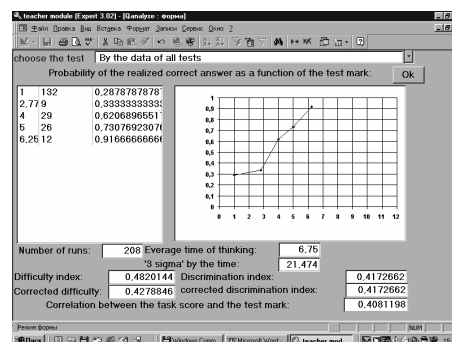


Fig. 3. Information for the test author about the statistical properties of the test task

### 4. PRACTICAL USE

We have prepared the system of the test tasks in the environment "Expert 3.04" on some topics:

- "Mathematical methods in psychology";
- "Binary coding";
- "Elements of the mathematical logic".

Now we are able to start **the third stage** of the preparation of the system of the pedagogical diagnostics - **approbation and verification** of the test tasks.

Our technology of verification is based on the requirements of the Standard of the Ukrainian Ministry of the education and science [8] and takes into account features of the automated pedagogical diagnostics.

The analysis of the test begins with definition of a level of educational achievements of the students on the basis of the expert's rating, for example, it may be a traditional examination. The complete procedure of verification assumes that such rating is determined by the experts irrespective of the test, which is being verified, and not so long ago, so as qualification of the students has not changed essentially. Approbation should be organised with enough number of examinees to guarantee sufficient number of answers for any test task. Determination of the student's rating by experts cannot be organised so often, as it is necessary for constant updating of the database of the test tasks. Therefore for the current verification it is possible to offer definition of a level of educational achievements with the help of the same automated system of pedagogical diagnostics and to check a correlation of the separate test tasks with integrated result of testing. In such case the approbation data are being collected continuously, including the independent work of the students with the automated system. Validity of the automated system of testing as a whole is checked through comparison of integrated results of testing with results of other kinds of the control: interview, examination, execution of practical works etc. For maintenance of reliability of the current verification the automated system does not include to the analysis the answers, which are received at testing of not registered

examinees: teachers and other users, whose names are not in the lists of the students groups. The answers of the test pass, which has not been finished in full, are not analysed too. The answers are not taken into account, if the time of its execution is smaller, than it is necessary for acquaintance with the text of the task. There is an opportunity to specify additional conditions of selection of the valid answers with use of the Access environmental (for example, date and time of testing, educational group, variant of the test etc.).

After distribution of the schoolboys according to their educational achievements the conformity of a level of the test task and its empirical index of difficulty is being checked. According to the requirements of the Ukrainian educational standards the schoolboy with an average level of educational achievement (the mark of 4 on the scale of marking with 12 levels) "... knows about half of educational matter, is capable to reproduce it, to repeat after the model the certain operation..." [6]. Just the tasks of the level 2 in our classification have such contents. Thus, the index of complexity of the tasks of a level 2 can not be smaller than 0.5 for such schoolboys. We consider allowable for the tasks of a level 2 on sample of the schoolboys with an average level of educational achievement an index of complexity in borders 0.5-0.9. It is necessary to note that such range of an index of complexity is not convenient from the viewpoint of improvement of test's statistical parameters. However, the database of the tasks of a level 2 represents a set of the facts of an educational matter, which are obligatory for study. Therefore, author of the tasks can't change its difficulty without change of the curriculum.

Thus, for the tasks of a level 2 on sample of the schoolboys with an average level of educational achievements we have such algorithm of analysis of the task quality:

- The task doesn't require correction, if the difficulty index within 0.5-0.9, the discrimination index is higher 0.25, that is, discrimination index satisfy the requirements of the standard [8] (see example on the fig. 4.).
- The difficulty index is more than 0.9. This test task should be analysed with the help of the diagram of dependence of difficulty from a level of educational achievements of the schoolboys. It should be determined, whether this task has the discrimination ability for the schoolboys with an initial level of educational achievements, accordingly, this task's level should be changed. Otherwise, this task should be removed from the test (see example on the fig. 5).
- The difficulty index is smaller 0.5, it is necessary to analyse the contents of the task, such situations are possible:
  - The task is not reproductive, its discrimination ability satisfy the requirements of the standard. It is necessary to change a level the task (see example on the fig. 6).
  - The task has low discrimination ability for all schoolboys, it means, that some mistakes in the formulation of the task take place. Such task should be removed or corrected (see example on the fig. 7).

There is possibility of the situation, when all experts agree that the task is correctly designed and satisfy the curriculum, in such case mastering of the schoolboys should be checked by some another method and, may be, the quality of educational process should be analysed.

For the tasks of levels 1, 3, 4 by the best will be a range of difficulty index 0.5-0.6 (allowable 0.3-0.7) on the sample of the examinees of appropriate level of mastering. The analysis of these tasks on a difficulty is carried out by analogy with level 2.

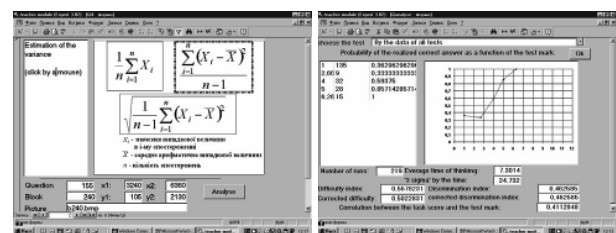


Fig. 4. A typical task of the level 2

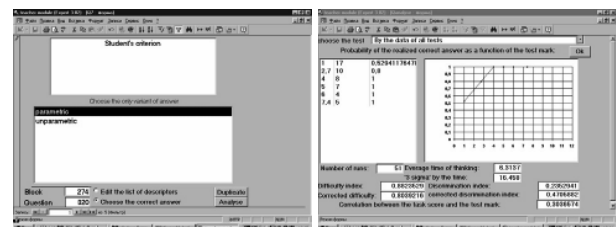


Fig. 5. A typical task of the level 1

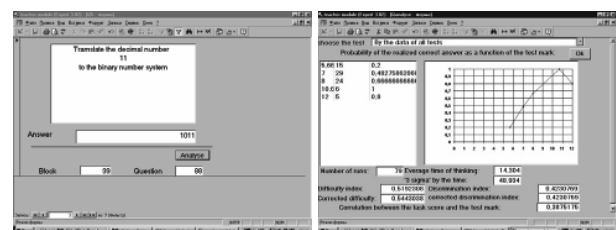


Fig. 6. A typical task of the level 3

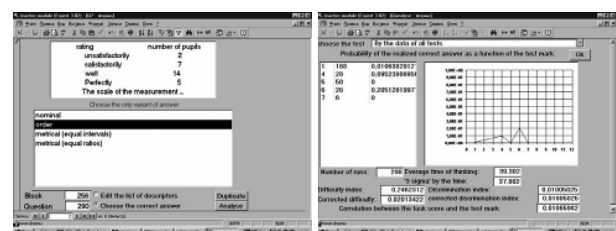


Fig. 7. An unsuccessful task

After finishing of three stages of preparation, the system of pedagogical diagnostics is ready for practical use. The stage of practical application of the system combines procedures of testing and statistical processing of the obtained results

including the interpretation of the results for students, teachers and authors of the test tasks. The expert system of pedagogical diagnostics needs in continuous modernisation of its database. Naturally, it requires return to previous stages of a work with system.

## 5. CONCLUSIONS

New comprehensive algorithms of testing and marking are suggested. These algorithms consider possibilities of the computer technologies and Ukrainian standards.

The methods of administrating the database of the test tasks is proposed and used in practice in the educational process of the Kharkiv National Pedagogical University.

The automated system of the pedagogical diagnostics is designed.

## 6. REFERENCE

1. Rozenberg N.M. Measurement problems in didactics. – Kyiv: High school, 1979. – 175 p. (RUS)
2. Brown Frederic G. Principles of Educational and Psychological Testing. – Hinsdale: Dryden Press, 1970. – 468 p. (ENG)
3. Avannesov V.S. Test tasks composition. – Moscow: Testing Center, 2002. – 240 p. (RUS)
4. Shmelev A.G., Beltser A.I., Larionov A.G., Serebryakov A.G. Adaptive testing of knowledge in the "Teletesting" system. // <http://www.teletesting.ru/de/st109.html>. (RUS)
5. Hadwin A.F., Winne P.H., Nesbit J.C. Annual review: Roles for software technologies in advancing research and theory in educational psychology. // British Journal of Educational Psychology. – V. 75, Part 1, March 2005. – P.1-24. (ENG)
6. Criteria of marking of the educational achievements of pupils in the system of general secondary education. // Education of Ukraine. – 2001 p. – № 6. (UKR)
7. Kolgatin O.G. The Statistical Analysis of the Test with Different Form of Tasks. // Measuring of the educational achievements of the schoolboys and students: humanistic, methodology, methodical, technology aspects. - Kharkiv: OBC, 2003.- C.10-11. (UKR)
8. Means of diagnostics of a level of educational and professional preparation. The tests of the objective control of a level of educational and professional preparation. - Order of the Ministry of education and science of Ukraine № 285 from 31 July 1998. (UKR)

## THE AUTHORS



### **Lyudmyla Bilousova:**

Professor, PhD in Physics and Mathematics;

Head of the Informatics Chair of the Kharkiv National Pedagogical University named after G.S.Skovoroda;

the author of near 200 published scientific works, among them 22 school-books;

Fields of scientific work are computational mathematics, computer science and didactics of E-learning.



### **Oleksandr Kolgatin:**

Associate Professor, PhD in Technical science;

Post doctoral student of the Kharkiv National Pedagogical University named after G.S.Skovoroda;

the author of 45 published scientific works, among them 3 school-books;

Fields of scientific work are computational modelling, computer science, pedagogical diagnostics.



### **Larisa Kolgatina:**

Assistant of the Informatics Chair of the Kharkiv National Pedagogical University named after G.S.Skovoroda;

the author of near 40 published scientific works, among them 3 school-books;

Fields of scientific work are computer science and didactics of E-learning.

# ELU PROJECT APPROACH TO IDTV PEDAGOGY



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

Pavel Čech, Daniela Ponce, Vladimír Bureš, Kamila Olševičová  
Faculty of Informatics and Management, University of Hradec Králové  
{pavel.cech; daniela.ponce; vladimir.bures; kamila.olsevicova}@uhk.cz

**Abstract.** The paper presents main issues related to interactive digital television (iDTV) and its utilization in education. The paper summarizes pedagogical aspects, among which belong interactivity, video learning experience, personalization and customization, informal learning and edutainment, or social activity. A special attention is paid to differences between t-learning and other types of technology-based learning methods.

**Keywords:** T-learning, e-learning, iDTV pedagogy, education process.

## 1. INTRODUCTION

Technological development comes with new possibilities how to enhance provided services and products. A relatively new technology that will influence our life in close future is transmission from analog broadcasting of TV to digital one. Digital TV brings, due to its own technological principle of work, new challenges. One of those is education through interactive digital TV (iDTV), so called t-learning. It is obvious that TV or instructional TV (ITV) has already been used in pedagogical processes, but iDTV is based on new technological principles that enable come with new technological solutions. These are, for instance, interactive applications which usability is currently being explored. Since there are several ways in which digital signal can be transported to the receiver (e.g. terrestrial – DVB-T, cable - DVB-C, satellite – DVB-S, or internet – IPTV), this paper, and our research generally, is focused on possibilities related to education with the usage of DVB-T. In comparison to other technological approaches DVB-T has its own features and limitations that influence its utilization in educations (e.g. broadcasting model “one-to-all” or limited possibilities for feedback in form of return channel).

## 2. ALIGNING E-LEARNING AND T-LEARNING

It is obvious that “re-inventing a wheel” is on of the worst approaches to exploration and establishment of anything as well as of pedagogical issues of t-learning. That is why the initial effort has to be directed to research and results that has already been done in this area. When searching for a research of iDTV pedagogy one has to claim that there is a limited amount of papers published or new information available. This statement can be supported for example by probably the best source of current knowledge in this area: the t-learning study by Bates ([1]). Bates claims that “the study has found limited existing pedagogical research to draw upon” and therefore “there is a need for the educational research community to look at and present evidence as to how people learn in their home environments” ([1]). According to Taylor and Traxler ([16])

iDTV still has (in comparison to computers) functional limitations and limited understanding as yet of how best it can serve as a learning medium. Due to lack of experience with educational process via iDTV, we have to try to adopt existing principles and approaches from e-learning and iTV pedagogy.

Due to similarity to ITV (here, the similarity is caused by the usage of the same device which is TV, but in fact there are limited number of aspects that are the same in ITV and iDTV from the pedagogical point of view) and e-learning, current iDTV pedagogy tend to be mostly derived from these two perspectives. Let’s consider the interrelation of e-learning and t-learning as first. While some authors (e.g. [8]) say that “iTV<sup>1</sup> can facilitate e-learning, and also add value to this practice”, other researchers stress that there are several differences between t-learning and e-learning that makes prohibitive just translate e-learning to DTV [2]. This also includes the pedagogy principles. The fact that t-learning is not a subset of e-learning, but a completely new phenomenon (and therefore the pedagogy can not be easily transformable) is obvious also from other approaches that are depicted in the following figures. While Lytras et al. [8] consider iTV as the convergence of two different technologies: Television and Computer technology (and more specifically the Internet), Damásio et al. [12] perceive the expression “t-learning” as the intersection of the uses of television with the uses of the computer to produce an e-learning experience.

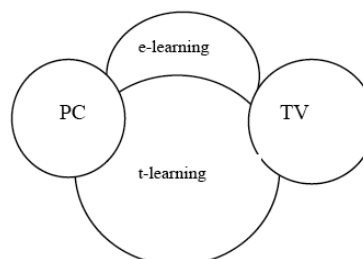


Fig. 1. Damásio et al. approach. [12]

<sup>1</sup> Here, iTV means interactive TV which can be considered as a more general concept than iDTV.

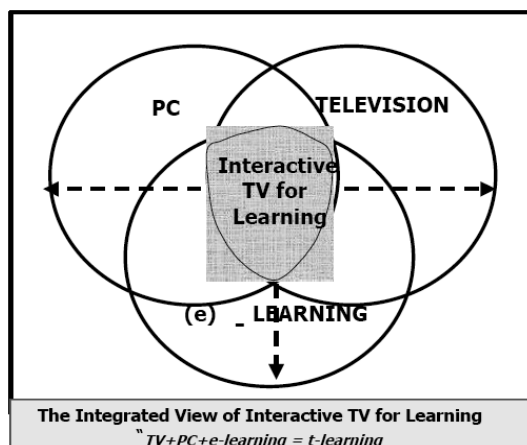


Fig. 2. Lytras et al. approach. ([8])

Although e-learning is relatively sufficient, ITV offers probably better starting point for creation of iDTV pedagogy, since it is based on the usage of TV device and audio/video materials. This similarity is important, for it was proved that viewing television helps learners to mediate their experiences and understanding of the world [7]. According to Gibson ([4]), these findings have been supported through a variety of studies of video technology, the use of which has provided strong contextual support for the acquisition of knowledge ([6], [10] [13], [18]). Although some authors (e.g. Monsma in [9]) suggest some modification of pedagogy while using ITV, it is obvious that only few of them can be used for iDTV. The main problem is that ITV is mostly perceived as the medium that transfer a video signal of a lecture or lesson to, for example, geographically separated classrooms (e.g. rural schools, training of rural doctors, etc.). Therefore, the modifications still take into account a classroom that can be, for example, divided into groups for team work; other suggestion says that students should have large nameplates, or it contains a time dynamic adjustments to give a time for distant students to respond to questions. Consequently, the recommendations utilizable in iDTV pedagogy (at least partially) are for example beginning class with a question, role-play or other interactive activity, or making an effort early in the course to direct questions to learners.

### 3. ISSUES OF T-LEARNING PEDAGOGY

One of the issues of t-learning is also to acquire its own learners. There are several papers that pay attention first of all to **motivation** of learners to study via a new medium and the ways how to keep learners to be interested in learning. Some authors (e.g. dos Santos et al. [2]) suggest that a possible solution to facilitate the engagement of the learners in t-learning programs is the development of applications that presents t-learning as entertainment, or edutainment applications. Starting with this idea of entertainment, the student can then be invited to participate in more formal activities. Another approach that can be made is to present the educative application as something fun, such as a game that may encourage the student's curiosity to learn through

iDTV, in a way that these come to execute applications in which the concepts can be transmitted or the learning can be improved. Findings also mostly describe **interactivity** as the main factor that makes people to learn. Nevertheless some authors warn that the statement "the more interaction there is in a distance education class, the better" is a myth ([14]). They say, "Interaction is needed and should be available. However, interaction is not 'end all and be all' of learning... the forcing of interaction can be as strong a detriment to effective learning as is its absence". We can also find efforts to define a **profile** for persons that would be most satisfied. Simonson et al. believe these people are older and non-traditional students ([14]). Sorensen ([15]) and Pool ([11]) agree that distance education is better suited for non-traditional students because these individuals typically need less peer-to-peer interaction.

The comprehensive study [1] created by Bates can be used for our purposes. It deals with pedagogical issues related to classical television watching. From the educational point of view, Bates in this document describes home as a place of learning, barriers to learning, and learning through television. He focuses his attention on questions how people learn through TV, television viewing habits, or television viewing habits, and provides ten scenarios of future development, which should widen horizons as to what might be possible through using a range of iDTV technologies. It would helpful to bear in mind some **reached conclusions** that support the effort of the iDTV pedagogy construction. The most important ones are ([1]):

1. Within the context of increasing lifelong learning opportunities, more attention should be focused on finding solutions for increasing learning opportunities in the home.
2. There is evidence to suggest that this will increase participation of those already engaged in learning. However, there is also growing evidence to suggest that this is not encouraging wider participation of those not already active in learning.
3. Traditionally television has tended to be used as an informal mode of learning. Therefore, enhancing learning opportunities through the use of iDTV solutions could help in achieving this aim.
4. Unsurprisingly, given the scarcity of developments in this field, there has been little research into using iTV for learning purposes.
5. Although it is probably accepted that the television in its traditional format is a very powerful medium, the body of research into its role for learning is rather more limited. It has tended to focus on the impact that TV makes on individuals or on the role of specific educational TV programmes like those used as part of an open university type course.
6. Understanding the role of interactivity is a very complex process with most research focused on interactivity in computer-based environments. Considerably more research is needed into its role within interactive digital TV learning environments.



### Interface design of iDTV applications

As already mentioned earlier, games and interactive applications are possibility how to make people to be involved in education through iDTV. These are related to other issues. A key aspect in the development and utilization of t-learning applications is related to the usability and the *interface design* of iDTV applications, which must be designed in a way that it facilitates the user interaction. Some usability and design questions for iDTV are ([3]):

- **Users** – While in e-learning studying is an individual activity, in t-learning applications it must be considered that *watching television is usually a group activity*.
- **Screen distance** – In general, learners are usually in larger distance from televisions with specific habits (e.g. so called “sit-back” or “lean-forward” attitudes). In this way, their visibility to the rest of the ambient it’s bigger, as the possibility of distracting with events aside the television show. Therefore, there are some strategies in modeling iDTV applications that aim to maintain the viewer attention, such as: clear and large text fonts, spaced text and divided in small parts, use of sounds, colors and images that attract the user attention.
- **Remote control** – There is a specific way in the usage of remote control (in comparison to keyboard, mouse, pen, chalk, etc.). Generally, the applications for iDTV must consider the use of the remote control, avoiding difficulties for users to navigate in a t-learning application ([5]). Some strategies for solving this problem are: important parts of the screen must be placed logically in the television screen; use the numeric keyboard to browse the options list; avoid using abstract icons, as a finger pointing to some part of the screen (which key would activate the icon?); minimize the number of keys that can be pressed; avoid pages that needs the scrollbar. The text input is a particular problem that can be solved with the use of a virtual keyboard in the television screen, manipulated by the remote control, or using a numeric keyboard to the selection of characters, such as it happens in the cell phones keyboards.
- **Applications visibility** – It is necessary to check the context of the iDTV application in the designing the user interface. In t-learning applications, the educational material shall not overlay or difficult the video visualization.
- **Fonts and colors** – Saturated colors and with much bright should be avoided. The font size depends on the middleware and the STB fonts processing. In general, avoid using small fonts (less than 22 pt.) to not difficulty the text visualization by the user.

### 4. CONCLUSIONS

iDTV brings new potentials and challenges to education. It can both help to enrich study content and increase number of people who are involved in learning. However, it is important to emphasize that iDTV education can significantly contribute first of all to informal education.

While in a *formal education* (that refers to systems of organized learning that are “hierarchically structured” and “chronologically graded” usually from primary schools to universities) and a *non-formal education* (which is considered as “any organized educational activity outside the established formal system” that has identifiable learners, evident learning objectives and usually leads to final diploma or certificate) can utilize t-learning in relatively small extent, an *informal education* (usually described as “the truly lifelong process that allows individuals to acquire knowledge, skills and values from daily experience” with the principal sources of learning including the home, work, friends and media ([1]) seems to be prepared to take an advantages of t-learning in the best way. The overall advantages of the usage of iDTV application for learning are (generalized from the [17]):

- The service is available 24/7 all year round, putting the control and timing in the hands of the learner.
- Already developed to a highly usable and compelling stage, there is the potential for further functionality and range as the technology continues to evolve.
- Having a presence in this medium can complement and attract learners to existing learning and information in other mediums (book, educational CD, etc.).
- Content can be branded, localised or regionalised as required.

Nevertheless, apart from probably well known technological problems and constraints related to digital broadcasting in several European countries, it is necessary to point that there is a lack of iDTV pedagogy principals from the educational perspective. As P. J. Bates says: “...there has been little research into using iTV for learning purposes”. We can use as our conclusions his statements:

1. Although it is probably accepted that the television in its traditional format is a very powerful medium, the body of research into its role for learning is rather more limited. Research has tended to focus on the impact that TV makes on individuals.
2. There appears to be limited research into the importance of informal learning as a means of drawing people into be formalized learning.
3. Despite some evidence to suggest that more people wish to learn from home, there appears to be limited work into understanding the conditions and requirements that are needed in order to make the home a conducive learning environment.
4. Understanding the role of interactivity is a very complex process with most, but limited, research focused on interactivity in computer-based environments. Unsurprisingly, there has been little research into using interactive TV for learning purposes.

Although the desired iDTV pedagogy has to be developed and specified in more details for its own context, it can draw experience from existing case studies and lessons learned in e-learning and iTV education.

## 5. REFERENCES

- [1] Bates, P. J.: T-learning Study: A study into TV-based interactive learning to the home, Final Report, PJB Associates, UK, 2003
- [2] dos Santos, D. T., Terêncio do Vale, D., Pedrosa Meloni, L. G.: Digital TV and Distance Learning: Potentials and Limitations, 36th ASEE/IEEE Frontiers in Education Conference, San Diego, CA, 2006
- [3] Gawlinski, M., Interactive Television Production, 1st ed. Oxford: Focal Press, 2003, pp. 199–237.
- [4] Gibson, I. W.: Studying the Professions via Interactive Television: Using the Workplace in University Teaching, University of Southern Queensland, Australia, (on-line) [http://kolea.kcc.hawaii.edu/tcc/tcc\\_conf96/gibson.html](http://kolea.kcc.hawaii.edu/tcc/tcc_conf96/gibson.html)
- [5] Hedman, A., Lenman, S., Heinig, C.: "Place Metaphor in Digital Television", Studies of digital television for distance learning – interactions and expectations, Jan. 2002, pp 292-297.
- [6] Johnson, R.T.: The video-based setting as a context for learning story information. *Childhood Education*, 66, 1990, pp 168-171.
- [7] Luke, C.: Television discourse processing: A schema theoretic approach *Communication Education*, 34, 1985, pp 91-105
- [8] Lytras, M., Lougos, C., Chozos, P., Pouloudi, A.: "Interactive Television and e-Learning Convergence: Examining the Potential of t-Learning", *The European Conference on e-learning*, 2002
- [9] Monsma, J. W.: Putting the Family on the Tube: An Interactive Television Approach to Teaching Family Communication, The Annual Meeting of the National Communication Association, Chicago, IL, 1997
- [10] Pea, R.: Integrative media in education: Progress and prospects. Paper presented at the Annual Meeting of the American Educational Research Association, 1990, Boston.
- [11] Pool, P.: Teaching via interactive television: An Examination of teaching effectiveness and student satisfaction. *Journal of Education for Business*. 72(2), 1996, pp 78-82
- [12] Damácio, M. J., Quico, C., Ferreira, A.: Interactive television usage and applications: the Portuguese case-study, *Computers & Graphics* 28(2): 139-148, 2004
- [13] [Schwen, T. M., Goodrum, D.A., Knuth, R.A., Dorsey, L.T.: Enriched learning and information environments. Paper presented at the Annual Meeting of the American Educational Research Association, 1990, Boston.
- [14] Simonson, M., Smaldino, S., Albright, M., Zvacek, S.: Teaching and Learning at a Distance: Foundations of Distance Education. *Second Edition*. Upper Saddle River, New Jersey : Pearson Education, Inc. 2003
- [15] Sorensen, C.: Students near and far: Difference in perceptions of community college students taking interactive television classes at origination and remote sites. (ERIC Document Reproduction Service No. ED393 509), 1996
- [16] Taylor, P., Traxler, J.: Interactive Digital TV For Learning and Skills, Post - 16 E-learning Practitioners' Conference 2004, (on-line) [http://ferl.becta.org.uk/content\\_files/ferl/pages/news\\_events/events/2004/november/workshop\\_presentations/C9.ppt#548,2,INTERACTIVE DIGITAL TV FOR LEARNING AND SKILLS](http://ferl.becta.org.uk/content_files/ferl/pages/news_events/events/2004/november/workshop_presentations/C9.ppt#548,2,INTERACTIVE DIGITAL TV FOR LEARNING AND SKILLS)
- [17] Taylor, P.: KickstartTV - A New Medium for Learning, Vision, April, 2006, (on-line) <http://www.kickstarttv.co.uk/>
- [18] [Walker de Felix, J., Johnson, R.T., Schick, J.E.: Socio- and psycholinguistic considerations in interactive video instruction for limited English proficient students. *Computers in the Schools*, 7(1/2), 1990, 173-190.

## THE AUTHORS

**Pavel Čech** received the Ph.D. degree in information and knowledge management from the University of Hradec Králové (UHK) in 2005. His research interests include knowledge management, knowledge-based technologies, e-learning and t-learning. He works as assistant professor at UHK. His educational activities cover object-oriented modelling and knowledge management.

**Daniela Ponce** received the Ph.D. degree in applied informatics from the University of Economy, Bratislava, in 2007. Her research interests include ontology engineering, semantic web, knowledge acquisition, e-learning and t-learning. She works as assistant professor at UHK. Her educational activities cover ontological modelling, rule-based systems and multi-agent systems.

**Vladimír Bureš** received the Ph.D. degree in information and knowledge management from the University of Hradec Králové in 2005. His research interests include knowledge management and knowledge economy, e-learning and t-learning, ICT in business management. He works as assistant professor at UHK. His educational activities cover systems theory, marketing research and knowledge management.

**Kamila Olševičová** received the Ph.D. degree in information and knowledge management from the University of Hradec Králové in 2005. Her research interests include knowledge management, ontology engineering, multi-agent systems, game theory, e-learning and t-learning. She works as assistant professor at UHK. Her educational activities cover multi-agent systems, logic programming, ontological modelling and rule-based systems.

## ACKNOWLEDGEMENT

*This paper was created with the support of the European project ELU, IST-4-027866. ELU project is partly supported by the 6th FP of the European Union.*



# FINDING A BALANCE IN BLENDED LEARNING WITH EXTRA LARGE STUDENT GROUPS

Peter Fabian<sup>1</sup>, Arnold Muhren<sup>2</sup>, Wim Veen<sup>3</sup>

<sup>1</sup> Faculty of Management Science, University of Zilina, Zilina, SK, peter.fabian@fri.uniza.sk

<sup>2</sup> TU Delft, Delft, NL, a.muhren@tudelft.nl

<sup>3</sup> TU Delft, Delft, NL, W.Veen@tudelft.nl

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## Abstract.

Teaching large groups of students is an increasingly common phenomenon in higher education, which may be found de-motivating by the students, because they feel like just one of many students in the group and miss the personal attention of the teacher as well as among teachers, who are often dissatisfied because they have little contact with their students. As a consequence, there is a higher drop-out rate and a lower success rate on the exams, especially in technical universities, which is leading to a shortage of engineers at a European level. The article describes objectives and approaches of the recent SOCRATES/Minerva project 225552-CP-1-2005-NL-MINERVA-MPP Blend-XL: Finding a Balance in Blended Learning with extra Large Student Groups, which strives to make the large-scale education (groups of more than 100 students) more motivating and more personal through the effective use of ICT.

**Keywords:** Blended learning, e-learning, effective use of the ICT, extra large student groups

## 1. INTRODUCTION

Teaching large groups of students is an increasingly common phenomenon in higher education, especially in the first year of study, when many students follow introductory courses or core modules. These courses are often taught in large groups in big lecture theatres. Students may find this de-motivating because they feel like just one of many students in the group and miss the personal attention of the teacher. Teachers are often dissatisfied because they have little contact with their students and don't know how well they are progressing. As a consequence, there is a higher attrition rate and a lower success rate on the exams than in small-scale education, especially in technical studies where a high dropout rate is common and is leading to a shortage of engineers at a European level. The idea behind this project is that large-scale education (groups of more than 100 students) can be made more motivating and more personal through the effective use of ICT ([3], [5]).

It has been decided to form an international consortium of higher education institutions to tackle this problem and propose a project within the EU SOCRATES/MINERVA programme, which would focus on the design of useful pedagogical models for learning situations in which face-to-face activities are mixed with online activities, often referred to as "blended learning". The project proposal has been evaluated favourably and from 1.10.2005 the project with supposed duration of 3 years has been started.

## 2. BLENDED LEARNING APPROACH

Blended learning is the reaction to the hype around e-learning in the nineties when many people felt that classroom teaching would be strongly diminished and

education was going to be online, using digital learning environments, without face-to-face contact ([1], [7], [8]).

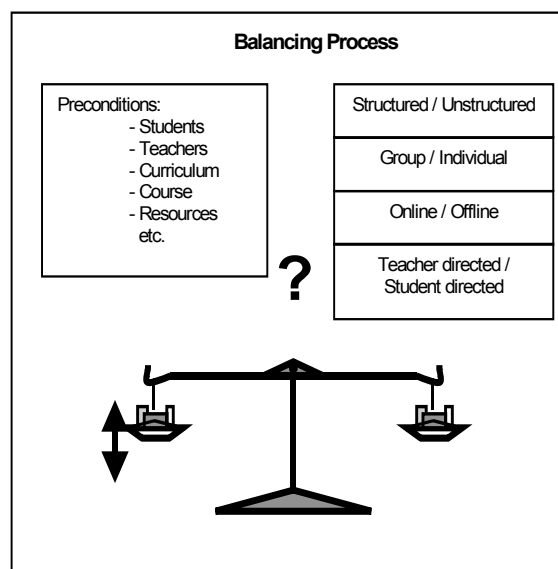


Fig. 1. Balancing dimensions of blended learning

In practice, often a blended approach is chosen, combining online and offline activities.

However, blended learning is more than this. Meijerink and Verkroost ([2], [4]) have extended this definition by adding three dimensions: structured/ unstructured, group/ individual, and teacher/ student directed (see figure 1).

In each educational setting these dimensions will be balanced differently because of different preconditions. It is a challenge to balance these dimensions in such a way that

an optimal learning situation is established. The definition will be used as a starting point for this project. Other dimensions will be added to the definition.

Blended learning accommodates the human need for social interaction and offers possibilities for students with different learning styles and learning paths. By blending a variety of methods, the motivation of the learner will increase.

Developing blended scenarios for teaching large groups of students is tough because many existing educational design models often do not focus on the inclusion of ICT ([6]). This often leads to the adoption of trial-and-error design behaviour by teachers with varying outcomes for students. Existing educational design models often assume there will be small groups of students allowing much room for contact between student and teacher. When working with large student groups this contact is often not possible. Working with large student groups sets an extra set of preconditions for blended learning. This project aims to fill the gaps in educational design models with the use of ICT for large student groups.

### 3. OBJECTIVES OF THE PROJECT

The objective of the project is to improve the communication between teacher and students when working with large student groups and to increase student success rate and motivation by offering educational design models for blended learning. These models will help teachers to develop a blended learning situation in which they feel connected to their students and which is motivating for their students.

The models consist of dimensions of blended learning and how they can be balanced and combined successfully. The use of different cases from different countries and educational settings ensures the applicability of the models outside the project and gives it a European impact. This will add impetus to the academic development in the field of educational design.

The following main research questions are posed:

- Which preconditions influence the balance of a blend and what is the nature of this influence?
- Which dimensions can be identified in blended learning situations with large student groups?
- When can we call blended learning situations with large student groups an “effective blend”?

How can these insights be used in educational practice?

### 4. INNOVATION

The innovative power of this project lies in the following aspects:

- The educational design model will give teachers a tool for transforming their educational practice into a blended learning situation. One cannot introduce ICT well without changing the educational setting. Whether this transformation leads to a real innovation of

education depends on a large set of factors. Insight in these factors is necessary to improve the quality of the innovation.

- The development of an educational design model for blended learning of a more generic nature than a specific pedagogical view is also quite innovative because existing educational design models are always based on a specific pedagogy. The model that will be developed integrates different pedagogical views.

## 5. PEDAGOGICAL AND DIDACTICAL APPROACHES

The project draws on the idea that there exist some generic dimensions in blended learning that are relevant for different types of education and different educational settings with a different pedagogy. Irrespective of which pedagogy is adhered to, these dimensions are relevant but they will be balanced differently.

Educational design is often led by learning outcomes. They drive what we do and regardless of whether we are using the technology or not, the way we achieve learning outcomes follows a consistent route. We provide the students with an educational setting or environment in which we give them the resources, information and support which we think they need to undertake tasks that lead to new insights and meet our learning objectives or outcomes. Our key role is to provide guidance and support. If this is applied to a virtual learning environment it is equally true. However, it does mean we may need to re-think how we develop the setting or environment, how we may need to change the nature of the tasks to ensure student engagement, and what activities we expect the student to undertake. We also need to rethink the mechanisms by which we provide guidance and support. This is what is called “transition” or “transformation” of education: new ways of teaching and learning have to be developed for online learning ([9]).

## 6. NEW ORGANISATION OF EDUCATIONAL PROCESSES

This project will develop new organization forms of educational processes at different levels:

- The educational development process, which is necessary to change from a traditional to a blended learning setting.
- The educational process, which is necessary in a blended learning setting, including for instance teacher and student roles, and the use of technology for communication ends.
- The process of continuous development, which is necessary to fine-tune the balance in blended learning.

## 7. GROUPS INVOLVED

The target groups of this project are:

- The teachers who participate in the case studies that are brought in by the partner institutions. In total, there will

be approximately 40 teachers from five different countries.

- The students, who are taught in the blended learning settings in the case studies of the project. In total, there will be approximately 2700 students from five different countries.
- Teachers in Europe who want to design a blended learning situation for a large student group and want to do this in a more systematic and sophisticated way. Specifically, these will be the teachers from the participating institutes and their partner institutes. Dissemination activities will expand this outside the project.
- The academic field of educational design.

## 8. PROJECT OUTPUTS

The output of this project will comprise:

### a) Five blended courses for large student groups

At the end of the project, five courses that are now being taught in a traditional way will be transformed into a blended format.

### b) An educational design model for blended learning situations with large student groups

This design model consists of a general model, containing the dimensions on which blended educational settings can be balanced. The model in figure 1 is taken as an input; the final model will be based on the processes in and outcomes of this project. The model will be accompanied by guidelines for balancing the dimensions.

### c) Scenarios and cases from educational practice

The model will be complemented with scenario's, stemming from the different cases. These scenario's contain a description of the educational setting in which they have been developed, guidelines for application and the evaluation results.

### d) A toolkit for blended learning with large student groups

The toolkit contains an overview of current available technology and software for supporting blended learning with large student groups. An important criterion for the content of this toolkit is the accessibility for teachers. It has to be easy in use and easily to purchase without high costs.

### e) A digital handbook for teachers

A digital handbook for teachers will be developed, based on the project's outcomes. It contains the model, the scenarios and the toolkit. Hyperlinks will be used to cross-reference between different experiences and cases. The handbook will be put on both the projects' website and on a CD-ROM.

### g) A virtual centre of expertise on blended learning with large student groups

The project's outcomes and experiences will be made public by means of a website. This website is meant to be a Virtual centre of expertise on blended learning with large student groups. Its content will therefore not only stem from the project, experiences from outside the project will also be brought in. It will contain documents, discussion forums, and links to other resources.

## 9. IMPLEMENTATION OF OUTPUT

The model for blended learning and its accompanying tools and scenarios will be implemented at the five participating institution of the project, in five courses:

- Building management (Delft University of Technology, The Netherlands) will be taught two groups of 500 students during the project by 2 teachers.
- The Joint Honours Study Skills Module (Northumbria University, UK) will be taught to approximately 360-400 students. Seven teachers will be involved inside the project; outside the project 20 teachers will be reached with the project.
- Multimedia information systems (University of Zilina) will reach 360 students choosing the subject. One lecturer and two lab teachers usually teach the subject. If the project method proves to be successful, it may be spread to different subject within the curriculum.
- Techniques of programming (RWTH Aachen, Germany) will be taught to at least 800 students by 3 teachers.
- Interpersonal communication (Academy of Humanities and Economics, Poland) will be offered to more than 150 students from B.A. and M.A. level. Four teachers will take part in the project. Results of this project will be presented to all teachers involved in e-learning at the Academy

## 10. EXPERIENCES WITH THE PROJECT IMPLEMENTATION

### Project Implementation at University of Zilina

For the case study of the Blend-XL project at the Faculty of Management and Informatics the course "Multimedia information system" has been selected. It concerns information on media elements, their capture, storage, editing and maintenance and their integration into the multimedia applications of various types.

Its workload at the Faculty consists of 2 hours lecture/week and 2 hours labs/ week during the autumn semester and its ETC value is 6.

To get the credit, student must actively participate in the laboratory exercises, develop semester thesis, which contains multimedia application and pass the written and oral exam. The current pedagogy is based on the face-to-face learning with Web based support.

The subject is elective, each year there are about 100-120 students taking the subject.

The spatial detachment of the faculty sites in the cities of Ruzomberok (about 60 km distance) and Prievidza (about 60 km distance) makes the workload on the lecturer and lab teachers larger, with the inevitable loss of time for transport. Usual solution is in blocking of the lectures, so their period is 14 days. This itself does not provide problem, but in case of holiday or other irregularity, the loss of teaching hours, which cannot usually be gained by any rescheduling is quite high.

#### Problem areas

The problems either in organization and pedagogy of the subject are common to the situation of other subjects taught at the faculty, so it relates to wider educational context of the faculty. The time schedule is composed in a way that gives priority to scheduling of time and location of the obligatory courses, with rest of the time and space (left-over) given to mandatory subjects. Because of the optional solution of the mandatory subjects by students of different grades, to satisfy their availability, they are often pushed in the schedule into time slots, which are considered by students as unsuitable. This leads often to absence of students at the lectures and connected difficulties with catching up of the subject matter at the laboratory exercises, where the attendance is compulsory.

#### Organizational problems

Before the project implementation the subject was taught in a traditional face-to-face method with the traditional lectures and labs. Due to the large number of students, large lecture room is needed. Because the subject is elective and student stem from various core study groups, the only time available is either early morning, or late evening, which are not the best times suitable for learning and therefore numerous and frequent absenteeism can be observed.

#### Educational problems

The subject is attended by students with variable degree of skills and knowledge on the subject, from various study specialization and from bachelors' as well as masters' courses. Some of them are already specialists, skilled in professional development of multimedia applications, but usually without any theoretical background, others are beginners, with almost no practical skills in development of multimedia applications. By joining the core curriculum provided in form of lectures with Web based e-Learning support and resources, subject may become more interesting for all groups.

#### Action research methods and instruments

The specific research questions to be solved within the project are to find the way, how to overcome the organizational and educational problems, with the use of Blended learning methods.

The basic steps to be taken:

- Review of the practice used in teaching
- Identification of the educational aspects to be improved
- Proposal of modifications
- Implementation of the improvements

- Analysis and evaluation of the influence of improvements.

#### The instruments

- Modification of the methodology according to the discovered facts and continuation of work, possible further modification in case of no improvement
- Monitoring of activities
- Review and evaluation of the modified actions

The first action research cycle in the initial period of the project focused on the review of the current practices, identification of the decisive aspects and implementation of modifications. These measures will be evaluated and those with the positive aspects will be implemented in new action research cycles, as new areas of investigation will emerge.

#### Organisation of validation group

The first validation group will consist of students who have chosen the subject. In the first stage there were 186 students in Zilina, another 70 in the satellite faculties, 40 in Prievidza and 30 in Ruzomberok in the autumn semester 2006 (October 2006 – January 2007).

The content of the course is given by the pedagogical documentation. The course has been in the beginning supported by online system – MS Internet Information Server only, containing supporting material and lecture slides, developed in Microsoft Power Point programme.

The communication between teachers and students has been made possible through face-to-face contacts during the lectures and lab exercises and with the use of e-mail. Communication among students was not monitored by any means.

To facilitate the monitoring of student activities it has been decided to implement learning management system (LMS) Moodle. In the first stage of the cycle the original material developed earlier was be used. The use of the content was be monitored and user appreciation was assessed through evaluation.

To facilitate comparison of the results reached at the partner institutions, the cross-case questionnaire developed and used at other partner institutions was used.

#### The results

As usual in the cases of new educational methods introduction, the assessment of the results reached is problematic. The evaluation of the questionnaires filled in by the student community shows more „customer satisfaction“ with the implementation only and usually not the pedagogical benefits. When comparing the grade results, the bias of individual evaluation by the examiner and variations between the student classes can make the results unreliable.

Moreover in the recent pedagogical practice in Slovakia (or at least at the Faculty) misunderstanding of the blended learning concept combined with the above-mentioned organizational difficulties may lead to even higher absence at the lectures („everything is on the Web“ - principle) and lead to decrease of the quality of the learning.

The results of the grading are shown in the Fig. 2. When compared to the preceding year, the number of average or „bad“ grades has been increased. The result is further biased because of the relatively high number of students not attending the exam (drop-outs?). Deeper analysis of the results as well as the use of the Moodle-based system is planned in the next stages of the project.

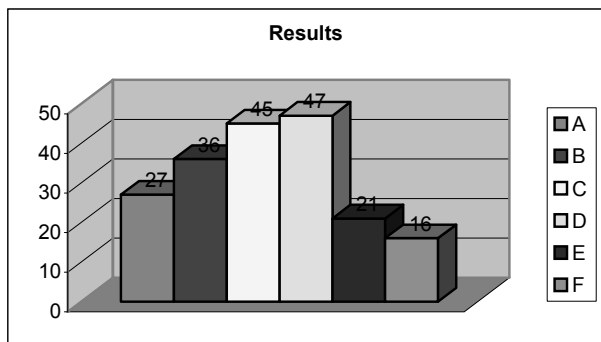


Figure 2: Grades reached in the first stage of the project implementation

### **Description of the programme / Planning**

The objective of the project is to improve the communication between teacher and students when working with large student groups and to increase student success rate and motivation by offering educational design models for blended learning.

In this case study it has been decided to change the original WWW support system with the use of dedicated LMS Moodle, in order to facilitate better communication between students and teachers, to provide additional communication and social computing tools and also facilitate the monitoring of student activities.

The use of the content will be monitored and user appreciation will be assessed through evaluation.

The elements of e-learning (tests for self-evaluation, FAQ, discussion forums, wikis) will be gradually added, to facilitate change from WWW supported face-to-face learning to blended learning.

These changes will help to develop a blended learning situation in which the students should feel better connected to their teachers and which will be for them motivating, overcoming the existing organizational and educational problems.

The model of blended learning developed will be compared with the results of other project partners.

The courses will be evaluated using student and teacher questionnaires and interviews, observations, and analysis of computer log-files.

The quality of the educational design model will be established by comparison of the educational results and its acceptance at conferences and journals.

The results reached in the subject chosen for the case study will be used in another subject, also taught at the Faculty of Management Science and Informatics, facing the same educational and organizational problems. It is also planned to use and disseminate the results reached on international scale by use of the model at the Faculty of Economics and Administration of the University in Pardubice in the Czech

republic, where similar subject "Multimedia" is being taught.

The first action research cycle at the University of Zilina in the initial period of the project focuses on the review of the current practices, identification of the decisive aspects and gradual implementation of modifications. The effects of these measures will be evaluated, compared with the experience and results of other project partners and those with the potentially positive aspects will be implemented in the new action research cycle.

## **11. REFERENCES**

- [1] Graaff, E van der, Veen, W & Verkroost, MJ (2001). Success and failures of an online course on problem-based learning. In (Ed.), *The impact of ICT on the curriculum*. (pp. 117-126). Brussels, Belgium: SEFI.
- [2] Pilot, A, Geloven, M van, Lam, I, Tartwijk, J van & Veen, W (2002). ICT-innovation in Higher Education, differences in key issues between disciplines. In (Ed.), *27th International Conference learner-Centred Universities for the New Millennium*. (pp. 32, 285-290). Vilnius: Vilnius Pedagogical University.
- [3] Zanden, AHW van der & Veen, W (2004). Innovation in Higher Education; Demand-driven or Market-pushed. In Lorenzo Cantoni, & Catherine McLoughlin, (Ed.), *Proceedings of ED-MEDIA 2004*. (pp. 194-201). ED-MEDIA.
- [4] Verkroost, M.J., Meijerink, L., Boogaard, A. van den & Lintsen, H. (2003). Making Education more Flexible and Massive with ICT. The Case of STUDIO. Paper presented at the ALT-C conference in Sheffield.
- [5] Verkroost, M.J. & Lintsen, H.W. (2002). STUDIO: Educating the Broad Engineer in an Electronic Learning Environment. SEFI Conference, Florence, Italy.
- [6] Verkroost, M.J. (2001). Building Virtual Communities for Professional Development. *Proceedings BITE 2001 conference*, Rotterdam, 23-24 November 2001. 10 pp, published on CD-ROM.
- [7] Fabián, P. (1999). Educational and Training Systems Design, *Scientific papers of the University of Pardubice, Series D*, 4, pp. 55-64, ISBN 80-7194-232-4, Pardubice, 1999
- [8] Fabián, P. (1999) Development of Web-Based Education Systems, in *Studies of the Faculty of Management Science and Informatics, University of Žilina*, ISBN 80-7100-537-1, Žilina,
- [9] Fabián, P., Čapek, J. (2001). Web-learning Environment Requirements, in *Lecture notes of the international conference Virtual University, LCDE- FEI STU Bratislava*, Bratislava

## THE AUTHORS



**Dr. Arnold Muhren**

TU Delft, Centre for Education and Technology  
Jaffalaan 5, 2628 BX Delft,  
the Netherlands  
e-mail: a.muhren@tudelft.nl

A. Muhren is the BLEND-XL project manager and also teacher at the Open University in the UK



**Prof. Dr. Wim Veen**

TU Delft,  
Centre for Education and Technology  
Jaffalaan 5, 2628 BX Delft,  
the Netherlands  
e-mail: w.veen@tbm.tudelft.nl

W. Veen is the director of the Centre for Education and Technology and project co-ordinator. W. Veen is author of numerous publications on e-Learning and Homo Zappiens.



**Assoc. prof. Ing. Peter Fabián, PhD.**

University of Žilina  
Univerzitná 8215/1, 010 26 Žilina,  
Slovakia  
e-mail: peter.fabian@fri.uniza.sk

P. Fabián is a lecturer at Faculty of Management Science and Informatics in Zilina. His subjects concern the programming, multimedia information processing and knowledge representation. He is a local co-ordinator of the project.

## ACKNOWLEDGEMENT

*The SOCRATES/MINERVA project "Blend-XL" is funded with support from the European Commission.*

*This paper reflects the views only of the authors, and the Commission cannot be held responsible for any use, which may be made of the information contained therein.*





## PRESERVING THE EXPERT'S KNOWLEDGE FOR THE NEW LEARNERS' GENERATION: A WEB-BASED KNOWLEDGE MAP

Peter Fabian<sup>1</sup>, Sanaz Sattari<sup>2</sup>, Wolfgang Backhaus<sup>2</sup>, Klaus Henning<sup>2</sup>, Ellen Sjoer<sup>3</sup>, Eamonn McQuade<sup>4</sup>, Pedro Pimenta<sup>5</sup>, Jose Carlos Nascimento<sup>5</sup>

<sup>1</sup> University of Zilina, Zilina, SK; <sup>2</sup> Center for Learning and Knowledge Management and Department of Computer Science in Mechanical Engineering, RWTH Aachen University, Aachen, DE;

<sup>3</sup> TU Delft, Delft, NL; <sup>4</sup> University of Limerick, IE; <sup>5</sup> University of Minho, Guimares, PT

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The SOCRATES/Minerva project “WeKnow” aims to develop a web-based Knowledge Map for higher education; thus trying to achieve a combination of various knowledge types. Teaching of traditional engineering and scientific knowledge will be enriched by providing practical knowledge. The passing of knowledge from knowledge owners, such as experts from industry and science to the new generation, which has to replace them successfully if EU economies wish to remain competitive on global scale, should be facilitated with the use of the recent ICT. The implementation of a Knowledge Map should serve the purpose of intelligent retrieval of learning contents and knowledge stocks from a web-based system. It also corresponds to new learning styles such as ‘discontinued’ and ‘non-linear’ learning behaviour. The paper addresses the idea of combining different areas of knowledge within a new web-based educational environment generating synergies for the learner.

**Keywords:** Blended learning and training, semantic nets, non-linear learning

### 1. INTRODUCTION

Higher education institutions have to address new demands of the practice and of their students. The new learning methodologies beside traditional learning environments use new learning styles, strongly focused on the use of Information and Communication Technology (ICT) and enabling non-linear learning.

The method to be used within the SOCRATES/ Minerva project “We Know” combines the E-learning and Blended learning concepts with the Knowledge Map concepts. It should provide a multiple answers to the new developments which deal with the demographic change in the EU, the ICT based “net generation” which learns practice-oriented and playful and, last but not least, general conditions such as the Bologna Process which influences higher education programmes.

### 2. PROJECT OUTLINE

“WeKnow” is an EU-funded project within the Socrates/ Minerva Programme in the field of ICT and ODL in education. The project seeks to develop a web-based Knowledge Map as an educational competence-based learning environment. Therefore, the project exploits synergies between learning and knowledge management systems for complex learning contexts and resources, as well as new ways for conceptualising and integrating individual and group activities within consistent educational scenarios.

Knowledge Maps as knowledge management tools support individual learning processes by providing relevant knowledge, e.g. processing professional expertise and information for students. The Knowledge Map helps

making learning matters and project-oriented documents and information easily available, searchable and usable and serves as a learning platform for the active and self-directed learning of students. In this case knowledge is not a static supply of interlocked learning processes, but is continuously generated and associated with the actors (teachers, experts and students). The Knowledge Map uses semantic web structures, which offer logical connections and combinations between the contents of the map.

The specific objectives of the project are to retrieve and render expert, scientific skills and (tacit) knowledge of (retired) experts and university teachers applying the storytelling method as well as to integrate expert knowledge and academic knowledge in a way that suits the new generation of students, the so-called “net generation” best and to put the integrated knowledge into educational practice.

The strength of “WeKnow” is a thorough analysis of the needs and content contributions of all the target groups in order to overcome the classic barriers between general academic education and vocational training. Five European universities supported by industrial experts will carry out a case study to test and validate the web-based Knowledge Map in order to ensure the transfer of practice-oriented knowledge in combination with scientific knowledge.

“WeKnow” started in October 2005 and has a runtime of 24 months. The five academic partners come from all parts of Europe. Web-based Knowledge Maps will be implemented by the RWTH Aachen University (Germany, project co-ordination), TU Delft (The Netherlands), University of Limerick, (Ireland), University of Zilina (Slovakia) and University of Minho (Portugal).

The project motivation is threefold. The need to optimise higher education processes is a societal one. Qualification

in terms of scientific knowledge and abilities to act and interact in a highly specialised knowledge society is an asset and necessary element of the future university education.

Secondly, “WeKnow” meets new demands of the so-called “net generation”. Due to a thorough adaptation of information technologies, new learning styles of students evolved which will be addressed by the project.

Thirdly, the European Union initiated the Bologna Process and aims at an adjustment of university courses by supporting bachelor and master programmes. This policy leads to an upcoming redesign of higher education programmes in Germany and other European countries with new demands and new structures.

### 3. CHALLENGES OF THE BOLOGNA PROCESS

The joint Bologna Declaration and the initiated process include several perspectives. As to the practical dimension of the process, the European Commission declares:

“The aim of the process is thus to make the higher education systems in Europe converge towards a more transparent system which whereby the different national systems would use a common framework based on three cycles:

Bachelor, Master and Doctorate.” [1]

Consequences and chances occur in Germany and several other EU member states due to the novel structure of Europe’s higher education landscape. The length of study shortens and, additionally, industry demands more practice-oriented learning inputs within the newly designed bachelor and master programmes. But how to accomplish this task in a limited time frame?

Knowledge Maps provide an innovative answer and bridge the gap between practice-oriented learning demands and shortened study duration. Lessons learnt from EU educational projects such as “WeKnow” enable university government and administration bodies to work with the experiences already made when implementing innovative learning tools in traditional courses in order to cope with various new demands.

Therewith, WeKnow addresses actual developments.

### 4. A NEW GENERATION OF EXPERTS

The demographic change challenges European economies. The German example is probably the most prominent one. Today’s elite is going to retire; younger experts will avail leading positions.

Thus one problem remains: Not only scientific knowledge is needed to lead companies strategically. European markets are highly industrialised and complex. In order to cope with this complexity and dynamics of markets, graduates require a more holistic education, which combines domain education and general aspects (economic understanding, teamwork, networks).

A ‘forwarding’ of professional expertise and knowledge will substantially enhance the performance of young graduates.

According to the European Commission 20% of the European working population shall go into retirement

within the next five years [2]. The implicit knowledge and experiences from the so-called “baby-boomer” generation, which is an important feature for the performance of companies within the European Knowledge Society, are in danger of deterioration. Due to the looming loss of knowledge in companies the need for its preservation and management is increasing daily. The documentation of the existing knowledge and its availability to the universities has, therefore, gained great importance. Universities have to increase their performance to ensure sustainable human capital development and to enable their students to enter the labour market.

The so-called “net generation” develops new learning styles. Reasons for new ways of learning are rooted in new methods of communication. Modern forms of communication are based on ICT and its devices. Email, instant messengers, mobile phones, chat rooms and online communities for example are instruments which are used by the “Homo Zappiens” – a ‘species’ coined by Wim Veen [3]. The word zapping indicates the most prominent feature of the net communicator and learner generation: discontinued communication and learning in a non-linear fashion. Many teenagers are more familiar with popular URLs than with irregular verbs. Iconic skills, digital media and non-linear approaches juxtapose the traditional step by step learning of the older generations. The “Homo Zappiens” is able to construct meaningful knowledge from discontinued audio-visual information flows. So no longer textual design dominates as learning behaviour utilises images, often in a playful fashion. Wim Veen’s sound assumptions rely on multi tasking features as well as (virtual) networks.

Learning networks consisting of learners as described above are a very likely example. They are in need of contents, which are suitable and conditioned for this special way of learning and dealing with contents.

Multi tasking is one prominent feature as they refer to different media at a time. Simultaneously, the “Homo Zappiens” uses his PC with perhaps different desktops, TV, types in a chatting programme, maybe reads a paragraph in a text book and is talking with a friend on his mobile at the same time. So he is virtually connected with friends or a relevant peer group in contrast to the older generations’ individuals who learnt behind closed doors. One can detect a splitting of learning and interaction for the older generation in contrast to an ICT-based combination of learning, playing and leisure time for the “net generation” which mostly consists of young people around twenty years of age [3].

Up-to-date university teaching, as “WeKnow” strives for, has to respond to that skill. This means to redesign learning procedures and environments. Knowledge Maps resemble a system, which allows the search for and acquisition of knowledge within modern e-learning environments.

Knowledge Maps should, therefore, be integrated in blended learning concepts for higher education. Disadvantages of e-learning or e-learning phases within blended learning concepts can be overcome by a positive combination of social exchange in attendances phases and virtual net-based exchange. The surplus generated by multimedia support is another important aspect [4].

## 5. KNOWLEDGE MAP OFFERS A SELF-DIRECTED LEARNING

Knowledge Maps grant intelligent individual learning environments. E-learning with Knowledge Maps as an essential component of knowledge transfer shall be seen beyond the traditional interpretation of e-learning: as a system in order to search and acquire necessary knowledge at any time. Knowledge Maps shall be introduced in a blended learning concept into higher education. Blended learning, as a combination of attendance courses and e-learning, uses the advantages of both learning forms, e.g. opportunities for a social exchange during the attendance courses as well as multimedia support for the learning processes of e-learning. Disadvantages of these learning forms, e.g. time and place dependence of attendance courses or social isolation during e-learning phases can be compensated. The envisaged development of the web Knowledge Map within the project “WeKnow” will integrate the surplus of blended learning concepts.

Knowledge Maps try to visualise knowledge profiles and attempt to enhance the transfer of explicit and implicit knowledge between experts. The Knowledge Map concept combines, therefore, codification and personification strategies within the broad field of knowledge management. In general, the spectrum of the included data and information varies from highly individual knowledge about processes to structured method-based knowledge [5]. The search function of a Knowledge Map is normally based upon a unique knowledge model which has been set up for the organisation alone displaying links between data and information generated in different projects and the experts’ knowledge. The available relations are associatively interwoven through semantic nets, which build a knowledge net – similar to human thinking processes [6,9]. Semantic nets, data and text mining enable a context sensitive display of the retrieved information and the available knowledge carriers’ experiences, inputs and knowledge in general [7]. Fig. 5 visualises an expert interview. This expert interview and naturally all other sources of the Knowledge Map are ubiquitous and no longer bound to a single lecture.

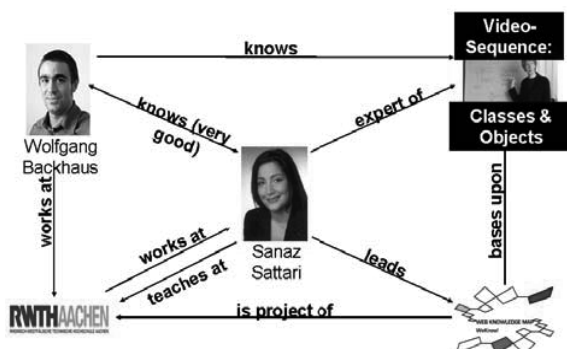


Fig. 1: Simplified structure of a semantic net

The students can retrieve it any given time at any place, and of course more often than only once – a surplus generated

by applying web-based education features. The course adapts to individual learning styles and meets requirements already outlined above when dealing with the “net generation”.

The Knowledge Map, based on a semantic net, contains multimedia files such as text, video or audio documents, e.g. interviews from experts which help to integrate their specific practice-oriented knowledge into the students’ learning contents. The contents are semantically linked by connections like “works at”, “bases upon”, “leads” or “knows” (Fig.1).

|                               |   |                                |
|-------------------------------|---|--------------------------------|
| EXPERT KNOWS ...              | SANAZ SATTARI   | ... READS LECTURE              |
| Tobias Valtinat (very well)   | Address   | Computer Science I             |
| Wolfgang Backhaus (very well) | Dennewarstr. 27   | ... KNOWS EXPERT               |
| ...                           | 52074 Aachen  | Tobias Valtinat (very well)    |
| PERSON                        | Germany   | Manuel Santos                  |
| COOPERATES WITH               | Phone   | Camacho (a bit)                |
| ...                           | 0049-241-80 911 64  | Wolfgang Backhaus (very well)  |
| Wolfgang Backhaus, M.A.       | Email   | ...                            |
| UNIVERSITY                    | sattari@zlw-ima.rwth-aachen.de  | ... WORKS AT                   |
| EMPLOYS ...                   | Objectives  | UNIVERSITY                     |
| RWTH Aachen                   | Project Manager WeKnow  | RWTH Aachen                    |
|                               | Attachment  | ... GIVES SPEECH ON CONFERENCE |
|                               | Video "Classes & Objects" (Tobias Valtinat) (9.7 MB)                  | KnowTech2006                   |
|                               | Sanaz Sattari   | ... LEADS PROJECT              |
|                               | Search Google, Wikipedia, Encyclopædia Britannica for "Sanaz Sattari" | WeKnow                         |
|                               |   | ... TEACHES AT UNIVERSITY      |
|                               |   | RWTH Aachen                    |

Fig. 2: User view of the Knowledge Map

By searching knowledge in this embedded semantic net, corresponding experts can easily be found in the web Knowledge Map by navigating through the different categories or search functions. If new contents or experts need to be added, users with appropriate administrative rights can do this easily. The structure and relations displayed in Fig. 1 are embedded in a browser view (Fig. 2). The user does not – necessarily – have to be aware of the semantic structure, which builds the backbone of the Knowledge Map.

### 5.1 A case study of RWTH Aachen implementation

The lecture “Computer Science in Mechanical Engineering I” addresses software design processes from an engineer’s point of view. As the mandatory lecture presents the input traditionally in a lecture hall for about a thousand students, the learning contents will be achieved in project-based work. Students work in groups of five or six and shall achieve more detailed skills and knowledge in software (re)design and object-oriented programming (C++). Simultaneous to the lecture, students develop their own raw concept of a software design, which will then be implemented [8].

The core idea of the project is to optimise processes on a marshall yard. The students endeavour how the yard is run and elaborate weak spots in the process.

The task is to model the activities. Employees at the gate have to be in a position to survey everything at all times. The case study does not imply the overall description of the yard but focuses on the modal split from the road to train. Parking of the trucks, the movements of the portal crane, the slots given to the trucks and comparable details have to be optimised. The students initiate an exemplary software

development process. The software ensures that the work can be carried out more efficiently. Therefore, students take several steps (i.e.):

- procedures for collaborative and project oriented work,
- state of the art of the marshalling yard,
- class-responsibilities-collaborators
- class diagrams.

For instance, a class diagram for the marshalling yard will look like the example in Fig. 3.

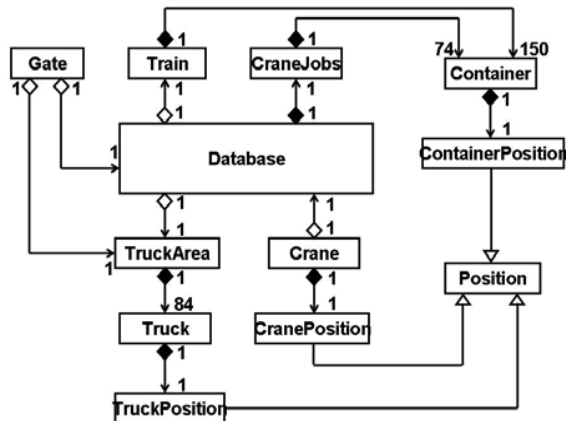


Fig. 3: Class diagram of the marshalling yard [8]

The Knowledge Map in its final version will then provide interviews (text documents, audio, video files) with gate workers and crane operators describing their daily work and the problems that occur. In addition, the map will provide expert knowledge, for instance, about class diagrams.

The Knowledge Map prepares relevant knowledge in context to the software design task given. It combines procedural and scientific knowledge. How class diagrams function can also be learnt from study books, but the web-based Knowledge Map offers a tailored explanation and demonstration of class diagrams which exactly corresponds to the students' needs to fulfil the task given and which is then relevant for the course. Of course, students are encouraged to refer to alternative sources as well. In the



Fig. 4: Expert video on class diagrams

end, the Knowledge Map becomes an intelligent and 'mapped' knowledge pool combining different contents. Fig.4 visualises an expert interview. This expert interview and naturally all other sources of the Knowledge Map are ubiquitous and no longer bound to a single lecture.

The students can retrieve it any given time at any place, and of course more often than only once – a surplus generated by applying web-based education features. The course adapts to individual learning styles and meets requirements already outlined above when dealing with the "net generation".

## 5.2 Semantic Web – New Possibilities on the Web

Semantic web applications generate a surplus in comparison to standard web pages in the usual html- format. The idea of semantic web applications goes back on Tim Berners-Lee, who also invented the World Wide Web. The idea is more a vision, but as ICT dominates more and more and technological developments evolve ever faster, this vision is most likely to become a new trend, which "will unleash a revolution of new possibilities" [9]. At least, Berners-Lee et al. pledge this in the subtitle of their landmark article on the semantic web published in 2001.

Berners-Lee and his co-authors offer a scenario, which is based on the idea that all devices are connected to the web and that semantic web agents interact with the 'device surroundings' [9]. The original scenario is about two siblings, who have to manage several doctor appointments for their mother, which are planned and proposed by 'an understanding' web agent. The agent 'compares' the schedules of the siblings, 'proposes' suitable local doctors and is 'able' to set appointments and reschedule minor meetings of each sibling to fit with the mother's therapy sessions.

It sounds much like artificial intelligence but semantic web engines simply tune the possibilities of the web by enriching http and html. So the web will not 'understand' and 'compare' as human beings would, but the web contains additional information, which allows the computer to interact with different systems in order to generate a surplus. As Berners-Lee et al. point out; the starting point is quite motivating to develop a vision:

"Most of the web's content today is designed for humans to read, not for computer programs to manipulate meaningfully." [9].

The scenario by Berners-Lee needs to be transferred to the main topic addressed by the article, namely Knowledge Maps in web-based education. An 'intelligent' web allows a more sophisticated navigation within its vast and apparently unordered contents. Semantic enabled engines support the user to extract information and knowledge from web-based sources. The users' previous knowledge is not that vital anymore as semantic ICT assists in interpreting and connecting contents. E-learning and blended learning profit because of new learning environments as a navigation allows promenading through implicit and explicit knowledge stocks [10]. Interconnections and valuable sources can be retrieved systematically and not only by chance or skilled use of search engines like Google, Fireball, AltaVista or Lycos, among others. ICT literacy is

an asset to retrieve information from the WWW and can be described as “the ability to use digital technology, communication tools and networks appropriately in order to solve information problems in order to function in an information society” [11]. The study namely challenges of ICT literacy, which touch several fields. Within an abundance of information one has to identify trustworthy information and these pieces of information need to be communicated effectively. The study findings reveal that only few test takers (n=3600 from 36 US universities and colleges) demonstrate key ITC literacy skills [11]. Therefore, the environment should be adapted to obvious needs.

The actual demands can be best described as supporting features or devices to navigate and find information. This is the service offered by the implementation of Knowledge Maps, which can help to tackle this problem in higher education environments. It becomes palpable that the new generation whose members are about to enter in their professional lives are familiar with ICT. Though, one necessary precondition has to be complied with: Despite all self-motivation a professional guidance and tutoring process has to assist young experts to deal with the over abundance of digital contents on the WWW successfully.

To be enabled to use the global knowledge available, the target group shall use knowledge efficiently. The web-based Knowledge Map project tries exactly to attempt this very challenge, which might be crucial for the years to come.

### **5.3 Knowledge Management and the Exposure of Engineers to Knowledge**

As RWTH Aachen applies the Knowledge Map as a web-based education tool within the Faculty of Mechanical Engineering one more relation should be stressed. This section aims at pointing out that learning with a web-based Knowledge Map also prepares for a later work environment. An excursus shall underline this thesis. Germany is traditionally strong in exports. The quality label “Made in Germany” refers especially to one occupational group: engineers. Their capability of innovation and their know-how stand for the economic success of the technology sector in Germany and for European Union on an international perspective [7]. Though, the classical image of the engineer is changing due to developments best described as the knowledge society. The solitary puzzle solver will have to act with a stronger focus to the market and will have to cooperate with other actors if he wants to remain successfully. It will be crucial for Europe and Germany as a leading technology and knowledge places, how engineers will handle their knowledge in future and to what extent they are in a position to think and act in economic dimensions. The actual behaviour of engineers towards knowledge shows which demands occur for organisational frameworks and which tools are suitable for the implementation of knowledge management focusing the needs of engineers as knowledge workers [7]. Knowledge Maps can certainly be of value for companies and organisations as well: The principal idea is transferable.

The knowledge and learning of engineers is special. Mental models for engineering work processes reveal a strong reference to domain knowledge. Meaning, engineers follow rules and think in phases, though trying to rely on quantifiable information. This is – to some extent – due to the typical focus in engineering science to look for hard factors in the first place and to accept softer factors, which emerge from a social science perspective subordinately.

## **6. CONCLUSION**

Semantic webs are a trend, which will gain importance in the next few years. The ‘understanding’ of web contents will offer many opportunities. As the presented Socrates project “WeKnow” demonstrates, the field of web-based learning and ODL offers a perfect field to work with semantic nets and ‘intelligent’ web structures. Information and (the resulting) knowledge can be activated in order to create synergies. Web-based education and tailored access to information and knowledge addresses the novel learning behaviour of future experts, which have been introduced as the “Homo Zappiens”. Non-linear and simultaneous multi-source learning are new approaches, which have to be taken into account when designing new higher education concepts. This is an aspect to refer to in connection with the Bologna Process. Blended learning concepts will be a sustainable and forward-looking answer.

## **7. REFERENCES**

- [1] European Commission, *The Bologna Process* (Online:[http://ec.europa.eu/education/policies/educ/bologna/bologna\\_en.html](http://ec.europa.eu/education/policies/educ/bologna/bologna_en.html), [Nov, 2, 2006])
- [2] DG for Employment, Social Affaire and Equal Opportunities of the European Commission, *Employment in Europe 2005. Recent Trends and Prospects*. (Luxembourg, Office for Official Publications of the EC, 2005)
- [3] W. Veen: Learning Strategies of Homo Zappiens, *Proc. Online Educa 2005*, Berlin, Germany 2005, 20-25
- [4] S. Sattari, W. Backhaus & K. Henning, The Web-based Knowledge Map, *Proc. Knowtech 2006 Conference on Knowledge Management in Economy and Administration*, Munich, Germany, 2006, 229-239.
- [5] S. Scheermesser, *Wissenslandkarten. Der Wegweiser für Wissenssuchende*, (SENEKA-Journal (1) 2000, private publishing, Aachen, 2000, 16).
- [6] G. Schoeler, T. Valtinat, & G. Bornefeld, *Die Virtuelle Plattform SENEKA und ein weiteres IT-gestütztes Wissensmanagement-Tools des Projektes*. (In: Henning, K.; Isenhardt, I.; Oertel, R. (Hrsg.) *Wissen - Innovation - Netzwerke. Wege zur Zukunftsfähigkeit*. Berlin, Springer, 2003).

[7] N. Hofmeister, U. Kagelmann, G. Schoeler, M. Hinsch & R. Schulze, *Wissensmanagement der Ingenieure. Die Praktiker holen sich weltweit, was sie brauchen* (Duesseldorf, VDI-Verlag, 2004).

[8] K. Henning, S. Kutscha,, *Informatik im Maschinenbau, 6th edition* (Aachener Reihe Mensch und Technik, Vol. 31, Aachen, Mainz, 2003).

[9] T. Berners-Lee, J. Hendler & O.Lassila, *The Semantic Web. A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities* (Scientific American.com, Online, <http://www.sciam.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21&sc=I100322> [Nov., 2, 2006]).

[10] M. Polyani, *Implizites Wissen* (Suhrkamp, Frankfurt, 1985).

[11] Educational Testing Services, *2006 ICT Literacy Assessment. Preliminary Findings* (Online: <http://www.ets.org>, [Nov. 20, 2006]).

## THE AUTHORS



### Peter Fabian

University of Žilina, Univerzitná 1, 01026 Žilina, Slovakia,  
e-mail: [peter.fabian@fri.utc.sk](mailto:peter.fabian@fri.utc.sk)



### Sanaz Sattari

Center for Learning and Knowledge Management and Department of Computer Science in Mechanical Engineering, (ZLW/IMA), RWTH Aachen, Dennewartstraße 27, 52064 Aachen, Germany. S. Sattari is the co-ordinator of the project.



### Wolfgang Backhaus

ZWL/IMA, RWTH Aachen, Dennewartstraße 27, Aachen, Germany,  
e-mail: [backhaus@zlw-ima.rwth-aachen.de](mailto:backhaus@zlw-ima.rwth-aachen.de)  
W. Backhaus is the Head of the Section Knowledge Representation at the Centre.



### Klaus Henning

ZWL/IMA, RWTH Aachen,  
Dennewartstraße 27, 52064 Aachen,  
Germany

e-mail: [henning@zlw-ima.rwth-aachen.de](mailto:henning@zlw-ima.rwth-aachen.de)

K. Henning is the director of the Centre



### Ellen Sjoer

TU Delft, Centre for Education and Technology, Jaffalaan 5, 2628 BX Delft, NL, e-mail: [e.sjoer@tudelft.nl](mailto:e.sjoer@tudelft.nl)

E. Sjoer is a senior researcher at the Centre at the Faculty of Technology, Policy and Management at TU Delft



### Eamonn McQuade

Department of Electronic and Computer Engineering, University of Limerick, Limerick, IE

e-mail: [eamonn.mcquade@ul.ie](mailto:eamonn.mcquade@ul.ie)



### Pedro Pimenta

Department of Information Systems, University of Minho Largo do Paço, 4704-553 Braga, PT

e-mail: [pimenta@dsi.uminho.pt](mailto:pimenta@dsi.uminho.pt)

P. Pimenta is lecturer in Informatics at the University of Minho, Portugal.



### Jose Carlos Nascimento

Department of Information Systems, University of Minho Largo do Paço, 4704-553 Braga, PT

e-mail: [pimenta@dsi.uminho.pt](mailto:pimenta@dsi.uminho.pt)

P. Pimenta is lecturer in Informatics at the University of Minho, Portugal.

## ACKNOWLEDGEMENT

*The SOCRATES/MINERVA project "WeKnow" is funded with support from the European Commission.*

*This paper reflects the views only of the authors, and the European Commission cannot be held responsible for any use, which may be made of the information contained therein.*



## CONSTRUCTION OF THE SYSTEM OF DISTANCE LEARNING WITH VARIABLE KERNEL TECHNOLOGY USING

Pavlo Fedoruk

Precarpathian National Vasyl Stefanyk University, Shevchenka 57, Ivano-Frankivsk 76025, Ukraine

Tel. +38 0342 596048, fax. +38 0342 231574, e-mail: pavlo@pu.if.ua

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The article reveals the architecture of the system of distance learning on the basis of technology of variable kernel, which helps to receive new technological abilities for projecting similar systems. The usage of the given technology helps on request to integrate certain module into the system as well as to synchronize the job of two all-sufficient platforms of distance learning, which at modern variety of existing SDL opens new perspectives in the development of the given branch and lets to provide full and effective organization of the learning process.

**Keywords:** System, Distance education, Information and Communication Technology.

### 1. INTRODUCTION

The analysis of problems of making and developing of innovative directions in learning shows that in Ukraine and abroad during the last decades more and more attention is given to distance education. Starting from the beginning of the 90-th, in the pedagogical theory and practice distance learning is identified as one of the most perspective directions of development [1]. Parallel methodological as well as technical researches are conducted in the given branch. During the last 15 years of fast development a great number of program packets are made for the distance learning. They are used to be called systems of distance learning (SDL). This term includes small applied programs as well as the whole program complexes. Most of such learning systems at present are just a library of static hypertext books and test tasks that are insufficient for full ranged and effective organization of the learning process [2].

Each of the popular systems has its advantages, so using at practice different program packets and platforms for distance learning the necessity of two individual systems integration often appears. But this process is prospectless from technological point of view. Each system has its ideology of fulfillment and architecture.

Experience of construction of program packets for distance learning shows that often appears the necessity not only to integrate a module into the system but to synchronize the work of two all-sufficient platforms of distance learning. As the result appears the necessity to develop the architectural principles of SDL of new generation construction, which will not have the disadvantages of modern SDL. In the given paper the architecture of SDL of new generation, under its construction the greatest attention is given for the possibilities of integration and broadening. As result it is proposed to use the technology, which is based on ideology of variable kernel.

### 2. THE TECHNOLOGY OF VARIABLE KERNEL

In the process of architecture construction it was analyzed a few models of module system construction. The most effective from the point of view of the given task the prototype of constructed kernel of operation systems was identified (were analyzed the models of operation systems Windows, Linux, Minix and some other Unix systems) [3,4,5].

The analysis of the weak points of modern systems of distance learning lets formulate demands for the next generation:

1. the maximum plainness of kernel of the system;
2. easiness of module integration apart from technology of their realization;
3. plainness of integration of two all-sufficient systems (multikernel systems);
4. open standards of cooperation of different system modules with kernel.

Tries to use module architecture for SDL projecting have existed for a long time and there are to a great degree successful projects in the direction. But investigated projects have an important defect – strong referencing to technology. On new demands for each of them may construct module that will have necessary functionality. But technical abilities of this module will be restricted by possibilities of technology, on the basis of which it is constructed (programming language, operation system etc.). In the process of investigation of this question a task appears to construct widening system, realization of which will solve the problems. Search of the concept for construction of ideologically new system reveals the model of variable kernel.

The kernel of the system of distance learning, to our point of view, must realize minimal functionality of the system, which includes transporting of data packets between system modules. Modules in their turn are realizing the main system functionality, divided logically between them. One

of principles of module system construction gives attention to making understandable and well-documented interface of module cooperation with kernel. In our case the common interface is difficult to identify because module may be realized with the help of any technology (acceptable is the variant of technology using, that will be constructed in future from the moment of kernel making), so it is unknown whether it will include documented functions at the given moment or not.

Realization of the system broadening leads us to the architecture of minikernel [6]. Minikernel is minimal kernel of computer operational system that provides only main operational system processes (system request), at the time when other processes (that usually are fulfilled by kernel) are provided by programs with system rights on user level, that is called servers. Surely, minikernel provides services of the type of address amplitude managing, providing streams and connection between processes.

Advantages of minikernel approach to the system projecting;

- adding new service doesn't demand the change of kernel;
- system has better possibilities of security, as more functions are fulfilled in the user mode than in the kernel mode;
- simpler kernel project;
- higher system reliability in comparison with others.

Cooperation between processors in the system, which uses minikernel technology may be organized by one of the two main ways: synchronous or asynchronous exchange of messages. Synchronous interaction is organized similar to subprogram chain: request is fulfilled by process, the process is waiting while the request will be fulfilled, the process, that initiates request renewed control. Such approach to architecture demands clear organization of interaction between processors, as it exists high possibility of blocking the processes as well as kernel. This is the weak point of synchronous process interchange. Between advantages of such approach to the architecture OC – simplicity of the kernel. Synchronous interchange between processes is realized in OC QNX [7]. Other OC of the family UNIX use asynchronous messages exchange. In some OC the combined model (Linux, Minix) is realized.

Minikernel servers – programs similar to others, except the kernel gives some of them an advantage to coordinate with memory parts, which are not available to most of the programs. It lets servers to coordinate directly with hardware resources of computers. That is on the whole this is the program that fulfils the function of middle chain between outer computer equipments and applied programs. In the context of our problem solving the most valuable in the architecture of minikernel is interchange of servers with the help of kernel. As the function of server is broadening of hardware operation system possibilities, the given ideology may be also used for computer variable kernel projecting, which should also include analogical broadening possibilities.

### 3. ARCHITECTURE OF BROADEN SOFTWARE PRODUCT OF NEW TYPE

Let us characterize the main components of software product of new type.

*Kernel* – is the central system component, which provides message transport between system modules. The kernel is an analogue of operation system kernel.

*Driver* – is an intermediate element between interaction of kernel and module. It fulfills data change from common system format into understandable for the format module and vice versa. For example: the driver, which connects modules in the form of DDL libraries, driver, which receives and sends messages by UDP protocol, driver, which connects modules realized in the form of COM objects.

*Module* – is a functional element of programming system, which may be added to the system without any changes in other parts of the system and fulfill the given functions independently from technology of its realization. Module connects the system (the system kernel) with the help of one of driver kernel.

*Variable kernel*- will be called the kernel of programming system together with all its drivers.

*Data packet* – is structural object identified for characterization of information, witch is transported from one module to another. The determinant of the module of sender of information, the addresser determinant, the command (a short text field, identified for addresser understanding of the type of received information), data (field, which include the information in itself) are included into the structure of the data packets.

*Hook* – is the term, derived from software API OC Windows. It describes the same object in our suggested structure, that is the procedure of selecting by module the data packets, that is not appointed for the given module, data processing, which is included into the data packets (possible to correct), and returning the data packets to the kernel for the next processing. Hooks widen the possibilities of programming system, including SDL. With the help of hooks we may realize high functionality and minimum shorten dependence of modules one from another. A hook contains in itself filtering task for batch. On practice, at constructing big broadening systems from the point of view of optimization a demand in dividing systems into some partially autonomous subsystems may come about that is creation of multikernel. Analyzing described technologies we have developed the concept of construction of broaden software of new type. The independence of system modules from realization technology and platform of fulfilment were the main demands at constructing the given system.

### 4. THE PRINCIPLES OF SYSTEM FUNCTIONING ON THE BASIS OF VARIABLE KERNEL

The data exchange between modules 1 and M+1 is shown on the scheme (Fig.1).



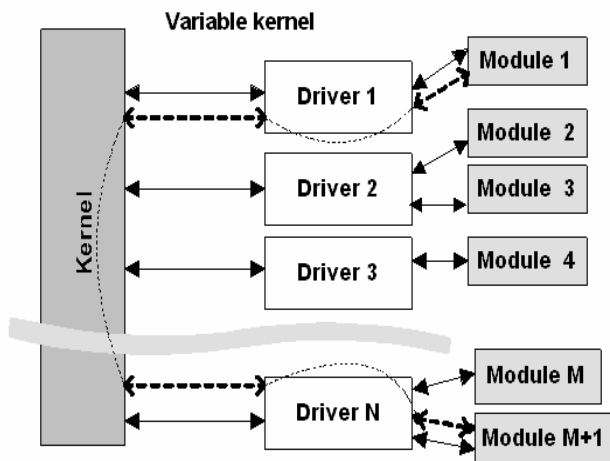


Fig. 1. The scheme of interaction of broad system on the basis of variable kernel.

The next scheme demonstrates the way, which data packets pass through from the moment of their sending by any module till the moment of its receiving by an addresser. The scheme is divided into three parts: modules, drivers, kernel. Such division depicts the type of the element of the system, which fulfills the functioning at every moment of time (Fig.2).

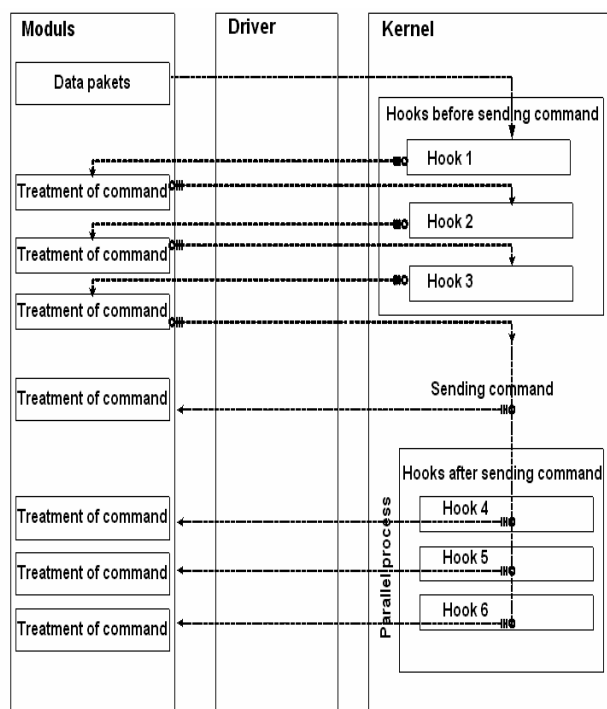


Fig. 2. The scheme of data packet movement.

Let us describe the procedure of transferring of data packet from one module of the system to another.

- the data packet is sent to kernel through the driver.
- kernel fulfills search by the table of hooks and chooses those, filtration task of which agrees with given data packet. Only those hooks are taken into account that

are constructed for selection of data packet before sending to addresser.

- kernel sends by turns data packet to modules, that put needed hook and waits the returning of the data packet from them. The data packet may be changed by module. Sending is provided with the help of given drivers.
- kernel sends data packet (maybe with information changed) to addresser.
- kernel finds hooks, that are put at selecting the data packets after sending to addresser, and the task of filtration of which is satisfied by the given data packet.
- kernel sends in turns data packet to modules that put given hooks.

## 5. USAGE OF SUGGESTED ARCHITECTURE FOR DEVELOPMENT OF DISTANCE LEARNING

The next scheme illustrates the architecture of the distance learning system on the basis of technology of variable kernel (pic.3). As you can see from the picture, the architecture of the system is multikernel.

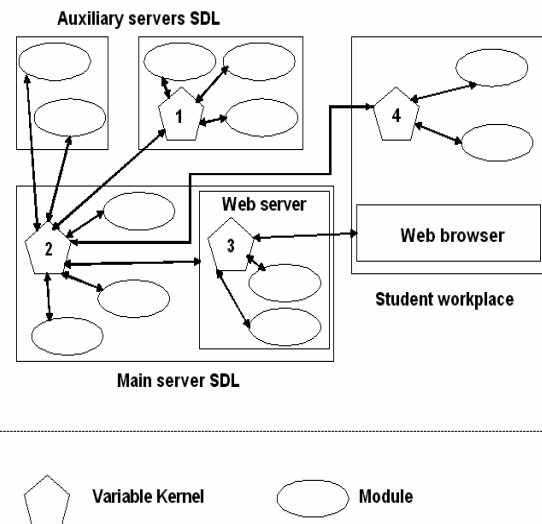


Fig.3. Architecture of the distance learning system on the basis of technology of variable kernel.

Adding additional kernels lets divide the system into logical parts that will simplify additionally the function of SDL and minimize load on the system hosts.

The main functionality of SDL is realized in modules of kernel 2 (here and further on variable kernel we call just kernel), which is situated on the main server of the system. As it is clear from the scheme, part of modules can be situated on separate physical servers. If it is necessary to divide logically the function, we may input additional kernels.

A certain kernel is identified for managing by web-server of SDL. Identification of certain kernel lets relieve the kernel of load concerned with interface part of SDL. At present web interface is the main way of interchange of SDL and a

student through the Internet. But in future there may appear another need in different types of cooperation. Described architecture lets us use new types of cooperation with the help of modules usage situated on the working place of the student. When it is necessary to move much functionality onto the student's computer you may place there separate kernel (kernel 4 on the scheme).

## 6. CONCLUSION

Developed architecture of the distance learning system on the basis of variable kernel technology lets get new technical abilities for projecting such systems, such as: maximum simpleness of kernel system, lightness of modules integration independently from the technology of its realization, open standards of interchange of different modules of the system with kernel. The usage of the technology lets integrate certain module into the system as well as synchronize the work of two all-sufficient platforms of distance learning that at present day variety of existing SDL opens new perspectives in the development of the given branch. Realized system on the basis of described architecture will give ability to get rid of disadvantages of modern SDL, that remake them into library of static hypertext and test tasks that in its turn will provide sufficient and effective organization of the learning process.

## 7. REFERENCES

- [1] Fedoruk P. I Adapting the Learning Process in Distance Learning System Based on Evaluating the Speed of Student's Perception and Comprehensibility of Knowledge // Proceedings of the Ninth IAESTED International Conference on Computers and Advanced Technology in Education, held October 4-6.– Lima, Peru, ACTA Press, 2006. – P. 351-356.
- [2] Fedoruk P.I. Means, instruments and abilities of modern distance learning systems // Electronics and Wire. – Kyiv, 2006. – №29. – P. 76-87.
- [3] <http://msdn2.microsoft.com/en-us/library/aa909237.aspx>
- [4] <http://tldp.org/LDP/tlk/tlk.html>
- [5] <http://www.minix3.org/>
- [6] Khawar M. Zuberi , Kang G. Shin, EMERALDS: A Small-Memory Real-Time Microkernel, IEEE Transactions on Software Engineering, 2001, v.27 n.10, p.909-928.
- [7] Dan Hildebrand (1992). "An Architectural Overview of QNX". Proceedings of the Workshop on Micro-kernels and Other Kernel Architectures. ISBN 1-880446-42-1.

## THE AUTHOR



### **Pavlo Fedoruk**

Ph.D., Associate Professor, Director of Information Technologies Centre at Precarpathian National Vasyl Stefanyk University, Ivano-Frankivsk, Ukraine. He published 46 professional publications in three different languages, including 3 books. His research interests are in mathematical and software support of calculated machines and systems, artificial intelligence, adaptive systems .



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

## ADVANCED KNOWLEDGE ASSESSMENT SYSTEM (FUNCTIONAL SPECIFICATION)

Ján GENČI<sup>1</sup>, František JAKAB<sup>2</sup>

Department of Computers and Informatics, Technical University of Košice

<sup>1</sup>genci@tuke.sk, <sup>2</sup>jakab@elfa.sk

**Abstract.** e-learning has become widely accepted technology during last decade. However, main attention was devoted to content development, its presentation and functionality of learning management systems during this period. On the other side, it seems, there was not so high interest in the area of knowledge assessment. Paper deals with the functional specification of advanced knowledge assessment system.

**Keywords:** e-Learning, open learning, knowledge assessment

### 1. INTRODUCTION

e-learning became widely accepted technology during last decade. However, main attention was devoted to content development, including authoring tools, content presentation and specification and implementation of functionality of learning management systems (LMS). These aspects were deeply developed and LMS were released in the many both commercial and open-source implementations ([1], [2]).

Hardcopy published curricula have linear structure (what correspond to “structure” of human learning process, which is linear also – we mean, human is not able to learn several mental knowledge simultaneously). This linear structure is logically converted to tree structure using chapter numbering. Tree structure presents knowledge structure of curricula, starting with the basic (low level) knowledge at the leaves of the tree. Upper layers of the tree group lower layer knowledge to the more complex knowledge.

During the period of intensive development of curricula and LMS systems there was not so high interest in the area of knowledge assessment although some standards regarding testing were developed (e.g. [3]). Usually, developers did not respect testing standard and the few types of questions were implemented in the LMS for testing purposes only – true/false, one-from-many, many-from-many types. Developed tests are “flat”, usually composed as a “random” subset of questions, usually tight with basic knowledge, only. There is no methodology implemented in the LMS supporting test development, systems do not support test and question lifecycle. LMS systems lack functionality about statistics regarding tests and questions used (reporting functionality).

Course developers develop also tests and they are usually not aware the fact the tests have to be carefully developed and tuned afterwards. Every question has to be explored in the details to reveal and remove “hidden” meaning in the test question and presented answers.

Another problem regarding knowledge assessment consists in the “complex” testing (i.e. midterm or end of the course

knowledge assessment). Question is usually designed to prove the fact the students were able to remember information from the presented relevant chapter. Final course assessment (testing) consists of mixture of questions from chapter tests. Higher levels of testing questions, which are able to prove higher-level of course material understanding, are not so frequent.

Authors’ personal e-learning experience in the frame of the one of the largest e-learning project - CISCO Networking Academy Program (NetAcad) and also as an university teachers proved another aspect of testing – test questions are usually very quickly revealed after first release. In the global systems, what the Networking Academy program is, students are very often able to find questions and answers on the Internet. “Local test” (developed in-house by teachers) are stolen using current technology (digital cameras, mobile-phones). In this case, results do not reflect real students’ knowledge and testing is carrying the formal character, only.

Mobile phone technology became phenomenon. We discovered that sometimes students are using mobile phones with hands-free set to get required information from their colleagues be prepared to consult all available resources (i.e. books, lesson notes), make a photos of the screen. We believe others approaches are not discovered yet.

We are aware, not all type of knowledge can be assessed by computerized test. However, our experience in the area of information technology education convinced us in the possibility to fight with mentioned problems and reach quite high level of knowledge assessment.

### 2. ADVANCED KNOWLEDGE ASSESSMENT SYSTEMS – REQUIREMENTS

To address drawbacks presented in the previous section, we briefly summarize them:

- impossibility of testing questions to demonstrate level of understanding of course material;

- absence of curriculum structure (model) definition in the LMS;
- poor set of types of question implemented in the LMS;
- personalization of the test and (possible) strong limitation in the time;

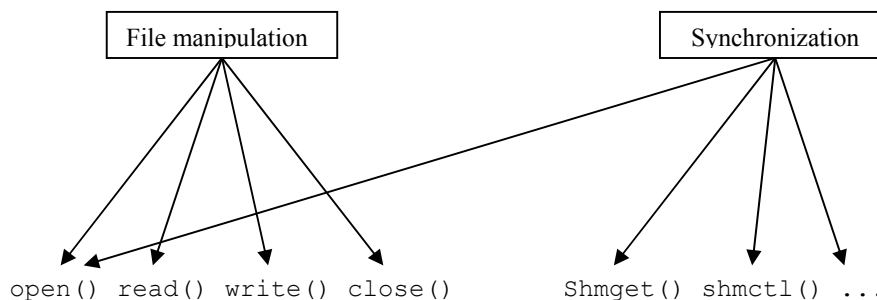
To assist developers in their work, we require following functionality of LMS in the area of testing:

- testing question lifecycle support;
- flexible way of generation of tests;
- test lifecycle support;
- open to incorporation of new type of testing questions;
- support for test developers collaboration;
- extensive reporting (regarding items, learning objects, whole test).

In the next chapter we will try to introduce technologies and approaches we are regarding helpful in the

### 3. ADVANCED KNOWLEDGE ASSESSMENT SYSTEMS – TECHNOLOGIES

To alleviate, or even eliminate, drawbacks of current LMS systems in the area of knowledge assessment, the approaches described below we regard helpful.



**Fig.1 Example of cognitive structure of the curricula**

We illustrate this in the short example. One of our course – Unix/Linux system programming – presents, among other topics, two (practically independent) topics - file manipulation and synchronization of processes. File manipulation topic contains learning items regarding functions `open()`, `close()`, `read()` and `write()`, while synchronization topic is build around the concept of semaphore. However, special form of `open()` function can be used for synchronization purposes. Structure of the curricula for this case is presented on the Fig. 1.

We require every question to be assigned to particular node of the graph. It gives us possibility to specify if question tests basic or more complex knowledge. It is clear, definition of structure of curriculum must be supported by the AKAS.

#### Taxonomy of the cognitive aims.

During the learning process human being passes several phases of knowledge acquisition– starting from the remembering, going through the understanding and using it in the productive activities, at the end. Learning process has to pass these phases which are usually named as cognitive aims.

There are several specifications of levels of cognitive aims. We call it taxonomies. Well known is Bloom taxonomy [4], which defines six levels of knowledge and intellectual skills. Another one, widely presented in Slovakia, is Niemierko's taxonomy [5], which define four levels.

Categorization of testing question to different level of taxonomy can give us possibility to assess if the student reaches required level, or to find out, which level of taxonomy student reached during learning process.

We require every question designed in the system must be assigned to particular level of chosen taxonomy. Several taxonomies, even defined by the user, should be supported by the AKAS.

#### Definition of knowledge structure of curriculum.

To better understand cognitive aims of curricula, map of knowledge (learning objects or learning items) and their relationships is useful. In this case we get knowledge structure of curricula. This structure must be represented as oriented graph.

#### Rich set of types of questions.

As mentioned above, many of the LMS systems provide only few types of question. As usually, it is true/false, one-from-many and many-from-many types. However, to evaluate higher level of knowledge, it will be valuable have other types of testing questions, i.e.:

- clickable figures (allow to ask to specify required part of a figure);
- short free text evaluated on regular expressions;
- input for evaluation program.

Possibility to incorporate on the user level evaluation program represents the most flexible approach. On the other side, this approach represents security risk

### Personalization of tests and strong limitation in the time.

We believe, problem of cheating can be partially eliminated by strong personalization of the tests. It means each student have to get its own version of the test. Common approach used in the current systems – changing order of questions and changing order of answers in the one-from-many and many-from-many types of question – seems to be insufficient. Solution could be higher variability of the testing questions – specify much more positive and negative answers for particular question (i.e. if we specify 3 positive and 4 negative answers for one-from-four question type, overall we have 12 different combinations for one question). Another solution could represent free answer question type evaluated by regular expression or even evaluated by special designed program.

“On-line” cheating (using mobile phone or other on-line communication tools) can be hardly completely eliminated. Some technological solution can help, especially in area of limitation of on-line communication. But they cannot be used in all situations and some of them can be limited even by legislation (e.g. local cancellation of mobile signal is not allowed in the Slovakia). Time restriction is the means, which could help to eliminate this problem. We shall require system functionality to allow limit not only overall test duration, but also to limit particular questions or parts of tests.

### 4. CONCLUSION

According presented ideas we started design and implementation of advanced knowledge assessment system. We explore two ways:

- extension of LMS Moodle for richer question types;
- design and implementation of system from the scratch.

First approach seems to be more productive, because of enormous amount of works involved into the LMS Moodle, but could be limited by its structure. Second one pretends to be solution covering broader functionality presented in the paper, but will require full development of the system.

### 5. REFERENCES

[1] Virtual learning environment. From Wikipedia, the free encyclopedia  
[http://en.wikipedia.org/wiki/Course\\_management\\_system](http://en.wikipedia.org/wiki/Course_management_system)

[2] edutools. Decision-making tools for E-D-U community.  
<http://www.edutools.info/>

[3] IMS Global Learning Consortium. Question and Test Interoperability Project Group.  
<http://www.imsglobal.org/QT1.html>

[4] Learning Domains or Bloom's Taxonomy.  
<http://www.nwlink.com/~donclark/hrd/bloom.html>

[5] BLAŠKO, Michal: Systém výučby s uzavretým cyklom v podmienkach kvality školy (MONOGRAFIA). Košice: KIP TU, 2006. ISBN 80-8073-498-4.

### THE AUTHORS

**Frantisek Jakab** was born in 1959. He received the MSc.degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Košice. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modeling, simulation and network management, new form of multimedia-based communication, QoS, tele-learning systems, intelligent tutoring systems and virtual universities. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)).

**Jan GENČI** (1961). He received the MSc.degree in Systemotechnic engineering from the Odessa State Polytechnic University, Faculty of Automation and Computing (Ukraine) in 1984 and the PhD. degree in the area of Programming and Information Systems at Technical University of Košice in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical University of Košice. His research interests include general programming, database technologies, computer linguistics, and virtual universities.

### ACKNOWLEDGEMENT

*This work was supported by KEGA grant 3/4174/06*





## LEARNING OBJECT REPOSITORIES AS A TECHNOLOGY FOR VIRTUAL COMMUNITY OF TEACHERS?

Zdena Lustigova  
Laboratory of Distance Education, Charles University Prague  
E-Mail: lustigo@plk.mff.cuni.cz

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The paper deals with the key problems of learning objects, metadata standards, taxonomies, search queries, and other “illnesses” of the existing learning object repositories. As an example of national effort on this field, and concrete model of solution the author presents in the main part of the paper TELMAE Educational Portal and Learning Object Repository, developed at the Laboratory of Distance Education, Charles University in Prague, that have been offered to science teachers, educators and students in the Czech Republic since 2001. The Telmae portal consists of teachers’ and learners’ online supportive environment, gateway to online courses, online journals, learning object repository EDUPORT and SCORM based “unified gateway” to learning objects at 6 Czech universities, participating in the project. The key factors, advantages and limitations of this solution, and the possible benefit for virtual learning community of teacher and learners, arising from the creative background of Telmae supportive learning environment, are discussed at the end of the paper.

**Keywords:** choose at least 3 of them from the List of Recommended Keywords (important for searching on the CD ROM). You can also add own ones (but they will not be listed on the CD ROM).

### 1. LEARNING OBJECTS

There are many learning objects’ definitions. Let’s use one of the most practical:

*Learning objects (LOs) enable and facilitate the use of educational content online. Internationally accepted specifications and standards make them interoperable and reusable by different applications and in diverse learning environments. The metadata that describes them facilitates searching and renders them accessible*

#### Learning object terminology

Learning objects terminology brings a lot of uncertainties and misunderstandings. It might include assets (Wiley 2000); content object (ADL, 2003; OASIS, 2003), educational object, knowledge object (Merrill, 1999), Learning object (generic) term credited to W. Hodgins (Jacobsen, 2001); Learning resource (IMS Global Learning Consortium, 2000). media object (ADL, 2001), RLO (Reusable Learning Object) (Cisco Systems, 2001; MERLOT, 2002); etc.

### 2. LEARNING OBJECT REPOSITORIES (LORs)

#### Layout of the text and formatting

A Learning Object Repository according many definitions is storing content (assets/ e-learning units, etc.) as well as their metadata records.

In the so-called “learning object market”, the repository is a very important part. It is the place where we submit learning objects for storage; expose them for searching and gathering by others, and from where we deliver them upon request.

#### Existing LORs - International effort

Interest in learning object repositories is a worldwide phenomenon.

In general, international LOR developments are focused on following:

1. Development of interoperability standards and metadata schemes
2. Design and deployment of centralized repositories, digital libraries, or federated repository networks aimed at empowering individual educators as well as communities of practice

Selected examples:

SMETE Open Federation in the United States

<http://www.smete.org>,

EDNA Schools Online Curriculum Content Initiative in Australia <http://socci.edna.edu.au/>,

MERLOT <http://www.merlot.org>,

ARIADNE <http://ariadne.cs.kuleuven.be>

#### The case of TELMAE educational portal and LOR

The Educational Portal TELMAE, developed at Charles University in Prague, is based on the principle of open access and publishing. The quality is ensured by several (subject oriented) editorial boards and cross review system. The Educational Portal TELMAE contains 1/ LOR TELMAE EduPort, 2/ Online Journals, 3/ “Gate to online courses”, and many other communication, information and consultancy tools and services. The Telmae portal and LOR has served to its users since 2001, with the main vision to create a virtual community of teachers. A simplified structure of the portal is shown in the figure 1.

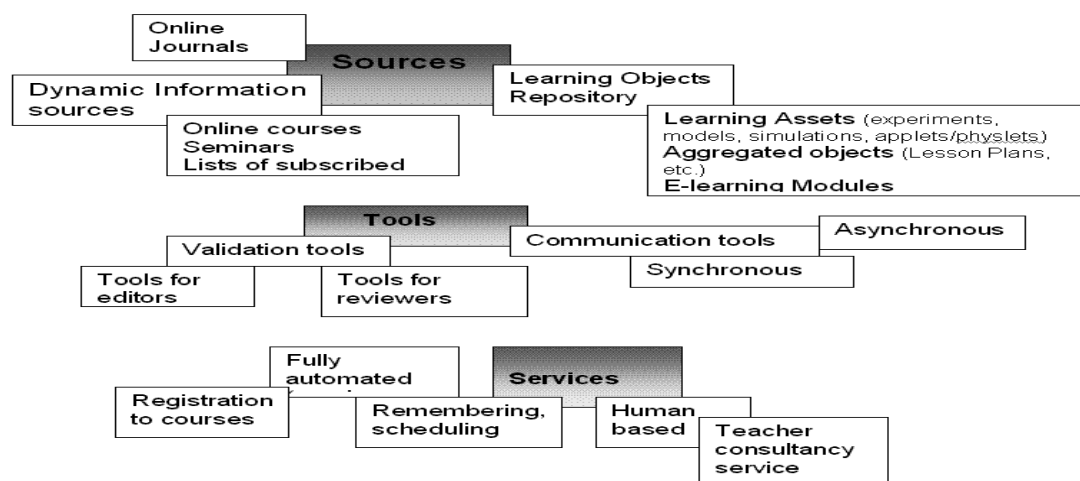


Fig. 1. Functional structure of the LOR TELMAE - user's view

The TELMAE learning objects metadata has been collected since 2001. Now, the TELMAE Eduport contains about 1400 learning objects including their metadata envelopes. These metadata are produced and accessible in two languages (Czech and English).

Telmae Metadata are created with respect to the basic SCORM metadata subset. Daily updated metadata sets are public accessible and automatically exchanged with other digital libraries and learning object repositories on the national level.

Then the EDUGATE at <http://telmae.eu> enables access to all learning object repositories at Czech Universities, participating in the project.

#### Interoperability on the international level –gaps

Authors of the study on Learning Object Repositories [5] conclude: “The need for less onerous metadata tagging strategies is being explored. Accurate metadata tagging is the key to making learning objects accessible through

search and retrieval functions.” All Learning objects repositories meet similar problems.

1. To choose the best metadata subset with respect to users', authors' and indexers' needs and with respect to existing LO Standards.
2. To choose the best taxonomies (subject taxonomies, learning objectives taxonomies, etc.) again with respect to your users and with respect to potential interoperability on the international level, which is practically impossible, too.
3. To find the best conversion tables with respect to language/cultural/social specifics (structural data).

According to the comparative study [3], based on the work of Eric Duval [2] and our own observations of LOR's users behaviour, log files and search queries statistics, we found metadata elements frequently used by authors might be less used by indexers and *might not be used by searchers at all*.

| Metadata element    | Most used vocabulary value             |  | Percent |         | Element Filled in |        |
|---------------------|--|--|---------|---------|-------------------|--------|
|                     | ARIADNE                                | TELMAE                                 | ARIADNE | TELMAE  | ARIADNE           | TELMAE |
| Document language   | French                                 | Czech                                  | 42.4 %  | 98.1 %  | 100%              | 100%   |
| Usage rights        | Free                                   | Free                                   | 62.0 %  | 100.0 % | 100%              | 100%   |
| Science type        | Exact, Natural and Engineering Science | Exact, Natural and Engineering Science | 69.1 %  | 98.8 %  | 100%              | 100%   |
| Main discipline     | Informatics/Information Processing     | Physics                                | 43.4 %  | 82.4 %  | 100%              | 100%   |
| Sub discipline      | General / Sundry                       | Mechanics                              | 40.2 %  | 36.0 %  | 100%              | 100%   |
| User type           | Learner                                | xxx                                    | 95.1 %  | xxx     | 100%              | xxx    |
| Document type       | Expositive                             | xxx                                    | 64.9 %  | xxx     | 100%              | xxx    |
| Media (MIME) type   | Text / HTML                            | Text/html                              | 25.4 %  | 77.6 %  | 100%              | xxx    |
| Document format     | Narrative text                         | xxx                                    | 23.5 %  | xxx     | 100%              | xxx    |
| Operating system    | Multi-OS                               | xxx                                    | 63.8 %  | xxx     | 100%              | xxx    |
| Granularity *       | Lesson                                 | lesson(lesson plan)                    | 92.7 %  | 64.1 %  | 92%               | 100%   |
| Didactical context  | University degree                      | Secondary school                       | 69.7 %  | 87.0 %  | 53.3 %            | 100%   |
| Interactivity level | Medium                                 | xxx                                    | 67.7 %  | xxx     | 53.2 %            | xxx    |
| Semantic density    | Medium                                 | Medium                                 | 76.4 %  | 63.0 %  | 52.4 %            | 100%   |
| Difficulty Level    | Medium                                 | Medium                                 | 72.8 %  | 56.5 %  | 52.2 %            | 100%   |

Table 1. Elements used in searchers queries (Ariadne, Telmae comparative study). Telmae empty cells (marked with xxx) or 100% cells identify the basic differences. (Notice, that published table illustrates a very limited part of a large comparative study).



A comparison presented in table 1 give us a clear idea about the usage of metadata in both indexation and search processes in different national LORs. In the case of Ariadne this comparison reveals that data elements used by more

than 50% of the indexers are not used by the majority of searchers (e.g. granularity, didactical context and semantic density elements).

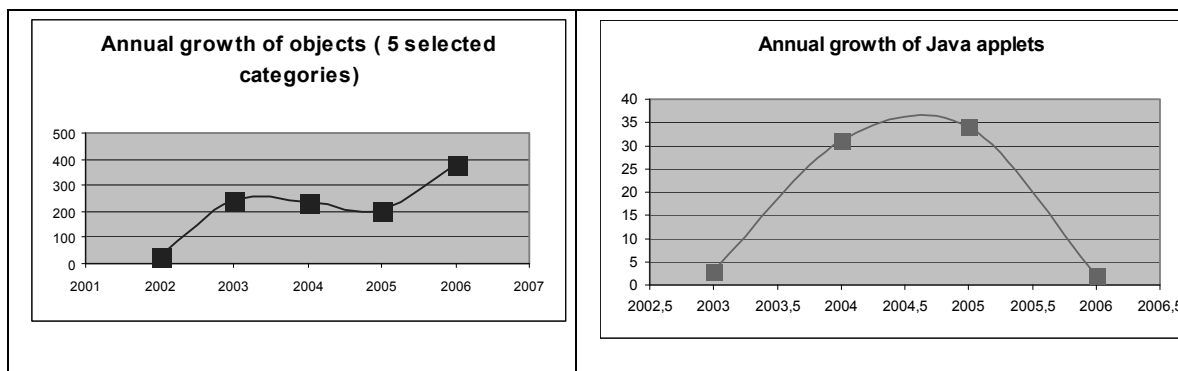


Fig. 2. Annual growth of different kind of Telmae learning objects (left – hypertext objects like lesson plans, right – java applets).

Analysis for the frequency of elements used in searchers' queries reveals that searchers mostly accept the default provided data elements. According different studies, the most used 20 data elements by searchers are default provided data elements. to choose the best taxonomies (subject taxonomies, learning objectives taxonomies, etc.) with respect to users' needs and to interoperability requirements.

To some degree, there is a lack of clarity on the technologies being developed or deployed within the projects. The study team found it difficult to isolate the actual technologies that could be shared or that could be licensed.

### 3. LORS AND VIRTUAL LEARNING COMMUNITIES

Virtual communities are more and more frequent phenomenon on the modern Internet and become more and more popular topic at various scientific forums. Some thinks [6], that "Virtual communities have been identified as the "killer applications" on the Internet Information Superhighway. Their impact is increasingly pervasive, with activities ranging from the economic and marketing to the social and educational. Despite their popularity, little is understood as to what factors contribute to the sustainability of virtual communities."

Generally, we suppose, according research results [6], the existence of two critical issues in system design: information accessibility and community adaptivity on the sustainability of virtual learning communities.

#### Telmae experience

Telmae Learning Object Repository has been running for 6 years. The connected virtual learning community appeared in 2003 in connection with country large program, called State Information Policy in Education, which stimulated the

interest of teachers in New technologies and their needs for learning objects, based on (or connected to) Information and communication technologies.

The growth of text and hypertext objects (like lesson plans, simple experiments or classroom projects) seems quite natural. Without financial support for the review process the number growth, but the quality falls rapidly down and community members slowly loose their interest.

More complicated objects and sophisticated information (the non-hypertext objects, like java applets, video, audio, which production needs more knowledge and better technical skills and tools) will not survive without stimulation at all. Both figures surprisingly argue for the fact, that the sustainability of the learning community of teachers must be stimulated and supported (at least partially and not only financially) outside of the community.

### 5. REFERENCES

- [1] ARIADNE. Available at: <http://www.ariadne-eu.org/>
- [2] Najjar, J., Ternier, S., Duval, E.: The Actual Use of Metadata in ARIADNE: An Empirical Analysis. *ARIADNE 3rdConference, 2003*. Available at: [http://www.cs.kuleuven.ac.be/~najjar/papers/WWW2003\\_najjar.pdf/](http://www.cs.kuleuven.ac.be/~najjar/papers/WWW2003_najjar.pdf/).
- [3] Duval, E., Hodgins, W., (2003). A LOM Research Agenda. WWW2003. Available at: <http://www.cs.kuleuven.ac.be/Eerikd/PRES/2003/www2003/www2003-paper.pdf>.
- [4] Jones, S., Cunningham, S. J., McNab, R., (1998). An Analysis of Usage of a Digital Library. ECDL,1998. available at: <http://www.cs.waikato.ac.nz/~stevej/Research/PAPERS/eurodl.pdf/>.

[5] A Report on Learning Object Repositories. Review and Recommendations for a Pan-Canadian Approach to Repository Implementation in Canada. Available at: <http://www.canarie.ca/funding/elearning/lor.pdf>

[6] Hock-Hai Teo, Hock-Chuan Chan, Kwok-Kee We, Zhongju Zhang: Evaluating information accessibility and community adaptivity features for sustaining virtual learning communities. International Journal of Human Computer studies. Volume 59. Issue 5.

## THE AUTHOR



**Zdena Lustigová** works as the associated professor at Faculty of Mathematics and Physics, Charles University, Prague. Her educational work and her research and development been concentrated on computer aided education, especially on computer based laboratories (system

ISES, Remote and Open Laboratory for Science Education) and since 1993 mainly on development, use and evaluation of new computer based methods of learning, especially online learning. Since 2000 she has worked as the main developer of Telmae Learning Object Repositories.



# ONTOLOGY-BASED MODELS FOR PERSONALIZED E-LEARNING ENVIRONMENT

Michal Šimún, Anton Andrejko, Mária Bielíková  
Slovak University of Technology, Faculty of Informatics and Information Technologies,  
Ilkovičova 3, 842 16 Bratislava, Slovakia  
simun.michal@yahoo.com, {andrejko, bielik}@fiit.stuba.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Students who use educational web-based applications aim at learning knowledge in chosen area. However, their level of knowledge and interests are different. For effective learning it is necessary to provide an individual approach to each student. Educational application should recommend students learning materials that are easily understandable according their level of knowledge and are interesting enough to keep the students' attention. A solution is personalized approach to the student learning process by development of adaptive web-based applications. Personalization requires reasoning on knowledge related to each user and application domain. In this paper we describe a proposal of three main parts of adaptive web-based application – domain model, user model and adaptation model that we designed for the course of programming learning. We employ Semantic Web technologies in order to be able reuse existing educational materials and add a semantic layer responsible for personalization.

**Keywords:** concept, course, e-learning, learner, metadata, ontology, modeling, portal, domain model, user model, adaptation model, adaptive web-based application

## 1. INTRODUCTION

Many of the web-based content oriented applications offer mass of information to users with variety of interests, knowledge, and other personal characteristics. This causes users several problems [4]: users can get lost in information space, get information which they can not understand or it is not interesting for them (cognitive overload) or the user is suggested logically incoherent documents.

Described problems are more obvious in the e-learning applications, where students with the different level of knowledge, interests, and goals learn some educational material. A way to improve the effectiveness in information acquisition offers the personalized approach to the user provided in adaptive web-based applications. Adaptive web-based applications reflect some features of the user in the part called user model and employ this model to personalize various visible aspects of the system to the user [4]. To achieve good personalization we need to express structure and semantics of the knowledge representing by documents in the learning domain explicitly.

A part describing document's semantics is called domain model. User characteristics are retained in the user model, which includes user's characteristics necessary for the personalization. Adaptation model contains a specification of processes that manipulate data about user's activities to build and change the user model, and it provides an adaptation of visible aspects of the system on the basis of modeled characteristics in the user model [6].

In this paper we describe proposal of models of the adaptive web-based system – domain model, user model and

adaptation model. We use the Semantic Web principles for models representation and manipulation. Our models are based on ontological representation (OWL/RDF) that enables not only to represent meta-data but also to reason in order to provide the best solution for each individual learner. The models are part of the educational portal that we used also for other domains (job offers and publications). It is based on the architectural style of information systems – a layered model. Here, we assign the domain and the user model into a data layer and the adaptation model into an application layer. Personalization is based on user's characteristics that are stored in the user model. Domain model represents semantics of educational documents (in our domain of learning programming it contains explanation, programming exercises and tests).

## 2. RELATED WORK

The use of explicitly expressed semantics is not a brand new idea in the e-learning domain. There are applications that realize personalization and use ontology representation to capture semantics. The overview of e-learning trends in the context of the Semantic web is in [1]. We describe a few selected applications to point out main drawbacks of existing approaches.

System NetCoach [11] extends ELM-ART that is regarded as one of the first web-based adaptive applications. Domain model of NetCoach consists of fragments – educational explanation materials and tests questions, where documents presented to the student can have just one fragment. The author can create relations between fragments that express a *structure* of the course (by the *part-of* and *successor*

relations), the *prerequisite* relation (fragments that are necessary to know for understanding actual fragment) and *inference* (fragments that are regarded as known when actual fragment is known). More views on user's knowledge are available, e.g. knowledge discovered from user's visit of the concept, user's tests and inference relation between fragments. Personalization is realized by link annotation and documents recommendation. The document is recommended when the user knows every prerequisite of that document. Disadvantages are that the user model represents only user's knowledge for every fragment. The relevance or relation role to express the strength of relation is not possible in the model.

Domain model of KBS Hyperbook [9] consists of 2 types of concepts – projects and information related to project. The goal of the recommendation in KBS is to select the most relevant project for a user and advise the user concepts related to this project. System selects the project on the basis of two criteria – project goal distance and fitness. Project goal distance expresses whether the concepts related to the project belong to the user's goal. Fitness expresses a relevance of the project on the basis of user's knowledge of concepts related to the project. In KBS it is impossible to model prerequisites between projects that are important in the recommendation process.

In [7] the educational course consists of a set of concepts. Each course has defined objectives and necessary resources. The set of concepts is ordered in the hierarchy using predefined concept's attributes *nextConcept*, *previousConcept*, *hasRequisite* and *isPrerequisiteFor*. The proposed model provides general concepts and uses class *Resource* to define semantics of the concepts. The relations between concepts do not have defined the strength or the relevance.

The domain model described in this paper is an extension of the ontology described in [5]. We extended the domain model in particular by test questions, explanations and relations in domain model. We changed also the structure. The personalized approach is covered by the adaptation model that is responsible for the recommendation of learning documents. There is a lot of knowledge provided by current educational applications. As the user is able to understand just some of them and is not interested in every learning material, it is important to advise the user, which document is suitable for next studying. This is possible by representation of semantics of learning materials, interconnections between knowledge to be able reason appropriate sequence for particular user.

### 3. DOMAIN MODEL

Domain model represents semantics of educational materials. We divided domain model into two interconnected parts – *educational knowledge items space* and *concept space*. Knowledge item space consists of knowledge items – topics and keywords. For our domain of learning programming, the topics are chosen on the basis of the ACM Computing Classification System for Software

([www.acm.org/class/1998/D.html](http://www.acm.org/class/1998/D.html)). The second part of the domain model consists of concepts that represent characteristics of educational material. Concepts are assigned to knowledge items from knowledge item space by defined relations.

#### Knowledge item space

Knowledge item space represents a set of knowledge items that divide all educational courses into separated parts. Authors of a course define knowledge items and relations between them. Prerequisite is a relation between knowledge items and determines which item(s) is necessary to know on defined level of knowledge (specified by relevance of the relation) to understand the others. Prerequisites are connected using logical conjunctions AND or OR, which allows the author to express whether a student should know *one* (OR) or *every* prerequisite knowledge item (AND) An example of knowledge item space is shown in the Fig. 1. Knowledge items and prerequisite relations between them create acyclic directed graph.

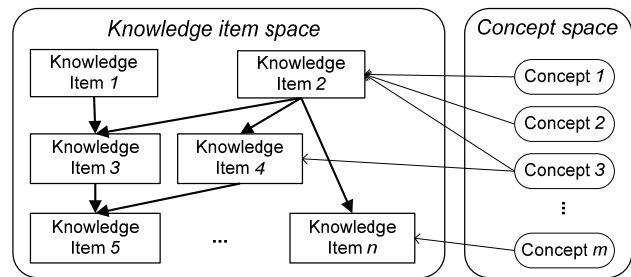


Fig. 1. Domain model

#### Concept space

Concept space describes characteristics of educational material that enable several alternatives of information fragments for the knowledge (e.g. difficulty level of the concept). Fragments are built into documents that are part of an educational course.

Every concept has general characteristics defined in the *Concept* class. Every concept has assigned *DomainAttribute* that represents properties of the concept in chosen domain. General characteristics of every attribute are defined in the *Attribute* class, which also contains relevance – *hasRelevanceAttribute*. We defined attributes specified programming language for the concept (*LanguageAttribute*), level of difficulty of the concept in the domain of learning programming (*DifficultyAttribute*). Every concept can have assigned text fragments, whose position in the concept is determined by the *IndexAttribute* attribute. Fig. 2 depicts proposed definition of the concept.

The educational courses are defined in the *Course* class and are represented in the hierarchical structure as a tree, where root of the course tree is assigned to the course by property *hasRootConcept*. Concepts consist of *IndexedFragment*, which represents logically separated part of the concept. Every fragment is connected to its assigned concept by concept's property *hasFragment*.

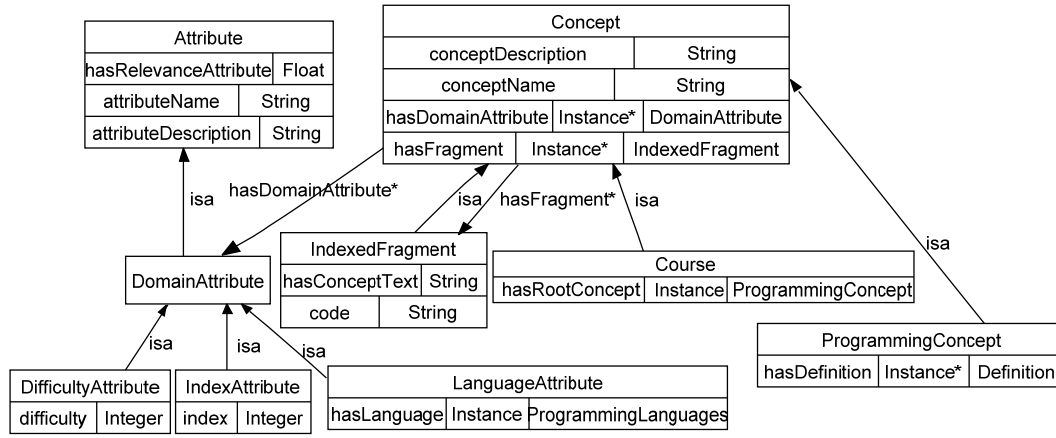


Fig. 2. Definition of the concept

In our proposal we distinguish four types of programming concept's fragment – *Note*, *Solution* (represents solution of programming example), *Definition* (text defining a problem in the concept or explanation text) and *Hint* (gives the user an advice to solve the example). It is inspired by existing system for learning programming ALEA – predecessor of currently developed semantic web portal for e-learning [3].

The educational concept *ProgrammingConcept* (see Fig. 3) encapsulates all the types of the concepts necessary in the programming course. Every such a concept can have assigned definition fragments (*hasDefinition*) that occur in the educational document. We model following types of the *ProgrammingConcept*:

- *Exercise* – exercise in programming language according to the concept's *LanguageAttribute*. Exercise consists of the fragment's definition, hint, and solution. The exercises are grouped by *ProgrammingExercises* entity.
- *Explanation* – explanation of some problem.
- *Template* – general scheme of programming.
- *TestQuestion* – one test question used to examine student's knowledge. Test questions are grouped by entity *ProgrammingTest* and create test.

Every defined concept is connected to knowledge items in the knowledge item space (Fig. 1) by the *isRelatedTo* relation with assigned relation's relevance. The semantics of the relation depends on type of the concept in the relation. Concepts can explain (*Explanation concept*), exercise (*Exercise concept*) or test (*Test concept*) part of chosen knowledge item that is determined by the relevance of *isRelatedTo* relation.

#### 4. USER MODEL

We proposed the user model (also called student model in e-learning) and divided it into *general part* (domain independent) that can be common for user models in different domains, and *domain specific part*. Both parts have assigned defined characteristics that allow keeping track on changes of the attributes – the count of attribute's updates, time of the last update, and identification of the source of change.

Domain specific user characteristics are inherited from *StudentAttribute* entity (see Fig. 4). Here, we distinguish three types of student's attributes, namely *StudentActivity* – activity while using the system, *StudentInterest* – estimation of user's interest for concepts and knowledge items, *StudentKnowledge* – student's knowledge of domain model parts. User model characteristics express relation between user model and domain model – defined concepts or knowledge items; therefore, our model belongs to overlay user models. Student's knowledge (interest) in domain model is defined as probability that student acquired some level of knowledge (interest).

#### 5. ADAPTATION MODEL

Adaptation model is responsible for building and updating user model characteristics and for personalization of the application to the user on other side [10]. In most educational applications recommendation is realized only on the basis of user's knowledge.

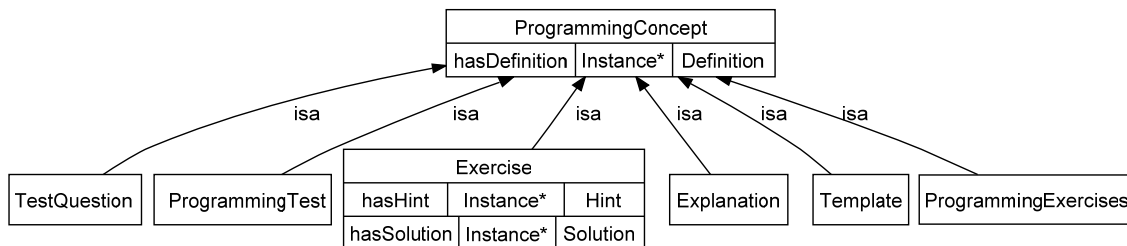


Fig. 3. Programming concept

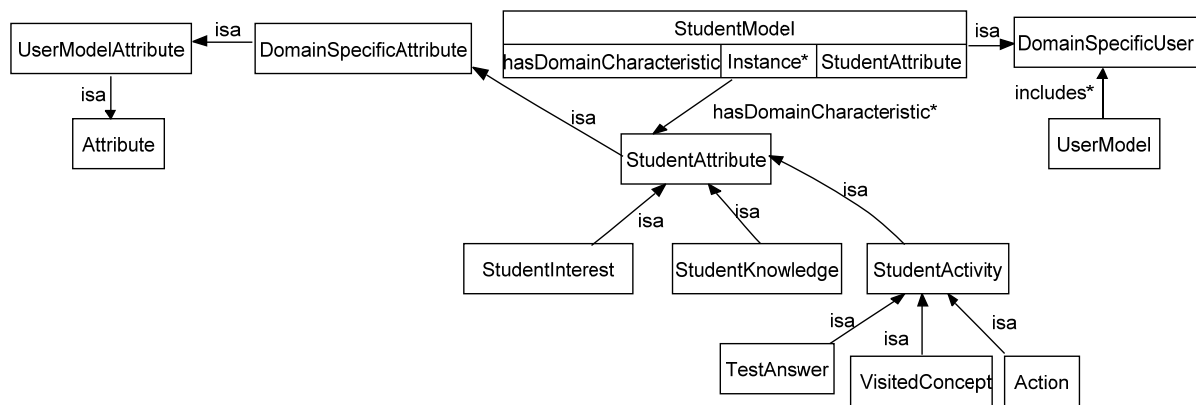


Fig. 4 Domain specific part of user model

Concepts that do not fulfill all prerequisites are usually not recommended. Recommend concepts are determined on the basis of chosen metrics – user’s knowledge, goal. We have proposed an improvement of this process dividing the process of concept selection for recommendation into two phases. First phase is preprocessing of information from the domain model for particular course. Afterwards, the most relevant document for the user is selected based on appropriate on knowledge item selection and related concepts selection from the domain model.

#### Preprocessing of domain model

To be able recommend relevant document we need to find the most appropriate knowledge item and select related concepts. When students want to study selected knowledge item but they did not fulfill required prerequisite, the knowledge item preceding the prerequisite is recommended, including direct or indirect prerequisite. *Direct prerequisite* of knowledge item  $A$  involves knowledge items connected to  $A$  with direction to  $A$ . *Indirect prerequisites* of knowledge item  $A$  consist of items connected to the direct or indirect prerequisite of  $A$ . On the other hand, in the recommendation it is necessary to select for knowledge item  $B$  all items, where  $B$  is direct or indirect prerequisite – direct or indirect use of  $B$ . Direct use of knowledge item  $B$  involves all knowledge items connected to knowledge item  $B$  with direction from  $B$ . Indirect use of knowledge item  $B$  involves items connected to direct or indirect use of  $B$  (used items) with direction from used items.

For this purpose we transform the domain model into the layered model (see Fig. 5). On every layer occur knowledge items that have prerequisite from upper layers. When a knowledge item belongs to layer  $n$ , then the item has prerequisites just from layer 1 to layer  $n-1$ . Layer 1 consists of knowledge items that do not have any prerequisite from designed course. Every knowledge item has also related concepts from concept space. Described transformation is always possible, because condition of correctly designed knowledge item space is modeled as acyclic directed graph.

#### Selecting relevant document

The relevant document represents educational material that a user wants to read and also is able to understand.

This process consists of two steps:

1. *Selecting a knowledge item* – the most appropriate knowledge from the knowledge item space are selected for the student.
2. *Selecting a concept* – concepts related to knowledge items (selected in the step 1) are ordered by relevance for the student.

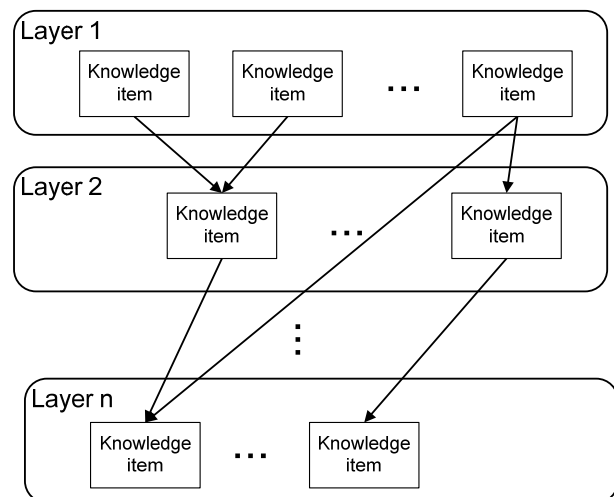


Fig. 5 Layered model of domain model

In the first step we look for items, where all prerequisites are fulfilled and mostly correlate with user’s preferences (attributes that define the relevance of knowledge item for the user). User’s preferences are expressed by local and global preferences. Here multicriteria search of the best object in domain space methods can be used [8].

Defined attributes for knowledge items in our domain are *interest*, *knowledge* and *count of accesses* (read) of a knowledge item. Local preferences represent values of attributes used in chosen knowledge item and are explicitly expressed by fuzzy function. Global preference defines relevance of attributes and its combination in evaluation function of knowledge items. Evaluation of knowledge item is expressed by aggregation function.

An example of aggregation function, where variable  $U$  stands for the user and  $KI$  stands for the knowledge item:

$$\text{recommendationValue}(U, KI) = 0,5 * \text{interest}(U, KI) + 0,3 * \text{knowledge}(U, KI) + 0,2 * \text{access}(U, KI)$$

This aggregation function determines that the most relevant attribute for the user is the interest. Fuzzy functions  $\text{interest}(U, KI)$ ,  $\text{knowledge}(U, KI)$  and  $\text{access}(U, KI)$  represent local preference of these attributes that express similarity between required value of attribute and value of this attribute stored in the user model.

We proposed the process of selecting relevant knowledge items is as follows:

1. *Find Start item, i.e. from the knowledge item space, where searching will start.*
2. *Create Lists of relevant and actual items. Assign Start item to actual items.*
3. *IF List of actual items is empty  
THEN Select most relevant items from List of relevant items and finish with recommending them.*
4. *Take first knowledge item  $KI$  from actual items*
5. *IF Prerequisites of the  $KI$  item are not fulfilled  
THEN Assign not fulfilled prerequisites to List of actual items and continue in step 3.*
6. *Evaluate actual item by relevance value.*
7. *IF actual item can not be assigned to List of relevant items  
THEN Continue in step 3  
ELSE Assign actual item to List of relevant items*
8. *Gather items that directly use actual item and assign them to List of actual items  
Continue in step 3.*

Knowledge items are selected from the layered domain model. Firstly the initial knowledge item should be chosen to start the process (Start Item). When the user had read some document from the concept space and it is regarded as interesting for the user, then the starting item represents concept's related knowledge items. If none of related knowledge items are interesting for the user, then the start item represents the most interesting item in knowledge item space. If the user did not read any document, then is chosen knowledge item from first layer of layered model. Start items are assigned to the list of actual items. The List of actual items contains items which relevance will be probed for the user. If the list is not empty, first item is removed and marked as actual item. The student is able to understand actual item only when prerequisites of item are fulfilled.

Prerequisites items are stored in the layered model in upper layers of actual item. If these prerequisites are not fulfilled, then prerequisites items are moved into the list of actual items. Otherwise, actual item is evaluated by relevance value that expresses relevance of the item for the user.

Relevance value is expressed by equations as follows:

$$\text{relevanceValue}(KI, SP, U) = \text{relevance}(KI, SP) * \text{recommendationValue}(KI, U),$$

where

$$\text{relevance}(KI, SP) = \prod_{i=SP}^{KI-1} \text{relevance}(i, i+1)$$

In these equations  $KI$  stands for knowledge item, whose relevance is explored,  $SP$  stands for starting point that led to  $KI$  and  $U$  represents the user. Relevance expresses importance of the knowledge item for starting point and is acquired as multiplication of relations relevancies between starting point and actual knowledge item.

Actual item is assigned into the list of relevant items if relevance value is greater than defined threshold. The process of selecting relevant items will be moved to items that directly use actual item by inserting these items into list of actual items – these items are stored in layered model in lower layers. If relevance of actual item was already explored and its relevance value was greater, then the choosing process will not be moved to lower layers, because this path was already explored from other starting point with greater relevance value. The process of choosing relevant knowledge item is finished, when the list of actual items is empty. Then the most relevant items from the list of relevant items will be chosen on the basis of item's relevance value.

In the second step we select concepts related to relevant knowledge items chosen in first step. Every concept related to relevant knowledge items is evaluated by relevance value. The application recommends documents that include the most relevant concepts. Relevance value of concept is expressed by equation:

$$\text{relevanceValue}(C, KI, U) = \text{relevance}(C, KI) * \text{recommendationValue}(C, U),$$

where  $C$  stands for the concept that is evaluated by the relevance value,  $KI$  represents chosen relevant knowledge item while  $C$  is related to this knowledge item and  $U$  represents the user. Expression  $\text{relevance}(C, KI)$  expresses the relevance of the relation between the concept  $C$  and knowledge item  $KI$  (relation between concept space and knowledge item space). Recommendation value is expressed the same way as knowledge items (by global and local preferences) and attributes of aggregation function in recommendation value consists of the count of access to the concept and user's preferred type of concept (test, explanation or exercise).

## 6. CONCLUSIONS

In general, information systems can be designed according layered model with data, application and presentation layers. E-learning applications that ensure improvement of student's work by personalization should reflect each layer to reach this purpose. The main contribution of this paper is layered structure of the domain model for e-learning based

on prerequisite relation and its interpretation in the adaptation model. The definition of semantics of presented documents (domain model) and characteristics of students (user model) are stored in the data layer.

We added to existing approaches explicit division of educational knowledge space into two interconnected parts – knowledge items space and concept space. Knowledge items space consists of topics occurring in the course. The concept expresses characteristics of educational documents in the course and each concept belongs to knowledge item(s). This enables reusability and various combinations of knowledge items characteristics according context of learning.

The model is reflected by novel method for concept recommendation which is based on appropriate interpretation of the prerequisite relation which is crucial in learning application domain. First, in the recommendation process is chosen the knowledge item that can be considered as the most relevant from knowledge item space and has fulfilled all prerequisites. Afterwards, the relevant concept from the concept space that is related to selected knowledge item is chosen. Relevance of the knowledge items and concepts is estimated by aggregation function on the basis of user's characteristics – knowledge, interest, read documents.

We evaluate proposed approach on the adaptive portal framework developed for personalized applications based on ontological representation of models [2]. Learning programming is not the first application integrated within this portal, we already built two prototypes for application domain of personalized recommendation of job offers and publications. Our future work is oriented towards authoring proposed models, mainly automatic discovery of relations between the concepts.

## 7. REFERENCES

- [1] Aroyo, L., Dicheva, D.: The New Challenges for E-learning: The Educational Semantic Web. In Educational Technology & Society. Vol. 7 (2004) 59-69.
- [2] Barla, M., Bartalos, P., Sivak, P., Szobi, K., Tvarozek, M., Filkorn, R.: Ontology as an Information Base for Domain Oriented Portal Solutions. In 15th Int. Conf. on Information Systems Development, ISD 2006. Budapest, Hungary (2006).
- [3] Bielíková, M.: An adaptive web-based system for learning programming. Int. J. Continuing Engineering Education and Life-Long Learning, Inderscience, Vol. 16, Nos. 1/2, 122-136.
- [4] Bielíková, M., Kuruc, J.: Sharing User Models for Adaptive Hypermedia Applications. In 5th Int. Conf. on Intelligent Systems Design and Applications, ISDA 2005. Wrocław, Poland. ACM Press (2005) 506-511.
- [5] Bielíková, M., Moravčík, M.: Modeling the content of adaptive web-based system using an ontology. In 1st Int. Workshop of Semantic Media Adaptation and

Personalization, SMAP 2006. Athens, Greece. IEEE Computer Society Press (2006) 115-120.

- [6] Brusilovsky, P.: Adaptive hypermedia. User Modelling and User-Adapted Interaction, 11 (2001) 87-110.
- [7] Gascuena, J. M., Fernandez-Caballero, A., Gonzalez, P.: Domain Ontology for Personalized E-Learning in Educational Systems. In ICALT 2006. IEEE Computer Press (2006) 456-458.
- [8] Gurský, P., Vojtáš, P.: Multicriterial search of best object with support of several users. In Znalosti 2007. Ostrava, Czech republic (2007) 52-63 (in Slovak).
- [9] Henze, N., Nejdí, W.: Adaptivity in the KBS Hyperbook System. In Int. Workshop on User Modeling and Adaptive Systems on the WWW, Toronto (1999).
- [10] Henze, N., Nejdí, W.: A logical characterization of adaptive educational hypermedia. In New Review of Hypermedia 10 (2004) 515-530.
- [11] Sosnovsky, S., Brusilovsky, P.: Layered Evaluation of Topic-Based Adaptation to Student Knowledge. In Workshop on Evaluation of Adaptive Systems at 10th Int. User Modeling Conference (2005) 49-65.

## THE AUTHORS

**Michal Šimún** received his Bachelor degree in 2006 by the Slovak University of Technology. Currently he is a student of Software Engineering master degree programme at the Slovak University of Technology, Faculty of Informatics and Information Technologies. His research interests are in the area of the Semantic Web specialized to personalization of web-based applications – adaptive hypermedia.

**Anton Andrejko** received his Master degree in 2004 by the Technical University in Kosice. Currently he is a PhD student at the Slovak University of Technology, Faculty of Informatics and Information Technologies. He works in the area of user modeling and personalization.

**Mária Bielíková** received her Master degree (with summa cum laude) in 1989 and her Ph.D. degree in 1995 both by the Slovak University of Technology in Bratislava. Since 2005, she has been a full professor, presently at the Institute of Informatics and Software Engineering, Slovak University of Technology. Her research interests are in the areas of software knowledge engineering and web information systems, especially adaptive web-based systems including user modeling.

## ACKNOWLEDGEMENT

*This work was partially supported by the Cultural and Educational Grant Agency of the Slovak Republic, grant No. KEGA 3/5187/07.*





## DIGITAL MEDIA ENGINEERING AND DESIGN: PROPOSALS FOR THE INTERDISCIPLINARY STUDY PROGRAM

Martin ŠPERKA, Alena KOVÁŘOVÁ  
Slovak University of Technology, Faculty of Informatics and Information  
Technologies, Ilkovičova 3, 842 16 Bratislava, Slovakia  
tel.: +421 2 602 91 548, fax: +421 2 654 20 587,  
web: [www.fiit.stuba.sk](http://www.fiit.stuba.sk), email: [sperka@fiit.stuba.sk](mailto:sperka@fiit.stuba.sk) | [kovarova@fiit.stuba.sk](mailto:kovarova@fiit.stuba.sk)

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Rapid development of information, communication and audiovisual technologies creates new applications, which need professionals [1], [2] who are able to understand them and to be able to design new products. Many of these products have engineering and esthetic aspects. In this paper we focus on this field, which is in Slovakia not taught in a comprehensive way: Digital Media Design. The goal of our research was to summarize the requirements of the students and professionals interested in this field by means of questionnaires. These requirements can be met by joining study programs at the Faculty of Informatics and Information Technologies (FIIT) and Faculty of Architecture (FA) - Institute of Design at the Slovak University of Technology (STU).

**Keywords:** Digital media design, multimedia curriculum, interdisciplinary study program.

### 1. INTRODUCTION

Among new products are those using digital media (DM)-applications integrating interactive text, image, animation, video, sound, virtual or enhanced reality. They can be computer network applications, interactive CD/DVD ROM, mobile devices, information kiosks and objects (consumer and industrial electronics) containing multimedia interfaces and systems. These DM are gradually filling every kind of our human living spheres, therefore it requires, besides technological foundation, user-friendly interface. The designer of such interface should have knowledge and skills in electronic engineering, information technology and design. There are many companies where engineers and designers work together, but in many of them engineers or designers exclusively. Even the integrated teams need to find common language for communication and the knowledge of fundamentals in other field is very valuable. For this reason, in many countries exist schools providing combined education in information technology and design. Unfortunately in Slovakia there is neither such university nor a faculty to cover this. To use effectively existing facilities, resources, expertise, competences as well as existing subjects within one university we decided to research and explore possibilities of extending existing study programs at the STU in Bratislava. The main idea is that FIIT could provide major IT oriented program with minor in design and vice versa, FA the bachelor in design with minor in digital media design. Graduates of this type of study program should cover the lack of experts on our market area. But this simple idea showed to be more complex. There exist several reasons. The first one is that existing subjects should be modified to meet pre-requisites knowledge for both groups of students. The second one is traditional border between world of science and engineering on one side and the art and design on the other.

### 2. DEFINITIONS OF DIGITAL MEDIA DESIGN

To clarify, first of all we needed to define the DM design in context of user interface design. Analyzing curriculums (related to DM) from different countries e.g. [1], [2], we realized that the term of Digital Media is understood in different ways depending on country, orientation of people's professions or type of university – if it is an art-oriented or a technical one. The term DM still isn't a common term and belongs to a group together with multimedia, intermedia, cross-media, new media and interactive media. Also the term design is understood differently. One can tell that web-design is art emphasizing creativity and attraction. Others define it as engineering discipline, where visual-design rules are stabilized, which are necessary to learn and respect. This problem was also the reason for creation international Socrates Erasmus project Joint Degree in Media Development Engineering [5], where the goal is to define common body of knowledge and an international study program. Among universities from Belgium, Denmark, Finland, Poland, Slovakia and Spain is also our faculty.

All of these definitions certify the fact of existence of different groups of people working in the same field. Each group has its own vocabulary and when they meet, they don't understand each other. Just an ordinary example – imagine a company creating web sites. An art designer needs to communicate with a programmer and vice versa but they both use different "languages". Would it not be better to have one person in the company who would understand both – the art and the program? If it would, would the students feel like to study such field, which would cover that? To answer these and other important questions, we prepared three types of specialized questionnaires. First was given to different companies associated with DM, the second was distributed to students of FIIT STU and the third one to the FA STU. Few

questionnaires were distributed to Academy of Fine Arts and Design (AFAD) students.

### 3. QUESTIONNAIRES

All types of questionnaires should help us devise a student profile and create a suitable curriculum of current studying program on FIIT SUT and on Design Institute of FA STU.

#### *For Companies*

Questionnaires for companies (see Tab. 1) were constructed to find out what kinds of profession/knowledge they would require from their employees provided that they would be graduates of Digital Media Design program.

**Table 1.** Questionnaire for companies

|   |  |
|---|--|
| 1 | Does your institution develop both software and user interfaces?<br>a) If yes, user interfaces are designed by programmers.<br>b) Programmers in collaboration with graphic designers or artists.<br>c) Others (please specify).   |
| 2 | Does your company develop contract websites? *<br>a) If yes, websites are developed only by programmers (experts in informatics).<br>b) Only by graphic designers or artists.<br>c) Programmers collaborating with graphic designers or artists.<br>d) Others (please specify).  |
| 3 | Does your company develop websites on its own? *<br>a) If yes, websites are developed only by programmers (experts in informatics).<br>b) Only by graphic designers or artists.<br>c) Programmers collaborating with graphic designers or artists.<br>d) Others (please specify).  |
| 4 | Does your company design and develop interactive CD/DVD ROM-s (for example catalogues, text books, games...)? *<br>a) If yes, websites are developed only by programmers (experts in informatics).<br>b) Only graphic designers or artists.<br>c) Programmers collaborating with graphic designers or artists.<br>d) Others (please specify).  |
| 5 | Does your company / institution develop product or program devices that require creation of digital interactive user interfaces like cell phones, cash dispensers, information kiosks, car electronics or audiovisual technology?<br>a) If yes, interfaces are designed by programmers.<br>b) Programmers in collaboration with graphic designers or artists.<br>c) Others (please specify).   |
| 6 | In the design process of presented products would you prefer:<br>a) An expert with programming and also visual (audiovisual) skills or<br>b) Graphic designer with minimal but sufficient informatics skills or<br>c) Team of specialists?   |
| 7 | Do you think, that creating a new study program, where curriculum is focused on informatics courses (basics of programming, Internet technologies, multimedia technologies, ...), esthetics and design courses (basics of audiovisual communication, basics of design methodology and tools for creation, image processing, animation, video, audio ...) and business/law courses (management and marketing of electronic content, intellectual property, copyrights, ...) is needed and useful in Slovakia? |
| * | Note: We assume collaboration with content creators.   |

#### *For Students of FIIT*

A questionnaire for students of FIIT was designed to find out in which of the FA courses these students would be interested, if they had the chance to make the choice. The courses, put in the questionnaire, were chosen according to our research of similar curriculums on different universities (see Chapter 2).

1. If you work in a company, do you take part in creation of human-computer interface design? Such as interfaces for programs, for cell phones, for information kiosks, CDs, DVDs, presentation etc.

2. If you work in a company, do you take part in a web-pages design?
3. If there would be such study program on FIIT that would extend your knowledge and skills about design of DM, would you join this program?
4. Which of the following courses (from FA) would you prefer to have in this study program?

The list of courses (provided by FA) is following: Design Basics I, II, Drawing I, History of Fine Arts I, II, Computer Aided

Design, Ergonomics, Color, Fonts, Graphic Presentation, Design History, Visual

Communication Design, Drawing Design, Photography, Graphic Design, Working with

Camcorder, Photographic Design, Video Production.

#### For FA and AFAD Students

These questionnaires were made under the same principles as those previous ones, just the courses were taken from FIIT and we added 4 more to them.

1. If you work in a company, do you take part in creation of human-computer interface design? Such as interfaces for programs, for cell phones, for information kiosks, CDs, DVDs, presentations etc.
2. If you work in a company, do you take part in a web-pages design?
3. If you work in a company, do you take part in a creation of computer games?
4. If you extended your knowledge within your study on AFAD getting informatics knowledge and skills, which are connected to interactive DM design, web-design, and games, which of the following FIIT courses would you choose from a list of subjects?

The list of subjects (provided by FIIT STU) is following: Procedural Programming (algorithms and language C), Object Oriented Programming (Java, C++ or C#), Principles of Information Systems, Computer Networks, Operating Systems, Database Systems, Database Systems, Human-

Computer Interaction, Development in Java 2 Platform, Artificial Intelligence, Computer Graphics (algorithms, tools, systems), Multimedia Systems (media types principles, coding, compression and authoring), Principles of Web-Engineering, Internet Security. Other Subjects (not all now provided): Web-design, Markup and Scripting Languages for Internet (HTML, JavaScript, PHP), Information Searching, Data Mining, Semantic Web, XML, Web3D – Virtual Reality on Internet.

#### 4. EVALUATION

The majority of data was obtained from FIIT students working in different companies as we did not find any effective way how to have them obtained directly from company leaders. We

gathered 119 filled questionnaires. The following chart (Fig. 1.) shows the percentage of every positive answer in each group of questions. We left out the questions of type "Others (please specify)." because only a minimum of responders chose it.

As we can see from the results, our student's work usually in companies where programmers are needed, art designers wouldn't be able to do this work on their own (see the low percentage of 1c, 2b, 3b and 4b), but that is nothing curious about it. An interesting result is that about a half of these students work in companies where collaboration with graphic designers or artists would be effective. Finally, the majority of respondents (80%) thought that creating a new study program where curriculum is focused on informatics, esthetic, design and business/legal courses is needed and useful in Slovakia.

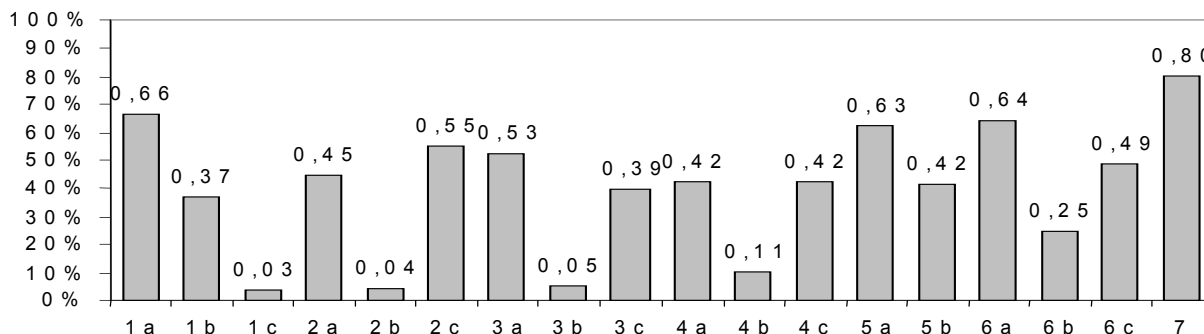


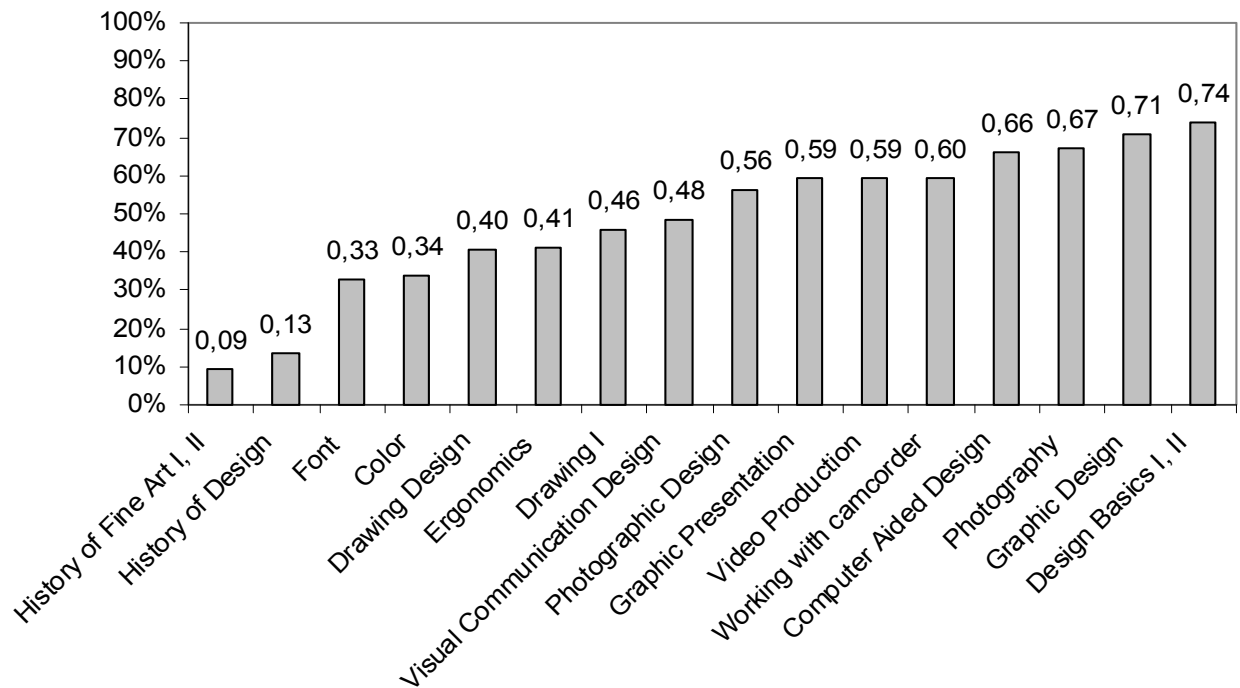
Fig. 1. Evaluation chart of answers from companies

Responders of this type of questionnaire were third year bachelor students. All of them visited the course of Human Computer Interaction so they should have a good picture about the importance and complexity of designing in DM. We had 193 responders. The percentages of positive answers on the first three questions were 71%, 44% and 83%. This shows that many students indeed already work with design and would like to have also a study program focused in such a way. The following chart (see Fig. 2) shows their preferences on different FA courses related to DM design.

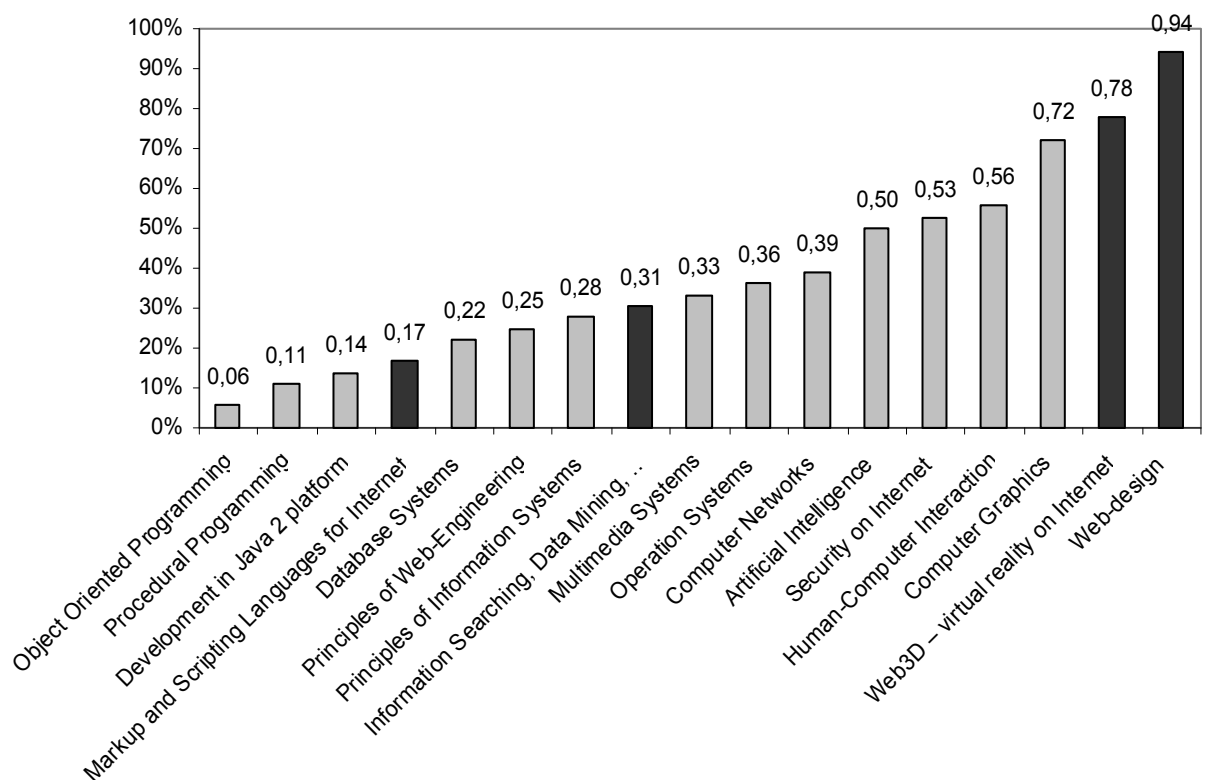
It is obvious that students really do not care about history, less than a half would like to know more about things like font, color, drawing staff, ergonomics and visual

communication design. More than a half of responders but less than  $\frac{3}{4}$  was interested in the rest of the courses. The most attractive courses are Design Basics and Graphics Design what show the lack of information from this area in our educational process.

We got 36 questionnaires from FA students. Fig.3 shows the results. We did not obtain many responders from AFAD, but taking those few as a relevant sample, none of them liked Procedural Programming, Object Oriented Programming, Database Systems and Development in Java 2 platform. Every responder likes Human-Computer Interaction, Web-design and Web3D. Each one works in some company.



**Fig. 2.** Evaluation chart of student's options studying at FIIT



**Fig. 3.** Evaluation chart of student's options studying at FA

## 5. CONCLUSIONS

It is reasonable and necessary to create a new study program on DM Design, as the companies would often find effective to have somebody understanding both the programming and the art design. FIIT STU students like to know most about Design Basics and Graphics Design and the FA and AFAD students about Human-Computer Interaction, Web-design and Web3D.

*Acknowledgement:* We would like thanking to Lubomír Horník, associate professor at the FA STU and Oľga Zemanovičová, who helped us to collect data at the FA STU and AFAD. This work was partially supported by the Slovak Cultural Grant Agency (KEGA) under the contract No. 3/3206/05 - Study in Design of Interactive Digital Media.

## 6. REFERENCES

- [1] Šperka, M.: Multimedia in Computing Curricula. In: proceedings of the International Conference on Computer Systems and Technologies (e-Learning) – CompSysTech'2002: Sofia, Bulgaria, 20-21.6.2002. – pp.IV.16-1 – IV.16-5.
- [2] Šperka, M.: Education in Multimedia: What Future Tools Creators Should Know. In: Reader of Abstracts

Bridging the Gap Between Eastern and Western European Multimedia Content: Salzburg, Austria, 24.- 26.5.2002.

- [3] Pratt Institute, Digital Design and Interactive Media, [http://www.pratt.edu/digital\\_design-assoc#](http://www.pratt.edu/digital_design-assoc#) Retrieved 20.2.2007.

- [4] Carnegie Mellon University, Faculty of Design, Master of Design in Interaction Design, <http://www.design.cmu.edu/files/intdprogbook2007.pdf> Retrieved 20.2.2007

- [5] Official web site of the Socrates Erasmus project Joint Degree in Media Development Engineering. <http://www.jdmde.eu>. Created in January 2007.

## THE AUTHOR(S)

**Martin Šperka**, associate professor, teaching and research in Human - Computer Interaction, Multimedia and Computer Graphics.

**Alena Kovárová**, PhD. student research interests in Human - Computer Interaction, Multimedia and Virtual Reality in e Learning





**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**Cases & Projects**







# E-LEARNING ENVIRONMENTS WITH REMOTE CONFIGURATION, CONTROL AND VERIFICATION OF DIGITAL SYSTEMS

Ján Bača, Stanislav Šuba, Milan Hauliš

Computer Engineering Laboratory, Department of Computer and Informatics

Faculty of Electrical Engineering and Informatics, Technical University of Košice

Letná 9, 042 00 Košice, tel. +421 55 602 2500

jan.baca@tuke.sk, stanislav.suba@tuke.sk, milan.haulis@tuke.sk

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** A concept of laboratory environments with remote user network access creates a possibility to handle configuration, control and testing functions of the lab equipment through a client-server communication model. According to target device disposition the accessions are designed as shared within a group as well as unshared. The solutions create conditions for virtual lab exercises organization within the e-learning service of Computer Engineering Laboratory at Technical University of Košice. This is a work with real logical system environments, functional computer units, computers as well as peripherals and networks representing specific models of computer environment. The development work on these objects contains issues of embedded systems and application of distance learning network services security aspects.

**Keywords:** RemoteLab, remote device, remote access, remote user, e-learning

## 1. INTRODUCTION

A rapid development of computer networks allows transfer from communications within local networks with passive monitoring of information sources to active user approach using Internet by interactive communications between connected subjects. The internet communication utilization markedly increases for e-business, government access, banks, companies as well as for distance learning.

Within the learning environment creation we emphasize university lab workplace accessing for a wide range of students. Beside the basic training services providing based on software technologies, Computer Engineering studies are much more interested in extended possibility to actively solve trained topics on real objects conveyed via the specialized lab workspace.

## 2. LAB FOR REMOTE USERS

In the Computer Engineering laboratory environment, providing learning support in the computer systems hardware area, the lab works with remote access are being created. These labs allow students to solve practical tasks without their presence in the lab spaces and therefore enhancing the learning possibilities with another medium. The lab is equipped with a server containing mainly a lab-portal with accesses to information (e.g. services provided pasive and interactive content by Videoserver streaming platform through accessing archive or IPTV) and learning applications as well as remote lab task portal with access to real equipment workspaces.

The server utilizes LDAP authentication, virtual class creation, running of learning program sets [1] [4] and study materials, time reservation of equipment workspace access

with monitoring, activation (deactivation) of devices and their control computers.

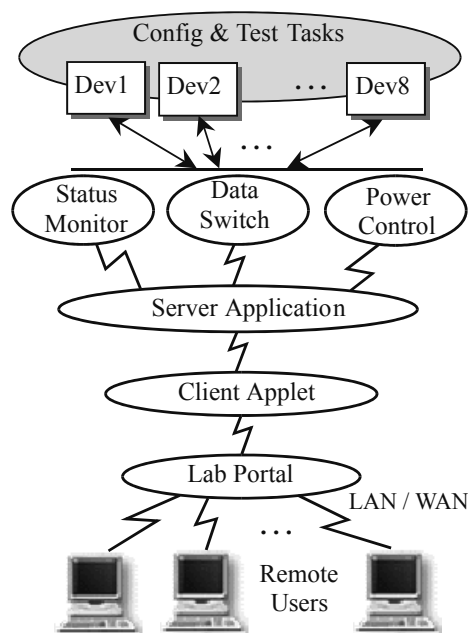


Fig. 1. General communication server scheme

Devices for tasks (workspace cores) are in the simplest case represented by a compact device with embedded computer equipped with standard interfaces.

Didactically more suitable are modular solutions when there is a re-configurable and programmable interface unit inserted within the workspace controlling computer in a universal composition. Reconfiguration can be specifically

performed through a local console by reprogramming of the specific circuit function in operation or control environment. The change of a structure and function is then available for other users.

Embedded DCC (Device Control Computer) in an active functional state enhances the lab server function by connecting server components related only to a specific workspace.

Workspaces are oriented on a basic performance of configuration, debug and verification activities on a monitored object, which is understood as a specific model of logical circuit, functional computer unit or dependent computer surrounding.

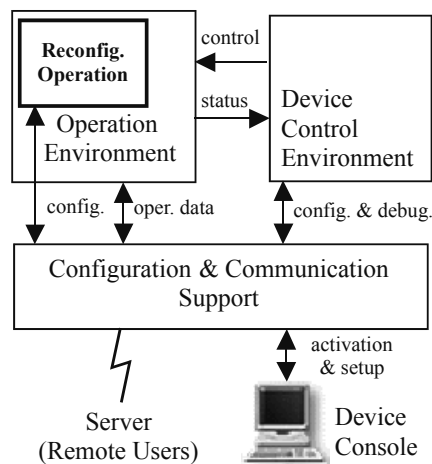


Fig. 2. General communication scheme - Device(i) decomposition

It is possible to generate one or several tasks on a single workspace (characterized by device type). Each tasks must have a specific client-server structure created.

Decomposition of device show on Fig.2 allows separation of operating environment part from system controlling part. Controlling device environment can be created with different software and hardware ratio.

Remote access contains processes of configuration preparation, device application control configuration transfer, preparation and data transfers for main functional verification. The structure according to workspace device remote access management class is as follows:

A. Shared accesses within a group to cooperating devices with testing functions and switched multi-thread user access:

- WAN model configuration with a set of routers
- direct communication between computers

B. Unshared single user accesses to configuration and testing functions over a group of cooperating devices:

- communication between computer units
- fault tolerant TMR system
- parallel system

C. Unshared accesses to testing functions of non-cooperating devices:

- program control of peripheral drives with non-standard interface
- program control of digital integrated circuit tester
- microprogram control of specialized digital units verifactor (ALU, memory, ).

### 3. LAB TASKS

Tasks based on the general communication scheme (Fig.1, Fig.2.) are generated according to requisites. Important part of the service is implied in miscellanea and variability of object environment.

#### Routers config environment

The first applied support of e-Learning was making accessible a group of routers for remote users (Fig.3) – working name VirtualLab [8]. The workspace is of type A. with shared access within a group. The access of cooperating group to individual routers is solved on lower levels through a switch.

The system architecture was adjusted to real technological conditions and cooperation requirements (configuration router interface, implementation possibilities, application designation and its security, including into a distributed system, central management [5]).

The main client function is an emulation of configuration terminal of the router that is made available. The possible conflicts between parallel configuration users are solved by the *Inactive* status utilization. Channel switching on a communication layer is solved by full RS 232 protocol. System configuration, monitoring and verification is performed by the *test* function.

Authentication securing is in two levels with hashing (MD5) and backward verification of password validity.

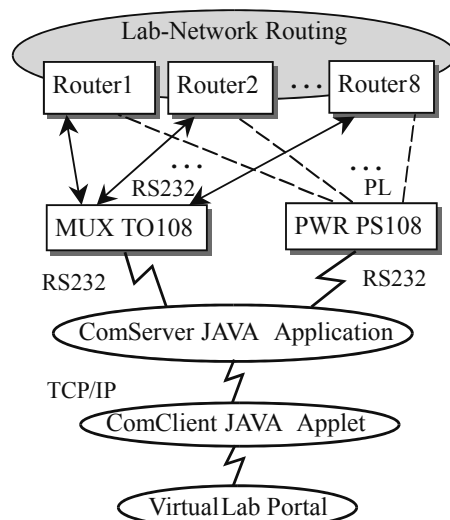


Fig. 3. Example of group-shared task - Lab routing

A bigger variability is possible when organizing groups of independent tasks, or unconnected devices (Fig.4) – working name „RemoteLab“ [1]. This is an environment for complex of tasks within remote lab focusing on analysis, synthesis and diagnostics of digital systems.

Communication protocols are proposed and implemented in an optimized way for each type of workspace. Their creation and selection of level of complexity are open for student development. Their algorithm with statuses and events (client-server) is available for continuation of works in workspace system manuals.

Definition of communication protocol allows to create any client program. Any programming language [3] can be used for this creation (e.g. C++, using MFC library) up to the level of multiplatform languages, e.g. JAVA.

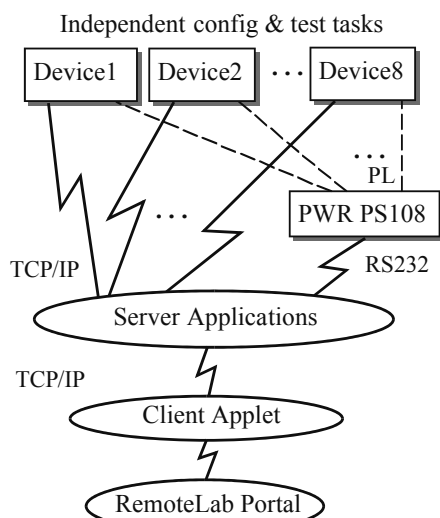


Fig. 4. Group of independent tasks

Remote lab tasks portal directs the user to modules of tasks with user documentation and contains functions for specific activation (deactivation) of workspaces.

The portal deals with handling tasks and assignments that involve creating assignments, setting up groups of students and specifying access time for selection task on remote device. The portal is written in PHP and uses a MySQL database server.



Fig. 5. Remote laboratory tasks portal

RemoteLab portal serving for creation [6] and administration of internet presentations is built as a content management system [7] (Web Content Management - WCM, Content Management System - CMS, Content Publishing). Main principle consists in separation of contents from the design and functionality (defined by special templates) of the page. The change in contents or correction of other information will not imply change of design. The user has the option to change page content and does not have to know a programming language, thanks to content management system.

Identity administration system connects the functions of faculty IS and target applications. The connection is standard through services according to assigned user roles (administrator – creator, lecturer, student, anonymous guest).

For non-shared workspaces login algorithms with login, rejection or reservation according to requirement are used. The third way is login by lecturer on agreed time periods.

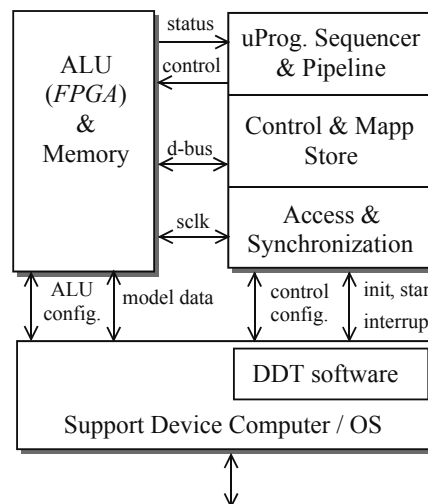


Fig. 6. ALU & Memory configuration and verification environment

#### Microprogramable environment

Model configuration on Fig.6 is determined mainly for tasks with various configuration and verification of selected processor functions based on microprogramming. It can be used also for logical testing of digital integrated circuits (memories, PLD, standard catalogue circuits) using AL functions of elements for status evaluation. The architecture allows to reach shortest possible testing cycles.

The main client function – debugging of micro program of a specified function is performed in a single-user mode with time reserved for the task.

System monitoring focused on verification of basic communication and synchronization functions of microprogram control module is performed by application of DDT software commands (DDT – Dynamic Debugging Tools).

To design of variant solutions, the set of device workspace is implemented into three connected block units as shown

fig.6. This approach is suitable from pedagogic and organizational reasons.

This configuration, as well as others listed here, can be implemented by one or multiple commercial development kits based on FPGA. The utilization of independent device controlling computer allows more fine modularity when designing interface solutions with real devices and equipment. The configuration allows utilization of existing interface modules as well as new HW-SW controller complex design for creativity in the programming (microprogramming) area on the target object environment modeling level.



Fig. 7. Client window with microprogram edit table

Microprogram of the controlling part is handled on the lowest model layer (represented by application management configuration), bit field descriptions and with operating (performing) and controlling circuits documentation on the logical schematics level. Well-trying examples accessible on the portal serve as methodological support.

Generating of the controlling microprogram file can be performed also in the organizer environment by gradual translation in phases – definition and source. The last software support is a dislocator of bit fields. These activities are accessible on an on-going basis and do not require second login to tasks.

The prepared file is saved into the lab-server user memory by an instruction through the device controlling computer to microprogram memory.

There is a different environment for controlling of peripheral systems with interface to computer surroundings (Fig.8). Considering the general communication scheme of the device part of the workspace (Fig.2) we emphasized the adjusting HW (EUI – Environment Interface Unit), while SW part is implemented by the control [2].workspace. When using an active time window reserved for access to workspace, controlling configuration is transferred.

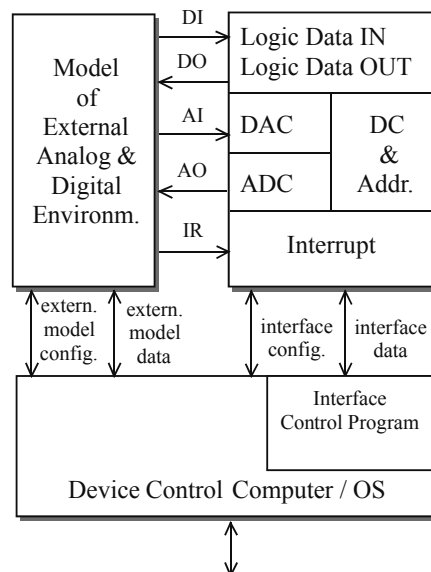


Fig. 8. Analog/Digital model interface design configuration and verification environment

Program service debugged by remote user is localized in a reserved part of working storage RAM together with status information space.

Workspace function consists of three parts connected into one structure. Firstly it is a non-standard parallel EIU-DCC communication, secondly it is a TCP/IP client-server communication through Internet and lastly it is the server core itself that integrates previous two functions and allows to include them under the lab server management. EUI control integration and network client-server communication into one modifiable application will decrease system load and increase server stability.

#### Signature analysis environment

One derived application for multichannel signature analysis [4] is limited to work with logical signals (Fig.9).

The whole diagnostic module consists of the communication module for the test circuit connection to PC and the programme module, which is installed in the DCC.

TESTLOG software contains the following applications: System (routines in programme), Stimulus (test creating), Logic analysis (test transmissions, response scanning, signal timing displaying), Signature analysis (test transmissions, response scanning, responses evaluation as the compressed - signatures) and Help.

Tasks of logical circuit function verification and testing with inclusion of faults are designed on a similar principle, both using FPGA possibilities in the model.

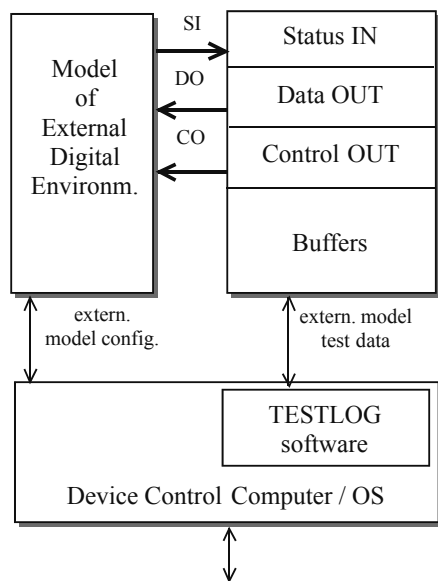


Fig. 9. Example with full program control for multichannel logic and signature analysis

#### TMR verification environment

Other example shows Fig.10 - The system based on triple modular redundancy (TMR) method, where individual computer modules communicate by message exchange. In contrast to traditional triple modular redundancy, where the results are compared in a voter, here the results are compared and evaluated in the modules.

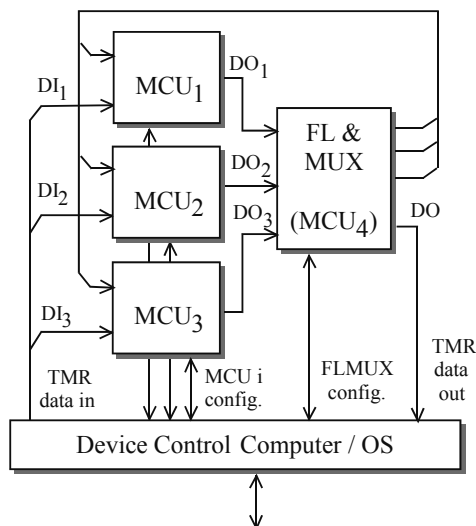


Fig. 10. TMR model design configuration and verification environment

Thus, the switching of a correct output is controlled by microcontroller's program and not performed by logical circuits, which contributes to the higher fault tolerance. Whole system consists of the FL-MUX unit and three replacement or reprogrammable MCU modules.

FL-MUX processor implements evaluation algorithm, data processing fault module detection algorithm and controls system synchronization.

DCC workspaces with TMR fulfill mainly communication functions with adjustment of input and output model data. Important function is configuration of processors.

Debugged and documented system function verification task can be used as a demonstration example, together with other tasks.

## 5. CONCLUSION

Proposed lab concept creates a sufficient space for efficient inclusion of further workspaces with different problems to be solved. They are opened mainly for computer engineering disciplines, IT and information systems as well as for other applied areas of IT. The whole OSI model levels, HW and SW system parts implementation levels and development tools creation is available.

Development of tasks for remote users is a necessary part of new understanding of the lab modernization process. Digital system analysis, synthesis and diagnostics workspaces are in this way more tightly connected with successful development activities of the computer network lab.

Engineering free hand design is left to students with selection of technologies in the digital system area, program creation and communication design. A necessary requirement is the ability to apply knowledge needed for functional, secure and reliable solutions, their documentation and presentation.

Development work on theoretical programming teaching modules, that are available to students through the same medium, are an important part in relation to these activities.

## 6. REFERENCES

- [1] Sieť virtuálnych laboratórií pre riadenie reálnych systémov. Projekt KEGA No. 3/3121/05, 2005-2007
- [2] Presalovič, M., „Laboratórne pracovisko so sieťovým prístupom“, Diplomová práca, KPI FEI TU v Košiciach, Košice, 2003
- [3] Sobota, B., „Informačné technológie. Elfa, Košice, 2006. ISBN 80-8086-045-9
- [4] Bača, J., „Internetovská aplikácia programového systému pre syntézu a diagnostiku logických obvodov“, In.: Proc. CSEW2001, Košice-Herľany, 25-26 October 2001, pp.118-123
- [5] Kapová, L., „Príspevok ku riešeniu koncepcie virtuálneho laboratória“. Diplomová práca. Technická univerzita. Fakulta informatiky a elektrotechniky. Košice 2005
- [6] BRADLEY C. : The evolution of pedagogic models for work-based learning within a virtual university, Computers and Education, 2002

[7] ONDREJ MARTINSKÝ - Dynamicky generovaný web, redakčný systém v PHP <developer.host.sk>

[8] Jakab František, Andoga Vladimír, Nagy Michal: Virtual laboratory: Experience with configuration of remote devices, Proc.: The 7th international conference on Virtual University, Bratislava, 14. - 15. December, 2006, Bratislava, E-Academia Slovaca, n.o., 2006, pp. 248-251, ISBN: 80-227-2542-0

[9] Kováčiková T., Klimo M.: Architecture and Protocols for NGN, in Next Generations Networks and Beyond, VITEL 2002, International Symposium on Telecommunications, Portorož, Slovenia, May 2002, 8 pp.

## THE AUTHORS



**Ján Bača** (doc, Ing, CSc), born in 1947, received the Ing (Msc) and CSc (PhD) degrees from the Faculty of Electrical Engineering, Slovak University of Technology, in 1968 and 1982 respectively. Since the 1969 he has been employed at the Technical University in Košice, since 1985 as Associate Professor at the Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics, Technical University in Košice. His current teaching and research interests are oriented towards design and diagnostics of logic circuits, computer nets, CAD systems, formal specifications and decomposition of systems.



**Stanislav Šuba** (Ing), born in 1952, the Ing (Msc) degree from the Faculty of Electrical Engineering, Technical University in Košice, in 1977. Since the 1992 he has been employed at the Technical University in Košice as Associate Professor at the Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics. His current teaching and research interests include different aspects of computer systems design and implementation, computer logic design, documentation and their E-learning support.



**Milan Haulis** (Ing) born in 1948, received the Ing (Msc) degree from the Faculty of Electrical Engineering, Slovak University of Technology, in 1971. Since the 1973 he has been employed at the Technical University in Košice as Associate Professor at the Department of Computers and Informatics, Faculty of Electrical Engineering and Informatics. His current teaching and research interests include different aspects of computer systems design and implementation, computer logic design, fault tolerant systems and their E-learning support.

## ACKNOWLEDGEMENTS

*The paper was partially prepared within the project "Network of virtual laboratory for real system control", No. 3/3121/05, 2005-09-09 2007-12-31 with the support of KEGA.*



## KNOWLEDGE MINING FROM ADAPTIVE COURSE

Marek Bober<sup>1</sup>, Petr Šaloun<sup>2</sup>, Zdeněk Velart<sup>1</sup>

<sup>1</sup>) Department of Computer Science, Faculty of Electrical Engineering and Computer Science, VŠB Technical University of Ostrava, 17. listopadu 15, 708 33, Ostrava-Poruba, marek.bober@vsb.cz, zdenek.velart.fei@vsb.cz,

<sup>2</sup>) Department of Informatics and Computers, Faculty of Science, University of Ostrava, 30. dubna 22, 703 01 Ostrava, Czech Republic, petr.saloun@osu.cz

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Knowledge mining from logs of adaptive systems is one of methods, how to obtain information, which can be used to verify used adaptation scheme and to determinate possible modifications of study materials. Paper is targeted to statistic methods, which can show differences between several groups of users and determine knowledge cohesion of users in progress and at the end of course. To determine difficult or simple questions in tests level of relevancy can be used. For log processing also methods of data analysis, such as clustering or decision trees, can be used. These methods are useful for detection of navigation in course and for determination, which parts of offered material is necessary to know for particular final mark.

**Keywords:** e-learning, learning technology, web-based courses, adaptive hypermedia, AHA!, statistical evaluation, data analysis

### 1. INTRODUCTION

Use of typical information systems or if you like e-learning system which offers study materials and obtaining knowledge about users from these systems in order to feedback has some constraints. Adaptive hypermedia in learning process can be used for personalization of content, navigation or presentation of information presented to users. Personalization can increase effectiveness of users learning process.

Adaptation of presentation or navigation in system depends on previous or actual knowledge of the student in the system and actual students behaviour. For the purpose of preparation of better learning materials personalized for individual user or groups of users it is necessary to obtain knowledge about users behaviour in the system and on the basis of confirmed hypothesis make a conclusions, that will be usable in personalization. There are some different methods how to analyze obtained data. We can target to specific area such as course productivity, course quality, suitability of usage course, etc. [12].

Our goal is to improve course by the adaptive techniques and personalization, which is backed by data analysis from logs. One of the possible solution is to observe students behaviour in the system and carry out data and statistical analysis over gathered logs, which will confirm or disconfirm our hypothesis and to apply obtained results back to the system.

Courses, which can be adapted are presented to users in adaptive systems. Most of adaptive systems works in WWW environment. Offered learning materials usually are several web pages, which are interconnected by hypertext links. Logs from users behaviour in the system are usually

saved into database, on these obtained data we apply statistical and data mining methods.

Goal of our work is to confirm or disconfirm hypothesis about characteristics of behaviour of specific groups of users in the system and about cohesion of offered materials. To achieve that we used above mentioned statistical and data mining method. Our results which we achieved were used to modify style of personalization of content and navigation of course and these results are a base for the next extension of adaptation to level of automatic or semi-automatic adaptation of offered learning materials.

### 2. ADAPTIVE HYPERMEDIA AND ADAPTIVE SYSTEM AHA!

Adaptive hypermedia allows adaptation of content, style of presentation and navigation to particular user or group of users. Advantage of use of adaptive hypermedia (not only for learning) is that they allow to increase effectiveness of the learning by the adaptation of learning material to individual user [2].

Hypermedia can be defined as a group of different type of media (text, pictures, audio, video ...) used in applications, which are interconnected by hypertext links [3].

Adaptation in adaptive hypermedia systems is based on knowledge about content of individual pages, relationships between them and hypothesis about knowledge, preferences and other characteristics of the user [2]. Adaptive systems not only offer learning material to the user, but also collect information about user's behaviour in system and based on this adapt content and style of offered materials.

Every adaptive hypermedia system is using adaptation techniques for adaptation of learning material. There are two groups of adaptation techniques – adaptation of content and adaptation of navigation. Nowadays, adaptation is often called personalization [7, 11].

Information hidden in web pages still increase and orientation in them becomes more difficult. We can make navigation better organized and by this allow the user better orientation. The goal of personalisation of navigation is to help to the user in orientation in hyperspace. Personalization of navigation is based on knowledge and characteristics of the user. There are five methods of adaptation of navigation: direct guidance, links sorting, link hiding, link annotation and map adaptation [7].

Most systems working with adaptive hypermedia are based on specific model. Adaptive hypermedia system AHA! (Adaptive Hypermedia for All) is made by the team of Eindhoven University of Technology lead by Prof. Paul De Bra. [7, 8, 9, 10] and is based on AHAM reference model [7, 10], which was constructed to provide abstraction of the structure and functionality of existing and future adaptive hypermedia systems, see Figure 1.

AHAM reference model defines four base models [4]:

- *Domain model (DM)* describes the application domain with fragments, pages and concepts. In the AHA! pages are simple XML files containing fragments of HTML text. XML tags are used to set boundaries of fragments and to provide conditions. Individually pages are connected through hypertext links.
- *User model (UM)* holds information about users and their behaviour in the system. In AHA! the user model consists of table which for each page or concept an attribute value that is updated when the user browses through the page.
- *Adaptation model (AM)* is defined as a collection of rules that defines how the adaptation must be performed. In AHA! the adaptation is defined through requirements relationships. For each fragment, page or concept can be defined a relationship which denotes under which circumstances this fragment, page or concept is used.
- *Adaptive engine* which performs the actual adaptation according adaptation rules and generates pages in such a way that user can distinguish desired from undesired information by use of some of many existing adaptation techniques. In AHA! there are used these adaptation techniques: conditional inclusion of fragments and hiding or annotation of links.

For adaptation of content it is necessary to obtain information on which the adaptation will be based – it is necessary to observe behaviour of the user in the system, his activities, which pages (concepts) he visited and how many times and the sequence of visited pages and how much time he spent on particular page. For the system to be able to obtain all this information it is necessary that all

users are logged into the system. If a user is anonymous, there is problem to record his behaviour and offer him personalization next time he visits the course.

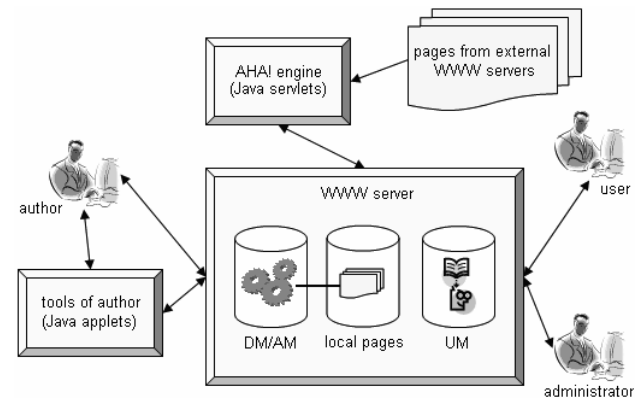


Fig. 1. Structure of AHA! system based on AHAM model

### 3. COLLECTING DATA

AHA! system contains user model, which can be store in MySQL database or XML files. We choosed the first variant. All information such as data about user, data describing style of adaptation etc. are saved in the form of records in the database tables.

Information about user's characteristic are saved to profrec table, which is built on principle of saving attributes and their value [10]. Attributes characterize user in system. Every attribute is bound to concept and every concept is bound to course. Prefix of attribute is name of concept and name of course e.g. *kurzcpp.ch01.numaccess*. where *kurzcpp* is the name of the course, *ch01* is the name of the concept and *numaccess* is the name of the attribute. Main attributes of concepts which are significant for obtaining knowledge about users, are:

- *knowledge* – stores „knowledge” about the concept, the value describes sense of content of concept with regard to content of the whole material.
- *numaccess* – count of accesses on the concept, how many times the concept was seen by the user.
- *visited* – boolean value, which is true if concept was visited by the user or false otherwise. *demanding ness* – the course is splited into several categories by the demanding ness of the content material. Value represents level of demanding ness.

System AHA! allows testing user's knowledge by tests with questions with multichoice answers. Information and results of tests are saved to profrec table with similar attributes and contain this information:

- Count of questions in test.
- Identifier of the question.



- Identifier of the answer and boolean value (true – answer was selected by the user, false – not-selected) and point evaluation.
- Summary result of test.

We distinguish two kinds of tests in the system. First is self test, which is situated at the end of each chapter and is intended to verify knowledge of the user from the chapter. This test could be repeated by the user several times. The second one is exam test. Students take three exam test during the semester. Evaluation of each of these exam tests is a part of the final mark student can receive for the course.

The data model contains table *accesslog*. To this table information about activities of the user in system is saved. Into this table following information are saved:

- *accessdate* – date and time of access to the concept.
- *session id* – identifier of the user.
- *name* – name of the concept, which was visited. *user* – login of the user, which user uses for login into the system.

For personalization of pages to several users or group of users are above information deficient. Therefore we designed our own table for logging – *ag\_logs*, which stores more information. We record following information:

- *type of access* – we distinguish access to the concept, access to the test and access to the system.
- *id of student* – identification of the user.
- *systems client properties* – in the type of access to the system we record IP address of computer, type of the browser and operation system which the user used. *date and time* – we log date and time for entrance/leaving to/from the system, concept and test. For further easier processing spend time over concept, test and session time in the system is automatically saved. *course and concept* – information about the course and concept the activity was carried out. *tests and evaluation* – if the activity was a test, information about questions and answers including points are saved.

The data, which describe behaviour of the user in the system, were saved continuously – when the user carried out some activity in the system. After finishing the course the collected data were transformed and modified for next processing and incorrect and wrong data were eliminated. All modifications were done with regards to the defined goals of work, which are described in the next parts of this text.

#### 4. METHODS AND AREA OF PROCESSING

Our target was to confirm hypothesis about style and behaviour of users in the system or about their learning

style. The first goal was to verify, if there are differences between students behaviour of full and part time students and based on this decide, if there is a need for course separately for full time and separately for part time students. The second goal was obtaining information about how the users knowledge during the course influences summary results. One of possible methods, how to obtain some overview, is to compare relation between the self tests and exam tests. To gain overview of questions interpretation it is necessary to explore all questions and answers in tests – which question were hard to answer or on the other side too easy.

For validating navigation in the course we used data analysis methods. For our purpose were suitable clustering and decision trees methods, where we search for paths leading to the particular final marks and which concepts are necessary to know to gain particular final mark. The results represent recommended paths in the course.

#### Statistical methods

One of the goals was to find, if it is necessary to have different courses for part time and for full time students. That means to find, if students of part time form have similar style of learning as a students of full time form. If there are big differences, then students of part time form have different learning style than students of full time form.

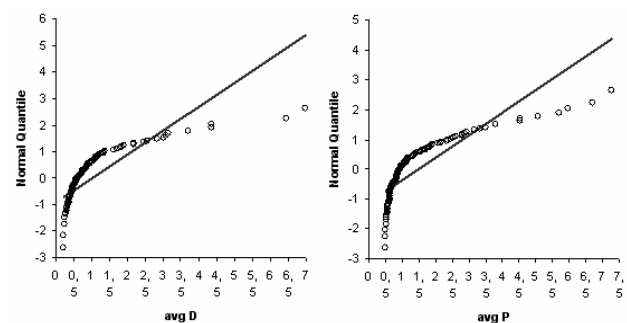


Fig. 2. The parting of average number of accesses to several concepts (left part time form, right full time form of study)

| n = 238             |         |       |        |        |        |
|---------------------|---------|-------|--------|--------|--------|
| name                | n       | Mean  | SD     | SE     |        |
| 0.99                | 119     | 0,993 | 1,112  | 0,1019 |        |
| 1.47                | 119     | 1,473 | 1,324  | 0,1214 |        |
| Source of variation | SSq     | DF    | MSq    | F      | p      |
| name                | 13,723  | 1     | 13,723 | 9,18   | 0,0027 |
| Within              |         |       |        |        |        |
| cells               | 352,771 | 236   | 1,495  |        |        |
| Total               | 366,494 | 237   |        |        |        |

Tab. 1. Value of half-way ANOVA test

For statistic analysis we used tool called Analyse-it as an accessory to Microsoft Excel [1]. For comparing both groups we used information about average accesses to

several concepts. Because access to concept does not mean, that both groups obtain the same knowledge, therefore we verified results on data of average knowledge for several concepts.

Values in graph (see Figure 2.) show the parting of average number of access to concepts of part time and full time students. The results shows almost same values.

If the data can be used for processing, we verified by the test called ANOVA, see Table 1. From results of test we can see, that null hypothesis about equality of averages did not confirmed and the data can be used for next processing.

For confirming previous result we used two comparative tests: vaporous t-test and Wilcoxon test [6]. Both t-test and Wilcoxon test confirm that average knowledge of students for part time and full time form study are not markedly different. Results of Wilcoxon test shows Table 2.

Learning material was divided into twelve chapters. On the end of each chapter self test was situated. From the gathered data we can obtain information how chapter was difficult or simple for the user. We can obtain this by comparing number of repeating self tests. Learning material was divided to three categories (see Figure 3 and 4) and by the testing of students with the help of tree exam tests, we can confirm or disconfirm results obtained by self tests. First and second exam tests tested knowledge from first and second category. Third test checked knowledge from all categories.

By this technique we obtain list of chapters which do most or least problems to users, see Figure 3 and 4. Results of exam tests confirm results of self test analysis.

The next elemental information is obtained from questions, whatever they are hardly, wrongly or simple formulated. One of the methods, how to obtain list, is to detect how users answered question – how many times the question was answered good, bad and none. For the list of bad or well answered questions is necessary to determine two levels of relevancy.

#### Relevancy levels of questions

Let's determine distribution of answers in percents. We determine relevancy level of wrong questions (*hvincor*) to 50 % that means all questions, which have had percentage of good answers lower than 50 %, can be wrong formulated. Let's *hvcor* (85 %) denote relevancy levels of simple questions. Usage of relevancy levels shows Figure 5. In our case, this is interpretation of third test.

#### Data mining methods

Based on the gathered information from the log, paths for individual students can be reconstructed. For individual student the path has no relevant information but in the context of tenths of students, it is possible to identify groups of students with common behaviour [14] or common navigation

| Alternative hypothesis            | value D  | Value P                                    |
|-----------------------------------|----------|--|
| n = 101                           |          |  |
| <i>Difference between pairs</i>   | <i>n</i> | <i>Rank sum</i> <i>Mean rank</i>           |
| Positive                          | 1        | 3,0 3,00                                   |
| Negative                          | 100      | 5148,0 51,48                               |
| Zero                              | 0        |  |
| <i>Difference between medians</i> | -10,592  |  |
| 95.0% CI                          | -11,592  | to - 9,440 (normal approximation)          |
| Wilcoxon's W statistic            | 3        | (normal approximation, corrected for ties) |
| 2-tailed p                        | <0.0001  |  |

Tab. 2. Wilcoxon test

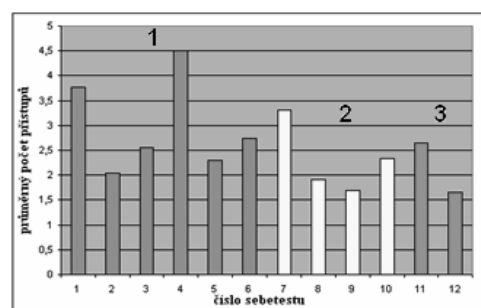


Fig. 3. Count of accesses to self tests

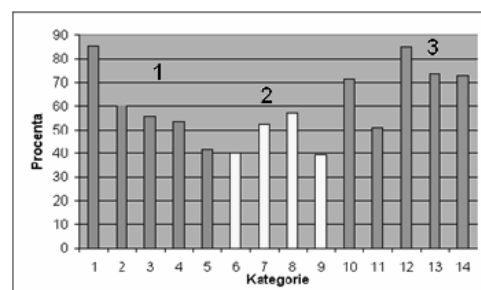


Fig. 4. Results of exam tests

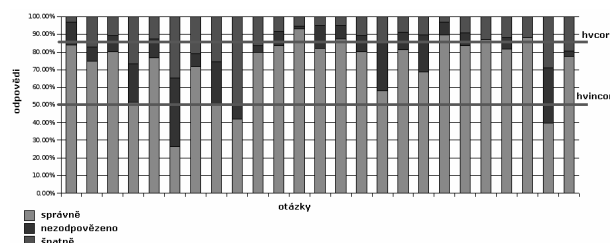


Fig. 5. Usage of relevancy levels

- From this information we can deduce: that course navigation is represented by several paths leading to

different final marks from the ours. Path in the course defines the minimal amount of information which is needed to achieve the defined final mark. Identified paths can be presented to students at the course beginning, where according the choose path the pass through the course is personalized for the student. This choice of student cannot work as limitation, but as a recommendation.

- Behaviour patterns of students in the closed part of the knowledge or in the whole course. According the determined behaviour the navigation in the course can be personalized. In this category falls cases such as where student likes to look at the examples first and the to see the learning material and others.

From logs of the system, it is possible to identify the previously described personalized navigation by the use of one of the following methods.

The first step of the analysis is to put together different paths students used in the course. Representation of the path is possible by vector of visited concepts or by the database table where columns represent particular concepts and rows particular students. In the corresponding column we put a star sign, if the student visited the concept. Alternatively we can put a sequence number, in which student visited the concept. In our case all the data were gathered to the table *ag\_logs*. Some columns in this table can have a NULL value, which means, that student did not visited the concept. For the statistical analysis is the best solution to substituted NULL values with some constant, which represent non-visiting of concept. Because we had not enough relevant data, we were able to process data only without the knowledge of sequence of visit of concepts.

On the gathered data we used data mining methods – clustering method and decision tree method. In the clustering method the input attributes are all columns representing concepts and column representing final mark. In the decision tree method the input attributes are also columns representing particular concepts and classification attribute is the final mark. The output of the data mining methods is in the case of clustering method groups of users with the same path through the course and in the decision tree method concepts (or in case the input data had also information about sequence of visit, also sequence of concepts) leading to the final mark.

Disadvantage of these methods is low reliability. In our case the marks can be split only into four groups and the number of concepts can be considerable big – in our case in the course of Programming in C/C++ we had over 100 concepts. With the growing number of relevant data the reliability of result will grow.

The obtained results of the clustering methods had not shown fundamental differences between individual identified clusters. This can be explained by the sequence design of the course with mandatory test at the end of every chapter and that in the input data was only information about visited or non-visited concepts. Abandoning the

necessary test at the end of the chapter and with the information about sequence of visit of concepts we will be able to clusters of users with similar paths through the course, which will represent personalized paths, which will be offered to student at the beginning of the course.

## 6. CONCLUSION

From results we can deduce, that full time and part time study form is not markedly differ. In consequence is not necessary modify content of subject matter for part time and full time study form separately. That means students of both forms have a similar study style on conditions determined in beginning course. Because adaptation in our system was in a base level, it would be interesting to obtain, if exist marked differences in other systems with more advanced adaptation techniques.

Comparing straight knowledge of students with final knowledge by the comparing exam and self tests results is one of the possible methods for creation feed back between the teacher and content of subject matter and their suitability and usage for students of different form study. From results we can say that exist some dependency between these tests. In detail research, which is not all in this paper, we discover subject matter area, which have coherency with some parts of (self) tests. With the help of these results we can modify content of subject matter and style of presented subject matter parts. Wrong formulated questions we obtain by the detail research and these questions were modified.

## 7. REFERENCES

- [1] Analyse-It Software, Ltd. <http://www.analyse-it.com/>, Analyse-it statistical software, statistics add-in software for Microsoft Excel.
- [2] Bieliková M. Tvorba obsahu v adaptivních hypermédiách pre e-vzdelávanie. Technologie pro e-vzdělávání 2004. Praha 2004. ISBN 81-01-03167-5.
- [3] Bober M, Velart, Z. Adaptive hypermedia and PDF forms in AHA! For e-learning. Wofex 2005. Ostrava 2005. ISBN 80-248-0866-8.
- [4] Bober M., Šaloun P., Velart Z. Interactive PDF forms for multichoice testing in AHA!. ICETA 2005. Košice 2005. ISBN 80-8086-016-6.
- [5] Bober M. Statistical evaluation of course Programming in C/C++. Wofex 2006. Ostrava 2006. ISBN 80-248-1152-9
- [6] Briš R., Litschmannová M. Study notes. <http://www.am.vsb.cz/bris/Teaching/Statistika> 01.rar, Statistika I.
- [7] Brusilovsky P. Methods and Techniques of Adaptive Hypermedia, Adaptive Hypertext and Hypermedia, Kluwer Academic Publisher 1998. ISBN 0-7923-4843-5

[8] De Bra P., Ruiter J.P. AHA! Adaptive Hypermedia for All. sborník WebNet Conference, říjen 2001.

[9] De Bra P., Aerts A., Smits D., Stash N. AHA! Version 2.0, More Adaptation Flexibility for Authors. AACE ELearn'2002 conference, říjen 2002.

[10] De Bra P., Aerts A., Berden B., De Lange B., Rousseau B., Santic T., Sints D., Stash N. AHA! The Adaptive Hypermedia Architecture. ACM Hypertext Conference. Nottingham 2006.

[11] Matušková, K., Bieliková, M.: Personalized Navigation in Open Information Space Represented by Ontology. Adaptive Hypermedia and Adaptive Web-Based System AH 2006, Springer LNCS 4018, 2006, ISBN 3-540-34696-1.

[12] Mendes E., Mosley N.: Web Engineering. Springer, 2006. ISBN 3-540-28196-7.

[13] Šaloun, P., Velart, Z.: Adaptive Hypermedia as a mean for learning programming. Workshop proceedings of the sixth international conference on Web engineering 2006 ACM Digital Library. 2006. ISBN 1-59593-435-9.

[14] Velart, Z., Šaloun, P.: User Behavior Patterns in the Course of Programming in C++. In Proceedings of the joint international workshop on Adaptivity, personalization & the semantic web. ACM Digital Library, 2006, ISBN 1-59593-453-7

[15] Velart, Z., Šaloun, P.: Evaluation testing with strong motivation. In Proceedings of the Seventh International Scientific Conference Electronic Computers and

Informatics ECI 2006, 2006, p. 64-69, ISBN 80-8073-598-0

[16] Velart, Z., Šaloun, P.: Education of programming in C++ in adaptive systems AHA! (in czech). In Technologie pro e-vzdělávání 2006. Praha 2006. ISBN 80-01-03512-3.

## THE AUTHORS



**Marek Bober:** is a Ph.D. student at the Faculty of Electrical Engineering and Computer Science of VŠB-TU Ostrava. His research is adaptive hypermedia.



**Petr Šaloun:** is associated professor at Faculty of Science University of Ostrava. His research covers adaptive hypermedia, syntax analysis and compilers.



**Zdeněk Velart:** is a Ph.D. student at the Faculty of Electrical Engineering and Computer Science of VSB-TU Ostrava. His main research topic is adaptive hypermedia.



## SATELLITE AND MOBILE COMMUNICATION AS MEANS OF MODERN DISTANCE EDUCATION TECHNOLOGY

Viktor Bondarenko  
Kiev National Economic University  
+38 044 066 2056033  
victorbondarenko@rambler.ru

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract:** This paper describes the use of technology of satellite and mobile communication for quality improving of modern distance education.

**Keywords:** satellite communication, mobile phone, training, multimedia, education, learning technology, E-learning.

### 1. INTRODUCTION

Intensive development of communication systems opens new perspective opportunities for the remote training. The satellite and mobile communication systems are most interesting directions of communication systems, which can be effectively used in the remote training.

The satellite Internet is a unique means of access to the educational Internet-resources in places, where are inconvenient the connection to the Internet through switched telephone channels, dedicated channels or using ADSL-technologies. The satellite channel provides the same fast and reliable data transfer, as well as dedicated channels.

Such satellite channel enables to receive large quantity of the educational information including multimedia manuals, average volume of which is measured in hundreds Megabyte. Because of high-speed access in the Internet, it is possible to see, to listen lectures, and to conduct training in the real time mode if the teacher is working with the WEB-camera.

The satellite TV, which is realized on that equipment as the satellite Internet, allows stable and qualitatively to see educational television programs. Such TV not depends on a territorial location of the television centers and ground transponders.

The means of mobile communication allow to use the GPRS (General Packet Radio Service) and the EDGE (Enhanced Data for Global Evolution) technologies of the

data batch transfer [1], due to them it is possible communication and information exchange between students and teachers practically from any place not only a country, but also all over the continent.

Taking into account above-stated, the specified communication facilities present large interest for the formation of the new technology, which can improve of education quality thanks to the more effective contact of students with teachers.

This technology is applied to all forms of training, but in particular, to correspondence and remote forms, because such students have not stable contact with teachers, because,

as usually, they are located on large distances from an educational institution. However, the stable contacts of students with teachers determine quality of received education.

The report is devoted to this problem, where is presented the technology of training. This technology is based on the use of satellite and mobile communication systems. The described technology is implemented at the Bank Faculty of the Kiev National Economic University.

### 2. GENERAL PRINCIPLES OF THE USING OF THE SATELLITE AND MOBILE COMMUNICATION IN EDUCATIONAL PROCESS

The technology of the use of the asymmetric satellite Internet in educational process is shown in Fig.1. A student install the complete set of equipment for the satellite communication (the satellite dish, the converter, the DVB-card), with which student can receive all entering data from the Internet, for example, educational sites, files, E-mail, consultation in the on-line mode. The student's query for receiving of necessary information is sent on the server with the help of another Internet-channel. Usually such Internet channel is the mobile telephone, which works on the GPRS-technology if the access to cheaper means of the data transfer is absent. Alternatively, it is possible to use the Internet, which is based on the switched telephone channel, if the student can use the stationary telephone communication channels. Such connection is based on the dial-up modem using. The satellite antenna and stationary or mobile telephone can work in pair, not creating any difficulties, as volume of the outgoing information is usually small (dialogue in forums, ICQ, E-mail).

The satellite «NSS-6» resource is used for organization of the satellite communication channel.

It is possible to describe information flows in the system as follows: the user (teacher, student) has the complete set of the equipment for reception of signals from the geostationary satellite and some ground connection with the Internet. When the student asks about any information in the Internet, his query is directed to the Internet provider or the mobile communication operator. The information, which

was asked by the student, is sent to him not directly and at first, it goes to the satellite provider. The satellite provider directs this information on the satellite, and already the satellite relays this information to the user. The user receives the information with the help of the satellite antenna and the DVB-card inserted in the PCI slot of the computer. The satellite access to the Internet uses the DVB-standards and technologies, which are used for the modern digital TV. This explains an opportunity of using of the same equipment for satellite access in the Internet and for the viewing of the digital satellite television programs and listening of the qualitative digital broadcasting, which also can be used in the educational purposes.

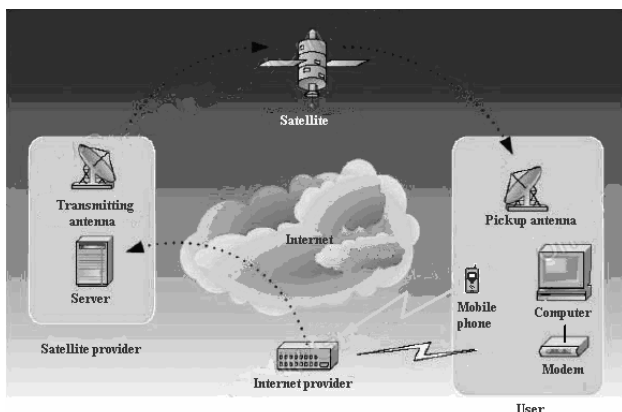


Fig.1. Technology of the use of the asymmetric satellite Internet in educational process.

### 3. THE BASIC MEANS OF THE EDUCATIONAL PROCESS TECHNOLOGY

The basic means of the educational process support are educational portals, in which are included such means of training: multimedia courses, simulators, tests. Let us consider briefly each element of the specified set.

#### Educational portals.

The most important components of educational process are educational portals. For example, the educational portal *educator.narod.ru* for support of the Computer Science training. One of such portals *victorbondarenko.euro.ru*, which supports the student's preparation on the discipline «Bases of the Electrical Engineers and Electronics», is shown in Fig. 2. It is possible to receive from this portal lectures, multimedia courses, simulators, tests, tasks for self-preparation, tasks for laboratory works, examples, tests for self-checking knowledge, instructions, materials for the review and discussions.

It is possible to communicate with the teacher, using the guest book of the portal. The E-mail is used for active communication of students with the teacher. The student can write to the teacher the letter using the address *victorbondarenko@euro.ru*. He can receive the answer with an explanation of problems, which have arisen during the task performance. After receiving the task, the student prepares for realization of laboratory works, carries out them on the laboratory stands and results forms. In case of necessity, the student can write materials for the common review and discussions.

The developed materials the student places on Web-server, sending them with the help of the FTP-protocol. Communicating with the Web-server, the teacher carries out consideration and analysis of the students works, forms the database of tasks processing results, which were executed by the students, carries out correction of a didactical material, which is on the server, carries out the tests construction and updating.

During check of the tasks, the teacher uses the database for preservation of the tasks check results. This database automatically calculates the total estimation of the student with the help of the formula, which is given by the teacher.

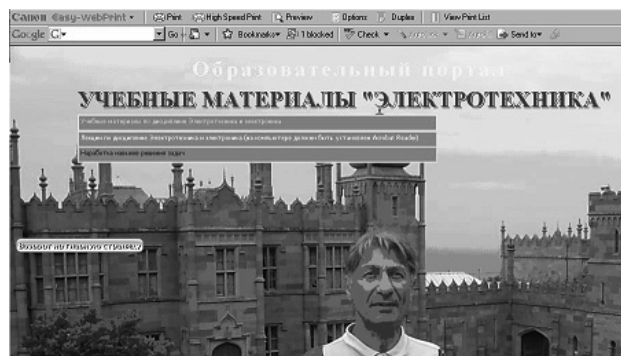


Fig. 2. The general view of the educational portal *victorbondarenko.euro.ru*

#### Multimedia courses.

The modern means of computer engineering allow considerably to raise a level of efficiency of the manuals, because a author can include in manuals besides the text and figures a sound, animation, functioning program systems, the algorithms of the work with the manuals can be inserted too.

Due to such means, the information perception by students essentially improves, because of that is the more effective training. Some manuals were created on the base of the methodology, which was offered in [2]. The first of such manuals was developed the multimedia course on the discipline «Computer Science».



This course occupies 135 Mbytes of a disk space and includes the loading module, which is loaded automatically after the disk mount. The course allows with the help of the convenient menu to select two themes of the multimedia course - « Web-pages Designing» (duration is 60 minutes) and «The work with the Excel» (duration is 120 minutes). The dense format MP3 was used for preservation of the sound. Further the menu has the item «The Test Word-Excel» for a call of the test for check of the Windows, Word, Excel knowledge, and then the menu item «Simulator Excel», which load the simulator for receiving of skills of the mathematical tasks solution in the system Excel.

The test tasks are called from the menu item «Test tasks». These tasks are intended for the independent decision. Besides, the menu has item «About the project», which contains the short information on system installation, and the author's information.

The multimedia course has such structure on each of the two themes. The theme is divided on fragments. The student has an opportunity to pass the fragment, which he already has learned. If the fragment is not learned after the first study, the student has an opportunity to repeat it so much time, how many is necessary. Each fragment includes the theoretical information, which is accompanied by an illustrative material and sound explanation. Then, the student has an opportunity to execute practical tasks. For this purpose, the necessary system (Internet Explorer or Excel) is automatically loaded and the example of the tasks solution is shown on subjects of a fragment. Further, it is offered to the student to execute the similar task independently. There is an opportunity to repeat each theme from a beginning after passage of all fragments of the theme. If it is not need, it is possible to performance of the laboratory work. It is carried out one laboratory work on the theme «Web-pages designing» and two laboratory works on the theme «The work with the Excel». The course contains examples of laboratory works, and examples of the reports design to them. Besides, some tens tasks are given on each laboratory work, so that each student of the group would receive the individual task.

#### Simulators.

Simulators are next important technological elements, which are used in training [4]. Let us consider in more details the work of the concrete simulator, which is used during study of the Computer Science course. The simulator is intended for a receiving such skills in the system Excel: the calculation of mathematical expressions, the work with matrixes, the forecasting, the solution of the linear algebraic equations systems, the solution of the nonlinear equations and the solution of optimization tasks.

After the simulator call, the student should be registered. He begins the work with the simulator by pressing the button «Beginning of training». The structure of the work with the simulator is shown in Fig. 3.

The student consistently carries out such actions on the simulator (see Fig. 4.):

1. First, it is necessary to analyze examples of the task correct decision, which are executed by the simulator (to press the button 1).
2. Further, the student receives the task with the data, which are random generated by the simulator (to press the button 2).
3. The student solves independently the task (decision should be brought in area «Results»).
4. It is necessary to confirm the termination of the task performance by pressing the button 3.

The simulator solves the same task simultaneously with the student and further compares the correct task solution to the student's task solution. After such comparison, the simulator puts the mark to the student for the executed exercise in the table of the database, which is constructed in environ-

ment of the system Access. The table of the database contains the name of the student, the number of his group, the title of the exercise, the date of its performance, the time of a beginning and termination of exercise performance, the time, which the student spends for exercise performance, mark for the executed exercise.

The student activity information is kept in the database Access as the table 1.

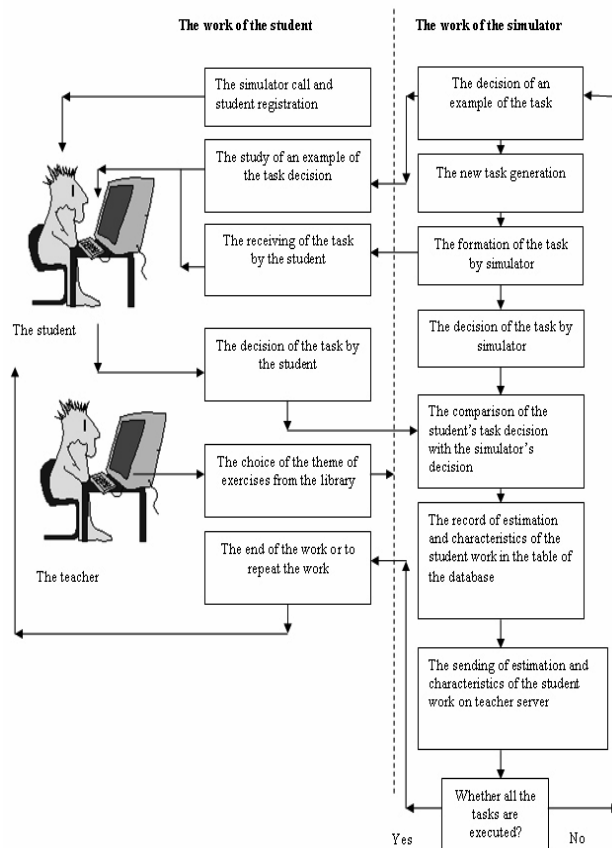


Fig. 3. The structure of the simulator functioning

| Name    | Group      | Exercise    | Date           | Begin        | End          | Time | Mark |
|---------|------------|-------------|----------------|--------------|--------------|------|------|
| Sidorov | 610<br>8/2 | Calculation | 02-05-<br>2007 | 20:26:<br>23 | 20:26:<br>24 | 1    | 0    |
| Ivanov  | 610<br>8/2 | Forecast    | 02-05-<br>2007 | 20:26:<br>29 | 20:26:<br>30 | 1    | 1    |

Table 1. The information of the student's activity in educational process.

The teacher can analyze activity of each student in different planes with the help of typical queries, which are generated in language SQL. He can determine weak places in the educational material learning, most expedient tactics of educational process conducting both in group as a whole and for the separate students. Such analysis is carried out with the help of the analysis system.

The work with the simulator is one of the constituent of student's preparation on the Computer Science course.

#### The tests.

The next components of educational process are the automated tests, which are constructed with the help of test-constructed system [3]. For example, Excel and Visual Basic test. The test includes questions about the systems Windows-2000/XP, Word, Excel and Visual Basic. It consists of 87 questions. Time of testing is 20 minutes. Figures are widely used in test. These figures are shown panels and menu of the systems Windows-2000/XP, Word, Excel.

|    | A        | B                                 | C         | D            | E                            | F                                     | G | H | I | J |
|----|----------|-----------------------------------|-----------|--------------|------------------------------|---------------------------------------|---|---|---|---|
| 1  | Розділ 1 | Обчислення в системі EXCEL        |           |              |                              |                                       |   |   |   |   |
| 2  |          | Значення                          | Операція  | Результат    | Технологія роботи з розділом |                                       |   |   |   |   |
| 3  |          | Роз                               | Гром      | Конкатенація | РозГром                      | 1. Подивіться як вирішується задача.  |   |   |   |   |
| 4  |          | 7                                 | -1,45     | Додавання    | 5,55                         | Для цього <div>натисни кнопку</div> 1 |   |   |   |   |
| 5  |          | 2,30E+02                          | 1000      | Віднімання   | -7,70E+02                    |                                       |   |   |   |   |
| 6  |          | -3,1                              | 4,2       | Множення     | -13,02                       |                                       |   |   |   |   |
| 7  |          | -5,45                             | -1,20E-03 | Ділення      | 4541,66667                   |                                       |   |   |   |   |
| 8  |          | 4                                 | 0,5       | Степінь      | 2                            | 2. Виріши задачу самостійно.          |   |   |   |   |
| 9  |          | 3+2i                              | 5-6i      | Додавання    |                              | Для цього <div>отримай задачу</div> 2 |   |   |   |   |
| 10 |          | 4+6i                              | 3,2-5,1i  | Віднімання   |                              |                                       |   |   |   |   |
| 11 |          | 2,1                               | 4,2-2i    | Множення     |                              | Екземпляр                             |   |   |   |   |
| 12 |          | 3-8i                              | 6-16i     | Ділення      |                              | 3. Після обчислення рішення           |   |   |   |   |
| 13 |          | 4-2i                              | 2         | Степінь      |                              | <div>підтвердь обчислення</div> 3     |   |   |   |   |
| 14 |          | Задачі для самостійного розв'язку |           |              |                              |                                       |   |   |   |   |
| 15 |          |                                   |           |              |                              |                                       |   |   |   |   |
| 16 |          |                                   |           |              |                              |                                       |   |   |   |   |
| 17 |          | Значення                          | Операція  | Результат    |                              |                                       |   |   |   |   |
| 18 |          | 1                                 | 8         | Конкатенація |                              |                                       |   |   |   |   |
| 19 |          | 11                                | 17        | Додавання    |                              |                                       |   |   |   |   |
| 20 |          | 1,00E+01                          | 16        | Віднімання   |                              |                                       |   |   |   |   |
| 21 |          | 6                                 | 5         | Множення     |                              |                                       |   |   |   |   |
| 22 |          | 14                                | 8,00E+00  | Ділення      |                              | Results                               |   |   |   |   |
| 23 |          | 4                                 | 11        | Степінь      |                              |                                       |   |   |   |   |
| 24 |          | 5+6i                              | 16+1i     | Додавання    |                              |                                       |   |   |   |   |
| 25 |          | 20+7i                             | 19+11i    | Віднімання   |                              |                                       |   |   |   |   |
| 26 |          | 11+4i                             | 15+10i    | Множення     |                              |                                       |   |   |   |   |
| 27 |          | 4+8i                              | 5+1i      | Ділення      |                              |                                       |   |   |   |   |
| 28 |          | 8+7i                              | 10        | Степінь      |                              |                                       |   |   |   |   |
| 29 |          |                                   |           |              |                              |                                       |   |   |   |   |

Fig. 4. The simulator window for receiving skills of mathematical expressions calculation in the system Excel.

The Fig. 5 shows the general view of other test, which is used during study of the discipline «Bases of the Electrical Engineers and Electronics». The test consists of four tasks. The time of testing is 20 minutes. In case of necessity of calculations performance, the student can made such calculations with the help of the system Excel, temporarily entering in the Excel from the test is possible to do with the help of the button «Excel» pressing.

After the termination of the test, the student automatically receives an estimation and quantity of questions, on which he has answered correctly. Questions, on which the student had no time to answer in time allocated for the test, are considered as such, on which are given the wrong answers. The protocol of the answers of the student is fixed in the file and the teacher can see it in future during the analysis of educational process.

#### 4. THE TECHNOLOGY OF EDUCATIONAL PROCESS

The technology of educational process is shown in Fig. 6. We will present the use of the satellite and mobile communication technology in educational process. This technology includes the considered above opportunities.

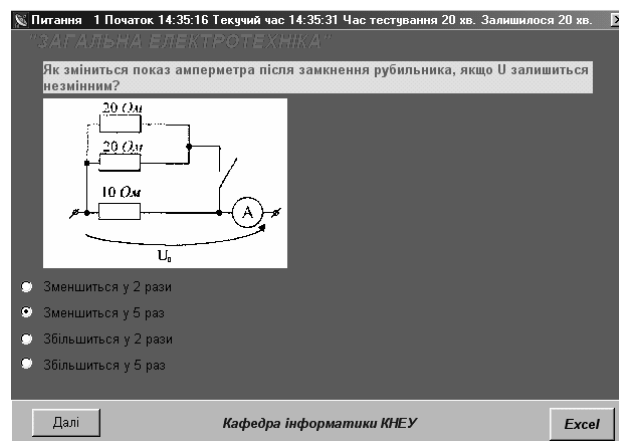


Fig. 5. The general view of the test on the course «Bases of the Electrical Engineers and Electronics».

The teacher prepares and places an educational material, necessary for learning (tasks, abstracts of lectures, multimedia courses, simulators and tests) on the Web-portals educator.narod.ru and victorbondarenko.euro.ru for use in the Internet. Simultaneously same information with changes focused on the mobile telephone using is brought on the Wap-portal (www.tagtag.com/educator).

The preparation of an educational material is carried out with the help of the various specialized editors (see Fig. 6.).

The student reads out the necessary information from the Wap-portal on the mobile telephone or from the Web-portal through satellite communication on the computer, carries out the tasks and results are sent with the help of the E-mail to the teacher, using for sending the mobile telephone or the Internet on the stationary computer.

If communication of the student with the teacher is direct, the teacher has an opportunity to write in the student mobile telephone the abstracts of lectures, tests, tasks and other information from the computer connected to the mobile telephone with the help of the cable. In such form, the educational material is very convenient for the daily work and it can be used as useful intellectual amusement if this material would has game design, which is creative and interesting for students.

Sound files with an explanation of a difficult educational material by the teacher can be loaded on the mobile telephone of the student from Wap-portal or from the computer connected to the mobile telephone with the help of the cable.



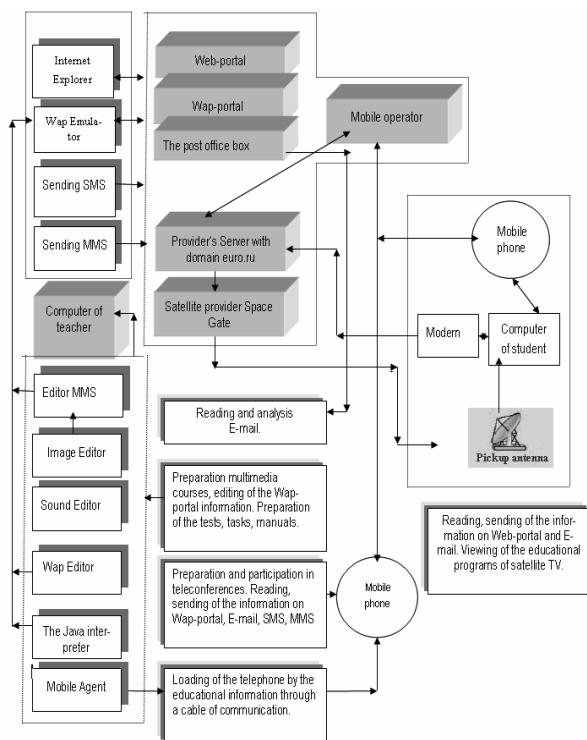


Fig. 6. The technology of the satellite and mobile communication in educational process.

## 5. CONCLUSION

The described above technology of remote organization of educational process is successfully developed at the Bank Faculty of the Kiev National Economic University. The implementation of this technology is carried out in parts and in the future, it is planned inclusion of the educational programs of the satellite TV. This technology is used for preparation of the specialists of the various forms of training. However, it is observed greatest efficiency of the technology in the student's preparation process of the correspondence form of training, because such students have not sta-

ble possibilities of direct communication with the teacher and this technology makes such communication more active.

## 6. REFERENCES

- [1] Victor Bondarenko Mobile Communication Technology as a Tool of Educational Process. Proceedings of International Conference "Modern (e-) Learning" July 1-5, 2006, Varna (Bulgaria). FOI-Commerce, Sofia, 2006, pp. 229-232.
- [2] В.С.Бондаренко Методологія побудови мультимедійних підручників. Удосконалення змісту та форм організації навчального процесу відповідно до міжнародних стандартів. Т2, Збірн. Матер.Науково-методичної конференції 2-4 лютого 2005 р., К.: KNEU, 2005, с. 56-58.
- [3] В.С. Бондаренко Інструментальний комплекс для формування адаптивних систем контролю знань. "Методичні та практичні аспекти застосування та розвитку системи контролю знань в університеті"Збірник матеріалів науково-методичної конференції. К.: KNEU, 2004, с. 173-176.
- [4] В.С. Бондаренко Дистанційний тренажерний комплекс для навчання роботі з системою EXCEL і тестування отриманих навичок. Образование и виртуальность. Вып. 9.Харьков, 2005, с. 60-64.

## THE AUTHOR



**Viktor Bondarenko** is now a Computer Science professor of Kiev National Economic University. He has worked in several scientific research institutes of the Academy of Sciences of Ukraine and taught at top-level universities of Kiev. The basic scientific interests are applied mathematics, modeling of complex organizational, social, economic and technical systems and processes, theoretical and applied programming. He introduces new modern technologies in process of training.





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

## SEMANTICALLY ENHANCED ADAPTIVE E-LEARNING SYSTEM

Svetla Boytcheva and Maria Nisheva  
Department of Computer Science,  
Faculty of Mathematics and Informatics, Sofia University –Bulgaria  
{svetla, marian}@fmi.uni-sofia.bg

**Abstract.** The present paper describes a work in progress in designing and implementation of semantically enhanced adaptive e-Learning system. As a result the implemented system is expected to provide more flexible course delivery in different modes, to provide and support personalized learning in different levels, to facilitate the process of knowledge base creation using tools for automatic knowledge extraction, to support multilingual courses and to apply automatic knowledge acquisition. The desired system has to be domain and platform independent in order to be able to be used as a platform for delivering different courses.

**Keywords:** Learning object, Metadata, Platform, Repository, Software, Standardization, System, Concept

### 1. INTRODUCTION

Past and current dynamics in education are requiring new and innovative learning and training solutions to meet both strategic and operational business, and learning objectives. The traditional ways of education no longer satisfy current and future needs and objectives. Simply converting traditional courses for Web-based delivery is not likely to be a sufficient solution to meet the varying needs of educational and research institutions and business. Designing and implementing successful Technology Enhanced Learning (TEL) solutions is not a quick and simple process. Organizations that fail to recognize the complexities and fail to take advantage of current best practices and lessons from other education and research institutions around the world, will likely waste both financial and human resources and pay a costly penalty at a time when learners have little tolerance for failure.

E-Learning was identified as one of the emerging areas in the last few years. Personalized support for learners becomes even more important, when e-Learning takes place in open and dynamic learning and information networks. Nearly no fully adaptive systems are available at the market. In order to satisfy the increasing user interest and demands of e-Learning systems, it is necessary to ease the process of development of such kind of systems. One possible step towards is to automate the knowledge acquisition and the testing of a user comprehension. Automatic extraction of formal knowledge specifications from free-text still looks too hard, effort consuming and time expensive. The other important task - automatic knowledge acquisition - requires preliminary defined description of each (important) word expected in the input text. In addition an upper layer type hierarchy and some semantic primitives are required. That is why the task of automatic knowledge acquisition from free text is shifted to extraction from restricted NL input only.

The main goal of our project is to create a prototype and to implement the main modules of an e-Learning system based on semantic technologies with some intelligent and adaptive features on human computer interactions. The main aims of the system are to provide more flexible course delivery in different modes, to provide and support personalized learning in different levels, to facilitate the process of knowledge base creation, to support multilingual courses, and to apply automatic knowledge acquisition. We attempt to design the system as a domain independent one in order to be able to be used as a platform for delivering different courses. We succeed to achieve solution on this ambitious goal for different tools and modules in certain points, but there are still many unsolved problems from theoretical point of view.

The paper is structured as follows: Section 2 overviews briefly some related research and stresses the attention to the open issues and main challenging problems; Section 3 describes the system architecture in general, facing some of the challenges of these new demands; Section 4 contains the conclusion and sketches some directions for future work.

### 2. RELATED WORK

During the last decade vastly rose the interest to computer based learning tools due to availability of bandwidth and powerful computers. Thus the learning systems have moved from particular environments (as industry and universities) to a larger community and became the necessity for long life learning. Learning is shifting from instructor-centred to learner-centred, and is undertaken anywhere, from classrooms to homes and offices. The rapid evolution of information technologies gives opportunities to offer a great diversity of software tools, protocols and standards to support learning where learners can engage and manage their learning. As a result users (learners and tutors) demands were changed.

For more effective and rapid learning users prefer to use one complex, domain independent learning platform instead of using several specialized learning systems and to spend too much time to learn how to use these systems.

Tutors need tools to automate the process of learning materials generation and to be able to reuse materials from existing courses. There are several authoring tools but only few of them offer semi-automatic facilities for course materials generation.

The new trend in personalized learning is not only tutors to set predefined objectives (goals) of the course (lessons) materials, to choose the didactic model for the course and thus to define navigational path they take through the learning material, but also learners to be able to set their own cognitive preferences. Cognitive states include things such as competencies and skills possessed by the learner, personal learning goals and more general aims, preferred cognitive style of learning and etc. Such theory is widely explored on so called knowledge spaces [1].

The main challenge of the personalized learning is to provide courses tailored to the different students backgrounds; this pushes the research to create an adaptive environment able to just-in-time craft the best learning path for each student.

**Research in modelling pedagogical strategies.** Today exists an increasing interest for so-called “active” and “rich” pedagogies that originate in various socio-constructivist schools of thought, e.g. project-based, problem-based, enquiry-based, webquest learning, discovery-based or case-based learning.

Teaching strategies, typically, can be represented as a series of high-level descriptive concepts representing learning activities to be undertaken. Teaching strategies are usually accompanied by a set of guidelines and scenarios intended to strengthen the course developers' confidence in using the strategy(s). IMS LD [2] is an e-Learning specification to model pedagogical scenarios, aimed to cover various learning situations and roles, with a strong pedagogical rooting. The benefit of the use of pedagogical scenarios, as stated in [3], is that the focus is put on the learning activities that should be done to achieve a learning objective rather than the learning objects. Adaptive web based systems are believed to be a promising challenge for efficient curricula.

**Research in modelling learner characteristics.** Every adaptive system needs a learner profile to perform the appropriate adaptation. In the area of learning, several approaches have been proposed to: tools to collect learners profiles [4]; tools to improve learner models [5]; development of learner profile ontologies [7]; development of learner profile standards – IMS Learner Information Package specification [6].

Adaptive Learning Systems would perform better if they would be able to exchange as many relevant fragments of information about the learner as possible. The use of

standards is recently gaining the attention of many researches as a promising solution for the problem of interfacing adaptive hypermedia systems. Adaptive Web-based systems are ready to make the jump from single applications to modular distributed frameworks in which multiple applications can share user models and adaptation rules.

**Research in modelling learning content.** A significant evolution on learning content design is the use of Learning Objects and their tagged metadata that make sharing and reuse of learning resources possible. The learning objects and metadata standards create opportunities for content designers to define and describe learning services to meet their specific requirements. Learning objects (LO) are a new way of thinking about learning content. They are *self-contained, reusable and can be aggregated*. LO are tagged with metadata. A lot of efforts have been put into standardization of e-Learning resources in the last few years: SCORM [10] incorporates IMS, AICC, ARIADNE, and the IEEE Learning Technology Standards Committee efforts into a single harmonized reference model for learning design and delivery. Several domain specific and general LOs repositories were created in last decade [8]. Generating metadata for learning material (LOM) is a complex and tedious task to be completed “by hand”. Therefore, the current trend is to automate this process. However, there are several important issues restricting this approach. In order to solve these issues, during the last two years researchers make effort to implement hybrid systems in which both human and computer collaborate for instantiating LOM attributes and to semi automate this process like in LessonMapper2 [9].

Many institutions and enterprises have set up Learning Management Systems (LMS) and organized their work around these new technologies that enables the management and delivery of online content to learners. WebCT, LearningSpace, Blackboard, eCollege, WebMentor, ATutor, Moodle, Claroline, Ilias, Colloquia, CHEF, Fle3, EduPlone, LON-CAPA [11].

In order to support and to easy a process of generation of course and learning materials (hypertext, multimedia, etc.) was implemented a lot of so called authorware tools like: Author Pro, Thinking Cap Studio, XplanaWorkbook, Web Author, ToolBook, Authorware, Macromedia Director [12].

Content packaging specifications (like IMS [13]) and standards allow courses to be transferred from one learning system to another. This is crucial since learning content can potentially be created by one tool, modified by another tool, stored in a repository maintained by one vendor, and used in a delivery environment produced by a different vendor. Content packages include both learning objects and information about how they are to be put together to form larger learning units. They can also specify the rules for delivering content to a learner.

**Research in adaptive web technologies.** By adaptive and intelligent technologies we mean essentially different ways to add adaptive or intelligent functionality to an educational system. The main characteristics of Adaptive Hypermedia Technologies are Adaptive Presentation and Adaptive Navigation Support. The role of Adaptive presentation is to adapt the content presented in each hypermedia node (page) to student goals, knowledge, and other information stored in the student model. In a system with adaptive presentation, the pages are not static but adaptively generated or assembled for each user (ActiveMath [15], ELM-ART [14], MetaLinks [18]). Adaptive navigation support is aimed at assisting the student in hyperspace orientation and navigation by changing the appearance of visible links. In the WWW context where hypermedia is a basic organizational paradigm, adaptive navigation support becomes both natural and efficient (KBS-Hyperbook [17], ActiveMath [15], ELM-ART [14], MLTutor [16]). Modern adaptive e-Learning systems are advanced with various intelligent tutoring technologies like Curriculum sequencing [17,19,20], Intelligent solution analysis [14,21,22], Problem solving support [23], Adaptive Information Filtering [16], Intelligent Collaboration Support - Adaptive group formation and peer help [24], Adaptive collaboration support [25], Virtual students [26].

**Research in semantic web technologies.** The new generation of the web, the so-called Semantic Web [27], appears as a promising technology for implementing e-Learning. The Semantic Web constitutes an environment in which human and machine agents will communicate on a semantic basis. One of its primary characteristics is shared understanding based on the ontology backbone. Ontology enables the organization of learning materials around small pieces of semantically annotated (enriched) learning objects.

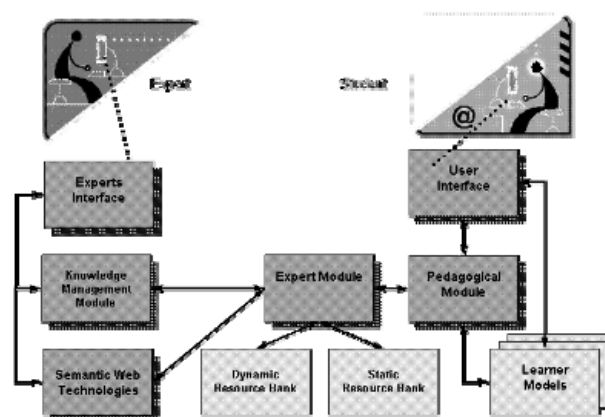
The Semantic Web brings structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users. A lot of such agents were developed [28]. Learning processes are described semantically in terms of a composition of user objectives (goals) and abstract from specific data and metadata standards. When a specific learning goal has to be achieved, the most adequate functionality is selected and invoked dynamically regarding the demands and requirements of the actual specific context. This enables a highly dynamic adaptation to different learning contexts and learner needs.

Although the potential benefits of Semantic web are many, it has become increasingly evident that the educational community will not be accepting SemanticWeb technology for meta-data very quickly. Most of e-Learning applications are seriously lacking in flexibility. Semantic Web technology has not been extensively used and studied for educational applications, and there is therefore a need for a detailed analysis of the needs of the e-learning community concerning Semantic Web infrastructures.

### 3. SYSTEM ARCHITECTURE

The system is an adaptive intelligent web-based e-Learning system with the following desired features:

- to provide more flexible course delivery in different modes - blended learning, distance learning, adaptive intelligent self-tutoring
- to provide and support personalized learning in different levels – Personalized Learning, Personalized Content, Personalized Technology
- to facilitate the process of knowledge base creation providing tools for: automatic knowledge extraction, automatic LOs generation, questions/answers generation tools, authoring tools
- to support multilinguality
- to provide automatic knowledge acquisition
- to use semantic web technologies



**Fig. 1 System Architecture**

The system contains the following modules (Fig. 1):

- User interface - for channeling computer-user interactions
- Learner models – set of lists of facts describing the history of user interaction and his performance in every step
- Pedagogical module - navigates user through the learning process
- Expert module - the domain knowledge base provides the structural description of the subject area
- Experts interface - allowing experts interactions with knowledge management module
- Knowledge management module - contains the tools facilitating automatic knowledge extraction and automatic knowledge acquisition and knowledge base update

The main modules of the system are implemented in Java in order system to be platform independent.

#### Expert Module

The Expert Module contains static and dynamic resource banks (Fig.2). In Expert Module the knowledge base contains repository of LOs encoded according to SCORM standard and Ontologies following principles and standards:

- Each Ontology concept represented as Learning Object (LO)
- Metadata description for each LO (following LOM and IMS standards)
- Knowledge repositories at each Content provider site, including LO and Metadata (packaged according to IMS standards)
- Ontologies published according to OWL

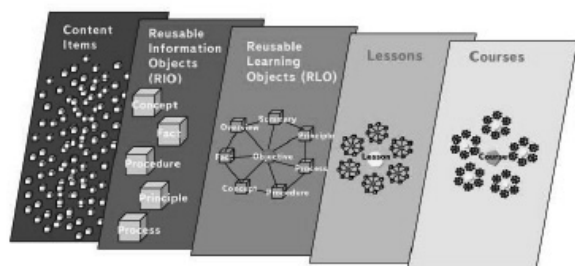
| Resources                | Language Independent   | Language Dependent  |
|--------------------------|--|---|
| <b>Static Resources</b>  | Concepts Type Hierarchy<br>LO metadata   | Lexicon<br>WordNet<br>Synonym Sets<br>Terminology Bank and Concepts weight<br>Partially anoted Learning<br>Texts/MMO/Materials<br>Grammar rules<br>Rules for LF translation<br>Text generation rules<br>Parsing rules |
| <b>Dynamic Resources</b> | Terminology Ontology<br>LO repository<br>Question/Answers bank in encoded format | LO presented in NL<br>Questions/Answers in NL format  |

**Fig. 2 Expert Module Resources**

Ontologies and Metadata are used to catalogue and index the LOs stored in the Repository. This digital repository can be externally accessible, searchable, and persistent which will allow content to be reused. A Learning Object is defined as "the smallest independent structural experience that contains an objective, a learning activity and an assessment".

- Objective: an element of a LO structural component that is a statement describing the intended criterion-based result of a learning activity.
- Learning Activity: an element of a LO structural component that teaches to an objective.
- Assessment: an element of a LO structural component that determines if an objective has been met.

If every lesson is defined as a set of objectives (aims and knowledge) then using LOs we can automatically compose Learning materials (Fig. 3) and Lessons. This approach allows us to develop adaptive e-Learning courses based on LOs and on personal user knowledge according to learner model.



**Fig. 3 Dynamically generated LOs based course**

### Learner Model

Most of the adaptive systems, which use knowledge representation and domain models, consider the student knowledge as a means for providing adaptivity. Student knowledge is a variable for every particular student. This means that these adaptive systems should evaluate or test the student knowledge, recognize the changes in its status and change the user model accordingly. Learner model contains information about user's assessment for LOs and Pedagogical Module (for more details see next Subsection) on this base can choose appropriate learning material in order to increase user knowledge in the domain and to achieve the course objectives. The Learner model keeps record to describe learners familiarity with the terminology which is closely related to domain knowledge: (i) know - the learner knows a term; the record is inserted for correct answers; (ii) not know – the learner doesn't know a term; the record is inserted for wrong answers; (iii) self not know - inserted when the learner chooses the "don't know" answer to certain LO, if such answer exists; and (iv) know wrongly - the learner's knowledge is considered wrong (eventually, might need corrections); the record is inserted for partially correct answer to a certain LO. Learner model is encoded in XML format and contains several records with the following information: date; Learning object ID; Lesson ID; LO type; Assessment type; Score; ontology concept , tested facts; exercise identifier (an unique ID corresponding to the tags course identifier, topic identifier and unit identifier from the LO annotation); counter how many times the user passes trough the tested learning object; indication of conceptual mistakes and unique index for tracking the whole dialog history.

### Pedagogical Module

The Pedagogical Module contains two main submodules - planning agent and curriculum. The main goal of the Pedagogical Module is to support personalized learning providing: (i) Adaptive presentation; (ii) Adaptive navigation support; (iii) Curriculum sequencing; (iv) Intelligent solution analysis and (v) Problem solving support.

The planning agent has two main strategies for active sequencing: local and global. Global planning plans the movement between exercises testing different concepts, according to their place in the ontology. For instance, if the student does not know the basic definition of a concept and its major additional facts, the pedagogical agent will choose to test first whether the student knows at all the super-concepts and only afterwards to suggest basic readings for the unknown concept. Global planning (i) chooses next lesson; (ii) chooses next LO in order to satisfy current lesson aims and (iii) makes decision between reading-exercise-test. Local planning plans the movement between drills testing different characteristics of one concept. Its main goal is to create a complete view about learner's knowledge concerning this concept. This strategy chooses exercises with increasing complexity when the learner answers correctly and it gives again previously completed drills if the learner has performed poorly. For instance, if a student does not know some fact related to the tested

concept (term), which is encoded in the exercise annotation with low weight, the pedagogical agent will suggest a reading.

The pedagogical agent chooses the next learner's movement depending on: (i) the annotations of available learning objects; (ii) the position of the tested concept in the type hierarchy; (iii) the current LM user's status according to student model: history and quality of learner's performance and (iv) student preferences of cognitive learning model - sequential, hierarchical, etc. The Course curriculum contains aims, objectives and prerequisites (list of terms/concepts and relations that have to be well known before starting the course) in different levels - global (course level), local (lessons level) and LO level.

According to the student model and student preferences, the planning agent creates a graph covering the curriculum. There are several different paths that can be followed through the curriculum from starting point to the end. There are used several course sequencing techniques and LO selection is based on a set of teaching rules according to the cognitive style or learning preferences of the learners. All curriculum sequences (paths) have to pass through the LOs representing basic/obligatory (most important) concepts/relations/definitions in the course. These paths can pass from as many as possible LOs representing additional information, according to student model and preferences. If the student interested more about certain topic, he/she can pass through several LOs that are not obligatory to finishing the course and contain external/additional information. In spite of the fact that most of these rules for course sequencing are generic (i.e., domain independent), there are no well-defined and commonly accepted rules on how the LOs should be selected and how they should be sequenced to make instructional sense.

#### Knowledge Management Module

Knowledge management module contains the tools for: (i) updating Knowledge Base (KB); (ii) Automatic Question-answers generation; (iii) Automatic LOs generation; (iv) Automatic Knowledge Acquisition; (v) Ontology management and (vi) Authoring tool.

The Question Generation (QG) tool, using the Expert Module information, automatically generates questions to the user in order to determine user's knowledge and misconceptions. This allows with the others prestored questions and tests to generate automatically several different types of questions. QG tool generates automatically also the scope of the correct answer in order to check against them the user's knowledge. This approach allows dynamic assessments generation. Another advantage of this approach is that the Pedagogical agent can interfere if the user needs some help or advises with automatically generated questions adapted to the current user's performance and knowledge. More detailed description of the approach can be found in [29 - 32].

The LOs generation tool generates LOs and updates LO repository depending on knowledge certainty factors.

Comparing content and objectives of LOs we can generate: LOs with same objectives but with different content or LOs with same content and different objectives and all possible relations between them in order to present information from different points of view. This approach allows more flexible and deep maintenance of information. Thus automatically generated LOs will be adaptive and reusable.

## 4. CONCLUSION AND FURTHER WORK

The expected outcomes of the system are several innovative tools integrated in flexible semantically enriched adaptive e-Learning platform. One of the main expected outcomes are generated repositories of digital resources like learning objects, ontologies, pedagogical scenarios, learner profiles according to standards for courses in the field of Computer Science and Artificial Intelligence. Thus all course materials will be reusable and interoperable by scientific communities.

As being a work in progress we can not give many evaluation results at the moment. We are expecting, after finishing the implementation stage of the systems - probably next academic year, to be able to make some tests with students and experts. We expect students from Artificial Intelligence MSc Programme and Computer Science BSc Programme to use the system during their education at the university as a supporting tool in order to improve and check their knowledge. The possible target groups for currently delivered courses are students at the University and researchers. We are planning, until the end of the project two courses from these programmes to be also delivered by system both in English and Bulgarian languages. The main difficulties that we have adopting the system to support courses in several languages is that the tasks of automatic knowledge extraction and knowledge acquisition uses a lot of language dependent resources and for different languages these tasks can be solved with not equal success. To design highly adaptive learning systems a huge set of rules and resources is required, since dependencies between educational characteristics of LOs and learners are rather complex.

## 5. REFERENCES

- [1] J. Heller, M. Levene, K. Keenoy, C. Hockemeyer, D. Albert, "An e-Learning Perspective of Cognitive and Pedagogical Aspects of Trails", Kaledoscope Deliverable D22.1.1, 2004
- [2] IMS (2003). IMS Learning Design Information Model, <http://www.imsglobal.org/learningdesign/index.html>
- [3] Hummel, H., Manderveld, J., Tattersall, C. & Koper, R. (2004). Educational modelling language and learning design: new opportunities for instructional reusability and personalised learning. International Journal on Learning Technology, 1 (1), 111-126.

- [4] Peter Dolog and Michael Schaefer (2005): A Framework for Browsing, Manipulating and Maintaining Interoperable Learner Profiles. In Proc. of UM2005, Springer Verlag.
- [5] Dimitrova, V.: Style-OLM interactive open learner modeling. Intl. Journal of Artificial Intelligence in Education, 13:35–78, 2003
- [6] IMS Learner Information Package Specification <http://www.imsglobal.org/profiles/index.html>
- [7] Musa, D.L.; Munoz, L.; de Oliveira, J.P.M. .Sharing learner profile through an ontology and Web services, Proceedings.15th International Workshop on Database and Expert Systems App., pp. 415 – 419, 2004.
- [8] Learning Objects Collections [http://www.uwm.edu/Dept/CIE/AOP/LO\\_collections.html](http://www.uwm.edu/Dept/CIE/AOP/LO_collections.html)
- [9] Motelet, O. and N. Baloian, “Hybrid System for Generating Learning Object Metadata”, In Proc. of ICALT'06, pp. 563-567
- [10] SCORM Standard - <http://www.adlnet.gov/scorm/>
- [11] Learning Management Systems <http://www.lmstalk.com/resources-LMSopensource.html>
- [12] Authoring tools - <http://www.e-learningcentre.co.uk/eclipse/vendors/authoring.htm>
- [13] IMS Content Packaging specification <http://www.imsglobal.org/content/packaging/>
- [14] Brusilovsky, P., Schwarz, E., & Weber, (1996) G., ELM-ART: An intelligent tutoring system on World Wide Web. ITS-96 (Vol. 1086, pp. 261-269). Springer
- [15] Melis, E., at all (2001). ActiveMath: A web-based learning environment. International Journal of Artificial Intelligence in Education, 12(4), 385-407.
- [16] Smith, A. S. G., & Blandford, A. (2003). MLTutor: An Application of Machine Learning Algorithms for an Adaptive Web-based Information System. International Journal of Artificial Intelligence in Education. 13(2-4), 233-260.
- [17] Henze, N., & Nejd, W. (2001). Adaptation in open corpus hypermedia. International Journal of Artificial Intelligence in Education, 12(4), 325-350.
- [18] Murray, T. (2003). MetaLinks: Authoring and affordances for conceptual and narrative flow in adaptive hyperbooks. International Journal of Artificial Intelligence in Education, 13(2-4), 197-231
- [19] Weber, G., & Brusilovsky, P. (2001). ELM-ART: An adaptive versatile system for Web-based instruction. International Journal of Artificial Intelligence in Education. 12(4), 351-384.
- [20] Nakabayashi, K., Maruyama, M., Koike, Y., Fukuhara, Y., & Nakamura, Y. (1996). An intelligent tutoring system on the WWW supporting interactive simulation environments with a multimedia viewer control mechanism. Proc. of WebNet'96, (pp. 366-371), AACE.
- [21] Brusilovsky, P., & Miller, P. (2001). Course Delivery Systems for the Virtual University. Access to Knowledge: New Information Technologies and the Emergence of the Virtual University. Amsterdam: Elsevier Science. 167-206.
- [22] De Bra, P., & Calvi, L. (1998). AHA! An open Adaptive Hypermedia Architecture. The New Review of Hypermedia and Multimedia, 4, 115-139.
- [23] Brusilovsky, P., Schwarz, E., & Weber, G. (1996b). A tool for developing adaptive electronic textbooks on WWW. Proceedings of WebNet'96, (pp. 64-69).
- [24] Ikeda, M., Go, S., & Mizoguchi, R. (1997). Opportunistic group formation. AI-ED'97, IOS.
- [25] Constantino Gonzalez, M. A., at all. (2003). Coaching web-based collaborative learning based on problem solution differences and participation. International Journal of Artificial Intelligence in Education, 13(2-4), 261-297.
- [26] Chan, T. W., & Baskin, A. B. (1990). Learning companion systems. Intelligent Tutoring Systems: At the crossroads of artificial intelligence and education (pp. 6-33). Norwood: Ablex Publishing.
- [27] Semantic Web <http://www.w3.org/>
- [28] The Intelligent Software Agents Lab <http://www.cs.cmu.edu/~softagents/>
- [29] Boytcheva, Sv., P. Dobrev, G. Angelova, CGExtract: Towards Extraction of Conceptual Graphs from Controlled English, Contributions to ICCS-2001, Stanford University Press, USA, pp. 89-116, 2001
- [30] Strupchanska A., Yankova M. and S. Boytcheva, Conceptual Graphs Self-Tutoring System, In Proc. of ICCS-2003, Springer LNAI 2746, pp. 323-336, 2003
- [31] Angelova G., A. Strupchanska, O. Kalaydjiev, Sv. Boytcheva and I. Vitanova. Terminological Grid and Free Text Repositories in Computer-Aided Teaching of Foreign Language Terminology. In Proc. "Language Resources: Integration & Development in e-learning & in Teaching Computational Linguistics", Workshop at LREC 2004, Lisbon, 2004
- [32] Angelova G., S. Boytcheva, O. Kalaydjiev, S. Trausan-Matu, P. Nakov and A. Strupchanska, Adaptivity in Web-Based CALL, Proc. of ECAI - 2002, pp. 445-449, 2002



## THE AUTHORS



**Svetla Boytcheva:** Assoc. Prof. at Department of Computer Science at FMI, SU. She has strong background at Machine Learning, Functional and Logic Programming, Computational Linguistics, Knowledge management tools and techniques, Learning models for adult and self-learning. She has been involved in several EC RTD projects such as Kaleidoscope, TENCompetence, Larflast, ILPnet2 and etc. She has more than 25 research papers.



**Maria Nisheva:** Assoc. Prof., Head of Department of Computer Science at FMI, SU. She has strong background in Knowledge Based Systems and Semantic Web, Functional Programming, Computer Algebra, Technology Enhanced Access to Cultural Heritage. She has more than 35 publications in the mentioned areas and has experience in numerous National and EU projects, including TEMPUS JEP 1497 and FP6 Project KT-DigiCULT-BG.





## INNOVATION IN EDUCATION INVOLVES QUALITY SYSTEMS IMPLEMENTATION AT UNIVERSITIES

Matilda Drozdová, Milan Dado  
University of Žilina, Univerzitná 1, Žilina  
+421 41 5134334, Matilda.Drozdova@fri.uniza.sk, Milan.Dado@fri.utc.sk, <http://www.utc.sk>

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The higher education system was one of the first areas where in Europe a wide reform started being implemented in the 80ies and 90ies of the 20<sup>th</sup> century. Hand in hand with the reform the idea of common criteria and methods of quality assessment at European level began being enforced. Up to now, however, the idea has resulted into several trends in the education quality assessment. Within the framework of the individual EU countries, as well as of the European Higher Education Area, various criteria and standards of the quality assessment have started being used. It is up to the decisions of universities which of the methods or standards they will use. One of the options is to implement self-assessment by the EFQM (European Foundation Quality Management) model. This approach has been used in the Leonardo da Vinci – SAETO Project, which the University of Žilina participates in. As the part of the Project the EFQM approach is being tested at some of the University Faculties.

**Keywords:** innovation, education quality, Total Quality Management, EFQM, ISO 9000.

### 1. INTRODUCTION

In the past, quality of higher education was not considered an independent problem-solving area. The rules of quality assurance were relatively stable, mostly settled by the State authorities. Once a university was founded and its educational program approved, it was assumed it would keep producing education of good quality.

Currently, this approach to quality is beginning to change remarkably. Liberalisation has been intervening into the education environment, and universities have to adapt to the changes. They need to learn how to face the competition on the education market, not only at national but also at European levels. The competition forces universities to re-evaluate their approaches in their activities, mainly in recruiting students and gaining necessary financial sources. The problem of quality is assuming a new dimension, and ways of quality assurance and management are being looked for.

In the course of years the views on the quality in education have been developing, and they are stemming from several quality concepts. Recently, the concepts defining quality as a compliance with the goal - 'fitness for purpose' - have been used the most. The concepts enforce the opinion that quality education is supposed to react to various needs, demands and interests of students, employers, society, government and state, and they start from the assumption that the educational institutions themselves should try to provide the demanded quality. This definition admits quality is specific, and depends on a customer's needs, in spite of the fact the specification of a final user is not always unambiguous in education. We identify with the opinion that the direct customer is the student, the indirect customers are employers, society represented by the government, and from the viewpoint of quality systems they are employees, too.

In recent years, university institutions have been forced to re-evaluate the ways of their functioning, and they take up working out and implementing quality assurance systems, especially on the basis of the consequences of constantly growing competition, and of economic influences in the university education area.

Quality assurance and assessment in education require, as in other areas, a system of methods and techniques which guarantee monitoring and coordination of processes, and unity of a university institution outputs.

Therefore standards and guidelines for quality assurance have been accepted at European level, with the official support of the European Commission. Their main objective is to provide help and guidance for university institutions at creating their own quality assurance and assessment systems, i. e. harmonising the existing various university systems, respecting and maintaining at the same time the national systems.

### 2. STRATEGIC DOCUMENTS OF EDUCATION

In the area of education several strategic quality-bound documents have been approved recently. They are the documents as follow:

#### Lisboan Strategy

At the meeting of the European Council, held in Lisbon in 2000, the top representatives of the EU countries and of the European Commission introduced the strategy of further directing and reforms of the EU. The main stimulus for its elaboration was the social changes caused by the globalisation in the second half of the 20th century, and by the need of transforming the European economy. The basic corner-stones of the transformation was starting-up the economic reform, building the information society by

means of supporting innovations, modernising the social and educational system and creating unified market. The aim of the Lisbon Strategy is to make the EU by the year 2010 the most competitive and the most dynamic knowledge economy in the world, the economy of sustainable economic growth, [1].

By the Lisbon Strategy, universities should respond first of all to the labour market and young people's demands, to the demand for lifelong education, and the best of the universities should become centres of research and development at an internationally comparable level.

In spite of the effort aimed at fulfilling the Lisbon Strategy, the European Commission's report on the state of the society for 2004 claimed the objectives had been too ambitious and they were not being fulfilled as expected. At restarting the Lisbon Strategy goals, it was again pointed out that also in the further European Union's development the priorities would remain the same: university education of good quality, science, research, innovations, employment and creating informative society and business environment. The basis of the Lisbon Strategy has not changed; they still are structural reforms and creating conditions for the development of knowledge economy which is based on the ability of people to work with new information and use them in practice.

#### Bologna Declaration

The Bologna Declaration was an important turning point in the development and direction of European higher education. The Declaration meant the beginning of university education reform in Europe, with the emphasis on the quality of institutions, [2]. It was officially declared at the Bologna University in 1999, during the meeting of Ministers of education and top representatives of universities from 29 European states. The main goal of the Bologna process is to create „European Higher Education Area“. 45 countries are participating in it at the moment. The Ministers have declared the goals which are supposed to be fulfilled by 2010. The goals are as follow:

1. To adopt a system of transparent and comparable academic degrees.
2. To adopt a system based on two main cycles, undergraduate and graduate.
3. To establish a system of transferring and accumulating credits (ECTS).
4. To improve mobility by removing obstacles.
5. To promote cooperation in quality assurance.
6. To promote European dimension in higher education.

The reform is based on simple principles many of which are being put into practice by governments and university institutions. From the viewpoint of quality the 5th of the objectives above is the most important one.

The aim of the Bologna process does not unify the national education systems but trying to find the tools to connect them and thus enable the various national systems to develop within the European Higher Education Area, and to guarantee transparency among university education institutions.

#### Ministry summits

Meeting of the Ministers have great importance. They are organized every two years, to evaluate what has been achieved in the recent period, and to accept necessary measures to improve the situation. Since the Bologna Declaration was signed in 1999, three meetings have taken place:

- Prague meeting in 2000, which was focused on lifelong education, students' engagement and improving attractiveness and competitiveness of the European Higher Education Area [3].
- Berlin meeting in 2003, where unifying the European Higher Education Area and European Research Area was emphasised. During the meeting the Berlin Communiqué was accepted. In the Communiqué the Ministers confirmed the quality of education as the basic element of the European higher education, which has been a condition to the creation of the European Higher Education Area. The Communiqué also re-confirmed that the higher education reform quality improvement and supporting the cooperation to provide the quality were one of the main goals of the Bologna process, as well as a part of the European Commission policy in the area of education. The Ministers agreed that the basic responsibility for quality assurance in higher education was up to the individual university institutions themselves. [4].
- Bergen meeting in 2005, where the importance of partnership in the reform process was emphasised. The overarching framework for the qualifications was accepted in the European Higher Education Area. Another important thing was also the approval and acceptance of the proposal of the standards and guidelines for assuring quality in the European Higher Education Area prepared by the ENQA - European Network for Quality Assurance in Higher Education [5].

#### Copenhagen Declaration

Accepting the Copenhagen Declaration [6] was an important event in the development of technical education in Europe. The main role of the Copenhagen process is to enforce technical education by means of improvement its quality, attractiveness, and by means of stimulating mobility within the European Union. The main goal is supporting the cooperation in the area of quality assurance, in the area of models and methods exchange, common criteria and principles of quality. The partners participating in the creation of the Copenhagen Declaration outlined 5 main objectives which were inevitable for the acceptance of technical education and for improving its quality:

- A single framework of competences and qualifications
- A system of transferring credits in technical education, similar to the European system of credits transfer in study
- Common criteria and principles for the quality in technical education
- Common principles for the acceptance of informal and unofficial education
- Counselling for lifetime education

### Common Quality Assurance Framework – CQAF

The common framework of quality assurance, the CQAF model, has been established as a part of the Copenhagen process, and is focussed on continuous quality improvement [7]. It is a general model which should serve as an instruction for the development and reforming the systems of quality evaluation in technical education. It helps the member states engaged in its preparation to develop, improve, monitor and evaluate their quality systems by means of a common referential system, and particular tools. The CQAF model provides simple instructions for self-assessment and refers to the „European guide for self-assessment“, which contains the instruction for the ways how to do self-assessment with particular quality criteria. The acceptance of the CQAF by the European Council in May 2004 was an important impulse for the cooperation in the area of quality assurance in vocational education.

The CQAF model offers a set of indicators to measure and evaluate the quality in vocational education. Each part of the model is assigned a certain number of quality criteria. The basic quality criteria are presented in such a way that they can be applied to different environments. The model also enables comparing performances and results in different member states and at different levels of the education system.

The model emphasises the external monitoring of the quality system at the institutions of technical education, which is possible to do in several ways, using different systems of quality.

### **3. QUALITY SYSTEMS**

Recently, the need of implementing common quality assurance criteria has begun to be enforced also within the individual EU states, by means of common steps at the European level, within the framework of the European Higher Education Area. The Berlin summit and Copenhagen Declaration have dealt with quality issues the most. The ENQA - European Network of Quality Agencies report referring to the proposals of quality standards, presented at the Bergen summit, stated the European Higher Education Area varied was characterised by the variety of university systems, social and cultural traditions. Therefore it was not possible to apply simple approaches to quality. Even the meaning of the word 'standard' is perceived differently in the quality systems in Europe, and it has different interpretations, from precisely defined regulation requirements to general rules. That is why the accepted standards and regulations do not have a formal directive character, they are characterised by general formulations, so that they are applicable by all of the university institutions and agencies dealing with quality assurance in Europe, and so that it is possible to respect the differences of national systems and programmes areas. Also the standards proposal accepts the priority of the national systems of higher education, and the importance of the institutional and agency autonomy within the individual national systems. The standards are more concentrated on what is supposed to be achieved than on how it is supposed to be achieved. The report on the standards proposal also stated that accepting

the standards and recommendations was only the beginning of the process of their implementation, and achieving the required quality. The standards do not denote what quality evaluation system should be implemented. Universities themselves have the right to decide what quality system they will use, whether they will develop their own system, or will adapt one of the already verified managerial quality systems.

Because the standards specify what is to be achieved, it is necessary to solve the problem how it is supposed to be achieved. There are more ways and tools of how to achieve required quality. Some of them have already been used at universities, the other ones are necessary to be implemented. Deciding for a standard requires analyses and experience of using quality systems. Therefore we are presenting them briefly.

#### Accreditation

The role of accreditation is first of all considering the abilities of a faculty to realise educational activities and award academic degrees in particular study areas and thus ensure quality at universities. Accreditation is very close to a control process, on the basis of which certain quality is maintained at university, and so is transparency between universities which have similar programmes. The acknowledged study programme has to fulfil given accreditation criteria.

In Slovakia accreditation is compulsory, and the accreditation committee [8] uses the criteria suggested by the committee itself, commented by universities representatives, and approved by the Ministry of Education of the Slovak Republic. The accreditation criteria are divided as follow:

- The accreditation criteria of university education study programmes.
- Criteria evaluating the level of research, as a part of the complex accreditation of a university 's activity.
- Accreditation criteria for habilitating proceedings, and proceedings appointing professors.
- Criteria for a higher education institution to become a university.
- Criteria for a university to become a research university.
- Accreditation criteria for accreditation of non-university institutions.

Accreditation consists of a self-assessment report elaborated by a university institution, and of the verification of the self- assessment documentation, which is done by the members of the accreditation committee. At accreditation only little emphasis is put on the assessment of the educational process itself, as well as of further criteria related to the quality management systems.

#### Evaluation

In comparison to accreditation, the evaluation of an institution is not compulsory. Among the definitions of evaluation, the best known are the ones describing evaluation as:

- competitiveness [12]. The EFQM is a tool helping organisations, by means of measuring, understand where they stay behind, and it gives impulses for solutions. The EFQM is based on 9 criteria; see figure 1 but it is not normative.

The intention of the EUA's Institutional Evaluation is not to evaluate the education and research quality but to go over the processes and mechanisms which have been implemented in order to measure and assure the university institution quality. The core of the evaluation is the evaluation of the institution itself, based on the EUA methodology. The methodology reflects the effort of the European higher education environment to elaborate appropriate procedures for the implementation of quality assurance systems at universities [10].

The above standards belong to the best known norms, and have become an international standard for the assessment and assurance of quality systems in enterprises. If an organisation meets the standards, it may apply for the certification of its quality system. Applying an ISO norm as such does not guarantee products and services quality. The basis of ISO 9000 is a procedurally oriented management focused on quality, which is characterised by shifting from hierarchical management to teamwork, as far as the managerial procedures are concerned. Appropriate measures are taken to ensure customers' satisfaction. The ISO 9000 norms are known as so called generic norms of managerial quality systems, and they can be used in any organisation – small or big enterprise producing certain products or providing a service; they can be used in any sector, in sales, state administration, public sector or governmental institutions [11].

### Excellence model EFQM

```

graph LR
    subgraph Leadership
        P[People]
        PS[Policy & Strategy]
        PR[Partnership & Resources]
    end
    subgraph Processes
        PR1[People Results]
        CR[Customer Results]
        SR[Society Results]
    end
    subgraph Key_Performance_Results [Key Performance Results]
    end
    Leadership --- Processes
    Leadership --- KPR[Key Performance Results]
    Processes --- KPR
    style CR stroke-width:4px
  
```

Fig. 1. Model EFQM source: SAETO Tutorials [13]

## Common Assessment Framework - CAF

- Strong points of organisation
- Areas requiring improvements

#### 4. QUALITY SYSTEMS COMPARISON

All of the mentioned systems have their bases in the self-assessment of an institution. The self-assessment differ in the number of data they contain, in the data-gaining periodicity, measuring and evaluating the data, in the depth of the data analyses, with the emphasis on feedback and process of permanent improvement of the institutions. Self-assessment is the most elaborated one in the methodologies of the EFQM and CAF Models.

The EU does not prescribe any particular internal managerial quality system; it is up to each university institution to decide for one. The internal quality systems of universities should meet the Standards and Guidelines Quality Assurance proposed for higher education, or the regulations contained in the CQAF proposed for technical education. According to the suitability comparing of the individual quality systems in [15], we may state the following facts:

##### Accreditation

Accreditation of an institution is required by Law. It is done by an accreditation agency. Its role is to check on the minimum criteria which have been stated for the approval of providing educational activities. Accreditation does not deal with the processes of an institution, or other areas of the institution. It does not focus on the quality of running processes, and has minor influence on further improvement of the processes.

By Law, it is done once in six-year period, it is not done regularly with the aim of permanent improvement of the institution performance. There is no regular quality monitoring in between the accreditations. Collecting data and evaluating them by the accreditation criteria at universities are not done regularly.

##### Evaluation

The evaluation of an institution is done on the basis of voluntarism and demand of the educational institution. Evaluations of universities are a suitable tool to monitor activities, functioning, outputs, namely for the institutions with no quality systems implemented.

The university gets an overview of what its quality evaluation and management system is like.

The evaluation of an institution is a single activity. Its results are recommendations which might become impulses for the university to introduce a quality evaluation system. It provides the basis for continual improvement of the institution.

The conclusions of a self-assessment report are the first step towards a quality system creation.

Self-assessment report is elaborated in detail but it reflects only the period immediately before the evaluation – it is a single act.

##### ISO 9000

Some of the advantages of the implementation of the ISO 9001:2001 quality systems are: mapping the processes, exact appointment of responsibilities and duties of all employees, confirming the certificate by the third side, better perception from the side of customers – students and

buyers of research results. The certification by the ISO 9001:2001 by themselves does not lead to improving the processes, it is a means of introducing a systematic approach to managing an institution activities, it does not have a direct impact on the quality and improvement of the educational process.

Among the problems associated with the ISO implementation are: different understanding of the notions 'quality' and 'quality management', disunited attitudes, lack of cooperation between an organisation's departments, insufficiently institutionalised and formalised processed of approving and decision-making in connection to the measures focused on quality, time-consuming and administratively demanding implementation of the system. Focussing the audit on optimization and documentation of processes often does not lead to improving the performance but to confrontation. Problems associated with the implementation of the system are mainly in the areas which require creativity, which is also the case of educational institutions [16].

##### EFQM a CAF

The intentions of the EFQM and CAF are by means of self-assessment to increase an institution's performance, and to keep improving it. It is also very important to collect, compare and analyse quality indicators with an emphasis on feedback.

The EFQM and CAF are based on TQM - Total Quality Management. TQM is an organisation's management's strategy which puts emphasis on working the quality demands into all of the organisational processes.

A common feature of all of the described quality evaluation systems is self-assessment of an institution. These differ namely in the depth of data analysing, which has been the most elaborated in the EFQM and CAF. As the quality systems by the ISO, also the EFQM has been applied the most by university institutions, faculties which intensively cooperate with practice. The implementation of the system sends out a message of quality readable by both, the surroundings and practical life.

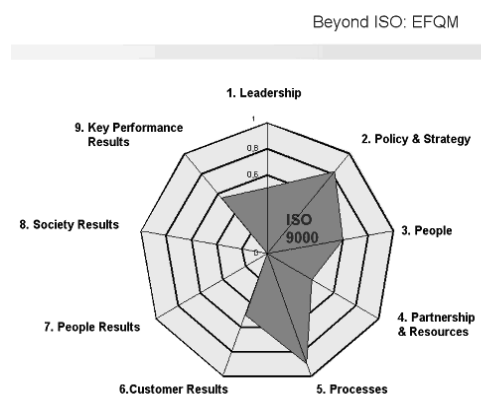


Fig. 2. ISO a EFQM comparison, source: SAETO Tutorials [12]

When all of the systems are compared, the one which has its methodology elaborated in the best way is the EFQM, and also the CAF. The latter's terminology and sub criteria (28

in CAF, 32 in EFQM) were adapted to the needs of state administration in the best way. Compared to the ISO, the EFQM includes all activities areas. Figure 2 shows the comparison of the areas emphasised by the ISO 9000 norms, and the areas observed by the EFQM [13].

#### **4. SAETO –SELF ASSESSMENT FOR EDUCATIONAL AND TRAINING ORGANISATIONS**

Within the framework of the European Union several calls have been published to submit projects aimed at the application of education quality standards, development of efficient tools to assure education quality, implementation and development of quality systems with the emphasis on information-communication technologies. These facts were also the impulse for the preparation of the Leonardo Project 2005LI/05/B/F/PP/164510 SAETO – Self-Assessment for Educational and Training Organisations. The University of Žilina is one of the project partners, and has been taking an active part in the project tasks. An on-line survey was done in the EU countries in the first phase of the project. 157 various institutions took part in it; therefore its results are not possible to be compared to the situation of universities. The objective of survey was to find out about the state in using the quality systems, and about planning their implementation in the nearest future, and to find out about the needs and requirements of educational institutions in connection to the systems implementation. The survey has shown the following:

- Most of the educational institutions have not yet implemented the managerial quality assessment system
- Currently the most frequently used system is the ISO, 87%
- Evaluation is mostly done in the form of written questionnaires
- Most of the answers have expressed a belief that doing surveys and self-assessment by means of information-communication technologies is the most effective
- Most institutions are planning to implement a quality evaluation system within 3 up-coming years, only 20% are not planning to do so
- Those who are planning the implementation, want to use the EFQM

The survey has identified the EFQM as very suitable tool for self-assessment of university institutions and improving quality systems. Among other models the survey presented the CQAF and CAF Models. On the basis of the project survey it was concluded that developing the self-assessment system model itself was demanding; for universities it would be simpler to adapt the quality management models which worked and were verified by real life.

Because the EFQM was originally determined for business area and production enterprises, it was necessary to re-transform the evaluation criteria of the model into the educational institutions' terminology. It was a process similar to the EFQM adjustment, as in case of the CAF Model determined for the state and public administration

institutions. The result is the EFQM determined for educational institutions.

Ensuring as effective way of gaining, evaluating and processing information as possible is done by means of the GOA WorkBench software tool, which was developed within the project.

The final phase of the project is the implementation of the EFQM into reality. The 'Field tests' of the Slovak version of self-assessment is being done at the Faculty of Management Science and Informatics, at the Faculty of the Operation and Economy of Transport and Communications, and at the Institute of Continuing Education of the University of Žilina. The results of the tests will be known in June 2007, and then compared to the results of the other project partners.

More information about the project is available at [www.saeto.com](http://www.saeto.com).

#### **5. CONCLUSION**

On the basis of the direction and development of the approaches to the assurance and assessment quality of higher education institutions in the EU it is obvious that from a formal point of view quality assessment by an external agency will still keep its importance. The agency will recommend an institution to be appointed the institution with the right to provide higher education. The EU's intention is to create a network of national quality-assurance agencies, both private and state, which will be certified and subordinated to a central agency - the European Register of quality assurance agencies [17].

Therefore universities have to re-evaluate their approaches so far to the assessment of the provided education quality by means of introducing quality systems. It is not enough any more to fulfil the minimum accreditation criteria, it is important to systematically and continuously assure the quality of the entire process of education, and the associated processes. Universities have the possibility of selection.

Using the SAETO Project results is one of the possible ways how to implement a quality system, and how to begin innovations in education. The adjusted model criteria for educational institutions and the possibility of using the software have been a great help for the implementation. However, improving quality, and the changes the innovations in education require, has to originate from the universities' managements, and implementing them is a task for both, employees as well as students of universities.

#### **6. REFERENCES**

- [1] Euro Info. 2005. Sformulovanie Lisabonskej stratégie. In: Všetko o členstve Slovenska v Európskej únii. In: <http://www.euroinfo.gov.sk/index/go.php?id=957>>
- [2] European Commission, Education and Training. 1999. Bologna declaration. In: <http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf> >



- [3] European University Association. 2001. Prague communiqué In: [http://www.eua.be/fileadmin/user\\_upload/files/EUA1\\_documents/OFFDOC\\_BP\\_Prague\\_communique.1068714711751.pdf](http://www.eua.be/fileadmin/user_upload/files/EUA1_documents/OFFDOC_BP_Prague_communique.1068714711751.pdf) >
- [4] European University Association. 2003. Berlin communiqué In: [http://www.eua.be/fileadmin/user\\_upload/files/EUA1\\_documents/OFFDOC\\_BP\\_Berlin\\_communique\\_final.1066741468366.pdf](http://www.eua.be/fileadmin/user_upload/files/EUA1_documents/OFFDOC_BP_Berlin_communique_final.1066741468366.pdf) >
- [5] European University Association. 2005. Bergen Communiqué In: [http://www.bologna-bergen2005.no/Docs/00-Main\\_doc/050520\\_Bergen\\_Communique.pdf](http://www.bologna-bergen2005.no/Docs/00-Main_doc/050520_Bergen_Communique.pdf) >
- [6] European Commission, Education and Training. 2002. Copenhagen Declaration. In: [http://ec.europa.eu/education/copenhagen/copenhagen\\_declaration\\_en.pdf](http://ec.europa.eu/education/copenhagen/copenhagen_declaration_en.pdf) >
- [7] European Commission, Education and Training. 2004. Fundamentals of A Common Quality Assurance Framework (CQAF) for VET in Europe. In: [http://eu2006.bmbwk.gv.at/veranst/qual/fundamentals\\_of\\_a\\_cqaf\\_for\\_vet\\_in\\_europe\\_version1.pdf](http://eu2006.bmbwk.gv.at/veranst/qual/fundamentals_of_a_cqaf_for_vet_in_europe_version1.pdf) >
- [8] Accreditation commission SR. 2002. Kritéria na posudzovanie spôsobilosti vysokých škôl a nevysokoškolských inštitúcií podľa par. 82 ods. 8. zákon č. 131/2002 Z.z. o vysokých školách. In: Kritéria. <http://www.akredkom.sk> >
- [9] LÉNARTOVÁ, G.: Potreba zdokonaľovania systémov hodnotenia kvality na slovenských vysokých školách. In: Zdokonalenie slovenského systému zaisťovania kvality – zborník zo záverečného seminára projektu ESQAS v rámci programu TEMPUS. Žilina: EDIS, 1999, 8 s. ISBN 80-7100-671-8
- [10] European University Association. 2005 Institutional Evaluation Programme . In: <http://www.eua.be/index.php?id=58> >
- [11] ČIKEŠOVÁ, M. 2005. Inštitucionálne hodnotenie vysokých škôl v Slovenskej Republike. In: Slovenská rektorská konferencia. In: [http://www.srk.sk/autoupload/Projekt\\_EVA\\_Verzia\\_A\\_2\\_5\\_5\\_2006.pdf](http://www.srk.sk/autoupload/Projekt_EVA_Verzia_A_2_5_5_2006.pdf) >
- [12] European Foundation for Quality Management – EFQM. In: <http://www.efqm.com/Default.aspx?tabid=35> >
- [13] SAETO presentations. 2007. Tutorials-en. In: <http://www.saeto.com/> >
- [14] Slovenská asociácia Európskych štúdií v spolupráci s projektom PHARE.: Spoločný systém hodnotenia kvality – Príručka modelu CAF 2006. 1. vydanie. Bratislava : GUPRESS, 2006. 93 s. ISBN 80-7160-223-x
- [15] Kuzmova, L.: Využívanie IKT pri implementácii systémov kvality v univerzitnom vzdelávaní, bakalárska práca, FPV, Žilinská univerzita, 2007
- [16] MATEIDES, A. a kolektív.: Manažérstvo kvality, história, koncepty, metódy. 1. vyd. Bratislava : Vydal: Ing. Miroslav Mračko, 2006. 456 s. ISBN 80-8057-656-4
- [17] Official Journal of the European Union. 2006. European Register of Quality Assurance Agencies. In: [http://eurlex.europa.eu/LexUriServ/site/en/oj/2006/l\\_064/l\\_06420060304en00600062.pdf](http://eurlex.europa.eu/LexUriServ/site/en/oj/2006/l_064/l_06420060304en00600062.pdf) >

## THE AUTHORS



**Matilda Drozdova:** associated Professor at the University of Zilina, Faculty of Management Science and Informatics, Department of Information Network. Since 1990, she has been working in the area of communication networks and information services. Currently, her research is

oriented to the implementation of information & communication services to the real life. She has worked on several European and national projects.



**Milan Dado** is full Professor and head of the Department of Telecommunication at the University of Zilina. He was active in the management of the international projects e.g. 3 projects in TEMPUS program, 4 actions in COST program, 2 projects in LEONARDO DA VINCI

program and European University Association project in quality culture in research management. At the present he manages participation in two 6.FP programs and national projects in area of intelligent transportation systems and e-learning. He is active in the technology and knowledge transfer and is involved in the preparation of new activities for the regional innovation strategy.



## ON-LINE SCHOOL BOOK OF APPLIED ECONOMICS



*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

Jozef Glasnák, Gréta Balátová  
Junior Achievement Slovensko – Mládež pre Budúcnosť, Seberíniho 2, 821 03 Bratislava 2  
Tel.: +421 2 4820 9047, Fax: +421 2 4820 9041, [glasnak@jasr.sk](mailto:glasnak@jasr.sk), [www.jasr.sk](http://www.jasr.sk)

**Abstract.** E-learning technologies are a very useful tool for education. In spite of many advantages, they are not wide spread in our education system. Organisation Junior Achievement Slovensko – Mládež pre budúcnosť (Junior Achievement Slovakia – The youth for the future) is conscious of the advantages of E-Learning technologies. Because of this we decided to release an on-line system educating students in the field our organisation is dealing with – economics and entrepreneurship. This system replaced classical paper school books and what is more, brings new additional progressive options and features which can not be realized in a paper book. This paper introduces our vision, process of its realisation and deals with problems we faced and ways how we solved them.

**Keywords:** course, digital literacy, distance education, e-learning, intelligent tutoring, interactive learning, internet access, knowledge, learning technology, learning style, pedagogy, portal, student, teacher, teaching, training, Web-based courses

### 1. INTRODUCTION

The mission statement of Junior Achievement Slovakia is: “The young graduates of our programs will know what they want to do in their lives and how they will achieve their goals.” Teaching and learning from paper books is quite a usual in Slovakia. But it is not only about learning from a book – an important as well as worrying fact is that there is only theory in these books without any practical examples. Students do not have the opportunity to practice their knowledges into practice, usually there aren’t points for discussion, practical exercises or possibility to test own knowledges. The IT technology of today, the software solutions can help us to change it. They can make the education more practical, effective and interesting. We are trying to use the most recent technologies in our programmes such as e-learning. We decided to release a new on-line system replacing classical paper schoolbooks, bringing new features into our educational programme Applied Economics and introducing a new way of educating it. In spite of many problems we are conscious of the tremendous potential of e-learning. We have already experiences in the field of on-line education.

#### Previous Experiences

JASR has already experiences with on-line education. It is well known especially for the project “e-Ekonómia” (e-Economics). In this project took part almost 2000 students in its 4-year existence. This project was presented on the Competition E-Learning in praxis which was a part of the Conference ICETA 2003. E-Economics won the category “On-line course.” This project enables each high school student to register on the web server and to study the basics of economics under the guidance of a skilled and experienced tutor – a distance teacher. This project was very successful because there are many schools without any

qualified economics teacher. It was open also for teachers who wanted to raise their qualification.

### 2. ABOUT JUNIOR ACHIEVEMENT SLOVAKIA

#### Junior Achievement Slovakia

Junior Achievement Slovakia teach enterprise, entrepreneurship, and “economic literacy”, focussing on the importance of market-driven economies; the role of business in the economy; the relevance of education in the workplace; the impact of economics on a child’s future; and the commitment of business to social, environmental, and ethical issues. We engineer multi-level and community-based “Private-Public-Partnerships”, encouraging businesspeople to be involved in classrooms as volunteers, in the organisations themselves as board members, and in programme expansion through sponsorship.

#### Educational programmes

JASR programs are hands-on, activities-oriented, and “fun” and involve experienced businesspeople directly in the teaching process. We offer various programs for students: Company Program, Business Basics, Global Business Ethics Program, Travel and Tourism Business, Banks in Action, MESE (Management and Economics Simulation Exercises), Management games, e-Economy, Get to know your money.

#### Goals of organisation

JASR offers students the opportunities to:

- Develop communication and build self-confidence.
- Gain professional skills and to gain hands-on experience.
- Learn creative approaches to working in a free market economy.

- Use free time effectively and creatively.
- Development and support of soft-skills.
- Stimulate entrepreneurial thinking and acting.
- Impart knowledge about the market economy and economic interrelations.
- Gain orientation for working life. Develop a positive attitude about work and the importance of contributing to community development.

#### Acceptance by authorities

We have a memorandum of understanding with Methodological – pedagogical Centre that is an organization directed by the Ministry of Education. The representative of Ministry of Education of the Slovak Republic is a board member - he is a member of Advising Committee. The Ministry of Education in Slovakia have accepted and registered Company Programme as a part of the national range of courses. Slovak public is aware of JA Slovakia and we have periodically been mentioned in media. What we appreciate the most is the fact that JA Slovakia is well known among the top managers in Slovakia and we pay a close attention to addressing the decision-makers in Slovakia.

### **3. APPLIED ECONOMICS**

The most spread educational programmes Junior Achievement Slovakia provides is Applied Economics. The target group of this program are the high school students aged 16-17. It is a one school-year programme consisting of three school lessons per week in average. The form of studies is usually optional or voluntary subject. This programme consists of two main parts: the student company and the theory.

#### The student Company.

The student company is an opportunity for students to prepare for future carrier through the experience of running their own company, to try in reality what they have learned in the theory. It prepares students much better for their professional life, as the student company does exist in the real market. The students need to communicate with the world outside of the school, they have to work in a team, solve real problems, be creative, take responsibilities, meet the deadlines, etc. They are coming into contact with such issues as to persuade employees to fulfil certain tasks or to change something, or opposite what to do with a non-functional management. Student company is the very difficult but interesting part of the Applied Economics Program. To be a member of a student company is a great and first opportunity to have the experience to be an employee or management member, to do business. But, before starting the student company, students have to learn some theory how actually the business works.

#### The theory.

Theory of each school subject is usually taught by books made of paper and teacher's lecture. It was done in the Applied Economics this way too. But in the school year has

been launched a new system using modern e-learning technologies – the On-line school book of applied economics ("OSAE").

### **4. ADVANTAGES OF OSAE**

There are many reasons why we decided to stop current way of teaching theory and release an On-line system. We can divide them into four main categories: The preferences of today's students, The support of teachers, The quality and up-to-dateness and finally The financial reasons.

#### The preferences of today's students.

The on-line way of studying is more attractive for a student. Students of today are not interested in reading textbooks, taking notes, it's boring. But browsing on Internet, solving practical exercises and answering multiple-choice questions, that is something else. It is something different, as they are used to from other subjects and maybe a little bored. Our goal is to get the young interested and involved. This system is also very easy approachable for students. They can log on to this system and study anywhere – at school, at home, in an internet café; all what is needed is a PC with an internet connection. Today, each high school has a classroom equipped with computers and majority of Slovak households with children has a PC with internet connection. Students can use their spare time on PC, internet more effectively, not only chatting or playing games. If they want to study, they do not need to carry a book with themselves.

#### The support of teachers.

At the high schools there are many teachers who teach Applied Economics and do not have enough qualification. And there is only a little part of them, who have some practical business experiences. OSAE is a useful tool to help the teachers. It contains many practical exercises with a help tool for teacher to assess, if the answer is correct or not. The tests with multiple choice questions can correct the system automatically. And besides of this OSAE enables teachers to educate students in a more interesting way. Each teacher wants to have students concerned with the subject, keen on it. Of course, thank to automatic and predefined tests it spares time of the teacher. He does not need to think up tests, print them and than to supervise students not to cheat, no more. If he wants to find out, where the gaps in knowledges of his students are, all he needs to do, is do some clicks with PC mouse.

#### The quality and up-to-dateness.

Thank to this system can we update the study texts practically just in time. We do not need to print new edition of paper school because of this. We can also oversee the activity of teachers and student, how often they log on, which websites of the system are most visited, etc. Soon, we are going to add two new features. Firstly, we want to use this system to measure the quality of knowledges of all students of Applied Economics by launching a general test obligatory for all students. This way we could measure the quality of schools involved in our programs, especially the

quality of students and teacher. Secondly, this system will be a basis for on-line registration of schools, students and students companies. We also intend to combine this system with the previous project E-Economy and open it for all high school students in Slovakia.

#### The financial reasons.

As we are a non-profit organization, it is very convenient for us that we do not need to print new edition of paper school books when we want to change something in the texts (e.g. if a law is changed). We also do not need to print new set of books for a new school entering Applied economics, we just create a new user account for new teacher and we train him on how to use it. Printing new editions of paper school books would be much more costly than creating this system.

### **5. DESCRIPTION OF THE ON-LINE SCHOOL BOOK**

The OSAE is a on-line system with three user interfaces – for teacher, student and administrator (Junior Achievement Slovakia office). Especially the interface for teacher and student is designed the way that it would be maximally user-friendly and every person familiar with PC can use it without any special long training.

#### Student interface.

Each student has to be registered to system by his teacher. After teacher registered him into his class, he becomes his entry password. Then he can start studying the chapters which teacher opens him. He can study them from any computer with internet access, e.g. if student is ill, he can study from home and communicate with his teacher. Student has the opportunity to study individually, test oneself, influence the speed of study but also ask teacher and listen lectures. He can also test himself using two possibilities: Automatic tests and Questions with open question.

Automatic test. They are made an average of four multiple choice questions corrected immediately after student fulfills the test. So the student can immediately see the result of the test and see where the gaps in his knowledges are.

Questions with open question. These questions consist of a real problem from the praxis and student has to decide the right solution and to defend it using arguments. Then teacher decides if it is correct or not. All the communication is on-line and teacher can send the comments to student to guide him to the right solution.

#### Teacher interface.

Teacher is the supervisor of student's education process. He can open the chapter for student as he is progressing, so he can control the activity of student and distinguish the speed of study for each student according to his abilities. For the cleverest students can teacher open more chapters to avoid them to get bored. And he can set lower speed for these, who need a little more time in order not to disgust them or make them feel they can not make it. Something like that is impossible to do in a "real class." Very notable feature of

this system is the connection between e-learning and classical education. Uniting of these two ways enables both teacher and student to gain benefits from this two ways of education. Teacher can spare his time and increase his effectively by combining lectures, discussions and e-learning. It is not our goal to replace teachers by computers. Teacher is the most important instance in the learning process. But in our age, computer has to be an important tool for education. Very useful tool is the Special test.

Special test. Teacher can give the students tests similar to the classical paper tests. But he does not need to think up tests and print them. With several clicks he can create a test with multiple-choice questions from the database in system. If he does not have enough computers in the PC classroom, or he needs to have a printed record, he can also print the tests as well as a key to the solution – test where the right answers are marked.

Adding own question to the system. Teacher can add his own questions to the system. He can use this tool if he is not satisfied with the question from the database in system or e.g. if he wants to ask students about recent news from the field of economics.

#### Administrator interface.

Administrator – a programme manager from Junior Achievement can check the activity of teacher and students. We know exactly who uses the system and how often. Thank to this we have a real-time relevant picture, how is the theory of Applied economics taught on each school involved in our program.

#### Technical solution.

The engine of the OSAE is user friendly software based on the system Web JET Content Management system developed by the company Interway. Thank to this system we can update the web pages immediate according to our needs without any special training. It is user-friendly to administrator of the system, but what is for us more important, it is user-friendly also for teachers and students without any special computer skills.

### **6. EXPERIENCES AND FEEDBACK**

OSAE has been released in the school year 2006/2007, so we are piloting the system and making it perfect. Let me mention once again that before we used paper school books. We arranged trainings where teachers attend a lecture on how to use the system and had the possibility to try it on the PC using both teacher and student interface and ask questions. Each teacher became a printed handbook including all texts, multiple-choice questions, questions with open answer and a user manual on how to use the system. After one year we received both positive and negative feedbacks. (we are going to do a detailed survey about using the system after end of the school year, but it was April in time of editing this paper). Let's summarise what the teachers and students appreciate the most at the system and what annoys them.

### Negative feedbacks.

Although thanks to the project Infovek each high school in Slovakia does have a classroom equipped with computers, the accessibility of computers is always a problem. Many teachers claimed that it is impossible for them to use OSAE because they need at least sometimes an entrance to a PC classroom and they can not reach it. There is usually only one or two such classrooms at the school and they are usually overextended. Unfortunately, we can not afford to help schools in the way of supporting them financially to buy PC equipment but we will emphasize the importance of having at least one lesson of Applied Economics pro week in a PC classroom in the next school year. We hope we can motivate teachers to make some effort to reach it. But it seems to us that more significant problem than lack of PC classrooms are the preconceptions of teachers because many of them have a negative attitude about using computers on the lessons. Many of them are not daily users of PC or internet and they did not receive any training to develop these skills from their employer. Many of them are used to classical paper school books and do not consider that OSAE does give an additional value to their students without any teacher's additional work.

### Positive feedbacks.

Many students concluded that OSAE is much more interesting than classical textbook. They appreciate also the possibility of testing themselves. Many of them assume this system to be a very good preparation to the entrance examinations on the universities. But there are also many teachers who appreciated this new system. Ing. Lenka Mikolajová from Business Academy in Banská Bystrica says: "I teach also so-called classical subjects but Applied Economics is the best one I met in Slovak school system. This year makes Junior Achievement my long-time dream come true and created an On-line school book on the web." Many other recognize the innovative approach of Junior Achievement Slovakia, the others the quality and efficiency of this system.

## 7. CONCLUSION

Junior Achievement Slovakia always tries to keep in step with the most modern ways of education and innovate its programs. There is a lot of discussion about the approaches to education and about the role of education in a modern country of 21st century. The society and the way of live has been dramatically changed in the past years but the school system is almost the same. We are conscious of the fact that we need a new generation of young educated people. In our programmes we are trying to make the young graduates of our programs know what they want to do in their lives and how they will achieve their goals. These young people are reason why we released OSAE. It is our responsibility to make the education attractive and approachable for the young as well as we can. New age means a need for new education.

### THE AUTHORS



#### **Jozef Glasnák**

4/2006 - ... – programme manager in Junior Achievement Slovakia, part-time; 2005 – student of Faculty of Management, Comenius University; 2006 - ... – member of the senate of the Comenius University, Bratislava; Coordinator of projects: Banks in Action, MESE simulation; On-line School Book of Applied Economics.



#### **Ing. Gréta Balátová**

Economic University in Bratislava, Faculty of Business Management, graduated in 2000; programme manager in Junior Achievement Slovakia since 1995 part-time, since 2000 full-time; 4-year teaching experience at Faculty of Business Management; Co-author of the set of ten books of Applied Economics (2001) and portal e-Economics; reviewer of the schoolbook to the subject Managerial Games (both in Slovak and English language); NCEE certificate holder; now on maternity leave.



# THE FULLY DISTRIBUTED ARCHITECTURE OF VIRTUAL NETWORK LABORATORY

Petr Grygárek, Martin Milata, Jan Vavříček

Department of Computer Science, Faculty of Electrical Engineering and Computer Science

Technical University of Ostrava, Tr. 17. listopadu, 708 33 Ostrava, Czech Republic

Tel.: (+420) 597 323 263, Fax: (+420) 597 323 099

E-mail: petr.grygarek@vsb.cz, <http://www.cs.vsb.cz/grygarek>

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** In this article we present our implementation of an advanced task-based fully distributed virtual network laboratory management system which supports on-demand variable topologies built from laboratory devices located at multiple sites connected via Internet. Each site can act as an independent virtual laboratory or share its' equipment with others. Available laboratory devices suitable for distributed virtual topology are searched dynamically when the task reservation is being requested, so that multiple topologies can be reserved in parallel. The distributed nature of the resulting system is completely hidden to the user. The architecture incorporates both hardware and software components and is completely based on open-source technologies.

**Keywords:** Virtual laboratory, Communication Technologies, Distance education.

## 1. INTRODUCTION

The practical work with networking devices is a necessary part of every networking course focused on developing real knowledge of computer network building and maintenance. For that reason, institutions providing education on computer networking field effort to build well-equipped networking laboratories and provide as much time as possible for students to access laboratory devices. Unfortunately, professional-level networking devices are often very expensive and cannot be made available to public access without supervision. On the other hand, the laboratory is most often idle during work-off hours, which makes investment to laboratory equipment inefficient.

For these reasons, we decided to implement a system called Virtlab, which allows to access laboratory equipment remotely via Internet. The architecture and experiences with our system will be described in the following article.

## 2. THE BRIEF HISTORY OF VIRTALAB PROJECT

Our work started three years ago. We decided to build the whole system using open-source technologies only, which promised to limit implementation cost considerably. The very first goal was to implement remote access to laboratory devices' consoles and appropriate web-based reservation system [1][3][4], as shown on figure 1. On the client side, we use standard Web browser with Java applets support to provide of terminal windows which simulate physical terminals connected to individual networking devices' consoles. Linux, PHP, MySQL, C and Java technologies were and still are used as a technical platform.

The original reservation system was designed so that we were able to offer particular tasks for reservations at

individual fixed-length timeslots. Our primary goal was not just to make devices' consoles accessible remotely in reserved timeslot, but to provide a set of meaningful tasks prepared by experienced networking teachers, which will direct students to particular topic they can experiment with. The decision of establishment of task-oriented learning system resulted from our previous experience that without a such guidance, students commonly don't have an idea what they could try to do with the laboratory equipment.

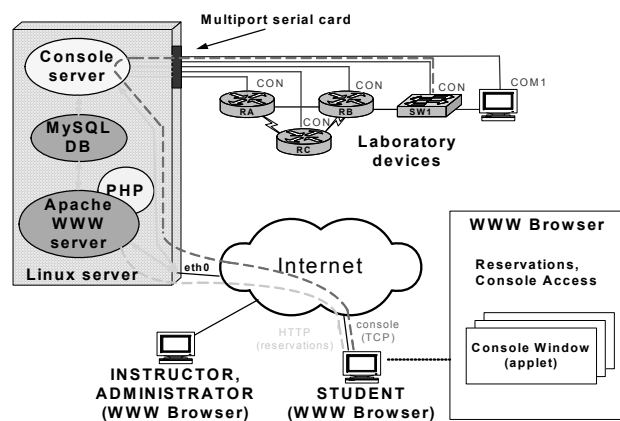


Fig. 1. The Basic Remote Access Architecture

From the beginning, we understood that it will be necessary to provide tasks with various topologies. Our first idea, that we will connect some topology manually, provide a set of continuous timeslots to access tasks on that topology and then change the topology to another, proved very unrealistic to manage. This is why we soon developed a concept of Virtual Crossconnect which allows us to connect required topologies automatically (fig. 2).

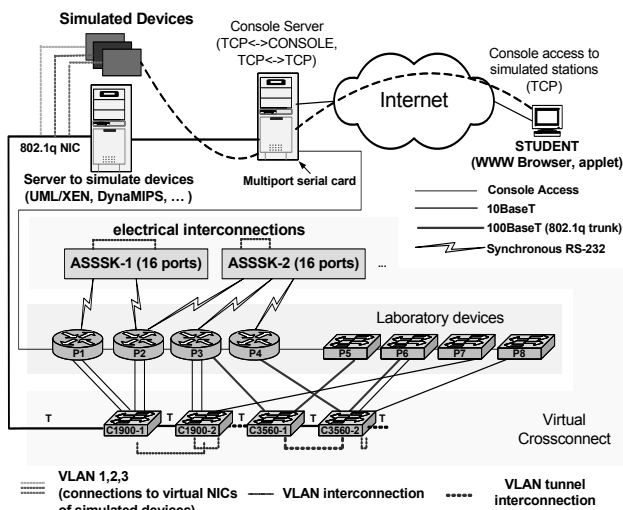


Fig. 2. The Virtual Crossconnect

The crossconnect is called virtual because it uses multiple crossconnect switching elements of various types to interconnect network devices' ports, but behaves like single entity from the point of view of the rest of the system. Very simple language was developed to describe required topologies. Those descriptions are stored together with specifications of individual tasks. Based on the topology description and description of the (fixed) interconnection between laboratory devices' interfaces and virtual crossconnect ports, we are able to generate configuration for every virtual crossconnect switching element and upload it to that element using either Ethernet or RS-232. The Virtual Crossconnect configuration upload is accomplished at the beginning of each reserved timeslot according to topology description required by the task to be scheduled at the ongoing timeslot (fig. 3).

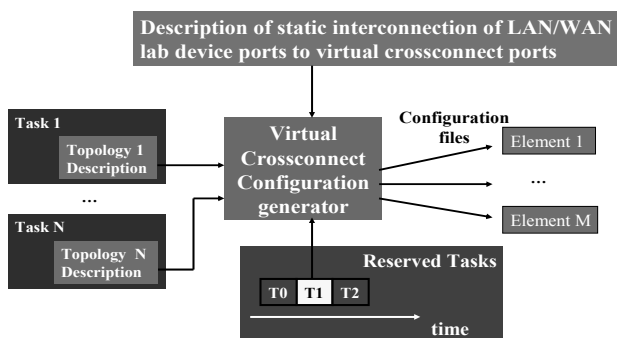


Fig. 3. Generation of Configurations for Virtual Crossconnect Switching Elements

We use VLAN-based approach and standard LAN switch to interconnect laboratory devices' Ethernet ports and our own hardware device called ASSSK-1 [5][2] to interconnect serial ports (fig. 4). While developing the crossconnect for serial WAN ports, we focused on synchronous RS-232 interface, because it requires least number of signals to be crossconnected. ASSSK-1 behaves as DCE, i.e. provides clocking for all serial ports. The core of ASSSK-1 is composed of the analog switch array and ATMEL

microprocessor which accepts commands from RS-232 controlling console and configures analog switch array accordingly. The command set to control the interconnections is very simple and inspired by IOS. The device is modular, so that other electrical interfaces may also be implemented if necessary.



Fig. 4. Our Implementation of Hardware-based Crossconnect for Serial WAN Ports

At the first implementation of ASSSK-1, we also tried to switch Ethernet ports, but it proved inefficient because of frequency limitation of available analog switch array circuits. Only 10BaseT ports can be switched by ASSSK-1. This is why we later decided to use VLAN-based interconnection using standard VLAN-aware 10/100/1000 Ethernet switch. The usage of VLANs is also advantageous for connecting of real networking devices with simulated ones, as shown on figure 2. Currently, we use XEN [9] to simulate stations and DynaMIPS [10] to simulate Cisco 7200-series routers. For interconnection of Ethernet trunk links, VLAN tunnelling technique [11] (also called QinQ sometimes) proved very useful. Using Cisco Catalyst 3500-series switch, we reached almost complete invisibility of the crossconnect switching element to laboratory devices, so that we can operate most of layer 2 service protocols like STP, CDP or LACP/PAGP between those devices transparently.

Because the implementation of Ethernet ports switching using LAN switch proved so efficient, we decided to simplify ASSSK-1 architecture so that it will only switch serial WAN ports. To make the device more replicable and decrease it's cost we also abandoned the modular approach and used FPGA technology to implement it with much more efficiency. The FPGA-based switching core is now fully digital. The prototype (called ASSSK-2 [8]) is currently under testing and all tests appear to be successful.

Another hardware device we are now working on is the FPGA-based multiport HDLC/PPP card for Linux-powered PC. Our aim is to experiment with WAN port switching using standard PC, which we expect to be both cheaper and more extensible. We started to work on tunnelling of serial links traffic over UDP, which allows us to create virtual WAN links over Internet, as will be explained later. The reason why we decided to develop our own HDLC/PPP card instead of buying the commercially available one is the low port density and high price of cards on the today's market.



### 3. MAJOR CHANGES IN THE ORIGINAL ARCHITECTURE

After the full implementation of virtual crossconnect, we realized the full power of it and we decided to change the overall philosophy of offering particular tasks at fixed-size timeslots with a schedule specified by Virtlab administrator. Our experience revealed that it was very difficult to guess how many timeslots should be each individual task made available for reservations. Very often nobody reserved timeslots in which an uninteresting task was offered, but on the other hand there was a contention for timeslots of another more interesting task. It led to suboptimal utilization of virtual laboratory.

The implementation of Virtual Crossconnect allowed us to redesign the architecture completely so that it is no longer necessary to create weekly task schedules and place them on the electronic noticeboard, where students can reserve particular timeslot with required task [6]. Today, we have almost finished the new version of the reservation system, which allows student not only to specify arbitrary timeslot, but also any task he or she wants to work on during the reserved time. Before the reserved timeslot, the virtual crossconnect simply interconnects the topology for any task that the student required for the timeslot.

The most important architecture change necessary to develop an efficient system of virtual laboratory usable by multiple students in parallel was the decoupling of logical network devices' identities specified in topology description for particular task from physical identities of laboratory devices actually used to interconnect the topology for a particular reservation. It allowed us to reserve the same task multiple times in parallel, provided that there are enough laboratory devices with required capabilities to act as logical network devices prescribed in the task's topology definition. In the previous architecture version, topology description were tightly bound to physical devices' identities so that it was not possible to reserve multiple tasks whose specifications overlapped in physical devices used, as shown in fig. 5.

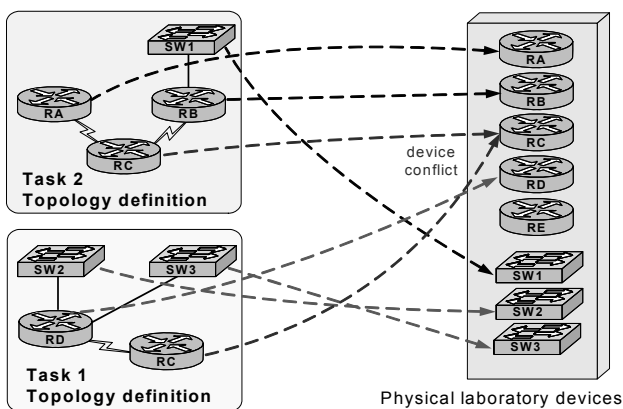


Fig. 5. Problem of Device Conflict in Case of Fixed Physical Devices Specification in the Task Description

By decoupling of logical identities of network devices in the task's topology description from physical ones, we only prescribe required features of individual network devices and their interconnection in the description of task's logical topology and map logical devices to physical devices dynamically at the reservation time (fig. 6). The mapping is based on the knowledge which physical devices are available at the time interval required by user for the reservation and on further limiting constraints, such as OS version or feature set supported.

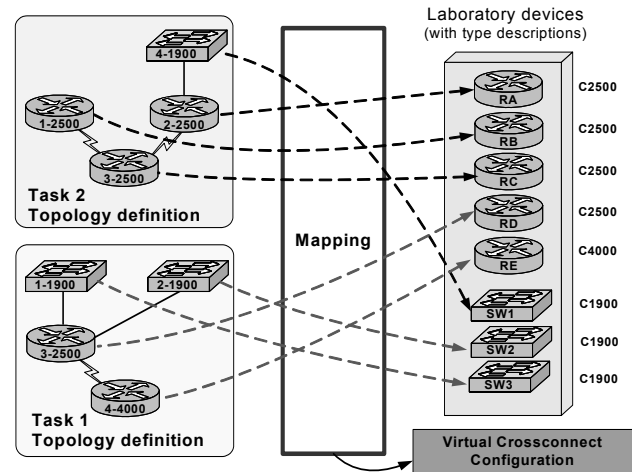


Fig. 6. Separation of Logical Task's Topology Description and Physical Devices Actually Used for Reservation

To implement the above mentioned principles, the original reservation system has been completely reworked. The new implementation of reservation and control system core was also created with regard to multilanguage environment. All menus and messages may be easily translated to any language utilizing UTF-8 charset and timezone. Each user may set it's own preferred language. We are now assessing means how to provide tasks' specification in multiple languages and to present the specification to the user in the language according to his/her preferred language setting.

### 4. THE NEW DISTRIBUTED ARCHITECTURE

After a period of successful operation, we decided to extend our architecture out of scope of our institution. The primary goal was to develop a truly distributed virtual networking laboratory, which will allow sharing of laboratory equipment from multiple sites transparently and building of arbitrary topologies even between devices at different sites using Internet tunnels (fig. 7).

In the new distributed architecture, we still maintain the task-oriented reservation philosophy. The only extension which came almost for free was the implementation of a feature which allows advanced students to specify their own topology they want to interconnect in the reservation time if no exiting task fills their current needs.

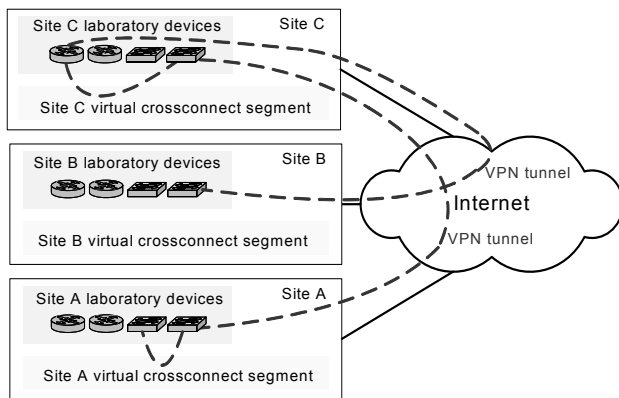


Fig. 7. Virtual Topologies using Internet Tunnels

We perceive the following main advantages of implementation of a distributed architecture:

- Individual sites may specialize on particular networking technology which they will make available to all distributed Virlab participants. It is very desirable for costly devices, which would not be used efficiently by limited number of users of a single site.
- It is possible to build a large-extend simulated WAN environment and teach students how to operate it. This will allow students to develop competences required in real industrial environment operation.
- Other sites may lend their devices as a spare if some device at any site should fail.

The requirement of full laboratory device distribution brought two problems to solve. We need to be able to create interconnections of interfaces of network devices at different sites via Internet tunnels and we also need to generalize mechanism of console access to be able to access equipment at multiple sites seamlessly. All this stuff has to be completely hidden to user, so that the student just uses the devices without care in what site each device he or she uses is actually located. The virtual topology between devices of multiple sites has to behave the same way as a single-site topology.

The interconnection of laboratory devices' interfaces between different sites is implemented using extended version of Virtual Crossconnect. The original concept was generalized to the distributed crossconnect architecture, which we now call the Distributed Virtual Crossconnect (DVC). The Ethernet port interconnection is still VLAN-based, but frames can be now passed between multiple "segments" of the DVC using UDP and our own implementation of tunnelling server. Currently, only Ethernet ports (including trunks) may be interconnected between sites using the DVC, but we are working on solutions which will allow us to tunnel HDLC or PPP frames over Internet tunnels also.

Concerning generalized concept of console access, our decision was to make users' terminal applet first connect to console server of the user's home site, which authenticates him or her using local authentication infrastructure. Only

after successful authentication, local console server proxies the console connection to console server of site where the laboratory device is physically located. There is a trust between virtual laboratory components at individual sites (see section 6), so that the target site console server just permits the connection to pass in. IPSec tunnels are implemented to secure communication between sites, so that external intruders are not allowed to get into the system from the outside.

Although the architecture is distributed in its nature, the virtual laboratory at each site may be utilized without dependency on other sites. We completely avoided any centralized entities which could create a single point of failure. It was also necessary to take into account political issues, so that administrator of laboratory at every site is able to specify which devices he/she is willing to lend to users of particular other site at given time.

## 5. COMPONENTS OF DISTRIBUTED ARCHITECTURE

The basic components of our distributed virtual laboratory architecture, which are present at every site, are shown on figure 8. The figure also shows basic interaction between components, as will be shortly discussed later.

At every site, interfaces of all laboratory devices are connected to the local segment of DVC, either physically or via trunk links (in case of simulated devices). The Tunnel Server extends the local VLANs used by DVC for laboratory devices' interface interconnection across Internet tunnels to other sites and also bridges VLANs if it is necessary to interconnect simulated devices connected to DVC using fixed VLANs. The Console server accepts connections to device consoles from the user's GUI (applet), authenticates them and forwards them either to consoles of local laboratory devices or to other sites, depending on the location of the target device. The local device's console may be reached either by RS-232 physical connection (Console Server incorporates multiple MOXA multiport serial cards) or via another TCP connection in case of simulated devices listening for console connection at preconfigured TCP port.

The Reservation Server serves in two ways. At first, it keeps tracks of local devices' reservations, requested by users of its own and other sites so far. Second, the reservation server acts as a proxy for site's Control Server (also called Virlab Server for historical reasons) to negotiate reservations of devices with Reservation Servers of other sites. If an user wants to make distributed topology reservation, he/she first connects to the Web GUI of Control Server of the site he/she belongs to. After the task to be reserved and time interval is chosen, the Control Server attempts to map task's logical topology to the physical topology. The Control Server first requests the local Reservation Server to provide it a list of devices available at any site for the requested time interval.

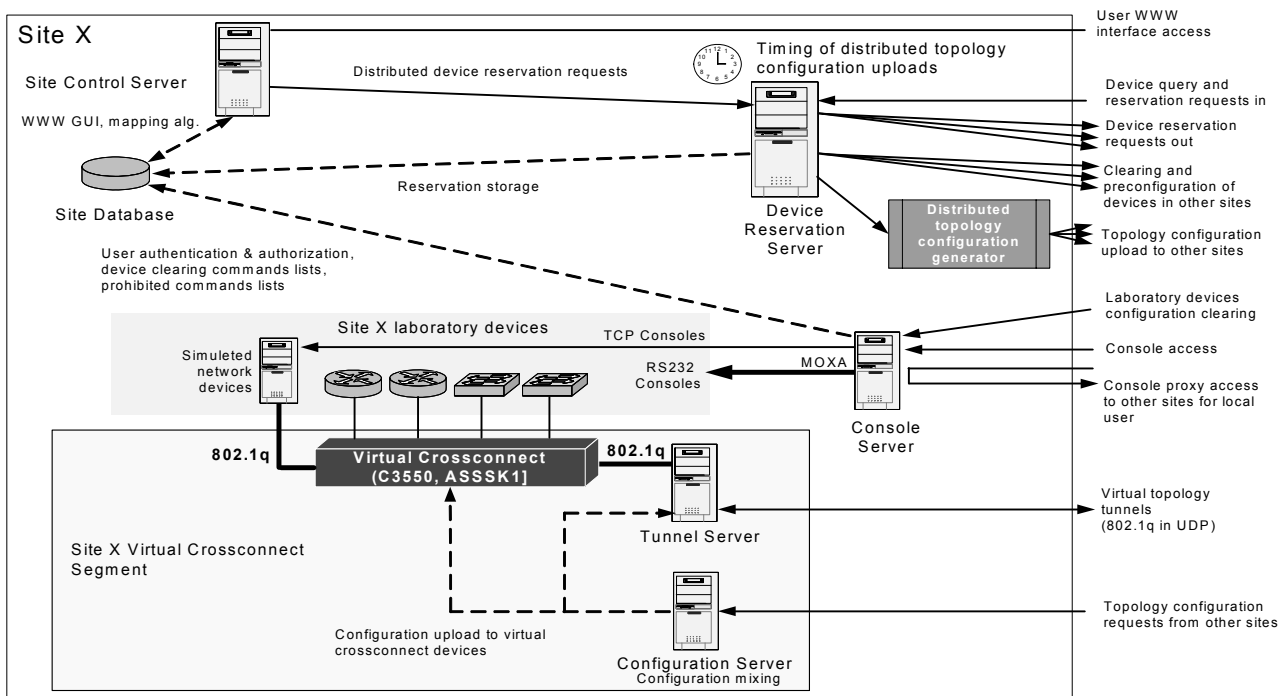


Fig. 8. Components of Distributed Architecture Present at Every Site and their Interactions

The Reservation Server queries Reservation Servers of other sites and those servers respond with a list of equipment which is free at required time and is allowed to be lent to the requesting site. After the Reservation Server returns the combined response to the Control Server, the Control Server starts a mapping algorithm to find suitable physical device for each logical device in the task's logical topology description. If the mapping is successful, local Reservation Server is requested to negotiate the reservation of previously offered devices with Reservation Servers of other sites. If the reservation was successful, the resulting mapping is stored into the local database at the requesting site. The logical topology description is converted to physical topology description, which takes into account physical identities of selected devices and is passed to the local Configuration Activator, which is a part of Reservation Server. The responsibility for creation of configurations for switching elements of DVC and uploading of these configurations to all affected switching elements is given to the Configuration Activator. At the beginning of each timeslot reserved by some local user, the Configuration Activator gets the physical topology description from the database, launches script that generates configuration of DVC switching elements and uploads these configurations to DVC segments of it's own and other sites using their Configuration Servers.

The Configuration Server of each site accepts topology configuration requests from other sites, combines them together and with the current configurations of DVC switching element's at it's site and uploads new configuration to those switching elements. As we use IOS-powered Cisco Catalyst 3550 and ASSK-1 with the similar configuration philosophy, our current switching elements

combine previous and new configurations by themselves, since the CLI IOS-style configuration is "incremental" by it's nature.

The last but not least component of the system is the Cleaning Server (not shown at fig. 8, which is somewhat simplified). This server is responsible for clearing of laboratory devices' configurations before they are made accessible to students at the beginning of reserved timeslot. We also plan to use the server to upload preconfigurations of individual laboratory devices before beginning of some tasks in the future.

The communication protocols between components were designed as text-based, HTTP-style request/reply transactions and are well documented. XML is used as data format whenever possible. This makes the whole system much more extensible and easier to debug.

## 6. THE SYSTEM SECURITY

Based on the 2-year experience with extending and maintenance of previous (i.e. non-distributed) version of Virtlab, we decided to implement security by a strictly layered approach. It proved inefficient to implement and maintain our own security mechanisms and it also resulted to poor readability and clarity of source code of the core Virtlab mechanisms, which increased a risk of implementation errors. This is why we decided to implement only pure functionality in the first distributed architecture implementation stage and rely on external security technologies whenever possible.

The security paradigm is based on two principles. The first one is that users are authenticated at their “home” site, where sets of roles assigned to individual users are maintained to authorize their activities. Either passwords stored in the local database or other external authentication systems operated at the site (such as LDAP or RADIUS) may be used. The other general idea is that components of Virlab installations at individual sites completely trust themselves. IPSec tunnels will be created between individual sites so that no external intruder can neither interact with any server at any site nor to forge traffic between laboratory devices passing through Internet tunnel. Only well-secured HTTPS-based WWW user interface and console server at each site is exposed to the public Internet. Concerning measures against potential local intruders, source IP/MAC address filters are planned to be implemented at all hosting systems so that only allowed communications between system components will be permitted.

## 7. CONCLUSION

The implementation of distributed architecture presented in the article is now almost completed. We are now entering the early testing stage. During summer 2007 we plan to establish a piloting environment between two sites – VSB-Technical University of Ostrava and Karvina site of Silesian University in Opava. A part of laboratory equipment for piloting environment was provided by Czech Scientific and Educational Network (CESNET) as it's portion of expenses on the project number 213/2006. The current running Virlab environment can be accessed at <http://virlab.cs.vsb.cz>.

## 8. REFERENCES

- [1] Grygárek, P., Seidl, D., Němec, P.: Enabling Access to Equipment of Computer Network Laboratory for Practical Training via the Internet. Proceedings of Technologies for E-Learning conference, FEL ČVUT Praha, 2005, ISBN 80-01-03274-4, pp. 43-52. [In Czech]
- [2] Seidl, D., Grygárek, P.: System for Automated Network Topology Management. Seminar on Opensources Solutions in Computer Network III. Silesian University Karviná, 2005. Presentation available at <http://www.cs.vsb.cz/vl-wiki/images/1/1c/ASSSK-SLU.pdf>. [April 2007] [In Czech]
- [3] Grygárek, P., Seidl, D., Němec P.: Virtual Network Laboratory for CNAP. Annual Conference of Cisco Networking Academy Program, Brno 2005. Available at <http://www.cs.vsb.cz/vl-wiki/images/a/ad/Virlab-prezentace-CNAP-Brno.pdf>. [April 2007]. [In Czech]
- [4] Němec, P.: Virtual Network Laboratory. Master's Thesis, Faculty of Electrical Engineering and Computer Science, VŠB-TU Ostrava, 2005 [In Czech]
- [5] Seidl, D.: System for Automatic Network Configuration Management. Master's Thesis, Faculty of Metallurgy and Materials Engineering, VŠB-TU Ostrava, 2005. [In Czech]
- [6] Grygárek, P., Practical Experience with Implementation of Virtual Computer Network Laboratory and Proposed Ways of its Further Development. Proceedings of Technologies for E-Learning conference, FEL ČVUT Praha, 2006, ISBN 80-01-03512-3, pp.58-68. [In Czech]
- [7] Kubín, R.: Ensurance of Security and Implementation of New Features of Virtual Laboratory System. Master's Thesis, Faculty of Electrical Engineering and Computer Science, VŠB-TU Ostrava, 2006. [In Czech]
- [8] Sedlář, P.: FPGA-Based Crossconnect for Serial Lines. Master's Thesis, prepared for publishing at Faculty of Electrical Engineering and Computer Science, VŠB-TU Ostrava, 2007. [In Czech]
- [9] The Xen™ virtual machine monitor. Available at <http://www.xensource.com/> [online, April 2007]
- [10] Dynamips Cisco router emulator, Dynagen. Available at <http://dynagen.org/> [online, April 2007]
- [11] Cisco Systems: Configuring 802.1Q and Layer 2 Protocol Tunneling. Available at <http://www.cisco.com/univercd/cc/td/doc/product/lan/c3550/12112cea/3550scg/swtunnel.pdf> [online, April 2007]

## THE AUTHOR(S)



**Petr Grygárek** (Ph.D., MSc.) is a professor-assistant at Department of Computer Science at VŠB-TU Ostrava. His professional interest is focused on computer networking, distributed systems and computer hardware. He is a coordinator and instructor of Regional Cisco Networking Academy and coordinator of Virlab development group. He holds CCNP, CCNA, CCAI and Network Security courses teacher's certificate.



**Martin Milata** (MSc.) is a Ph.D. student at Department of Computer Science. His thesis is focused on problems of routing in mobile ad hoc networks. He is interested in computer networks and hardware. He studies the 2nd semester of CCNP-level Cisco Networking Academy Courses.



**Jan Vavříček** is a MSc. student at Department of Computer Science. His diploma thesis is focused on the distributed virtual laboratory presented in the article. He is an instructor of AutoCont Training Center. He currently studies the last semester of Cisco Networking Academy Courses at CCNA level.



## ON THE POSSIBILITIES OF THE E-LEARNING DEVELOPMENT AT SMALLER UNIVERSITIES

Miroslav Hrubý, Jiří Dvorský

University of Defence in Brno, Czech Republic

miroslav.hruby@unob.cz, +420 973 443 646, jiri.dvorsky@unob.cz, +420 973 442 130

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Education based on modern information and communication technologies is nowadays acceptable for students of all age-groups. According to the fact that the creation of e-learning study support materials is a very demanding process in terms of time and professional requirements, the smaller universities may consider the question of whether this approach to education is possible and suitable for them at all. Our paper deals with some 'pros' and 'cons' that might be actual and important for this type of educational institutions in connection with e-learning.

**Keywords:** adult education, course, e-learning, teaching.

### 1. INTRODUCTION

Modern educational technologies, and e-learning in particular, continually penetrate into all types of educational institutions and all branches of university studies. Integrating Europe offers new technologies sufficient space for their development and application. Larger firms regard this process as a profitable entrepreneurial activity and their interest and involvement in this field is continually growing. The question of the approach and attitude to these new educational technologies cannot be postponed, because it could be converted into the question of a mere survival and future existence of new and especially smaller universities under the market economy and decreasing European population circumstances. Authors of this paper have participated in the e-learning introduction at the University of Defence in Brno in recent years.

### 2. THE CONCEPT OF A SMALLER UNIVERSITY

The concept of a smaller university (both in the Czech and Slovak Republic) could be used to denote a university, which in its accredited branches of study educates fewer than 1000 students. According to the necessity to guarantee the required quality of education in the accredited branches of study, the calculated per capita expenses in this case are much higher than in larger universities. Smaller universities could also be confronted with the problem of how to professionally guarantee the single branches taught. The limited financial sources for the development of a university make the investments decision-taking process for the university management very demanding. Consequently, they must be also very cautious about the investments into modern educational technologies. Those, who are convinced of the rightness of the permanent requirement to update the teaching process, might be confronted with the opinion that for the limited numbers of students in single accredited study programmes investments into e-learning are not well-founded.

### 3. THE FOCAL POINT OF E-LEARNING DEVELOPMENT

The availability of e-learning investments at smaller universities under the conditions of limited financial sources is sometimes quite difficult. Modern educational technologies require not only high-quality e-learning study support, but also the teachers, who are able to use this electronic support in their classes effectively. It is getting more and more obvious that the best tutor of the e-learning course is usually its author, because he fully understands his concepts and constructions and can utilize them in the optimal way. The quality of the e-learning content and the preparedness of teachers to manage, develop, and utilize it effectively, hang together.

The authors of this paper are convinced that the high-quality e-learning, as an instrument for effective education, is making its way successfully both in the Czech Republic and Slovak Republic. To attract the prospective students it is necessary for smaller universities to start using e-learning as an effective supplement to their traditional teaching wherever and whenever it is convenient.

According to the considerable initial human and financial sources requirements, it is suitable to determine the e-learning development focal points of the university, to achieve unanimity as for the choice of field application of this technology and the engagement of disposable human resources. For the first contact with this technology and its introduction at a smaller university, it is recommended to choose the e-learning application in that field where there is a sufficiently large target group of students.

At the University of Defence in Brno, which belongs to smaller universities, such a target group is undoubtedly the group of English language students. The role of human resources was taken over by the teachers of two departments – the Language Department and the Communication and Information Systems Department. Nowadays in the existing Language Training Centre – a

result of the merger of Language Departments of the first two faculties of the University of Defence – there are teachers, who are able not only to use e-learning support, but also to create it. That is how the initial goal in this field was achieved [3].

#### **4. ACCESS TO MODERNIZATION OF THE TEACHING PROCESS**

The authors of this paper believe that it is necessary to lay stress primarily on the systematic and high-quality education of the university personnel to secure the permanent modernization of the teaching process in their departments. The good example of the high-quality education in this field is the European Net-Trainers Course, which was organized by the university in Plzeň [2], [4]. This course properly reflected the needs of the Czech environment.

One of the authors took part in the seven-month pilot course, which started at the university in Plzeň in March 2006 and finished in November 2006. Thirty successful graduates were given certificates in February 2007. The regular Net-Trainers courses in the Czech Republic started in March 2007. We recommend this course to all people who are interested in modern educational technologies and who are willing to devote a part of their free time to their personal and professional development. This course is also organized in other European countries, so that it is also possible to study it in other European languages [1].

Smaller universities during the transition period to the full use of the e-learning study support should take these recommended steps in the following order:

- To get acquainted with the proven e-learning study support materials with the focus on their content and utilization.
- To lend or purchase the proven e-learning study support materials (courses) from other universities and test them in the local university environment.
- To adapt (to use the own sources) the chosen e-learning study support materials from other universities.
- To create e-learning study support materials by oneself.
- To exchange and share these materials.
- To jointly create and use these materials in the national environment.
- To jointly create and use these materials in the international environment.

For the successful development of e-learning at a university it is recommended to draw at least a small number of students into this process. The motivation up-keeping of these students and teachers, who participate in the creation of the own e-learning study support materials, influences to a great extent the acceptance of the new educational technology at the particular university and the effectiveness of its use.

The high-quality on-line educational course of the CISCO firm (known as the CISCO Academy) has been organized at the university of Defence for a couple of years. The questionnaire survey focused on the collection of data concerning the possibilities of the use of modern information and communication technologies at the university was prepared, carried out and evaluated in the year 2004. In the years 2005 and 2006 the e-learning English study support materials were continually created and nowadays they are widely used. It is pleasing to say that also other university departments (e.g. Department of Mathematics and Physics) started the creation and use of their own e-learning materials. Regarding the positive reaction of students and users in general, it is possible to presuppose that e-learning at the University of Defence has a very good perspective.

In the following two chapters (5 and 6) we present the concrete examples of the current and planned implementation of e-learning in the areas of language training and communication and information technologies at the University of Defence in Brno.

#### **5. E-LEARNING AS AN EFFICIENT ENGLISH LANGUAGE STUDIES SUPPORT**

Work on the existing ‘English Language Studies Support’ (ELSS) at the University of Defence in Brno (UoD) – as an example of e-learning application - was commenced in spring 2004. The main reason for this step was an intention to provide our undergraduates with an effective support for their language studies, enlargement or at least up keeping of the already acquired competence in English in the most attractive and modern way. The most expected effect was the emergence of the spontaneous activation of the human factor resulting both in the use of the modern ICT and the orientation on the main means of communication in the contemporary world – the English language.

Our approach was based on the following initial principles:

- ELSS was planned as one of the applications of the information system of the University of Defence.
- The main objective of this system was only to provide support – not the complex solution of the English language studies.
- The creation of this educational system was based on the given rules. On the other hand, it had to be open to anybody who wanted to present his/her interests and abilities in this area.
- ELSS was also planned to be open for all students and the staff.

Our conception of the ELSS was and still is based on conviction that the key to success rests in the application of the following typical principles of ‘open learning’, ‘distance learning’ and ‘e-learning’:

- Openness to everyone
- Independence of time
- Independence of pace of studies.

Our goal has always been the inventive application of these principles to meet the needs of ICT support of the English language studies. It has been necessary to reinforce and back especially the individual preparation of our students by the sensitive and attractive use of the accessible ICT.

The authors' priority has also been the possibility of 'study freedom', which is the possibility to study without being spied by the system.

The created system facilitates efficiently the preparation and perfection of all four language skills that are tested as a part of the prescribed language test in the Army of the Czech Republic (according to the NATO STANAG 6001 norm). Moreover, we have decided to devote a lot of space and means to support English grammar and military English studies. As a result there are six areas involved, the mastering of which guarantees the resulting quality of the whole.

All materials for each of these six areas are saved (stored) in the corresponding sections of support of the system. These sections are further divided into the number of selected categories that are specific for the particular area. Next, each category comprises the so-called primary elements of support (PES), which can be, for example, exercises, study materials, audio/video files, and tests.

To other important attributes of the ELSS belong:

- Low requirements for the user's technical equipment and his/her computer skills.
- The possibility for the students to take the role of the primary of elements of support authors.
- Spontaneous connection of pedagogical activity of the English language teachers and increase of their competence in the area of ICT.
- The authors' and users' independence of the commercial sphere.
- Non-commercial orientation and openness of the system.
- Provision of space for research, e.g. in the area of implementation of users' primary elements of support adaptation for single students.

Great attention has been paid to creation of clear instructions for work with the system. The 'Guide to Studies' provides all information necessary for the full use of the system by all possible users.

By the end of the year 2006 21 interactive documents with 132 'screens' were created (using the ToolBook II Instructor 8.5 software). On the basis of the MS Word software 86 documents were prepared and another 41 documents (using other software) were added.

The results of the questionnaire research, which was carried out in 2006, showed that these English language e-learning materials were positively received by the students and have become the integral part of their study activity.

Nowadays the number of English teachers who are able to independently create the interactive PES is growing. The

students who are willing to participate in this work are also very welcome.

## **6. COMMUNICATION AND INFORMATION TECHNOLOGY BASICS – MODULES SOLUTION**

The continually growing dependence of majority university study branches on information and communication technologies requires the necessary stress to be put on this area also in the university study programmes. The important moment is that modern educational technologies based on the use of communication and information technologies make it possible to effectively support the acquisition of the required students' knowledge and skills with regard to different branches of study.

It is a well-known fact that students of different branches during their stay at a university also need to gain different information and communication final knowledge and skills, but it is possible to define the common knowledge and skills basis within the single faculties, which could be developed further according to specific requirements of different study branches.

At the University of Defence the e-learning may be also used (besides the e-learning English language studies support) to form the basic communication and information technologies core knowledge. The bachelor study programme 'Military technologies' was accredited at the Faculty of Military Technology in 2005; it includes 10 branches of study, and is valid from March 7, 2005 to March 7, 2009. For the approaching re-accreditation the Department of Communication and Information Systems has prepared the offer of modules that cover all problems of communication and information technologies basics.

Discussing the question of how to specify the content and teaching methods of the introductory 'informatics' subject, the teachers from the Department of Communication and Information Systems of the University of Defence came to a conclusion that they will offer the students such an introductory subject in the form of the optional modules. The mechanism of functioning and the utilization of these offered modules will be as follows:

The subject 'Introduction to communication and information technologies' should be scheduled for the very beginning of university studies – as early as in the first semester with 60 lessons granted. It is possible to specify the content of the subject for the whole faculty not only on the unified basis but also in a modified way with regard to the requirements of different branches of study. This modified approach can have the priority.

The subject 'Introduction to communication and information technologies' should be lectured by the teachers of that department, which is responsible for the tuition of these highly specialized problems at the faculty. The department should offer, for example, 20-lesson

modules with the following structure to properly specify the subject content:

Module = [Title, Warrantor, Goals of Study, Study Plan, Literature].

Students can choose three modules from this offer – those that are the most important for each study branch. Three chosen modules from the existing offer would constitute the content of the subject ‘Introduction to communication and information technologies’ for each individual branch of study. The warrantor of the study branch may also take into account the students’ requirements presented by the questionnaire research.

It is also possible to consider the offer of other modules according to students’ interests in the form of an optional subject, which could be taught on a full-time or a part-time basis.

The offer of modules should be subject to corrections reflecting the interests of students and departments. Moreover, the structure of the each offered module should be continually up-dated by the warrantor and should also reflect the changing needs of students, departments, and a warrantor. All these materials should be easily accessible – e.g. at the Study Portal of the University of Defence.

The Department of Communication and Information Systems at the University of Defence offers nowadays modules in three categories: Information technologies, Communication technologies, and Information security. The single modules offered in each category are as follows:

#### Information technologies:

- Decision support systems.
- Information systems and operational-tactical systems at the Ministry of Defence and in the Czech Armed Forces.
- Interoperability in NATO.
- Databases and information systems.
- Computer software and the possibilities of its use.
- Computer graphics.
- Algorithm development basics and programming in Pascal language.
- Algorithm development basics and programming in Visual Basic language.
- Algorithm development basics and programming in C language.
- Algorithm development basics and programming in Delphi language.
- Algorithm development basics and programming in Java language.
- PHP – web application programming.
- Operation systems Windows basics.
- XML basics.
- Computer nets.
- UNIX and Linux basics.
- Specialised software and computer modelling.
- Computer hardware.

- Single chip microcomputers and their applications.
- Modern programmable circuits.
- Introduction to CCNA (Certified CISCO Network Academy).
- Information Sources Analysis.
- Project Management.

#### Communication technologies:

- Modern communication technologies for technical branches.
- Optical communication systems.
- Telecommunication technique.
- Modern radio techniques – focused on VLF technique.
- Software support for communication technologies – Mathcad, Matlab – including algorithm development basics and programming in these environments.
- Personal mobile communication means at military environment.

#### Information security:

- Legislation in the field of information security.
- Cryptology.

The pilot questionnaire research carried out in March 2007 was focused on the 4th semester students’ opinion and brought the following results:

- The most important modules for the Communication and Information Systems study branch are: Computer networks, Basics of algorithm development and programming in Language C, Modern communication technologies for technical branches, UNIX and Linux basics, and Communication technologies software support.
- The most required modules without respect to their importance for the Communication and information systems study branch are: Introduction to CCNA (Certified CISCO Network Academy), Telecommunication technology, Computer networks, and Cryptology.

Teaching methods in different modules depend on the quantity of students in single groups and on the ability of their warrantors to use the modern educational technologies (e-learning). It is also possible to consider the creation of teaching groups on the basis of the students’ preliminary knowledge, or to prepare the individual plans for the best students.

We find it suitable to modify the lectures (with regard to number of students in a group) by introduction of practically oriented parts with the use of computer and communication technology. The basic teaching attributes of all modules must be the teamwork and a sufficient amount of practical activities in laboratories and PC classrooms.

Setting the study goals adequate to requirements of single study branches is the fundamental problem. To make the exerted effort more effective it is also possible to consider the idea of sharing the study materials, exam tests, and the common creation of e-learning study support units.



Integration of students into this process is also very beneficial.

Regarding our experience at the University of Defence the current problems associated with the described modules solution and its gradual transition to e-learning study support are as follows: reinforcement of teamwork, greater involvement of students in the process of study materials creation, providing enough space for independent realization and solution of the set goals, and defence of individual and team projects.

## 7. CONCLUSION

According to language similarity and cultural environment closeness of the Czechs and Slovaks, the authors of this paper think that the mutual co-operation or sharing of the created and existing materials would be beneficial and perspective for both sides.

## 8. REFERENCES

[1] HRUBÝ, Miroslav, COUFALÍKOVÁ, Aneta, SMEJKALOVÁ MAZÁLKOVÁ, Markéta. European On-line Courses - a Step to Closer Co-operation in Education. In Proceedings 7th International Conference Virtual University VU'06. Bratislava, Slovak Republic, December 14 – 15, 2006. Bratislava : E-Academia Slovaca. p. 109 - 111. ISBN 80-227-2542-0.

[2] Net-Trainers Course [online]. [cit. 2007-03-13]. URL: <http://www.nettrainers.org/cz/index.asp?p=1-1>.

[3] STAŇKOVÁ, Eva, DVORSKÝ, Jiří, HRUBÝ, Miroslav. Challenging the Limits of International Co-operation in Creating and Sharing Electronic Study Materials in English. In Proceedings CD-ROM of the 17th ITEC Conference. London, U.K., May 16 – 18, 2006. London, U.K., 2006. 6 pp.

[4] VEJVODOVÁ, Jana. Challenges of European Net-Trainers: Transnational online course. In Information and Communication Technology in Education. Ostrava : University of Ostrava, Faculty of Science, 2006. p. 75-81. ISBN 80-7368-199-4.

## THE AUTHORS



**Miroslav Hrubý** works at the University of Defence, Faculty of Military Technology, Department of Communication and Information Systems. He is interested in the use of modern technology in teaching and learning processes.



**Jiří Dvorský** works at the University of Defence, Centre of Language Training. He is interested in the use of modern technology in teaching and learning processes.





## E-COURSE AND E-TOOL FOR SAFETY ON MACHINERY

Mikuláš Huba and Vladimír Šály  
Slovak University of Technology in Bratislava  
Faculty of Electrical Engineering and Information Technology  
Ilkovičova 3, 812 19 Bratislava  
Tel. +421 2 602 91 771, 746; Fax: +421 2 654 11 004  
Email: mikulas.huba, vladimir.saly@stuba.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Complying with safety standards on industrial electrical machinery is one of the biggest challenges facing European SME's in the manufacturing sector. With increased demands for safety and handling by the EU there is a need for certified operators to go and teach others how to live up to and comply with EU standards. There is a need for a training program where the knowledge of safety on machinery and further education regarding the safe handling of machinery can be taught. The Project aims at developing a learning system to which the people working in the industrial sector can comply with the standards given by the EU. The learning system will make the target groups able to work in a manner that is in line with EU directives. Electrical engineers, industrial workers, work environment officials, national certifying agencies, universities, industrial training facilities will all be target groups for the project. The partners in the project will supply the expert knowledge to the project as well as being the ones who will develop the learning modules. The learning system will be certified and it will be the base from where all the participants will get their knowledge.

**Keywords:** CBL, content-oriented applications, e-learning, engineering, interactive learning, standards, vocational training

### 1. INTRODUCTION

Accidents happen when machinery in the industrial sector is not properly constructed. The main objective of this project is to develop a learning system, which is used in training situations of individuals, government organisations and SME's. The challenge is to develop new tools and facilities in the process of improving local and international knowledge on how to handle, build, sell, buy and use industrial electrical machinery. The project will develop a certified European education in how to construct, maintain and certify industrial electrical machinery in Europe. In collaboration with the partners the project will establish a new training method with the sole purpose of teaching EU safety standards to the involved target groups. A number of people that go through the training program will be qualified to teach others what standards and regulations SME's have to use in the future to be able to work as certified subcontractors or producers within the EU.

### 2. PROJECT CONSORTIUM

**AM-Gruppen A/S:** The AM group is one of Denmark's leading consulting agencies in safety and better health in the workplace. The AM group has participated in a multitude of community-funded projects concerning the health and safety of employees in Danish companies. Their expertise and vast knowledge of standards and best practises accumulated over decades of consulting have made the companies involves with a much safer and better place to work. The AM Group consists of 30 qualified employees each with a specific area of expert knowledge on work

environment and safety in general. AM Group will be the main work environment consultant on the project.

**EU Vest:** Business Development Centre West – EU Vest – established in 1998 is a co-operation between the municipalities of Blaabyrg, Blåvandshuk, Bramming, Esbjerg, Fanø, Helle, Holsted, Ribe, Varde and Ølgod and the county of Ribe. The county and the municipalities in Business Development Centre West – EU Vest – are all located on the west coast of Jutland in Denmark. EU Vest has the overall objective of promoting innovation and growth within the regional business community. With consultants in both Esbjerg and Brussels, and a wide network of business development organisations in the region, the Centre provides the companies in the region with information, consultancy, and practical support in relation to new projects and business start-ups. 1st of July 2001, EU Vest took over all the tasks from the former Technological Information Centre, meaning that EU Vest will be responsible for the overall regional business development and implementation of the regional business and development strategies. EU vest will be the coordinator of this project.

**Industri Tech A/S:** Industri Tech A/S is located in the town of Esbjerg, on the west coast of jutland. Industri Tech A/S is a certified electrical contractor and consultant, and with two decades of experience in the field of safety on machinery we are represented in the S544 – Safety on Machinery commission under IEC, CENELEC and Danish Standard (DS), which is where the European standards regarding the use of safe technology on machinery are created. In this way Industri Tech has gathered vast know

how and expertise in the field and utilizes the knowledge in the process of forming any new directives to be implemented in the future. This fact also means that Industri Tech at all times is updated on any new legislation to come. Industri Tech offers consulting, development, production, installation and service to a wide range of control systems for machinery. And with our 24 highly qualified employees we are always on the look out for new innovative developments that can secure our customers advancement on technology and safety resulting in optimised and competitive production. Industri Tech A/S will act as the lead partner in this project.

**Technical University of Plovdiv - Technical College “John Atanasoff” – Plovdiv:** is a branch in the structure of the Technical University of Sofia – Bulgaria, carrying out vocational training to students, who have completed their secondary education and acknowledging to its graduates the higher educational degree “specialist”. The College is a member of the Bulgarian Branch Chamber of Electrical Engineering. The College consists of the following three departments:

- Electroenergetics;
- Electronics;
- Machine building

Each of the departments has been training students in the following subjects:

#### **Department of Electroenergetics**

- Electrotechnics;
- Electroenergetics and electroinstallation;
- Automation and control technics;
- Economics, management and marketing.

#### **Department of Electronics**

- Computer systems and technologies;
- Electronics;
- Communication technics and technologies.

#### **Department of Machine building**

- Machine and device building;
- Transport technics and technologies.

The College comprises highly qualified lecturers – engineers, Masters of Science, Doctors of Philosophy, Head Assistants, research workers. The Technical College of John Atanasoff will provide comprehensive pedagogical guidance throughout the project.

**FRAREG:** Established in 1989, Frareg is a ISO 9001 certified consulting company principally concerned with the integration of new competence into firm's values; one of our specializations – everthough not the only one – is counselling on the adjustment and optimization of the application of the new international and European body of law (i.e. safety concerned with work processes, total quality management, responsible environmental care, investments' facilities).

- Safety (fire risk, CE labelling, emergency plans, BS 8800 standards, alimentary hygiene, HACCP, working medicine...),
- Quality (UNI EN ISO 9000 standards, health, automobile, military sector standards...),
- Environment (UNI EN ISO 14001 standards, audit and ecomanagement system...),
- Technics (noise, microclimatic, microbiological survey, atmosphere emissions...),
- Privacy (consulting in privacy and data security)
- CSR (Corporate Social Responsibility: Social Report, SA 8000 Certification, Cause-related Marketing, Code of Ethics, Accountability 1000, ...).

Aware about the fact that know-how implementation cannot take place without the inclusion of human resources, in 1997 Frareg created its training and development division – Frafor – which produces yearly more than 4.000 hours of professional training both in technical and in management system tools (i.e.: informative systems; communication; costs analysis; marketing; dealing principles).

**STU Bratislava:** Slovak University of Technology in Bratislava represents the 2nd largest university in Slovakia founded in 1938. The Faculty of Electrical Engineering and Information Technology (FEI STU) is, at present, its largest faculty. Since 1993, the Faculty offers programs leading to a bachelor's degree (Bc.), and programs leading to a master's degree of engineering (Dipl.Ing.). About 2,000 undergraduate and 800 graduate and doctoral students are studying at the Faculty today. STU Bratislava is permanently giving attention to the development of the new learning technologies and to the strengthening of the social partnership in education. From 1995 it has hosted the National Centre of Distance Education and in 1996 established the Distance Education Centre within the framework of the PHARE Multi Country Cooperation in Distance Education Programme. From the beginning the distance education has been understood as the tool for cooperation with our industrial partners and for opening the higher education to diverse target groups Slovak university of Bratislava will act as the main consultant on the teaching and learning aspects of the project

### **3. COURSES FOR BASIC EDUCATION**

The TRAINING TOOLKIT has been developed to provide help in the organization and development of training activities focused on the standardization in the European industry, by defining a training programme in terms of target groups, trainer profile, objectives, learning contents, programme structure, methods and practical training activities, references to other resources/materials, duration, and certification. It is destined to vocational education training organisations willing to teach and train about the Directive 98/37/EC and the European standards, as well as about risk assessment and CE marking. It is destined to the training organisers and trainers of vocational education and training organisations. This document will be mainly used for the benefit of the project target groups – mainly students

at higher level of education – at technical colleges and technical universities, education and training specialists, as well as SME owners and managers, consultants in the area of machine and component production, repair and maintenance. The main focus of the training programme, however, is on university and college students, the first implied target group. The training materials are going to be pilot-tested with different target groups - entrepreneurs, SME managers and designers; consultants, education and training specialists; and first of all with students.

The training programme is organised in 9 different lectures, covering the main topics, identified to be very important by the project partnership from the point of view of safety on machinery and resulting from the requirements of the European Directives and standards.

- Lecture 1: Acquainting with the Directive 98/37/EC – Safety on Machinery (3 school hours);
- Lecture 2: Harmonized standards, related to the Safety on machinery Directive (3 school hours);
- Lecture 3: Electrical safety (3 school hours);
- Lecture 4: Mechanical dangers – terms and conditions (3 school hours);
- Lecture 5: Dangers, related to noise and vibrations (3 school hours);
- Lecture 6: Dangers, related to the ergonomic parameters of the machines and the influence of materials (3 school hours);
- Lecture 7: Safety components and parts, related to safety. Relationship between the control system and machine safety (3 school hours);
- Lecture 8: Risk assessment (6 school hours);
- Lecture 9: Market control. Responsibilities of manufacturers, supplies and retailers (3 school hours);

The total duration of the standard programme for the 9 lectures is 30 auditory school hours. For each lecture there is a 3-hour standard programme, except for Lecture 8 (Risk assessment), which is envisaged to last 6 school hours because of the amount and the complexity of the material under consideration.

By following this approach to the training programme, the partnership wants to provide this product with the necessary flexibility to enable its usage in different contexts, for different purposes and for different target groups. So, besides being used as a complete training programme, it was designed to be used lecture by lecture or in integration to broader training programmes.

#### General Target Groups

The considered course target groups are

- College and University students
- Consultants, education and training specialists
- Managers and designers from SME s in the area of machine production, repair and maintenance
- Tradesmen
- Users in the field of services

#### General Trainer's Profile

In order to ensure the success of the training programme, the trainers must be selected according to the following general profile:

- Electrical or mechanical engineering qualification
- Previous training experience (preferably in vocational training/engineering education)
- Good command of communication techniques
- General knowledge of the European Directives and standards

The trainer for each module could be selected according to the general or to a specific trainer profile, meaning that the same or different trainers can cover the training programme. The choice of the trainer for universities and colleges besides the requirements mentioned above should also follow the legislative requirements for each particular country.

#### General Objective

After going through the training programme, participants will understand the concept of standardization, its main broad areas and issues, the importance of acquainting companies and organisations with the requirements of the safety directive and standards, the risk assessment procedures and the technical dossier required for production, modernization and maintenance of machines and machine components, CE marking procedures and certification process on Safety on machinery, and they will also become acquainted with the certification bodies.

#### Specific Objectives

Participants going through the whole training programme will be able to:

- Identify the concept of standardization and its main broad areas and issues;
- Understand the importance of acquainting companies and organisations with the requirements of the safety directive and standards;
- Recognise the differences between directives and standards, and realize the responsibility of machine producers and suppliers;
- Recognise the importance of the risk assessment procedures in the industrial context and learn about the existing methods of carrying out the risk assessment of a particular machine or component;
- Identify the required steps to prepare a technical dossier and certification on safety as well as the way of CE marking;

#### Practical Training Activities

Besides a description of the learning contents that should be worked out by trainers, the partnership developed several didactical materials to be used in the training programme as practical training activities – Exercises – which are envisaged to be realized within 20 more auditory school hours, thus complementing the contents of the basic training system.

The partners strongly believe that such a pedagogical approach to the learning contents – a training programme structure based not only on theoretical expositions but also on practical training activities – is the most appropriate approach, taking into consideration the target groups and the training objectives.

The topics of the exercises are listed below and they follow, as a whole, the problems, discussed in the lectures, but in a more practical aspect:

- Exercise 1: Acquainting with the Directive 98/37/EC – Safety on Machinery (2 school hours);  
Exercise 3.1: Analysis of the electrical safety of machines in different areas of application (2 school hours);
- Exercise 3.2: Electrical safety (2 school hours);  
Exercise 4: Mechanical safety of machines (2 school hours);  
Exercise 5: Dangers, related to noise and vibrations (2 school hours);  
Exercise 6: Dangers, related to the ergonomic parameters of the machines and the influence of materials (2 school hours);
- Exercise 7.1: Risk assessment (by means of the Risk graph method – using the SOMA software) (2 school hours);
- Exercise 7.2: Risk assessment (by means of the Risk graph method – using the SOMA software) (2 school hours);
- Exercise 8.1: Analysis of control circuits (or parts of them) related to machine safety (2 school hours);  
Exercise 8.2: Analysis of control circuits (or parts of them) related to machine safety (2 school hours);

#### Practical Individual Course Work

Together with the lectures and the practical exercises, the training system offers suggestions for thematic practical individual tasks for students to be developed within 10 school hours of individual work under the guidance and the supervision of the lecturers and defended in front of the group.

The three elements of the system form together a complete and functional educational module, which could be used in the higher educational systems throughout Europe as a separate school subject (either compulsory or optional) or as part of a subject as well. The duration and the contents of the subject are equal to 5 ECST, which makes it useful not only for the traditional classroom educational systems but for modular systems of education as well.

The partnership is convinced that the preparation and the usage of these materials in training and awareness-raising situations can be a very positive contribution with a view to improve competitiveness and entrepreneurship (also a Leonardo da Vinci Programme objective), and to the development of new forms of learning and teaching (another Leonardo da Vinci Programme priority).

#### Certification

This training programme was designed to be included in the partners' own training portfolio as well as in other organisations offer. Due to this fact and to the reality that each partner country has its own legislation and rules concerning know-how assessment and certification, the partnership decided that the assessment of know-how and certification of this particular training programme/modules will be done according to each partner country own rules.

#### **4. COURSES FOR VOCATIONAL TRAINING**

Following are headlines for vocational training

- Machinery directive(Directives)
- Standards (European norms)
- Risk assessment
- User manuals
- Responsibility
- Existing machinery
- Safety related parts of control systems
- Mechanical safety
- Electrical safety, EN 60204-1
- Ergonomic solutions
- Noise
- Safety components

The responsibility of Slovakian partner is in Electrical safety chapter according the requirements of Machinery Directive.

The essential health and safety requirements applied to machinery are laid down in Directive 98/37/EC of the European Parliament and of the Council. This directive is a principal one related to machinery for professionals. The household appliances should follow the Directive 73/23/EEC (low voltage appliances).

The Directive 98/37/EC states among others requirements for:

#### Electricity supply

Where machinery has an electricity supply it must be designed, constructed and equipped so that all hazards of an electrical nature are or can be prevented.

The specific rules in force relating to electrical equipment designed for use within certain voltage limits must apply to machinery which is subject to those limits.

#### Static electricity

Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system.

Electrical safety on machinery is primarily regarding the standard EN 60204-1 but also some of the nominative references standards can be important for the creation of the

education. The standards used must of course be referring to the subject of safety on machinery.

## 5. SOFTWARE TOOL

The learning system is making the target groups able to work in a manner that is in line with EU directives. Electrical engineers, industrial workers, work environment officials, national certifying agencies, universities, industrial training facilities are all being the target group for the project.

Development of the "Safe Tech System" tool is web based and the standards and directives are implemented electronically and kept a jour at all times. The tool represents a working tool for trainees that have passed the "Safety on Machinery" module.

The courseware is developed independent of the specific learning materials provided at the various locations of training and is accessible to other training facilities that in the future want to conduct education and training within the project area.

Use of the tool:

- Ensures that the user is always using the latest and updated standards and directives for projects involving safety on Machinery.
- Ensures that the user produces risk assessments with high level of conformity and quality.
- Ensures that the user remembers the environmental aspect of the risk assessment.
- Ensures that EU declaration of conformity is correct and adequate.
- Ensures a high standard on technical dossiers that complies with EU standards.
- Provides quality assessment and quality control to projects involving machinery.
- Provides a list of safety components that comply with EU standards.

Content:

- Risk assessments
- Environmental assessments
- Safety related controls on machinery
- EU declaration of conformity
- Quality control.
- Technical dossier.
- Safety components approved in EU

## 6. CONCLUSIONS

The SOMA project has brought together different organisations in Europe to work together to promote and comply with the standards of the EU regulations regarding safety on industrial electrical machinery.

The developed training system will be accessible and useable from every country in Europe. Its core is represented by a training tool that is tailor-made to handle the specific task of educating people in safety on machinery.

The short term project impact will be an increased knowledge in safety on machinery among the partners in the project. It makes them able to spread their knowledge of safety on machinery to every region in Europe.

The long-term impact based on the certified tool for educating electrical engineers and other employees working with industrial electrical machinery in the area of safety management should result in an increase safety of machinery developed due to this tool.

## 5. REFERENCES

- [1] Leonardo project SOMA – Safety on Machinery  
<http://www.safetyonmachinery.com/>

## THE AUTHORS



**Mikuláš Huba**, STU Bratislava – initiator and director of the Distance Education Centre (former Phare Local Centre of Distance Education at the STU in Bratislava established in 1996), associate professor at the Faculty of Electrical Engineering and Information Technology, Institute of Control and Industrial Informatics



**Vladimír Šály**, STU Bratislava – associate professor at the Faculty of Electrical Engineering and Information Technology, Department of Technology. Active in material science, especially dielectrics and photovoltaic renewable energy research and also experienced in safety measures in electrical engineering.

## ACKNOWLEDGEMENT

*The paper preparation was partially supported by the Leonardo project Safety on Machinery SOMA.*







5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

## THE USE OF PODCASTING IN FOREIGN LANGUAGE TEACHING

Šárka Hubáčková, PhDr.,  
Univerzita Hradec Králové  
Rokitanského 62, 500 03 Hradec Králové  
sarka.hubackova@uhk.cz, www.uhk.cz

Ing. Pavel Hubáček, ČSOB a.s.,  
Hradec Králové  
hbck-hk@seznam.cz

**Abstract.** During some opinion polls concentrated on the language teaching students often say the scripts and some exercise books are not up-to-date enough and they do not motivate them very much. One of the ways, how to accommodate them in their demands, is the form of distance education by means of on-line courses. This form enables to compose these courses from some up-to-date audio and video files which can be downloaded from internet. Podcasting is very advantageous for automatic pursuing of novelties on the web sites chosen by an author.

**Keywords:** E-learning, computer, podcasting, iTunes, distance education, on-line courses, personal computers, digital media, broadcasting, download, streaming

### 1. INTRODUCTION

For some years already, the faculty of Informatics and Management of the University Hradec Králové has worked at the preparation of on-line training courses of the German language. Most often the courses are applied as the remedial ones in daily studies, but also as the independent courses in the inter-university studies during this academic year. The advantages as well the disadvantages of the on-line courses in teaching of a foreign language are under a constant discussion. It can be said that the contribution of the on-line education is indisputable in foreign languages, but it is necessary to consider a limited possibility of conversation. We therefore put some listening texts and video recordings with follow-up exercises into the on-line teaching as a partial compensation at least.

During some opinion polls concentrated on the language teaching students often say the scripts and some exercise books are not up-to-date enough and they do not motivate them very much. One of the ways, how to accommodate them in their demands, is the form of distance education by means of eLearning-courses. This form enables to compose these courses from some up-to-date audio and video files which can be downloaded from internet. However, the author's task is not finished by making an on-line course. It is suitable to modify the file destined for listening of a spoken word just from the point of view of its topicality much more frequently than the parts of the course destined for practising vocabulary and grammar, it means exercises and tests. The author of the course has to keep his eye on the different web sites making possible to download the audio as well as video files suitable for locating into a course. Suitability must be judged from the point of view of:

- a) The size of files: The thing is that at home many participants of the distance courses are still left back on the internet connection through a dialing

connection, and a downloading down of a huge file means a time lost connected very often with exhausting of the limit they have for downloading.

- b) The approval of the owner of given web sites with using of their content for non commercial study purposes. This problem doesn't take place in essence in using such files in on-line courses concentrated on teaching languages, because the authors of site make them directly for such a use and the files are very often at hand in both an acoustic and in a text form.

### 2. PODCASTING

Podcasting is very advantageous for automatic pursuing of novelties on the web sites chosen by an author. This method (there does not exist a Czech word for this term at the time being) means the way of the distribution of sound or video files nowadays used by the most of broadcast stations broadcasting through the internet. The user-listener can download these files into his computer or mp3 player according to his own choice, he can play them back at any time or make his own programme.

Wikipedia says: „A podcast is a digital media file that is shared over the web using syndication feeds, for playback on portable media players and personal computers. A podcast is a specific type of webcast which, like 'radio', can mean either the content itself or the method by which it is syndicated; the latter is also termed podcasting. The host or author of a podcast is often called a podcaster. The term "podcast" is a portmanteau of the name of Apple's portable music player, the iPod, and broadcast; a pod refers to a container of some sort and the idea of broadcasting to a container or *pod* describes the process of podcasting. Though podcasters' web sites may also offer direct

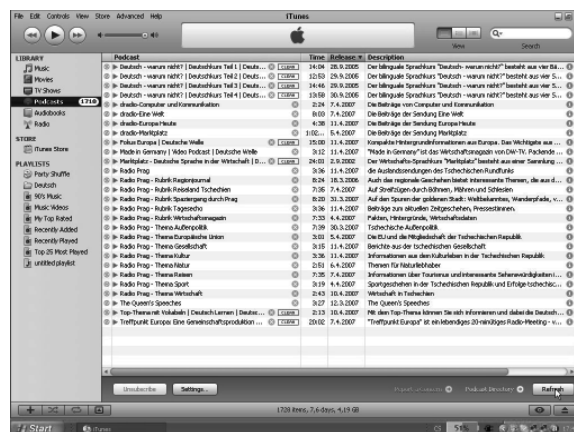
download or streaming of their content, a podcast is distinguished from other digital media formats by its ability to be downloaded automatically, using software capable of reading feed formats such as RSS or Atom.“ [1]

The use of the podcasting at the distance education is first of all in:

- The individual preparation: Students can download down the chosen file into their computers or mp3 recorders and play them back at any time they choose.
- The lektor's work: he either sends off the references to given web sites podcasting and draws student's attention to the files which are suitable for practising or which will be taught at the lessons. Or he downloads down the most suitable files and locates them into an eLearning course directly. It must be said that the lektor can create some sound files by himself and locate them into the courses, but making a good acoustic recording and its transmission into the format mp3 is time –consuming and the result might not achieve the quality of the file made from a professional recording. This holds true twice in the case of a file destined for the language teaching and done by a native speaker.

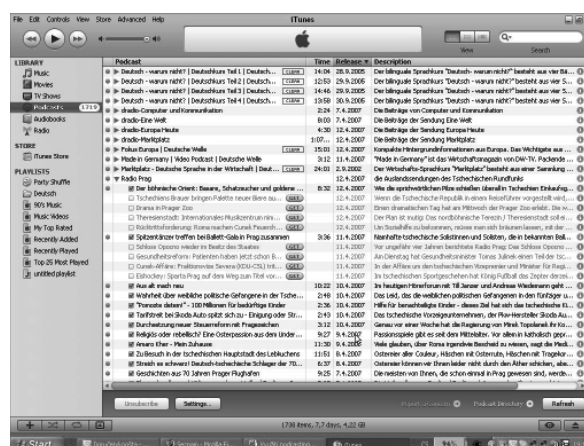
Well, how the podcasting may be used in concrete cases? To be able to use the form of podcasting completely, we must first install such a programme into a computer which makes possible an automatic downloading of audio or video files. There are several software at our disposal, for example jPodder, Juice, iTunes and they are free of charge as freeware. In my making the on-line courses for teaching German I use the widespread iTunes programme and have good experience with it. The iTunes software was worked out by the firm Apple initially for downloading music into the iPod recorder, which is also one of the results of its development activities. The programme may be downloaded free of charge from the web sites [www.slunecnice.cz](http://www.slunecnice.cz) or directly from the sites of the producer [www.apple.com](http://www.apple.com). After the installment the programme is ready to be used and it does not require any registration. Perhaps its only disadvantage is, that it is not yet located into Czech. This fact makes its operation a bit difficult at the beginning. The presetting of the programme, so that the automatic downloading of selected files could happen, is made like this: the programme iTunes is put into operation and the given web site offering the podcasting is opened at the same time. At the same time also the computer must be connected with the internet. As for the German language, the sites of RadioPraha ([www.radio.cz/de](http://www.radio.cz/de)) and the sites of Deutsche Welle ([www.dw-world.de](http://www.dw-world.de)) turned out to be a full success. Among the podcasting sites a thematic field must be downloaded. Some stations (e.g. Deutsche Welle) have at the site end of such a thematic field a push-button and by the clicking of it the reference (a sort of a communication channel) is automatically transferred into the iTunes programme. As for the other stations, we must copy the reference and through the choice “Advanced-Subscribe to Podcast” put it into the dialogue window “URL”. By this way we put all thematic references of different stations into programme, whose topicality we want to be persued automatically by iTunes. It

automatically makes the download of selected programmes after their launching. The thematic fields can of course be modified and completed at any time. The automatic download of the files proceeds like this: Whenever we launch the programme iTunes and click the button Podcasting, there occurs a clearly arranged chart of selected thematic fields we had chosen, as well the date of the last component in them. After a while the programme automatically starts to download the new files and to add them to their thematic fields (picture 1).



Picture 1: The automatic launch of download.

If the download does not start automatically, we shall launch it by means of a push-button “Refresh”. The downloading is then shown in the graphic way on the screen. At the same time proceeds the download of at most two or the files. If there are more files which can be downloaded, the programme arranges them in a queue. But if they are not downloaded for some reason (the connection is interrupted, there is a big time delay) it is possible to download them subsequently by means of re-clicking of the thematic field by use of the push- button “GET” (picture 2)



Picture 2: The hand download of further files using the push-button GET

There exists another advantage next to the chronological arrangement and the data of duration: It is a kind of an annotation of the component (picture 3). It accelerates the orientation by the next choice to the lector. Because the new files are increasing almost every day, it is suitable to put them in a CD after a time they take a big capacity in a hard disc.



Picture 3: The synoptic information about the file.

It is left to find out where they are saved. Because the programme iTunes is destined first of all to download music, the files are automatically saved in Windows into directories Music-iTunes-iTunes Music-Podcast.

### 3. SUMMARY

Podcasting was worked out in 2004 as a kind of an alternative of the radio broadcast through the internet. The aim was to compensate the illegal download of music by a

paid service under reasonable financial conditions especially for the youth. During several years this audiopodcasting underwent a quick development towards an uncommercial use. To apply it at the education is one of its chances. Many stations, next to already mentioned audio files in the mp3 format, broadcast the videopodcasting on the same principle. We think that podcasting calls upon the use in foreign language teaching.

### 4. REFERENCES

- [1] <http://en.wikipedia.org/wiki/Podcast> [27.2.2007]
- [2] <http://cs.wikipedia.org/wiki/Podcast>
- [3] <http://de.wikipedia.org/wiki/Podcasting>
- [4] <http://www.podcast.de/>
- [5] <http://www.podster.de/>
- [6] <http://www.dw-world.de/>
- [7] Mitáček, Z: Výuka jazyků a podcasting in <http://www.jazyky.com/content/view/129/51/>
- [8] EGER, Ludvík; BARTOŇKOVÁ, Hana. Studijní texty v distančním vzdělávání. Olomouc: UP, 2003. Centrum distančního vzdělávání. ISBN 80-244-0755-8.
- [9] HUBÁČKOVÁ, Šárka. Online Kurse Deutschunterricht, in Sborník prací z mezinárodní konference Odborný jazyk na vysokých školách. Praha: Česká zemědělská univerzita v Praze, 2005. 4s. ISBN 80-213-1345-5





## EUROPEAN STRUCTURAL FUNDS IN 2007-2013 PROGRAMMING PERIOD IN SLOVAKIA AND eLEARNING

Milan Ištván

Executive Director of a non-profit organization Partnerships for Prosperity (PPP)

+421 905 351 962, milan@p3.sk, www.p3.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract:** The starting Programming Period of EU 2007-2013 will be a big opportunity for development of eLearning and eContent in Slovakia by using the European Structural Funds. The Main Operational Program Informatization of the Society with financial allocation of 1,2 billions EURO has 3 priority axis: eGovernment, eContent/eCulture and Broadband. But for development of eLearning, the Slovak government prepared three other Operational Programs: Education, Employment & Social Inclusion and Research & Development. The author provides a short overview of these operational programs.

**Keywords:** Education, Employment, ICT Infrastructure, Operational Program, Research & Development, Social Inclusion.

### 1. INTRODUCTION

In the starting Programming period of EU 2007-2013, the Slovak republic has a big opportunity for building and developing the eLearning and eContent. Information Society is one of horizontal priorities for this period. Preferably, the most possibilities will be offered by OP Informatization of Society which uses ERDF (European Regional Development Fund) sources for building ICT infrastructure. From ERDF there is also available the OP Research & Development. From ESF (European Social Fund) we will have two OPs – Education and Employment & Social Inclusion.

### 2. CHARACTERISTIC OF OPs

#### OP Informatization of Society

*Priority axis 1:* Electronization of public administration and development of electronic services (at the central level, at the regional level and at local level)

*Priority axis 2:* Development and renewal of the national infrastructure of repository institutions (Improvement of the system of acquisition, processing, protection and utilization of repository institutions at the national level. Some of these activities: support for the management of the systems for content acquisition, protection and processing; electronization of repository institutions; purchase of information sources; improvement of the reliability of operation of information and communication systems; creation of the Slovak Digital Library and a network of specialized digitalization units of repository institutions; recording, collection and long-term archiving and protection of digital content, web-harvesting and web-archiving; systematic digitalization and provision of access to digital content of repository institutions on the internet.).

*Priority axis 3:* Improvement of broadband internet access (Measures: Development and support for sustainable use of broadband Access infrastructure; Stimulation of demand for broadband Access.)

Total financial allocation (EU+SR): 1.168 MEUR

Managing Authority of OP IS: Office of the Slovak government ([www.roopis.vlada.gov.sk](http://www.roopis.vlada.gov.sk)).

Intermediate Body: Ministry of Finance ([www.mfsr.sk](http://www.mfsr.sk)).

#### OP Education

One of the major tools how to achieve adaptability of graduates and employees on the employment market is gaining and evolving of key competencies. One of the key competences is also digital literacy (readiness of wide masses for the use of modern ICT), which is addressed by following activities: innovation of educational methods with stress on usage of information and communication technologies (ICT) in the educational process including the possibility to integrate the infrastructure ICT at schools; creation and realization of new generation of multimedia teaching aids and interactive education programs (TV programs, multimedia programs, eLearning); implementation of strategy of informatization of regional education. These activities will have significance also for education of people with special educational needs.

*Priority axis 1:* Reform of educational system and knowledge background (Measures: Change of traditional school to modern; University and R&D as a motor of development of Knowledge Society)

*Priority axis 2:* Whole life education as the basic principle of knowledge society

*Priority axis 3:* Support of education of people with special educational needs

*Priority axis 4: Modern education for knowledge society in the Bratislava Region*

Total financial allocation (EU+SR): 726 MEUR  
Managing Authority OPE: Ministry of Education (www.minedu.sk).  
Intermediate Body: Agency of Ministry of Education for Structural Funds of EU (www.asfeu.sk).

#### OP Research and Development

Defining direction of funds from the ERDF into building and modernization of auxiliary infrastructure in the area of information technologies as one of activities, represent special area of support in 3 measures of OP.

Measures:

- 1.1: Renewal and Build-up of technical R&D infrastructure
- 2.1: Renewal and Build-up of technical R&D infrastructure in the Bratislava region
- 3.1: Infrastructure build-up of higher education institutions and update of their internal equipment for improving the conditions of the education process (at improving conditions for new forms of education and learning process, in particular support of new technologies at building language classrooms, building chemistry, biology and physics classrooms, building information and technology classrooms, furnishing libraries with computers).

Total financial allocation (EU+SR): 1.422 MEUR  
Managing Authority OP R&D: Ministry of Education (www.minedu.sk)  
Intermediate body: Agency of Ministry of Education for Structural Funds of EU (www.asfeu.sk).

#### OP Employment and Social Inclusion

Each group of activities, in the field of employment increase, is oriented toward the support of usage of information technologies and acquirement of basic skills in this field. Exactly the preparation for entry and effort to sustain on the employment market is directly connected with development of IT and their usage. At the same time, the usage of eLearning occurs. The usage of eLearning by extending the basic skills plays a significant role also then, when the person is away from the employment market for example at maternity leave.

*Priority axis 1: Maintenance of employment growth*

*Priority axis 2: Maintenance of social inclusion*

*Priority axis 3: Maintenance of employment growth and social inclusion in Bratislava's Region.*

Total financial allocation: 881 MEUR

Managing Authority of OP E&SI: Ministry of Labour, Social affairs and Family (www.employment.gov.sk)  
Intermediate Body: SIA (Social Implementation Agency, www.sia.gov.sk), FSR (The Social Development Fund, www.fsr.sk).

### **3. CONCLUSION**

Between potential beneficiaries of projects we can see primary and secondary schools (respectively their founders), universities, Slovak Academy of Science (SAV) and non-profit organisations. First calls for projects we expect to happen in the autumn 2007. The financial participation for public sector bodies will be in general 5% per project.

### **THE AUTHOR**



Mr. **Milan Ištván** is a consultant in the field of Information Society, Structural Funds of EU and Public-Private Partnership. Concurrently from 2002, he is an executive director of a non-governmental organization Partnerships for Prosperity (PPP), which is supporting the building and development of eGovernment in Slovakia. In the years 2004-2005, he worked as a consultant for the Associations of Towns and Villages in Slovakia (ZMOS) for Information Society. For the last four years he was a member of the Governmental Council for Informatics. He is a member of the Working Group at the Slovak Governmental Office, which prepares the Operational Program Informatization of society.

In the years 1998-2002 Mr. Milan Ištván was a Member of the Slovak Parliament (NR SR). He worked in the Committee of NR SR for education, science, youth and sport and Joint Parliamentary Committee of EU and SR. He pursued the support of informatization of education (project Infovek), creation of legislation for the Electronic signature law and liberalization of the telecommunication market.

Mr. Milan Ištván is a graduate from the Philosophical Faculty of Komenský University in Bratislava in the field of journalism. During a year long study stay in Paris, in the Centre de Formation et de Perfectionnement des Journalistes, he cooperated with the Foreign political redaction of the News centre of the Slovak Radio (public broadcast). He speaks French, Russian and English.

Mr. Milan Ištván is 32 years old Slovak citizen and lives in Bratislava. He is married and father of a daughter.



## VIRTUAL LABORATORY

František Jakab, Vladimír Andoga, Michal Nagy, Martin Kapa  
Computer Networks Laboratory,  
Department of Computers and Informatics,  
Technical University of Košice, Letná 9, 041 20 Košice, Slovak Republic  
Email: vl@cnl.tuke.sk  
WWW: <http://vl.cnl.tuke.sk>

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** This paper deals with the remote laboratory VirtualLab solution developed at Computer Network Laboratory (Technical university of Košice). Aim of the project is to design and implement an e-learning environment, which provides remote access to specified laboratory network devices. This project will be used in educational process. Using this tool, the students can access and configure network devices like routers and switches remotely from any place via Internet. VirtualLab consists of the hardware and software part. The hardware part contains a group of server machines, network devices and two special devices called TO108 and PO108. The software part consists of four parts - communication client, central communication server, local communication server, information system).

**Keywords:** networking, remote access, virtual laboratory

### 1. INTRODUCTION

#### Configuration of network devices

To understand the conception of VirtualLab, it is necessary to understand the process of network devices configuration. In praxis, a network administrator has to be connected to the device, which he wants to configure. This can be done by various ways. One of them is the configuration via console port. After the administrator connects the cable to the proper port on a network device and on PC, he or she can start application that is used to communicate with network equipment via serial port. Example of such an application is HyperTerminal (Figure 1) on MS Windows platform or Minicom on GNU/Linux platform. After the network device has been turned on, the administrator can communicate with it by typing commands. On the same screen the network device will respond by writing its output.

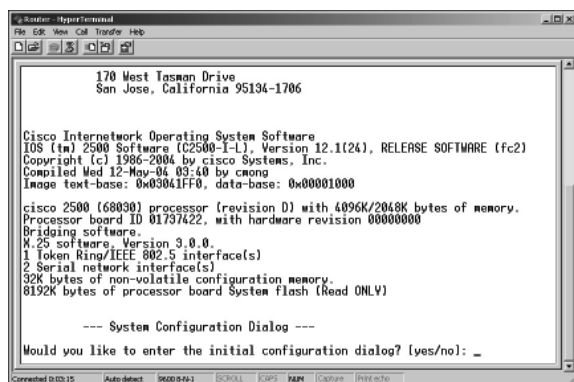


Fig. 1. HyperTerminal on MS Windows

#### Remote access

Our goal was to create a solution that would be as close to real model as possible. One solution is so called remote access. Remote access means that a device is not accessed physically, but from a distance using some intermediary device. This solution doesn't need physical presence of the student in the place where this equipment is located. In laboratories, specialized equipment is accessible only in some part of the day. In remote access solution, the equipment is accessible 24 hours a day, 7 days a week (24/7 model). Also many network devices are very expensive and some institutions cannot afford them. Or some institution has equipment that other doesn't have and vice-versa. To train on such devices, remote access can be used. Sometimes it is also useful to keep track of the configuration process. In remote access, this can be done by logging of all commands that the student has entered. After the student has configured the device, instructor can see where he has done mistakes.

#### Conception of VirtualLab

Virtual Laboratory solution consists of two main parts – the hardware solution and the software solution. The hardware solution was developed by Secondary school at Adlerova Street in Bratislava and consists of 2 devices, which will be described later in the text. The software solution was developed at Technical University of Košice and consists of 4 applications. The conception can be seen on Figure 2.

In VirtualLab project are used two similar terms, but each of them means something else. The term *server machine* means a computer, while the term *communication server* means an application that runs on one of server machines. The hardware solution consists of several server machines, console port switch TO108, power switch PO108 and set of network devices. One of the server machines is used as a

central point of architecture. This machine is called central server machine and on this computer runs an application called central communication server. On the other server machines, which are called local server machines, runs another application called local communication server. These computers are used for communication with TO108 using a serial connection and with the client application using a network connection. The whole chain of hardware devices that take part on the communication is user's computer – public network – central server machine – local server machine – TO108 – network devices.

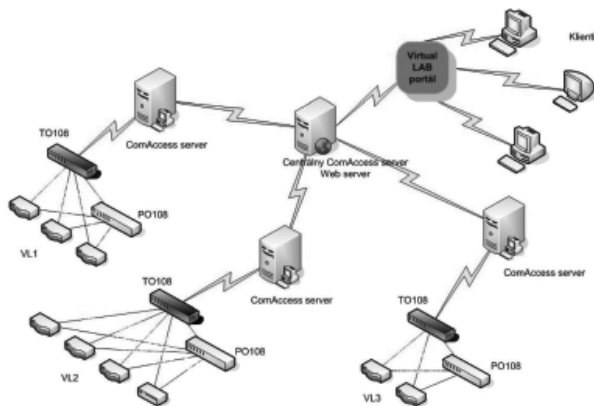


Fig. 2. Conception of VirtualLab

The set of network devices together with TO108 and PO108 is called laboratory kit (LabKit). One LabKit can consist of up to 8 network devices – e.g. switches, routers, firewalls etc. These are the devices, that student can train on.

Software solution is divided into four parts. All of them were developed using Java language. Its main advantage is the platform independence. We wanted to allow access for every student regardless of which operating system he or she uses. Java is widely supported on all main operating systems for personal computers, therefore it was the best choice for us. During analysis we decided to decompose the model into smaller parts because smaller parts are easier to develop, work can be divided into more parts and developers can work concurrently and independently on each other.

## 2. HARDWARE SOLUTION

### Console switch TO108

Console switch TO108 is a device that is used to communication between server computer and network devices. It behaves like a multiplexer. It has one input with RJ-45 plug that is used to send messages to one of the 8 output outlets (also with RJ-45 plug). Each of these outputs is directly connected to one network device. This way you can create a chain server - TO108 - networking devices. Moreover this device has one more output that is used to chain it with another device that is called PO108. With just one serial port on the server you are able to configure up to

8 devices concurrently. This chain is functional also in the opposite direction, which means that all devices can send the signal back to TO108 and from TO108 to the server. The message contains also information about originating port of TO108 and therefore the server is able to distinguish between communications. You can see the device TO108 on the figure 3.



Fig. 3. Console port switch TO108

### Power switch PO108

PO108 is also kind of a multiplexer, very similar to TO108. Its role is to provide power up to 8 network devices. It has 2 inputs – first one is used for the configuration and the second one is used to supply devices with power. The power supply input port is used just to supply the device with power. Its power is divided into 8 output devices according to configuration. One of the output ports on the TO108 is connected to the configuration input port of the PO108. Through this port it is able to configure PO108. Using special protocol, the server can tell PO108 which of the output ports should be up and which should be down. Using these two devices (TO108 and PO108), the server is able to fully control up to 8 devices – to configure them and to turn them off or on.

The whole laboratory kit consists of these elements:

1. TO108
2. PO108
3. Network devices (up to 8)

The scheme of interconnection is described on the Figure 4.

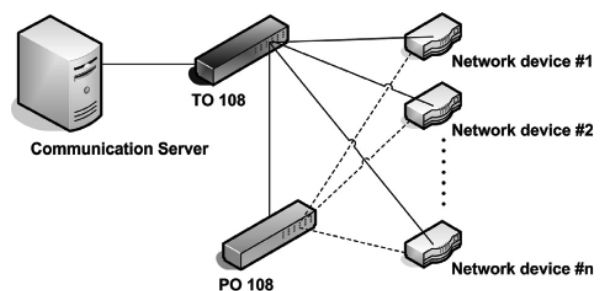


Fig. 4. LabKit scheme

## 3. SOFTWARE SOLUTION

### Communication Client

CommClient is Java WebStart application that consists of two application windows. In the first one there are 3 inner windows for chat and topology information. The student



can see the list of other active students and chat with them in order to solve some problem. The topology inner window is used for scheme of networking devices that student is configuring (Fig. 5).

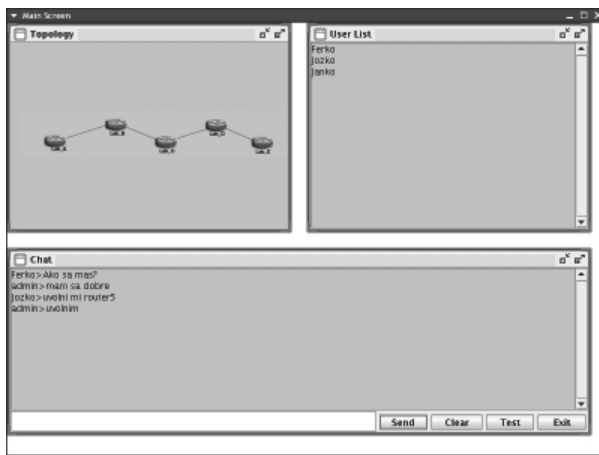


Fig. 5. CommClient – LabKit scheme

The second application window is used for configuration of the devices. In the upper part there are tabs (Figure 6). Each tab represents one networking device from topology in inner window that was mentioned before. Tabs that are coloured grey are not active. It means that the student has not reserved this device and cannot train on it. Other devices are active and student can configure them concurrently. The student can hold dialog with each device in its own tab. In the centre part there is text area where networking device responds. In the lower part there is text field where student can write commands to device. In the lower right part are several buttons. The send button is used for sending messages to networking device, clear button is used for console clearance, restart button is used for physical reboot of networking device and exit button is used for exit from the application.

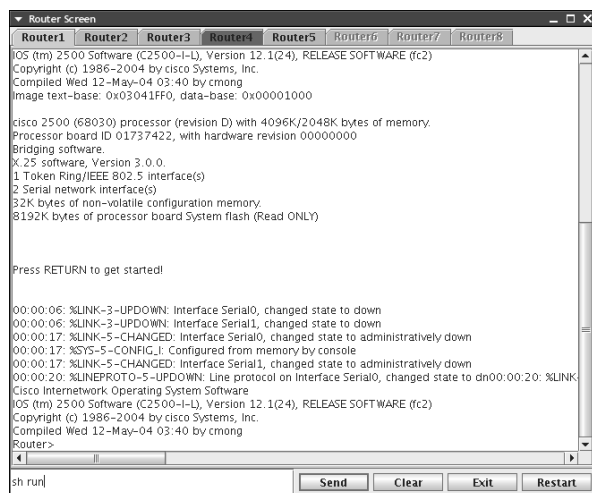


Fig. 6. CommClient – configuration screen

### Central Communication Server

In the VL project is used centralized architecture. Central communication server (CentralCommServer) stands in the middle of this architecture. It is a Java console application that provides interconnection between CommClient and Local communication server. The server communicates with relational database that contains information about users, laboratory kits, reservations etc. When a user wants to configure the network device, he or she must open the CommClient and then enter his/her login and password. After that, the message with login and password is sent to the CentralCommServer, which identifies and authenticates the user. If the user has been authenticated, the CentralCommServer sends a message back to the user with the information about devices that can be configured by the user. Also one message is sent to the Local communication server indicating, that the user has connected and that he or she will communicate with the LabKit. From this point the communication between client and LabKit is established. The student can now type commands. The commands will be sent to the CentralCommServer and then to Local communication server. The answer from a device will flow in opposite direction.

One central server is able to communicate with more local servers. The local servers rely on the information obtained from the central server. They do not have to access the database nor communicate with information system. This brings to the architecture more security, but introduces a single point of failure – the central server. We believe, that this is acceptable risk compared to advantages that brings this architecture.

### Local Communication Server

The second important part of the communication infrastructure is Local Communication Server (LocalCommServer). It is also a Java console application and its main purpose is to communicate with LabKit and with CentralCommServer. The communication server is connected to TO108 using serial connection and the communication takes place using a special protocol. LocalCommServer becomes a message from the central server. The message contains information about the command and about the device that should execute this command. The local server takes this message and decides to which port should be this message forwarded. The device executes the command and answers to the client. The answer is sent to the local server and then the LocalCommServer sends it to appropriate client through CentralCommServer. This way of communication is described on the figure 1. [1]

### Information system

Information system of VirtualLab (ISVL) is used as a central point of administration. This system can be used by 4 groups of users – administrators, lecturers, students and operators. Each of these groups has its own role. Administrator is a person that is responsible for whole system. His/Her main role is to add new users, manipulate with accounts, etc.

Lector is responsible for class creation, class management, student management and for the device reservations. When a student wants to train on the LabKit, he or she must have a reservation in a specific time period. This reservation is created by teacher.

Student can see his reservations and train on the laboratory devices (if he or she has active reservation in this particular time).

Operator is a person that is responsible for the laboratory kit. He or she configures it according to the scheme that the lector has chosen. [3]

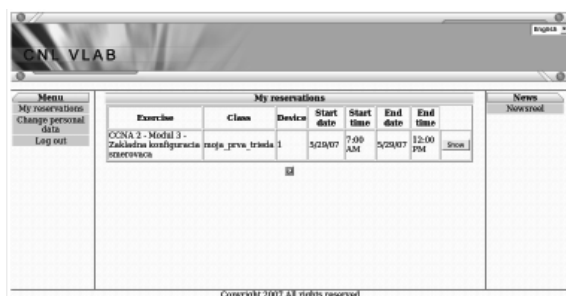


Fig. 7. ISVL – student screen with reservations

The system was built to provide management features for its users. These features can be divided into:

**User management.** There are two ways how a person can create a user account. The first possibility is to register. It is free and after the registration, the user is added to the system, but he or she has no role. The role must be added by the administrator. After that, the user can log into the system. The second way how to create an account is to create it by hand. The administrator will enter personal data of the user and assigns him/her a role.

All users are able to change their profiles. That means the change of name, e-mail, password, etc.

**Class management.** Virtual class represents group of students. It can be created by an administrator or a lector. Classes are represented by table in *class* database. In ISVL we can see list of existing classes or we can add new class. Creation of new class is really simple. First we define name of new class, date of expiration and name of existing lector which we choose from the list. After we create a new class, it writes to database its name, date of creating, date of expiration and ID number of lector, which creates class or to which this class was created. Lector can add/remove students to/from more than one class. Administrator can manage all classes but lector can manage only class which contains his ID number.

**Scheme management.** The scheme is a combination of network devices from the LabKit that the student can work with. The devices from the kit can be connected each other in several ways. Each way of connection represents one scheme. The schemes are created by hand by an operator. In the future this will be solved in other way. The devices will be connected to each other through a configurable switch. The switch will be managed by an external application and the reconfiguration of the LabKit to new scheme will be done automatically.

**Reservation management.** The reservation of devices is created by the lector for students of specific class. After click on List of classes, we get list of existing classes. From this point we can start to add new reservation. First step is to choose a topology, where we have several exercises and then we chose rack number. Next step is to choose Start Date, End Date, Start Time and End Time. Time, in which the student can assign devices, is limited by exercise of specific class. After the reservation is created, the lector can assign one or more devices to the student until expiration of the reservation. Sometimes it can happen that lector wants to assign one device to student, but this device is already assigned to another student. In this case, the system does not allow it, because the communication client does not allow to configure one device by two or more different users. [2]

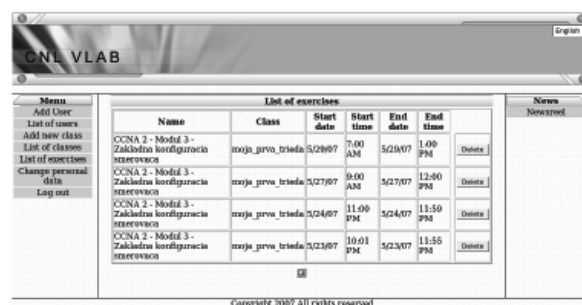


Fig. 8. ISVL – lector screen with exercises

## 4. SUMMARY

VirtualLab is a system of hardware equipment and software components that form a laboratory with remote access to network devices in order to configure them. It can be used in addition to the normal way of teaching computer networks. It allows full access to the device without physical presence of the student. It does not depend on the time or location and therefore it can be used worldwide.

## 5. REFERENCES

- [1] Andoga, V.: Application of clientserver architecture for configuration of remote devices of the Virtual laboratory. (Diploma thesis), 2007, pp. 31-46
- [2] Felber, M.: Experimental exploitation of the Virtual laboratory for educational purposes. (Diploma thesis), 2007, pp. 75-88
- [3] Horváth, R.: Concept of virtual laboratory information system (Diploma thesis), 2007, pp. 31-38
- [4] Materials of CNA, [online], Cisco Systems Inc., <http://cisco.netacad.net>, 2005

## THE AUTHORS

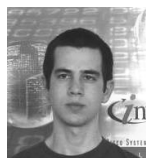


**Frantisek Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modelling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)).



**Vladimír Andoga** was born in 1982. In 2006 he ended his study at Faculty of Electrical Engineering and Informatics on Technical University of Košice and received Ing. (MSc.) degree. His main

interests include computer networks and Java programming language (especially Java Enterprise Edition).



**Michal Nagy** was born in 1984. He studies at Faculty of Electrical Engineering and Informatics on Technical University of Košice. His main interests include computer networks and object oriented languages (especially Java).



**Martin Kapa**: was born in 1984. He studies at Faculty of Electrical Engineering and Informatics on Technical University of Košice. His main interests include computer networks and web design.

## ACKNOWLEDGE

*The paper was prepared within the project "Network of virtual laboratory for real system control", No. 3/3121/05, 2005-09-09 2007-12-31 with the support of KEGA.*





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

## e-LEARNING AND IPTV NETWORK

Cyril Francisci, Milan Kováčik

Výskumný ústav spojov, n. o., Zvolenská cesta 20, 975 90 Banská Bystrica  
cyril.francisci@vus.sk, milankov@vus.sk, <http://www.vus.sk>

**Abstract:** The e-learning standards are a set of rules common among the companies dedicated to this technological area. The convergence in technologies is an essential aspect for the consumers, as the products that follow these standards.

Internet Protocol Television (IPTV) is broadcast-quality television and/or video signals that are delivered to subscribers or viewers using a broadband connection over Internet Protocol (IP). While IP stands for Internet Protocol, it does not actually mean the television content is streaming over the Internet. IP is simply the same method, protocol, or technology that enables you to access the Internet and IP-delivered television content is utilizing the same technology for delivery.

The purpose of this contribution is referring IPTV Network as an important technology for standardized e-learning process.

**Keywords:** Applications, E-learning, IP, IPTV, Network, Services, Standards

### 1. INTRODUCTION

Europe's vision for lifelong learning is expressed in the *Education and Training 2010* work programme. The three strategic goals are:

1. To increase the quality and effectiveness of learning in Europe;
2. To facilitate access to learning for all;
3. To open-up our systems to the wider world.

Internet Protocol Television is one of the very appropriate opportunities to ensure access to Information and Communication Technology (ICT) for everyone.

Firstly in terms of quality:

- IPTV can help enhance the context for learning (e.g. by bringing learning resources from the Internet into the classroom and displaying them on a digital whiteboard. Pupils interact with the material to explore the information, discuss with their teacher and their classmates and develop their own understanding.
- Art and design students to create their own innovative content as part of the learning process are using digital media.
- IPTV is helping to improve the quality of learning by making learning more flexible and better tailored to the needs of individual learners.

Further in terms of access to learning for all:

- IPTV can help bring learning to people who would otherwise be unable to participate.
- eEurope is supporting these efforts to ensure that every town and village in Europe is connected to the Internet and that services are being developed.

And finally in terms of opening-up the systems to the world:

- IPTV is helping to provide global access to the world-class education and training systems.
- IPTV is offering the possibility to reform our systems, to implement new ways of learning and to achieve the vision of lifelong learning for all.

### 2. e-LEARNING STANDARDS

Standardization is one of the essential building blocks of the Information Society. There should be particular emphasis on the development and adoption of the international standards. The development and use of open, interoperable, non-discriminatory and demand-driven standards that take into account needs of users and consumers in a basic element for the development and greater diffusion of ICTs and more affordable access to them, particularly in development countries. International standards aim to create an environment where consumers can access services worldwide regardless of underlying technology.

The challenges of standardizing e-learning go well beyond technical considerations. Indeed, the aim is to develop an educational heritage with all that this involves, not just in terms of solidarity but also with respect for cultural diversity.

Standardization is not simply developing uniform ways of doing or defining things, but an avenue for facilitating access to a collective wealth.

#### 2.1 Metadata

Metadata standards have been developed to support both machine interoperability (information exchange) and targeted resource discovery by human users of the web.

Metadata standards for the Internet are an attempt to bridge the gap between the comprehensive cataloguing which is done by professionals in the library context, and the free-for-all of document creation on the Web. In particular, these metadata standards allow creators of documents and

managers of resource collections to describe resources in a detailed manner facilitating targeted queries by search engines.

A metadata record typically consists of a set of elements (or fields), which describe in detail the content of the resource, its intellectual property rights, and its instantiation (e. g. date created).

Educational metadata standards extend the scope of description that can be included in a metadata record with information that has particular educational relevance. This is done by either defining education-specific elements, element refinements or encoding schemes.

### 2.2 SCORM (Sharable Content Object Reference Model)

One of the leading standards used in the development of e-learning course material is the sharable courseware object reference model or SCORM. Developed by the Advanced Distributed Learning (ADL) initiative to promote the interoperability of learning objects and Learning Management Systems (LMS). Based on several other specifications, the SCORM specification regulates how e-learning content and LMS communicate with each other for tracking student progress and also defines the structure of a learning object.

SCORM currently provides an interface for communicating information about a learner's interaction with the course content, a content packaging specification. That enables interoperability of learning content, a standard set of metadata elements that can be used to describe learning content and a set of standard sequencing rules, which can be applied to the organisation of the learning content. The technical standards used by SCORM work equally well locally, regionally or globally.

The SCORM 2004 documentation is a collection and harmonization of specifications and standards that defines the interrelationship of content objects, data models and protocols such that objects are sharable across systems that conform to the same model.

The Advanced Distributed Learning (ADL) Technical Team announces the release of the SCORM 2004 3rd Edition Version 1.1 Content Examples. These content examples are illustrations of SCORM 2004 3rd Edition conformant content that demonstrates concepts of SCORM content in the areas of design, development and implementation. In this release, the content examples were verified to work with Microsoft® Vista and Internet Explorer 7 [1].

### 2.3 Learner Information Specifications

Learner information specifications are devoted to support the exchange of learner information between different systems. They provide data models, including the syntax and the semantics, to describe both the characteristics of a learner and his or her knowledge/abilities.

The information is associated to learners and used by learning technology systems. Specifications define elements for recording descriptive information about: knowledge acquisition, skills, abilities, personal contact information, learner relationships, security parameters, learner preferences and styles, learner performance, learner-created portfolios, and similar types of information.

Learning technology systems should handle information about their students. Basically, this information comes from three different sources: personal information (address, phone number), preferences (operating system, network connection, desktop configuration), and academic information (courses completed, grades).

### 2.4 Assessment Specifications

Assessment specifications address the need of defining common formats and procedures for the exchange of evaluation material among different e-learning tools. The most outstanding proposal in this field is the Question & Test Interoperability specification from the Instructional Management System (IMS) consortium.

This specification is focussed on enabling the following functionality:

- The ability to provide question/item banks to users regardless of virtual learning environment deployed by the user.
- The ability to use question/item banks from various sources within a single virtual learning environment.
- Support for tools to develop new question/item banks in a consistent manner.
- The ability to report test results in a consistent manner.

### 2.5 Competency

Competency definition data objects are used to specify competencies, skills and learning objectives in a learning management system and in competency profiles.

The information models in these specifications can be used to exchange these definitions between learning systems, human resource systems, learning content, competency or skills repositories, and other relevant systems.

This standard shall specify the mandatory and optional data elements that constitute a competency definition as used in a learning management system, or referenced in a competency profile.

The standard is needed because there are currently many definitions of the terms e. g. learning objective, competency and skill.

The purpose of this standard is to define a universally acceptable competency definition model to allow the creation, exchange and reuse of competency definition in applications such as learning management systems, competency or skill gap analysis, etc.

### 2.6 Quality

Quality specifications are concerned with the specification of metrics, guidelines, taxonomies, etc. for the development of technology-based learning systems. Allowing both of end users to specify their specific quality needs and providers to declare their specific quality provisions in corresponding formats will be a highly important instrument for a global market in this field.

Supporting providers with effective procedures for achieving the required high quality of their services, products, and tools in the field of learning, education, and training is closely related to the identification of quality criteria and metrics [2].

The main educational standardization bodies are listed in [3].

### 3. IPTV NETWORK

Before delivering into the market opportunity for IPTV, it is important to understand exactly what IPTV is and is not, as a fair amount of confusion surrounds its definition. Some of the confusion is attributable to misconceptions over the use of the term IP, while further confusion stems from regional differences about what constitutes a pay-TV service [4] a [5].

Firstly, IPTV does not mean the Internet. IPTV does not mean unlimited access to video content delivered over the Internet. Instead, IPTV refers to Internet protocol (IP), which is a transport protocol, a delivery mechanism, and not necessarily the Internet. There are existing Internet-based video services that deliver on-demand digital content to a PC via a broadband connection but, these services do not typically deliver content to a TV viewing environment.

Secondly, IPTV service implementations vary on a geographic basis. Differences exist depending on local market conditions and requirements, particularly in the mix of broadcast and on-demand content deployed by service providers.

IPTV is multichannel and on-demand programming delivered via DSL or fibre and typically offered by a telco

or broadband service provider.

#### 3.1. How Operates IPTV

IPTV operates on a different premise than traditional satellite or cable television in that only selected programming and on-demand content are delivered to the consumer. With Satellite and cable, all channels are being pushed all the time to the consumer's home rather than a per-selection basis. IPTV's ability to provide two-way communication (you request a program from the TV guide and the program is delivered to you) offers true interactivity for the customer with the environment. HDTV, movies, past TV shows, and all other content can be distributed on demand and service providers can tailor the requested content and advertising based on customer preference.

IPTV also has other network implications, channels can only be delivered over IP networks as multicast, and so if you want to deliver live television, your network (from DSLAM to peering hub access) must be multicast-enabled from end to end. Live TV cannot be delivered by unicast, and multicast also enables the most efficient delivery of video data and the smoothest channel changing speed. Using dynamic technologies such as PIM (Protocol Independent Multicast) can help to reduce network overhead by only relaying the channels that have been

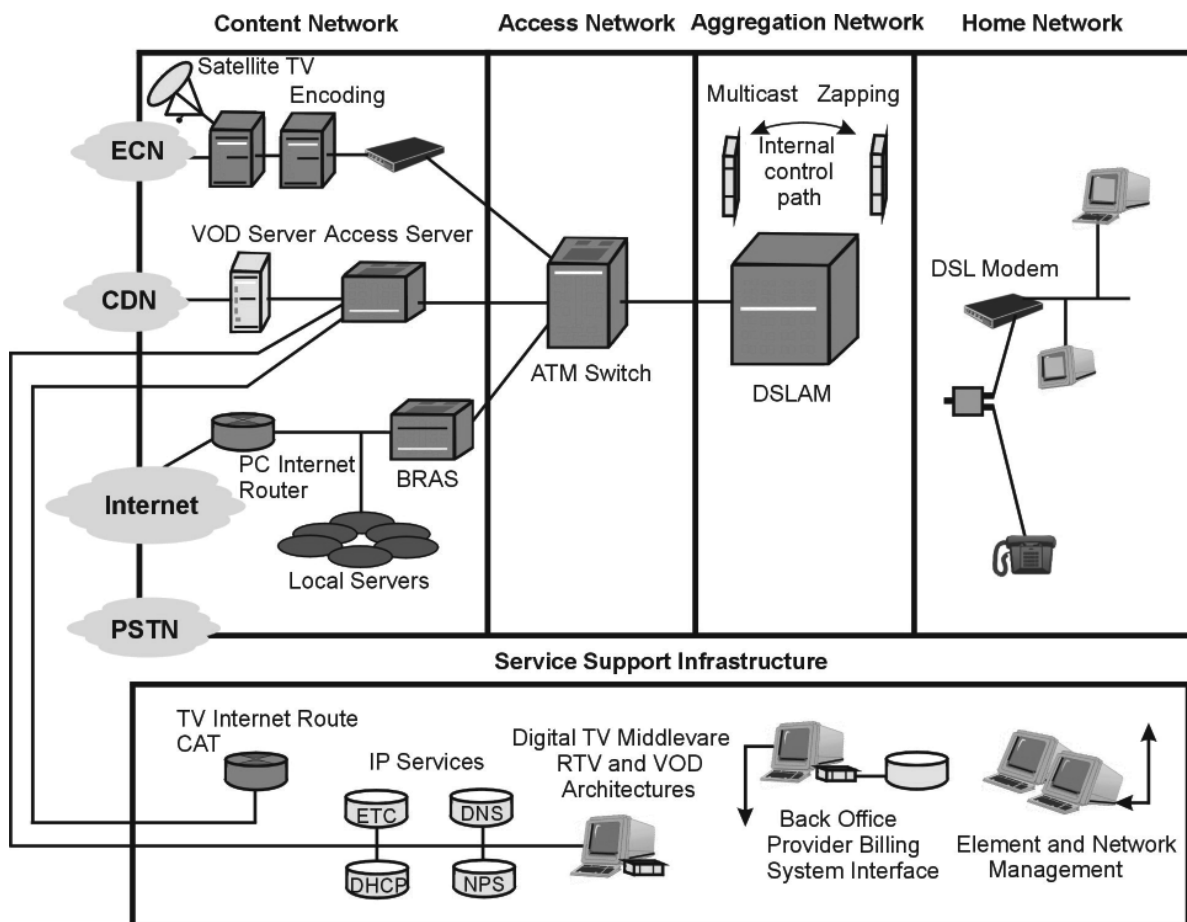


Figure 1: IPTV Network Architecture

specifically requested.

Video cannot be sent through Wi-Fi, it is unacceptable for most video applications, although they are fine for simple computer networking. Trying to send MPEG-4 is extremely difficult and unreliable. Newer technologies such as WiMax have yet to prove stable enough in a commercial setting even for PC connectivity.

In order to provide and run the required services, an end-to-end network architecture has to be developed and integrated into the existing telecommunications infrastructure. The Figure 1 shows an overview of such architecture. The various components can be clustered into several functional areas.

Content network with the so-called Head End is a part of a network, where the selected TV content (programs) is taken from the Broadband Delivery Network (BDN) by a satellite dish. Depending on the received formats, the content needs to be encrypted and decoded. In a next step the content has to be encoded into the right format and encapsulated into IP packets.

Content Delivery Network (CDN) serves for the on-demand services. Since the content for VoD is received in various formats including analogue formats such as BetaSP, and digital formats such as DVDs, it needs to be encoded at the right bit rates, suitable for transmission over DSL lines. In case of encryption the content is passed through encrypting devices before being stored on a storage-server. When the user requests them the videos are played out by several video-server(s). Each of VoD content must be also associated with the related metadata (e.g. rating, pricing policy and price). Broadband access to the Internet and access to the PSTN completes this module.

In the Aggregation network all data coming from the content and services network is aggregated and lead to an ATM switch infrastructure. Moreover this network module transports content and data to the different access networks and their DSL Access Multiplexors (DSLAMs). These are usually located in the central offices of the Public Switched Telephone Network (PSTN).

Access network: The proposed architecture supports conventional analogue POTS (Plain Old Telephone System) and where available digital ISDN service. The voice or telephony service is assumed to exist prior to deployment of the broadband entertainment service. This existing telephony service is not changed in any way by the addition of the overlay broadband entertainment services. The telephony service continues to be provided by the Public Switched Telephone Network (PSTN). The access network is where base band voice signals and physical layer DSL signals are combined. This is performed by a POTS splitter, which is generally integrated into the DSLAM. Achievable service rates depend largely on the length and the quality of the copper wire from the DSLAM to the customer premises. At the other end of the wire, a POTS splitter within the home network separates the voice signal from the combined DSL and voice signal. From this splitter onward the voice and DSL signals are run on separate wires within the end users' home. The PSTN/ISDN number (account) is transparent to the DSLAM and it still is within the responsibility of the Central Office PSTN/ISDN switch.

In the Home network the copper line ends and a device called "splitter" separates the low-frequency voice signal from the digital broadband signal. The voice signal still goes to the telephone, whereas the digital signal is brought to the DSL-modem, which is interacting with the DSLAM on the central office side. Connected to the DSL-modem are the end devices, usually a set-top box for the TV set and one or more PCs. These network components are connected via Ethernet or more conveniently - via wireless technologies.

#### 4. IPTV VALUE CHAIN

The IPTV value chain itself comprises two value chains: content distribution and IPTV infrastructure [8]. Content management governs the content life cycle from creation to consumption. The content life cycle is not unique to IPTV, but rather it is standard within the already existing entertainment content distribution flow.

IPTV infrastructure encompasses the specific equipment infrastructure, systems, subsystems, and software required to successfully execute on the content life cycle. The content distribution value chain directly links to the IPTV infrastructure value chain, as it is a required element to make an IPTV implementation work. The IPTV infrastructure value chain includes content acquisition, management, and delivery.

Core network capabilities:

- End-to-end or bearer QoS guaranty.
- Resource management: bandwidth management, lifetime of the established connections, traffic profile and a complete set of network parameters.
- Security, Privacy/identity, authentication, authorization and accounting, necessary mechanisms to guarantee secure network transactions.
- Regulations constraints, DRM (Digital Rights Management).
- Network flexibility: whenever a subscriber requests a program that is already being delivered to other subscriber(s), that request will result in shared distribution of that program (the subscriber joins the appropriate multicast group). This will conserve bandwidth by eliminating the Protocol (IGMP) tries to solve this dilemma. IGMP protocol enables DSLAMs, PON Optical Line Terminals (OLTs), and routers to need for identical instances of a program to traverse the network. The Internet Group Management passively "snoop" subscriber traffic in order to identify and properly assign multicast group membership.
- Billing.
- Content storage and distribution mechanism (e.g. Content segmentation at the edge, coupled with innovative protocols like Broadband Media Distribution Protocol (BMDP, which represents the UTStarcom solution), which enable the IPTV system to adjust storage and distribution heuristically according to trends in subscriber behaviour).



Other requirements are related to the technologies used in the access [9]. There are multiple options for delivering the IPTV to the home:

- ADSL is standardized in ANSI T1.413 and ITU-T Recommendation G.992. Most widespread DSL used for internet access. Provided bite rate from 512 kbit/s to 8 Mit/s downstream (to subscriber) and 640 kbit/s upstream (from subscriber). Distance to 3 km.
- ADSL2/2+ or Fast ADSL is new DSL generation. Provided bite rate to 20 Mbit/s, but only to 2600 m.
- VDSL is specified in ANSI T1E1.4 and ITU-T Recommendation G.993.1. VDSL provided bite rate from 13 Mbit/s (to 1500 m) to 52 Mbit/s (to 300 m).
- VDSL2 is defined in ITU-T Recommendation G.993.2. provided asymmetrical or symmetrical transport, bite rate to 200 Mbit/s on twisted pair.
- PON – passive optical network PON is defined in ITU-T Recommendations G.983, G.992 and G.993. bite rate is very high – for OC-3 (155 Mbit/s), OC-12 (622 Mbit/s), 1,25 Gbit/s, 2,5 Gbit/s až 10 Gbit/s. Have been defined 3 scenarios: ATM PON (APON), Ethernet PON (EPON) a Gigabit PON (GPON).
- APON provided downstream bite rate 155 Mbit/s and 622 Mbits/s and upstream bite rate 155 Mbits/s for data only (video is not included). Standard for video only is called Broadband PON (BPON). Maximum fibre distance between office and end-point is 20 km.
- EPON was established at 2004. Bite rate for multipoint topology is symmetrical 1,25 Gbit/s, end-users are providing with 10 Mbit/s or 100 Mbit/s.
- GPON is provided downstream 1,25 Gbit/s and 2,5 Gbit/s and 155 Mbit/s to 622 Mbit/s or upstream 2,5 Gbit/s.
- Modulation mechanism: DSL – ADSL using two modulation modes: Carrierless Amplitude (CAP) a Discrete Multitone (DMT). According Alliance for Telecommunications Industry Solutions was DMT choose for line coding of VDSL.

## 5. IPTV STANDARDISATION

As we know, the telecommunication network, the Internet network and cable networks are separated networks. Thus users cannot easily use other network services on one terminal now. But more and more users want to enjoy three network services within a business. For example, users watch live-TV on Television by cable network, while they want to get more functions, such as information browsing, VoD, video telephone by other networks. IPTV integrate applications of the three networks. IPTV users enjoy the networks experience, such as watching television and received e-mail at the same time. IPTV in business applications is due to the mutual penetration and crosscutting, but at network level it is separated.

ITU-T FG IPTV (Focus group for IPTV) suggests IPTV service classification according to ability of network and we propose the following services to IPTV FG for reference [7]:

- Audio-Visual services which can be considered as basic services and should be taken into account at first stage
- Other extended services which should be considered in IPTV framework Telecommunication Category
- Information service

Another standardisation organization ATIS (Technical planning an standards development organization of communications and information technologies companies) is leading contributor to ITU via the U.S. State Department Address the Highest IPTV Priority Items for the Industry [6]:

- Overall reference architecture for IPTV.
- Industry accepted standardized metrics and requirements for content security (digital rights management) and the quality of content delivery (Quality of Customer Experience).
- End-to-End QoS functionality to support multiple services (voice, video and data) on the same network.
- Interoperability standards and testing of components in the video delivery network.
- Secure and reliable delivery to subscribers of entertainment video and related services.
- Services are delivered across an access agnostic, packet-switched network that employs the IP protocol to transport the audio, video and control signals.
- In contrast to video over the public Internet, with IPTV deployments, network security and performance are tightly managed to ensure a superior entertainment experience, resulting in a compelling business environment for content providers, advertisers and customers alike.
- Secure and reliable delivery to subscribers of entertainment video and related services.

ATIS defines roadmap and requirements for IPTV architecture as it evolves over time, considering:

- Service Descriptions and Capabilities,
- Models for Content Sourcing,
- Models for billing and settlement arrangements for video services,
- Content security,
- Network Architecture models (Core, Access, Home),
- Application Architecture models (Service Enablers, App servers, Resources, API and Protocols models, Device functions models),
- IP network supporting infrastructure required to support IPTV: e.g., Domain Name Services (DNS), Network Time Protocol (NTP), network access authentication (RADIUS/LDAP),
- Evolving nature of terminal devices (multi-resolution support) Models for advertising insertion.

## 6. CONCLUSION

As some examples of services and applications it is possible to indicate [4]:

- ERNIE project

The provision of residential broadband entertainment and new interactive services (like traditional TV, upcoming Interactive TV services) via IP-based networks (especially over DSL access) focussing on acceptability and quality aspects compared to traditional TV services.

- ePerSpace project

The services identified in ePerSpace project are:

The exchange audiovisual content between user terminals and home equipment. Innovative seamless access by sharing user profiles in a secure manner. Home and Personal Devices building unified personal environments. Rich Media Object Management supplying the tools for content creators to make optimal use of the infrastructure.

- NGN Service Concepts project

Virtual Presence enables the user to be virtually present at another location, or receive information that is presented in a way augmenting the perception of the situation the user is in or the task the user is performing.

Scenarios where the user is virtually present at another location may have a one-way or two-way direction, and the other location may be in the real world or in the virtual world. In one-way scenarios the user may see or get other sense impressions from the other location, and may navigate and "move around" to do inspections, etc. In two-way scenarios the user in addition may cause changes in the other location.

- CONNECT project

The goal is to connect informal with formal learning by exploiting the huge and concentrated knowledge stored in museums, "break" the walls of the science park or the museum and virtually transfer the museum into the classroom and vice versa. Furthermore, the visit to a museum will be more personalized to the exact profile, knowledge level and personal interests of the visitor. The above will be achieved by the usage of innovative technologies, which will allow the real, and the virtual visitor to a museum to wonder around the exhibits enriching his/her learning experience with his/her own personal selections in an information rich environment.

An advanced learning environment will be developed, the CONNECT Virtual Science Thematic Park, in order to act as the main "hub" of all resources available in the CONNECT network of science parks, science museums and research centres. The Virtual Science Thematic Park will serve as distributor of information and organizer of suitable educational activities. It will incorporate all the innovative use of the technology for educational purposes and will also interconnect all the members of the network. It will also organize the procedure of students' both virtual and conventional visits to the science museums and thematic parks. These visits will fulfil (through an informal but yet structured way) main pedagogical aims of the official curriculum.

## 7. ABBREVIATIONS

|        |   |
|--------|---|
| ADL    | Advanced Distributed Learning   |
| API    | Application Program Interfaces  |
| ATIS   | Technical planning an standards development organization of communications and information technologies companies |
| BDN    | Broadband Delivery Network  |
| CBT    | Computer-Based Training   |
| CDN    | Content Delivery Network  |
| DSL    | Digital Subscriber Line   |
| DSLAM  | DSL Access Multiplexor  |
| FG     | Focus Group   |
| ICT    | Information and Communications Technology   |
| IGMP   | Internet Group Management Protocol  |
| IMS    | Instructional Management System   |
| IPTV   | Internet Protocol TeleVision  |
| ISDN   | Integrated Services Digital Network   |
| ITU-T  | International Telecommunications Union - Telecommunications   |
| LMS    | Learning Management Systems   |
| NGN    | Next Generation Network   |
| PON    | Passive Optical Network   |
| PSTN   | Public Switched Telephony Network   |
| QoS    | Quality of Service  |
| SCORM  | Sharable Content Object Reference Model   |
| TCP/IP | Transmission Control Protocol/Internet Protocol   |
| VoD    | Video on Demand   |

## 8. REFERENCES

- [1] <http://www.adlnet.gov/news/articles/406.cfm>
- [2] <http://www.cen-ltso.org/Users/main.aspx>
- [3] Francisci C.: Standardisation on e/Learning Process, ICETA 2005 Conference Proceedings
- [4] ETSI TR 181 003 V1.1.1 (2006-05)
- [5] [www.iptvinformation.net](http://www.iptvinformation.net)
- [6] Estefania, M: ATIS and IPTV Standards, 2006
- [7] ITU-T: FG IPTV-ID-0091, 2006
- [8] Enabling IPTV, IDC, may 2005
- [9] Kováčik, M: IPTV: Television with IP protocol (part 1), Telekomunikace 9, 2006

## THE AUTHORS

**Milan Kováčik**, Head of Standardisation and Metrology Division of VÚS, n. o. in Banská Bystrica. Responsible for testing of telecommunications equipment, metrology and calibration and standardisation process. Publications in Telekomunikace, eFocus, HN, Compliance Engineering.

**Cyril Francisci**, Head of Standardisation Department of VÚS, n. o. in Banská Bystrica. Responsible for activities of Slovak Secretariat of European Telecommunications Standard Institute.



## RECENT TRENDS IN INFORMATIONAL TECHNOLOGIES, HIGH EDUCATION AND SOME PROSPECTS AND RESEARCH TASKS IN eLEARNING.

Alexander Makarenko  
National Technical University of Ukraine (KPI), Institute for Applied System Analysis  
Pobedy Avenue 37, 03056, Kiev, Ukraine  
e-mail: makalex@i.com.ua

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia

September 6-8, 2007

**Abstract:** The present state and possibilities of future scenarios is for education system. For better understanding some general problems are discussed. Globalisation, sustainable development, interaction of cultures and international relations are under the consideration. Some consequences and prospects for Ukraine are shown. Possibilities of modelling, prognosings and decision - making are proposed in the fields of eLearning.

**Keywords:** High Education, Information technologies, Globalisation Problems, eLearning, Ukraine

### 1. INRODUCTION

Recently it is evident that Ukraine as the state is in conflict situation as in international aspects (between Europe and Asia) as in internal conflicts in the situation of scenario of development searching. Remark that the solution of these domestic problems will influence on the level of international stability in united Europe. Information technologies, automation and control are parts of society. But now IT is presumable main source of innovations and transformations in recent (and future) society. So in present report we will discussed such problems on the basis of recent methodologies, models, and concepts. Also the materials and issues of different meetings, conferences, exhibitions, publications had been exploited (SWIIS, EUROSCIENCE, IMACS, IFAC, ATA, EARMA, ISAGA, iNEER, CeBIT 02 - 06, WACRA Europe, EPAC, Ukrainian).

### 2. GENERAL PATTERNS OF INFORMATIONAL TECHNOLOGIES AND HIGH EDUCATION IN THE GLOBALIZATION.

For the discussion on local practical problems and their solutions as usually it is necessary to have in mind a general tendencies, challenges and properties of global systems. So here we in brief remark some current tendencies and possible background for solutions (many details are in current publications).

*Globalisation.* Now all recognise that the world became more and more complicated with many interactions between states, regions, institutions and individuals (mainly because of informational technologies). Globalisation destroys the national borders and leads to creating more or less homogeneous spaces: informational, economical, educational, and so on. This follows to needs in planning and prognosing on cooperation forms in sphere of IT and HE. Globalisation presumably follows to the improving international stability. But globalisation also poses new

problems of world order, the legitimacy of international organisation and on national's sovereignty. In the author's models (Makarenko, 1998, 2001, 2002) future global state is emergent attractor in some network models.

*Sustainable development.* Since Rio - de Janeiro (1992) it recognised the necessity of new way for humankind development - with preserving resources for future generations and with 'ecological' thinking. On the contrary now the society develops at 'economical' way with profit as main goal. In the models (Makarenko, 1998, Klestova, Makarenko, 1999) SD is another possible attractor in the society state. 'Ecological' way should to reduce the power of international conflicts and instability because many of conflicts are the result of the struggle on resources. But the tendencies are that IT and HE will be the main renewal resource in SD. This follows to necessity to apply the main principle if SD to IT and HE. It is interesting that from such point of view at some future stages we may anticipate the conflicts around such resources (especially around education and clever young peoples considered as the resources for industrial countries). This paradoxically may have also negative consequences for stability through stagnation of developing countries.

*Future intelligence manufactory.* Another one important aspect globalisation is future industry organisation. It needs special investigations with qualitative counting the scenarios of development (see (Makarenko, 1999). But presumably the future manufacturing will be flexible, with virtual production chains, transnational and with leading role of knowledge and information transfer. The science should prepare the frames for such new organisation. But the HE should be prepared to disseminate such innovations. Remark that knew organisation may in principle improve international stability by reduction of permanent conflicts between national industries.

*Interaction of different cultures.* One consequences of globalisation are deep penetration of different cultures. Earlier the border between cultures (and civilisations) had been indicated mainly geographically. Now we see mixture of the cultures also created by mass- media, immigrations, economical and other networks. The science, education, society organisation are some of the culture dimensions. In analogies with biology we may suppose that for the stability of the system the 'diversity of cultures' is important. This follows to the problem of preserving 'domestic' cultures. From another side the regions with intensive interrelations of the cultures are 'creative' zones, where innovations originate. One example in policy - Turkey. Thus one of the goals in planning the development of IT and HE should be search the optimal portion unification/national features. High education also should be ready and adapted to the exchanges of cultures of education and industry. The considerations above were general and further concretisation need in application to real problems. In next sections we will discuss problems of European and Ukrainian level.

### 3. SCIENCE, INFORMATIONAL TECHNOLOGIES, TECHNOLOGY TRANSFER.

Now we briefly pose the description of concept of science and technology followed from the works (Makarenko, 1998, 2000, Klestova, Makarenko, 2002) and some consequences. The science is described as the complex subsystem of society.

*Conflicts of West/East interest in science and scientific infrastructures.* The scientific infrastructure as the part of culture has own peculiarities in different countries. Historical difference between Eastern and Western science and education organisation exist. Long time just after USSR broken such infrastructures worked practically independently. Now the process of interaction increase essentially.

At first the education system of every European country (including former USSR states) is stable infrastructures, slowly changeable and historically originated. Every country has own peculiarities. In particular, in former USSR states we still have high level of fundamental education with abstract background. This may be essentially different from the case of western countries where the education now is more connected with industry. In Eastern European countries the high education systems still produce a large number of clever and well-educated young specialists. The domestic industry in our countries is frequently in stagnation and requires a very little number of new specialists. In principle this surplus may help to fill up the needs of western countries, especially in high tech fields (the example is USA). But for such goals preliminary adaptation of young specialists, searching potential working place and involvement of domestic universities are necessary.

*Modelling of information diffusion and science development.* Such model concept for science allows consideration of many new interesting problems (see (Makarenko, 2001).

Now we remark some another. For practical goals it is necessary to know what is the real tendency in innovation spreading and especially characteristic times of the processes. Technological innovation spreading usually was considered by the diffusive models. But the social innovations (including changes in education and science) had been hard objects for modelling. Proposed network models are well adjusted to such problems.

The difficult problem is to find the useful form and volume of young graduates exchange process. This may also constitute the topic of discussion and may be counting from models. We suppose the existing of the optimal number of involved in international workplace graduates. For example Ukraine has a lot of graduates every year and they may presumably to destroy educational system of middle European countries. From another side for recovering such resource some part of graduates should go to the domestic educational infrastructure. Also some scientific and technological environment in domestic countries needs for sustainable development of high education. So this is the subject for optimal control problems. The modelling of educational process requires mentality accounting and considerations internal structures. The simplest way consist in representing image of World in the individual's brain or in model as collection of elements and bonds between elements (Makarenko, 2001). In such World pattern there exist place for representing individual himself with personal beliefs, skills, knowledge, preferences.

*Former USSR countries. Current state of IT and HE.* There are a lot of publications on such issues in Russian and Ukrainian journals on science policy. Also the pattern is reconstruction from personal experience, multiple conversations with colleagues, and compare with experience of western colleagues, participation at conferences, workshops and exhibitions (including CEBIT 2002 - 2006). All this lead the author of report to conclusion that now the infrastructure of education and science in former USSR countries are at bifurcation point when the future way of development is chosen. Numerically HE constitutes large part of social life. There are a great number of young people who wish to receive high education. There exist a large number of universities and institutes with good past international reputation and good (and sometimes world) level of education. The same may be recognised for science and science in the fields of IT. But really the high-technologies industry in former USSR countries reduced essentially. There are a lot of reasons for such phenomena, but may be the main is the quality of governance and the power of old infrastructures in these countries. As the consequence of such reductions of high- tech demands nor young specialists nor investigations doesn't receive domestic applications. As the consequences the IT and HE doesn't receive enough financing. So the young people, researchers should search foreign orders (in better case or to do nonqualified job). Because of little salary in education and science the young doesn't intend to work as education and scientific staff. These follows to the growing old the staff and in visible prospects to destroy all education systems. Sometimes as the solution the education units (departments, faculties, and universities) reduce the educational level (the bright example - preparing a huge of 'managers' in former

technical universities). This is one of the choices in bifurcation points.

Remark that on the author's opinion the main solution in such circumstances is close international cooperation and involvement at 'grass' level in globalisation processes. Such involvement's should also lead to reducing international instabilities and may serve as 'pilot' involvement before presumable economical and military integration. Fortunately now the new possibilities are created.

#### 4. SOME CURRENT TRENDS IN IT AND HE.

*European Research Area.* Now in Europe new infrastructure is created - European Research Area (EUROSCIENCE, 2007). It is planned to make the zone without borders for research projects and partially supported by EC through the payments of member states. As the result the science will become more subnational and paneuropean.

*Bologna Protocol.* Since Sorbonna Declaration (1998) it was signed Bologna Protocol which poses the goal create to 2010 year a European Educational Space with unification of certificates, easy mobility, unification of education principles and many others.

*Black Sear - the Region for cooperation.* Now new prospective region for scientific and education cooperation is implicitly and spontaneously formulated. Namely Black Sea Region, which formally includes Bulgaria Georgia, Romania, Russia, Turkey, Ukraine is prospective for cooperation (including another interested countries from West and East Europe). The great interesting experience of interrelations of cultures and education systems has Turkey (as example sees Dohu and Isik University).

*EUROSCIENCE Open Forums 2004, 2006.* The non-governmental international organization EUROSCIENCE (EUROSCIENCE, 2007) plans to make forum for discussion on science and educational problems at Stockholm, 2004 and Munich, 2006.

#### 5. LARGE IT AND HE SYSTEMS AS FACTOR OF SOCIETY TRANSFORMATION AND AS SOCIO- TECHNICAL OBJECT.

Here we pose some remark on the large-scale infrastructures, which may serve as the tools for society transformation and reducing the international tensions. And in post- industrial society their significance should increase.

*Education system and international relations.* Educational system is one of the main (ore the main) tool for society transformation. For such tasks the system should be ahead the usual practice of society as in concepts as in implementation of ideas. Different scientific organisations especially in technical fields should help in such concept development. It is interesting that the model of educational unit development strongly depends on the scenarios of international relations and on international stability. Some different patterns for development of such unit exist useful for different scenarios (the author supposes to prepare

separate publication on such issue with model considerations).

*Geoinformational Systems (GIS) of governmental level.* From the beginning of their origin computer geoinformational systems (GIS) had been useful tool for representing a large volumes of information. Further this direction in building and application GIS have been developed. But with the enlargement of GIS scales in applications (see the growth of power in MapInfo, ArcInfo and others), it had been evident that GIS is not only the technical tool but became the phenomenon of social importance. It was recognized that applications of GIS in large-scale projects demanded the investigations of social aspects of such applications of GIS and society interinfluence.

But more intriguing is another aspect of GIS in large social systems. That is we can say about increasing influences of GIS on the social processes, decision making, informational and PR technologies, education and management. Partially it is connected with the visualization of digital databases (tables, fails) in visual (cartographic) types.

The next key factor is the development of accesses to the personal computer. Moreover INTERNET and another networks support elaborated informational and communicational infrastructure. The interfaces of GIS have become more and more flexible and adjusted to the information consumer. We may anticipate that future interfaces in 'professional' GIS will be familiar with it in computer games.

And the third factor in GIS developing is that the society will became postindustrial with key role of informational technologies (IT). Thus the investigations of GIS influences will growth (Klestova et al, 2001). The problems of optimal exploiting GIS of component IT also will be developed. Now such investigations (from the author's point of view) are at the initial stage. GIS roles will growth also in connections with distance education's, e-commerce, orientation systems as GPS, satellites communications and so on.

*IT network in High Education.* Themselves informational technologies networks are the transformation factors of high education. IT in such case became the direct social factor and their impact should be investigated and optimised on the strict methodological background including modelling.

*Ethical aspects.* Special attention should be paid to such a currently global aspect of ethics as interaction between science and international terrorism (Klestova, Makarenko, 2002). Al-Qaeda showed an example of use of scientific achievements (aeroplanes, computers, satellite communication) for specific, alien to science (and to the society that had created them) purposes. Hence, an important question: is it acceptable to provide modern technologies to different type civilisations, especially bearing in mind the possibility of the notorious "struggle of civilisations", described by S. Huntington? It can be asserted that the civilisation boundaries are getting less physical and more internally built-in in the society due to globalisation and migration processes. It looks as if an opinion is being formulated in the scientific world in response to this vital question, that the solution should be thought not in terminating all contacts but in making contacts which will

enable reduction of tension along the civilisations boundaries and in the growth of common interest areas. We would also like to place our expectations with the effectiveness of one of Warf's postulates, according to which language takes part in formation of consciousness. A common scientific language (and common goals) could become a relevant means of consciousness change in non-democratic countries. However, no rules can strictly regulate this process of a multiple interaction, and only personal ethical principles of the participants can ensure adequate control and self-restriction.

## 6. UKRAINE CASE STUDY

*Ukraine description.* Ukraine is sufficiently large country in Europe with large human potential (now about 48 millions habitats), large territory (607,7 thousand square kilometer), and with still well developed educational system which had originated in USSR epoch. Currently many new students come to high education system every year. There is about 50 university of highest level in Ukraine. But unfortunately Ukraine has now only 10 billion dollars GNP each year, miserable mean salary (about 60 dollars per month, officially 341 hryvna per month in domestic currency). All this follows to conflicts between high-level education system and industrial requirements, including informational technologies. Also one of the main source of difficulties is command- administrative governance system which is analogs to it in former USSR. Particularly the useful information in education (including international) doesn't deliver to the working in educational process specialists. Also the old governance system suppress the initiatives of basic (bottom level) educational units. Notwithstanding on such difficulties in Ukraine we still have a lot of educational units (departments, faculties, institutes and universities) with high level of education.

### *Negative trends.*

Some negative trends are common for all post- USSR countries. But Ukraine has specific problems. For example, Ukrainian education and scientific system is much less represented abroad. This restricts the possibilities for incorporating in international collaboration. Besides, Ukraine has less mineral resources than Russia and this follows to less level of mean salary. Next all recognise high level of corruption in Ukraine, which prevent from fast development. Also we have obsolete governance system and infrastructures. Nevertheless there exist some prospects for Ukraine in case of choosing some scenarios of development.

*Possible place in Europe* Almost independently on the development of domestic large industry Ukraine may take part in educational and scientific common space in Europe and in the world. Ukraine may prepare the young specialists for Western countries on the stable background. This will immediately improve the situation in Ukraine in the sphere of international relations and more important in transformations of Ukrainian society. Before the best carrier was through the governmental structures. The new role may open new possibilities and help to build civil society at Ukraine. Also Ukrainian researches may help to implement the scientific and technological investigations for developed countries. Of course for such goals it needs to have special infrastructures

for education and technology transfers and scientific management (see EWGTT, 2007).

*Some propositions for cooperation in IT and HE.* So such possible role of Ukraine forces the needs of further contacts and incorporating in international community. Many possibilities exist now from high governmental levels to the bottom level of individuals. In our fields of activities first of all it is involvement in different societies and non-formal activities. The second possibility is participation in different research and educational projects. Many possible issues and problems are represented implicitly in this report, especially at the next section. And third is participating in exchange of students, lecturers, collaboration on strict background with universities and institutes.

## 7. SUPPLEMENTARY TOOLS FOR SUPPORTING SOLUTIONS

*Mathematical modelling role.* The role of mathematical modelling will increase, especially in concerned problems. The main source of modelling will be necessity in prognosing for such complex objects as large scales social systems, when the only personal experience of leaders can led for wrong solutions with catastrophical consequences. This follows to development of models for social processes with accounting the behaviour and decision making in large collection of interacting individuals.

*Decision support systems.* The best examples of decision support systems now incorporate many different ideas from different fields - artificial intelligence, informatics, expert experience and many others. We suppose that in future DSS will incorporate more and more tools from classical automation including optimisation methods and also human factor containing modelling. Some of such models are described in (Makarenko, 2000, 2002; Levkov, Makarenko, 1998, Makarenko at all 2004).

*GIS.* The role of GIS as tool for saving, visualisation and preparing information will increase. Also GIS became society- transformation factor.

*Technological foreseeing, forecasting, backcasting.* Now developed countries try to make some investigations in such directions for the sake of future planning, anticipation and adaptation. Now Ukraine also makes some effort in this direction including scientific programs on such issues.

*Social informatics.* Till now the specialists on automations and control had deal mainly with mechanical or complex non-vital systems such as airplanes, space shuttles, power plants, factories, railway networks and so on. But recently all recognized that human factor and especially social psychology of large human systems would be one of the key problems. The global computerization and informatization gradually accelerate these processes of humanitarization. So in current conditions it is evident the necessity of creating and developing the tools for preparing the decision on the firm methodological background.

New educational specialty 'Social informatics' considers the problems of receiving, transformation, investigation, and modeling and explores the informational flows in large social systems and their models. Social informatics is complex interdisciplinary approach and consolidates the deep knowledge from mathematics and physics, computer sciences, management and humanity sciences (Makarenko, 2001).

*Gaming and Simulation.* Gaming and simulation approach is one of the auxiliary tools for improving human organisations for large complex systems.

*Nongovernmental Organisations.* It should stressed possible role nongovernmental and nonformal organisations in preparing concepts of transformations and in dissemination the ideas and innovations through their networks. It is important that NGO as usually take a large part of activity at 'grass' level with individuals, target groups, elementary units. Important problem is optimisation of society - NGO interaction.

*Mass- media.* All recognise now the important role of mass-media. But here we would like to remember some aspects. Mass- media are very useful for dissemination information on educational and scientific issues. But it requires special investigations on the form of prepared information. Also mass- media influence is object of modelling.

## 8. POSSIBLE TOOLS FOR ELEARNING INVESTIGATIONS

Because of large number of different problems closely connected to eLearning development it is necessary to make some collection and revision of existing tools for investigations.

*Mathematical modeling.* Mathematical modeling can help to investigate the phenomena by investigations of their models. Moreover, modeling can help in foresee and investigation of emerging new phenomena.

*Multi – agent approach.* We especially stress one new class of models (may be just new methodology for modeling and reformulating humanitarian sciences) – multi-agent models. In multi-agent models the social systems are considered as the collection of agents which can to realize the environment, to make decisions and to interact with other agents by communicational channels.

*Case studies* as the investigation tool consist in detailed investigation of the system by experts with questionnaires, time study of operations, visual control.

*Gaming and simulation.* In this approach special games are proposed for investigations of social systems with special design of roles and environment in the game.

*Optimization* as the discipline can help in searching solutions of the strict formalization of problem. Also frequently the problems of decision-making also are considered in optimization content.

*Humanitarian sciences* frequently also have specific methodologies which can help to understand as individual behavior (psychology) as collective behavior (social psychology).

*Social informatics.* Very useful for eLearning investigations is the new educational discipline – social informatics which considers models of society and especially the problems of collecting, monitoring, visualization, modeling of informational flows in the society.

*Geoinformational systems (GIS)* are special computer software and platforms which prepare special data bases which relates to the geographical maps of territories. Remark that all future e-services will be bases on the GIS.

*Game theory* investigates the models of human behavior and exploits the methodology of game theory for social systems.

## 9. SUMMARY

Thus in proposed report we have tried to prepare a general outlook on the problems of IT, HE. We had considered as some general issues such as globalisation, international cooperation as particular problems, which concerned Ukraine. Also some research problems had been described in text of paper. During the talk it is it is supposed also to present as a lot of examples and illustrations as the implementations of software which may be useful for eLearning development. Moreover many working algorithms and GIS useful for implementation in eLearning will be proposed. The topics of paper may serve as background for further cooperation.

## 10. REFERENCES

- [1] EUROSCIENCE, (2007) ( [www.euroscience.org](http://www.euroscience.org) ).
- [2] EWGTT, (2007) Euroscience Working Group on Technology Transfer. Ukrainian Branch ([www.kiev.technology-transfer.net](http://www.kiev.technology-transfer.net) ).
- [3] Klestova, Z., Makarenko , A. (2002) Conflicts of Interest between Eastern and Western Scientific Systems. *Ethics Science and Engineering Ethics*, Vol.8, No.3, pp. 387- 392.
- [4] Klestova Z., Makarenko A., Samorodov E. (2001) Geoinformational systems as technical tools for monitoring and decision- making in emergent situations and health care. *NATO ASI Series*. Kluwer AP, (Submitted).
- [5] Levkov S., Makarenko A. (1998) Geopolitical relations in post USSR Europe as a subject of mathematical modeling and control. *Preprints of SWIS'98*, Sinaia, Romania, May, pp. 89-94.
- [6] Makarenko A. (1998) New Neuronet Models of Global Socio- Economical Processes. In *"Gaming /Simulation for Policy Development and Organisational Change"* (J.Geurts, C.Joldersma, E.Roelofs eds.), Tilburg Univ. Press, pp.133-138.
- [7] Makarenko, A. (1999) Anticipatory properties of participating of production systems and approach to their modelling. *Proc. ASI'99 Conf: Life cycle Approaches to Production Systems. Management, Control and Supervision*, Leuven, Belgium, 6 pp.
- [9] Makarenko, A. (2001) Education and technology transfer in informational fields as the part of globalisation.

In "*Lecture Notes in Informatics. Vol. P-2*". (H.Mayr, ), GI-Edition, Bonn, Germany.

[10] Makarenko A. (2001) New technologies impacts on development of society. Environment, roles and actors. *Preprints of SWIIS'01*, Vienna, 2001.

[11] Makarenko, A. (2002) Anticipating in modelling of large social systems - neuronets with internal structure and multivaluedness. *Int.J.Comput.Anticipation Systems*, Vol.13, 16 p.

[12] Makarenko , A., Klestova, Z. (1999) A new class of global models of associative memory type as a tool for considering global environmental change. In "*Environmental. Change, Adaptation and Security*" (S.C.Lonergan, ed.), Kluwer, Pp.223-228

[13] Makarenko A. at all, (2004) Computer realization of approaches in prognosis, decision-making and pattern recognition. Proc. Conf. EUNITE'04, Aachen, Germany, 2004, 6 p.





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## MOTIVATING PRIMARY SCHOOLCHILDREN USING LATEST MULTIMEDIA TECHNOLOGIES IN EDUCATION

Miroslav Michalko<sup>1,2)</sup>, František Jakab<sup>1,2)</sup>, Miroslav Biňas<sup>1)</sup>

<sup>1)</sup> Computer Networks Laboratory, Department of Computer and Informatics, Faculty of Electrical Engineering and Informatics, Technical University of Košice, Letná 9, 042 00 Košice,

tel. +421 55 602 2500, <http://www.cnl.tuke.sk> miroslav.michalko@tuke.sk, miroslav.binas@tuke.sk

<sup>2)</sup> elfa s.r.o., Letná 9, 042 00 Košice, tel. +421 55 625 3839, <http://www.elfa.sk>, jakab@elfa.sk

**Abstract.** One of the most difficult task for every teacher is to motivate kids to study. It is very hard for children to remain focused, attentive and motivated to various topics during one school day especially when they have to passively absorb huge amount of educational content in traditional way. The article deals with implementation of creative educational gaming content into school curricula using latest multimedia devices. Building on existing successes European project eMapps.com will develop and validate adaptable interactive tools which enable games to be played on an innovative mobile platform, running on multiple devices and networks, which teachers can customise.

**Keywords:** interactive learning, classroom training, teaching, game, multimedia

### 1. INTRODUCTION

Motivation is key for teacher to be successful in providing knowledge for students. There are hundreds of materials available presenting best practises for teacher and parents. According to Wikipedia in psychology, motivation refers to the initiation, direction, intensity and persistence of behaviour. Motivation is a temporal and dynamic state that should not be confused with personality or emotion. Motivation is having the desire and willingness to do something. A motivated person can be reaching for a long-term goal such as becoming a professional writer or a more short-term goal like learning how to spell a particular word. Personality invariably refers to more or less permanent characteristics of an individual's state of being. Motivation in education can have several effects on how students learn and their behaviour towards subject matter. It can direct behaviour toward particular goals, lead to increased effort and energy, increase initiation of, and persistence in, activities, enhance cognitive processing, determine what consequences are reinforcing, lead to improved performance.

Because students are not always internally motivated, they sometimes need situated motivation, which is found in environmental conditions that the teacher creates. [1] This paper will present some of the aspect considered and created with European project eMapps.com. eMapps.com (Motivating Active Participation of Primary Schoolchildren in Digital Online Technologies for Creative Opportunities through Multimedia) is a project founded under the European Commission's IST 6th Framework Programme (FP6). Target group are school children in age 9-12. The main target countries will be the eight New Member States (NMS) of 'mainland' Europe: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia, although the project's outputs will be extended to other NMS and candidate countries in the later part of the project. It is also expected that results obtained in the NMS

environment will ultimately have considerable impact in the EU-15 countries too.

### 2. ALTERNATE REALITY GAMES

The problem of narrative, of integrating a linear storyline within an interactive game is widely acknowledged as one of the most intractable problems in the field of game design. Although many techniques exist and will attract developers and gamers for a long time to come, none of them solve the hardest problem; creating a truly dynamic narrative, of creating virtual worlds or Mixed Realities (outdoor and indoor) where although the themes and imagery in the world remain consistent, the actions of different players lead to completely different and credible outcomes.

ARGs are typified by involving the players with the story and its characters, by encouraging them to explore the story, solve plot based challenges, and interact with game characters. ARGs can be delivered via websites, email, telephones, or any other means of communication which is readily available to the players.

The most common medium used to date in ARGs is the Internet. ARGs generally feature a large game-reality consisting of multiple websites, all of which are presented as being real (non-fiction). The games are so ubiquitous that sometimes it is difficult for the players to tell if a website is real or part of the game. The use of pervasive media outlets that extend into the players' everyday life creates a situation where the game's alternate reality and the real world collide. As the in-game elements and real world overlap, the lines are blurred between the game world and reality. Some games have extended into players' everyday lives by pushing information towards players at certain times (e.g. SMS messages), whereas others have required players to initiate all communication to advance the plot.

By crossing over the game world into the real world, ARGs create a self-sustaining alternate reality that never admits to

being a game, but a universe coexisting with and crossing into the real world.



Fig. 1. Alternative Reality Game – Project booklet

ARGs inherently lead to and encourage player collaboration. The Internet is a highly pervasive medium used for delivering ARGs, and thus creates a perfect environment for the rapid delivery and dissemination of information. If an ARG uses an advertisement in a magazine to deliver a message, then only one player needs to acquire that magazine and scan the advertisement in order to publish it online for all players to access (Fig. 1.). The players can then use online resources such as forums or chat rooms to discuss the message and how it relates to the story. Thus the player base for an ARG becomes a unified collective, with the majority of player base composed of lurkers following the discussion amongst the more vocal player base, but jumping in at various stages in order to make a contribution which the active players might have missed or did not have access to. This blend of passive and active players sharing experiences and knowledge is unique to ARGs, and is an integral part of playing the game [3].

### 3. PROJECT OBJECTIVES

To exploit the engagement of young people with technology positively there is a need to make e-Learning content more engaging. Schools and education authorities in the New Member States (NMS) and throughout Europe need to find new ways to link with research and creative practice and to develop and adopt new educational methodologies enabling efficient use of ICT in delivering curricula (Fig. 2.).

The main objectives of eMapps.com are:

- to build communities of creative, networking children in the NMS, generating their own cultural content and communicating with peer groups in other countries;
- to contribute to the growth of a community of teachers who are aware of the potential for change through 'schools without walls' and who exchange knowledge

and experience through communication with counterparts in other NMS countries;

- to develop adaptable interactive tools (primarily games played on a mobile platform) with which to deliver learning objectives and which help to integrate the use of ICT in the delivery of the school curriculum;
- to establish processes and facilities for teachers and children to access relevant digital content available through a variety of sources while playing the eMapps.com games - and to make the multilingual and multicultural local content created during the games to be shared and repurposed for use in the wider eLearning context of schools and children in NMS;
- to create a child's living map of Europe, based on geography, history and heritage, accessible through mobile devices, which can be continuously expanded as an important and rich content resource for schools in NMS and elsewhere;
- to design and implement effective training and multiplier mechanisms for future exploitation of the eMapps.com outcomes by schools and teachers;
- to influence education policy makers at national and regional levels in NMS.

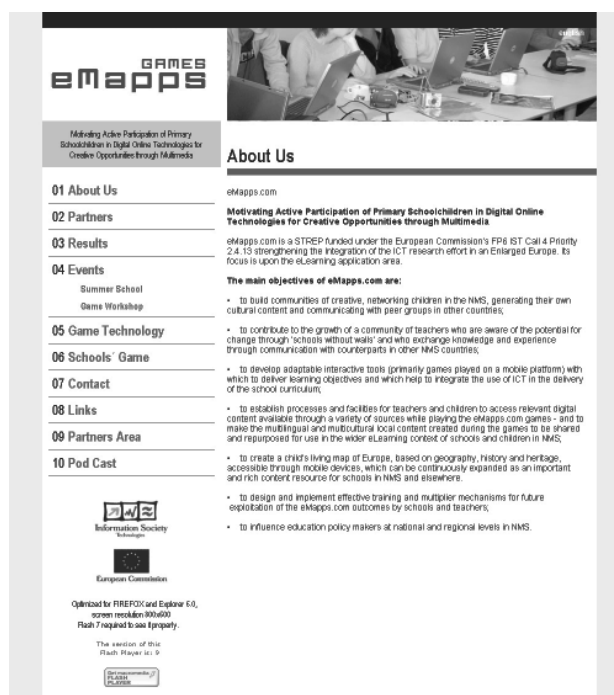


Fig. 2. Official project website – title page

eMapps.com will deliver a new game platform that can run on multiple devices, over multiple networks and which teachers can customise and apply to the school curriculum in a versatile manner. This will provide an exciting and challenging games environment which will encourage pupils and their teachers to explore extensions of the curriculum, by providing memorable and vivid content in

text, sound and images formats, compatible with a map-based environment. Easy content-building using Flash technologies will be complemented by a reliable, multilingual keyword-based environment which will increasingly provide rich content through more traditional search environments.

#### 4. HOW THE EMAPPS.COM GAMES WORK

eMapps games operate in a similar way to other computer games. The game takes place in a territory pre-determined by the game designers, probably teachers. This could be in a local town, park or other geographical location. The game can be played in 'real' territory where the players actually go out into the local environment or virtually, where all actions take place within a computer simulation). In either case, it is played using the eMapps.com platform, provided to each participating school (Fig. 3.).

The game is played by teams of children. Each team has a 'tram manager' working at a PC at 'control base', with players out in the field using handheld devices. There are several teams in any one game. Each team has their own 'desktop' - their view of the game platform - which is available on the team manager's PC.

The teacher adopts the role of 'game controller', remaining at the home-base along with team managers. The game controller has access to each team's desktop on the control monitor.

The game controller, the team managers, and the players in the field can all add objects to the desktop. The game controller is most likely to add clues and information (for use by the teams), the team manager may add solutions to clues (as evidence to the controller), and the players in the field will upload evidence of having achieved something.

Team managers use their team players in the field as 'avatars', guiding them according to information obtained or clues received. Information of this kind can be obtained by the team manager either directly to the desktop from the game controller, through the process of solving the clues or from an Internet search etc. Sometimes that information is passed by the game controller to the team manager in response to the avatars having achieved something in the field and having provided evidence of that achievement by uploading something (a video or audio clip, a photograph) to the team desktop from their hand-held device.

Global Positioning Systems are used by team managers passing coordinates to the avatars and also by the avatars to provide location information for their uploaded video/audio/photo content so that the site can be located with a 'pin' on the vector map on the desktop.

Sometimes information or clues are given to the teams by 'characters' they meet in the field. The 'characters' the avatars 'meet' could be a pre-recorded video (or audio or text or photo) of the character, made available to the team manager on the desktop and transmitted by the manager to the avatars. The 'characters' are not necessarily real people and a physical meeting may not take place: this means that the message or clue given by that 'character' is consistent for all teams [4].



Fig. 3. Children playing eMapps.com game – Summer School, Torun, Poland

#### 5. EXPECTED RESULTS

**Pedagogical framework** - Significant and systemic change in education may only be able to take place when society can achieve a much better integration of learning that takes place both in and out of school. eMapps.com draws upon the successful previous experience in stimulating children to create and post produce their own digital educational content based on local heritage, learning in the process how to work with different types of geographic map, how to locate objects in the territory - and in encouraging teachers to use this material in lessons.

**Engaging teachers** - The project's approach will harness the potential motivational gains from effective use of technology to the actual needs of the curriculum and timetable. To support this, eMapps.com will develop a toolkit for teachers which will enable them to use its products and to embed them in the curriculum.

- Teacher will have opportunity to implement new elements into teaching process in order to motivate students. Teachers will be able to follow the impact of eMapps.com on their students and to compare their achievements with other students who are not involved.
- Easy modifiable game platform for teacher where any game can take place. Thanks to used technology game will be platform independent;
- A Children's Living Map of Europe which locates the content and games produced during eMapps.com in a format to inspire others and in which any school or locality can participate.

Key aspects of innovation in eMapps.com include:

- using game technologies on mobile platforms and stimulating new ways of learning and creation of local educational content;
- utilising location-based technologies ('GIS') in school curricula;

- development of a new multimedia educational methodology enabling efficient implementation of ICT in national curricula in NMS;
- Development of validated reports and recommendations for educational policy makers in NMS, leading towards harmonisation of a long-term European educational strategy and implementation of cutting edge technologies in national curricula.

## 6. THE EMAPPS.COM SCHOOL SURVEY

As part of eMAPPS.com project survey data from a sample of 233 children in NMS schools were collected in order to analyse current state of use of games technology. Survey took place between October and December 2005 in eight participating New Member States. Questionnaires had 8 simple questions targeting game hardware and software. Target audience was in age 9-12 years.

### *Q1. Do you own any of these game platforms?*

There is relative uniformity among the schools, across the region, 2.3 platforms per respondent is average for boys, 2.0 for girls. PCs (boys 83%; girls 5%) and mobile phones (boys 60%; girls 77%) are by far the most common platforms among both boys and the girls. Ownership of mobile phones is slightly higher amongst girls. Amongst the 'proprietary' platforms, Sony Playstation (1 and 2) and Game Boy are owned by a significant proportion of respondents, although this amounts to under 20% of respondents in total. Ownership of Xbox or PSP and other platforms is as yet at a very low level.

### *Q2. Do you play games on any of the platforms listed in Q1?*

About 90% of children responding use one or more of the platforms listed for playing games. Just over 60% of the children use PCs for playing games. Many have access to and use PCs to play games, even if they do not actually own them. Mobile phones are used for gaming by 43-44% of the children who own them. Levels of actual use of proprietary games platforms which the children own are high for Sony Playstation but lower for Game Boy.

### *Q3. What kind of game do you play? Please write down the game's name.*

155 identifiable game titles were cited by boys and 148 by girls. The grouping of games by children in the selected schools appears to some extent to be function of peer emulation and/or access to specific titles at school or among schoolmates. The Polish children cited the widest variety of games. The popularity and use of individual game title is more widely dispersed among girls. An average of 2.8 games was cited by each of the boys. This figure was 2.0 for the girls. The suggestion may be that there are fewer attractive games available for girls. There is in general a wide dispersal of game titles cited: a majority of them is cited by only one child. Game titles for PCs and mobile phones are strongly represented. Nevertheless a clear top echelon of the most popular games emerged for the boys and the girls respectively. Action, military strategy and sports games are dominant among those played by the boys. Whilst there are some similarities in the list of top games

cited by the girls, mobile phone games are more popular and sports games in particular are less popular. The Sims is by some distance the most popular game title.

### *Q4. How often and for how long do you play games?*

The boys are significantly heavier and more regular players of games than the girls. 53% of boys play games every day as opposed to 27% of girls. Differences in access may account for some of the variation between schools in different countries. Only in Lithuania do a majority of the girls play every day. Only in Czech Republic do a minority of the boys play every day.

### *Q5. Do you have an Internet connection at home?*

54% of the boys and 57% of the girls have an Internet connection at home. There is a wide variety of types of Internet connections available at the children's homes. 86% of the boys and 75% of the girls who have a connection have a broadband connection. The proportion of children with an Internet connection at home appears to be significantly lower for the Slovakian schools than in the other countries.

### *Q6. Do you play games at school as part of the learning process?*

More than half of the children regard themselves as playing games at school as part of the learning process. A higher proportion of girls than boys regard themselves as playing games at school as part of the learning process. There is significant variation between countries, possibly depending upon practice and facilities in the selected schools [2].



Fig. 4. Children playing Slovak eMapps.com game – Primary school Cyrila a Metoda, Kosice, Slovakia

## 7. THE EMAPPS.COM PLATFORM

The platform will utilise latest Web2.0 developments such as Weblogs, Podcasts, Videocasts and will deliver them to the digital devices. Platform will specially focus on mobile devices such as mobile phones, PDA and Tablet PC over GPRS or 3G technologies (if supported by device and in coverage area of a local provider).

Platform use PHP, Java and Flash in order to provide requested functionality. School preset scenario allows

editing of audio, video, text and picture resources. Special 'pins' are available to locate places on the pre-set scenario. This key element of the platform allows creation of scenario where Alternate Reality Game can take place. Any mobile device that supports a browser can be used for uploading the content to any folder (Fig. 4.). The map also supports external links.

Game environment is platform independent and all information is saved in XML format. This will allow easy modification of scenario elements and language. Communication works on client-server basis.

## 8. CONCLUSIONS

The narrative of the games developed with emapps.com project combines two main approaches. First is classical game scenario with linear story, second contains elements of Alternate Reality Game blurring the virtual and the real. Players – kids – are more motivated to play unusual scenarios and knowledge gained during game play makes no "pain" to them. While games may primarily be centered around online resources, often events that happen inside the game reality will "reach out" into the players' lives in order to bring them together. Emapps.com games will help to acquire new knowledge and complex skills from game play. Main task for teachers creating game content is to target desired learning outcome by close cooperation with project's R&D. But it is important to understand that technology within the game is just the tool, human approach is the key, happy and clever children are the goal.

## 5. REFERENCES

- [1] Wikipedia, the free encyclopedia: Motivation [online], Máj 2007, Available on Internet: <http://en.wikipedia.org/wiki/Motivation>
- [2] Davies R., Krizova R., Weiss D.: eMapps.com: Games and Mobile Technology in Learning, ECTEL Conference, 2006
- [3] Wikipedia, the free encyclopedia: Alternate Reality Game [online], February 2007, Available on Internet: [http://en.wikipedia.org/wiki/Alternate\\_reality\\_game](http://en.wikipedia.org/wiki/Alternate_reality_game)
- [4] Official emapps.com project website [online], May 2007, Available on Internet: <http://www.emapps.com/>

- [5] Jakab F., Michalko M., Sidimak V.: Motivating Active Participation of Primary Schoolchildren in Digital Online Technologies for Creative Opportunities through Multimedia, 7th Int. Conf. Virtual University VU'06, Bratislava, December 14-15, Bratislava, e-Academia, n.o., 2006, pp. 155-159, ISBN: 80-227-2542-0

## THE AUTHORS



**Miroslav Michalko** is internal PhD student at Technical University of Kosice. his research activities are related to streaming, mobile multimedia technology and web services. He is responsible for Videoserver platform development as project manager and member of video@lab team at Computer Networks Laboratory. You can contact him at [miroslav.michalko@tuke.sk](mailto:miroslav.michalko@tuke.sk)



**František Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modelling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)). You can contact him at [jakab@elfa.sk](mailto:jakab@elfa.sk)



**Miroslav Biñas** is internal PhD student at Technical University of Kosice. His research activities are related distributed systems, videoconferencing technologies, ambient intelligence and to streaming technologies. He is responsible for newly developed archive system for VRVS and EVO videoconferencing systems and he is member of Computer Networks Laboratory. You can contact him at [miroslav.binas@tuke.sk](mailto:miroslav.binas@tuke.sk)





## EXPERIENCE WITH TEACHING ACCOUNTING VIA E-LEARNING FORM AT THE FACULTY OF MANAGEMENT AND ECONOMICS, TOMAS BATA UNIVERSITY IN ZLÍN

Milana Otrusínová, Marie Paseková  
Tomas Bata University in Zlín  
telephone 00420 576 032 404, fax number 00420 576 032 403  
e-mail otrusinova@fame.utb.cz, pasekova@fame.utb.cz

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The aim of this subscription is to sum up experience with teaching accounting subjects via e-learning on the Faculty of Management and Economics, Tomas Bata University in Zlín. The subscription aspires after the analysis of several aspects, which are arising from e-learning implementation as an educational support. The process of successful e-learning implementation is subjected to many factors, some of which were shown during realization of pilot project RIUS.

**Keywords:** distance education, eLearning, virtual university, benefits, problems

### 1. INTRODUCTION

The explosive development of ICT in the late of the last century had built good conditions for the inception of information society. The ability of quick getting relevant information and evaluation of their merit has become an important part of education.

Besides using ITC in economical, political and social field, ITC are being pushed ahead the education as well. One of the most frequented words belonging to this category is e-learning. The term e-learning is usually used to refer to computer-enhanced learning and is naturally suited to distance learning.

Under the notion of e-learning is understood the way of passing know-how, which uses multimedia and internet networks. E-learning widens the access to information and educational resources.

### 2. POSSIBILITIES OF DISTANCE EDUCATION

E-learning is effective, because enables education of all age-classes and it's an ideal tool for successful fulfilling the idea of long-life learning in both system of undergraduate education and further education of adults, especially vocational education. E-learning finds its exercise within learning process inside the companies, which is used for quick and economic enforcement of the new products or innovative and additional employees' education.

For a quite number of people it is the only way, how to keep or improve qualification due to lack of time for attending present courses.

Distance education is a modern method of teaching, which uses various technical and didactical pillars (e.g. CD-ROMs, e-conferences, on-line access) and direct or mediate pedagogical tutor. One of the important advantages of distance education is the possibility of free choice of time, place and pace, when and how the student will be studying.

E-learning form of study is useable especially for adults, who have limits due to workload or family, but on the other hand they are supposed to have high motivation level for education (e.g. better career, getting new professional skills etc.), life and professional experience and ability of self-studying, that they have built while attending secondary school or university.

Nowadays is increasing the value of education, demand for university education is rising. Consequently are growing requests for new education forms that are invoked by changes in position of schools within the system, by the change of graduates' profile, by the change of teachers' and students' position and by the progress in ITC. On the other hand there is a need of financial source connected with restriction of public expenditures of education. Another indispensable feature of e-learning education is cut in costs in education. It is being, together with its other basic characteristics such as topicality, flexibility and availability, predetermined for using in university education. This way of learning enables more students to participate (considering limited capacity for present forms of education) and therewithal enables education from whatever place at any time. Motto is suggested itself: e-learning – the effective education with low costs for everybody, anywhere, anytime.

### 3. EXPERIENCE WITH DISTANCE EDUCATION AT TOMAS BATA UNIVERSITY IN ZLÍN

At TBU in Zlín were taken the first steps for implementation such education form. Within the scope of pile project RIUS were created e-learning courses, which are offered within interuniversity education to students from Westbohemian University in Plzeň and University in Hradec Králové. Concerning accounting are being offered courses Basics of Accounting, Financial Accounting, and

International Accounting Standards. These courses are available also for combined study at TBU.

For success of e-learning among students it is necessary to understand the importance of this education form. It might help students in self-studying; in the ability of absorbing new knowledge which will they need for professional career. E-learning course should be composed of as many parts below as possible:

- Vivid study guides
- Illustrative examples with solution process for better understanding
- Training examples with results
- Examples with no results
- Proof-questions
- Means of motivation and self-evaluating tests
- Possibility of further communication among students and also with tutor

Characteristic of high quality study guide suitable for distant form:

- Aim formulation for every education unit
- Text structure suitable for graphic lay-out
- Text clearness by schemes, graphs and pictures
- Individual closed parts can't be too wide
- Setting key-words
- Short paragraphs, brief, clear, pregnant formulation
- Summing up after each chapter, i. e. main ideas and context
- Adding solved examples, applications, problem tasks, questions and self-evaluating exercises
- Stated references to specialized literature in the end of each chapter

An important part of electronic study materials is providing a feedback. All these elements should have been a part of texts in traditional education. Within this frame they help students go over the study troubles. The ambition is to create complex file of study materials so that optimal condition for students were guaranteed.

Students in general welcome the possibility of getting utmost materials for support that is why the majority of combined students were delighted to hear the possibility of adding e-learning to common lectures and consultations. Could be said it is adding distant elements into combined form of study. Students use study texts and other examples as well as consultations with tutor through virtual university called EDEN. This is really time-consuming especially when there are lots of students, so e-learning is demanding on both students and teachers.

Every pedagogue, who teaches throughout e-course, becomes a tutor of this course. This position is different from classical form of tuition. Tutor should have experience with present classwork, provides study guide, advice, consultations. He or she communicates with students electronically or via videoconferences. Tutor gives homework or tasks, controls their solving, motivates students for further education and provides feedback. Tuition is time-consuming because it is necessary to have individual communication with each student.

Demands on distant student are also different from the present student or combined form. Student isn't participating on tuitions or seminars, so the core of his work is self-studying and self-preparation. Requirements are imposed on student in the form of tasks and exercises. Student has to be motivated enough to finish the course and since the beginning he or she has to be sure he is able to manage it successfully. From the range of provided courses are the most popular Basics of Accounting and International Accounting Standards. About Financial Accounting in the frame of pile revision is hardly any interest.

#### Strengths and weaknesses of e-learning:

##### *Strengths*

- Time management of tuition according to the student
- Time saving in student's point of view
- Possibility of education for those who can't be able to study another form
- Self activity of the student
- Development in self-studying
- Opportunity to offer the education to students from different schools
- Usable within lifelong learning

##### *Weaknesses*

- Quality demanding materials and preparation
- Time-consuming for the tutor in case of a big group of students [specifically for accounting subject is maximum 15 students]
- Limited personal contact with students

## **4. CONCLUSIONS**

Rules of effective learning need no underestimation of important didactical aspects in distant forms. Student should critically judge his or her potential and consider duties and stress brought by studying. As same as traditional education, involves distant form high grade of self-control and concentration. It is possible to happen that people are under time pressure and they are occupied with other problems so that they are not able to finish exercises and homework. Unsuccessfulness of distant form students is very high, only 50% can finish it. Every applicant has to be aware of the extent, which is the same for both present and distant. It is necessary to study continuously not once in a year.

As every new thing, method or technique, e-learning has requirements on all sides involved. Implementation of distant form is a long term process, which is affecting students, teachers, management and ICT specialist.

## **5. REFERENCES**

- [1] Conference Proceedings eLearning in University Education 2004, Zlin 2004. 172 p. IABN 80-7318-190-8
- [2] VEJVODOVÁ, J. *The Roles of a Tutor in an Online Course*. In Information and Communication Technology in Education. Editor Erika Mechlová. 1. vyd. Ostrava: Ostravská univerzita, 2003. s. 305 -310. ISBN 80-7042-888-0



## THE AUTHORS

At the end of your paper write for each author:



**Ing. Milana Otrusínová**, assistant Professor at the Department of Finance and Accounting, Faculty of Management and Economics in Zlin, she specializes in accounting, public administration and controlling in her pedagogic and research

activity. These problems are a subject of her Ph.D. thesis. She has an experience with a distance education at university.



**Ing. Marie Paseková, Ph.D.**, assistant Professor at the Department of Finance and Accounting, Faculty of Management and Economics in Zlin, she has experience in research projects in the area of pedagogy – preparation of courses on accounting and

on International Financial Reporting Standards – and in research projects in the area of financial reporting and management of small and medium enterprises. This research is summarized in her Ph.D. thesis and her contributions have been published domestically and internationally.

## ACKNOWLEDGEMENT

*Tento příspěvek byl zpracován jako jeden z výstupů projektu ESF „RIUS – Rozběh interuniverzitního studia v síti vybraných univerzit v ČR“ registrační číslo CZ.04.1.03./3.2.15.1./0067*





## GET TO KNOW YOUR MONEY – E-LEARNING EDUCATIONAL PROGRAM

Táňa Piovarčiová, Erika Galanská  
Nadácia pre deti Slovenska, Heydukova 3, 811 08 Bratislava  
Tel.No: +421 2 52636461, fax: +421 2 52636471, e-mail: erika@nds.sk, http: www.nds.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** Within project Get to know your money, the first innovative, e-learning educational program focusing on personal finances management has been established in Slovakia, with secondary education students as its target group. It brings meaningful and methodologically elaborated teaching for life as well as new, attractive, student-appealing and motivating form of education which leads to understanding basic financial products commonly encountered in life and significantly affecting family situation. In dynamically changing economy conditions, program mediates new knowledge from the personal finances area, which, even though needed for life, is not provided by traditional education to most secondary education students. Information about personal finances then get through students also to their parents, friends and relatives. The project emphasizes growing personal responsibility for the finance-related decisions. *Current situation in Slovakia suggests that if the financial awareness does not improve, we may face serious economical and social problems in near future.*

**Keywords:** education, e- learning, evaluation, interactive learning, knowledge, management, methodology, school, skills, student, teacher, teaching, training, World Wide Web

### 1. INTRODUCTION

The Get To Know Your Money project came to existence in 2001 based on the initiative of the Children of Slovakia Foundation (CSF). The impulse for creating this project was the need to focus the attention to insufficient financial education in Slovakia, especially in the personal finances management area. Simultaneously, the project develops life skills of young people related to decision-making, versatility, independence, responsibility, and volunteerism.

#### Stages and areas of the project implementation

The project took place in 4 areas:

- *Curriculum creation* for the e-learning teaching of the project – in form of the „Personal Finances Management“ subject at secondary schools (teaching texts, methodology guidebook and website for teaching), program testing at selected schools (so called pilot project, 2000-2001)
- *Trainings for teachers and consultants*
- *Project implementation at schools* (2002-2007) – in Slovak-wide scope, at all types of schools.
- *Project development* (2003 - 2007)

### 2. ABOUT PROGRAM

*„Imagine a class where children learn through play. A class full of enthusiastic children who just cannot wait for the next lesson, who long for higher level knowledge and who constantly want to know more and more.“*

The project develops financial literacy of young people in

Slovakia by means of educational e-learning program Get to Know Your Money. Program participants gain knowledge and skills in the personal finances area which is necessary for successful personal, professional and community life in modern and rapidly changing society.

#### Long-term goals of the program

- To increase financial literacy in Slovakia.
- To introduce financial education into key competences – to promote the idea of program becoming integral part of official curriculum for secondary schools in Slovakia, for various schools in various forms.
- To present program also to other teachers, students, parents, public figures and peers not directly participating in educational part of the program by means of supporting financial education in community.

#### What does the program provide

- The project reacts to changing life conditions of young people and their needs.
- It helps to mediate practical meaning of the studied issue and its direct connection with future professional life.
- It significantly supports young people personality development, especially their responsible behaviour, ethical decision-making and critical thinking.
- It provides great opportunity and space for developing communication skills of students.
- It develops skills helping students effectively use information and communication technologies.

### Achieved results (2001-2007)

#### Quantitative.

- Integration of more than 90 schools
- More than 5 000 students participating in the program
- 140 trained teachers
- Trained group of 11 teachers and consultants helping their new colleagues implement the program at schools in all regions of Slovakia
- Elaborated textbooks, methodology guide, [www.poznaj.sk](http://www.poznaj.sk) website and its CD version
- Elaboration of pedagogical documents for non-compulsory and nowadays for optional subject – Personal finances management

#### Qualitative.

- Created educational program has been integrated into secondary schools curriculum. It is implemented mainly through regular secondary education at schools, hobby groups or as a non-compulsory school subject.
- Various target groups are being educated within the course of the project – secondary schools students, their peers, parents and teachers (mediated knowledge).
- The project provides integrated, methodologically elaborated and complex educational program with various materials – textbooks, methodology guidebook and website (as well as its CD-ROM version) – open and unique virtual teaching aid.
- All teachers working on the program are obliged to participate at the program methodology training.
- All implemented teachers can develop the project and share their experience by means of interactive parts of our website.
- Program teachers mediated some parts of the program also to other students (except those directly participating in the project) at other subjects classes, especially at economy, history and society oriented ones, as well as at substituted lessons.
- Aroused interest in personal finances management topic among students, teachers, parents
- The program motivates some students to educate in other economy-related subject with the potential impact on their future choice of profession
- Curriculum expansion using experience, themes and activities of teachers implementing the program
- Skills gained in the program increase chances of students to succeed in the labour market
- The program increases literacy of teachers in the personal finances area, as well as their ability to use IKT
- Cooperation with professional educational institutions, State Pedagogical Institute (SPI), and methodology centres for further education of teachers (MC) has been established

- The project introduces democratic education methods to schools and it supports the partnership approach to students, creation of positive relationships
- The project supports meaningful leisure time spending of students (not just in classes or hobby groups, but also out-of-class activities where students mediate their knowledge to friends), it also serves as prevention taking into account displays of violence and other anti-social phenomena
- The program is positively evaluated by parents, especially the utilization of gained knowledge and skills in the finance area of life
- International Youth Foundation declared the project to be the model project for young people in the Central Europe region
- The project and its possible modified implementations drew interest of foreign partnership organizations (Czech Republic – adapted program, in Poland, Spain, Nederland, Turkey, Hungary...)
- We created the model of cross-sectoral cooperation in creating and implementing educational program with the integration of various sectors representatives (civic, state and bussiness sectors)
- We created the model of innovative educational program (program of the future also for other topics)
- Positive reactions and feedbacks of program participants regarding implementation, innovation, issue importance, teaching methods and project management

#### Program implementation

Teaching material includes 9 basic consequent chapters.

Each chapter includes 3 basic parts:

- Explanation of economical theory and practice
- Questions and tasks
- Test

Students, motivated by the teacher, deal with questions and tasks, which they afterwards send to the teacher. Teacher has a chance to check the answers and, in case of wrong or insufficient answer, react and write notes for a student for each question and task. At the end of each chapter, there is a self-evaluation test with 10 questions; each of them has 4 possible alternative answers only one of which is correct.

For the teachers, there is a *methodology guidebook*, which is continuously updated with new ideas, experience and knowledge provided by the participating subjects and teachers themselves in the part called the Recipe book.

Participants received the *support information material about the project*.

Teaching materials in the text form are already obsolete, they were important at the project beginning when not all applying schools had troublefree Internet access. For the same reason, participating schools received these texts also on CD-ROM. We do not intend to print these texts anymore. They are *updated only at the website*.

Other ideas for further improvement include specific topics for learning such as investments, changing national currency to euro, reasonable use of modern tools of payment, using Internet for contacting financial institutions etc...

Curriculum development. Already created modules of the curriculum will be continuously updated and suitably supplemented according to changing economical and social conditions and laws. They will also react to actual issues (e.g. introduction of Euro in 2009 – pros, cons etc. Methodology part of the curriculum will also be continuously supplemented with new new experience, ideas and information sources for individual modules.

Within the curriculum development, we will focus on prevention from possible negative impacts of financial literacy (e.g. credit cards problems, loan products) and we will supplement it with actual information on taxes, retirement funds, investments, savings, loans etc. We will acquaint students with the list of basic recommendations and public policy for financial education.

Www.poznaj.sk. The most important tool of program implementation is the actual [www.poznaj.sk](http://www.poznaj.sk). It is necessary that this website is continuously updated with new information and that it reacts to rapidly developing trends in economy and personal finances management, often hard to predict. Due to these reasons, almost real time update is a vital element of program implementation. The key activity in this area therefore seems to be the simplification and improved administration of the [www.poznaj.sk](http://www.poznaj.sk) and introduction of the content management system (CMS). Several years of experience suggest that the current status is becoming almost unacceptable and that the CMS application is not only requested, but also imperative in order to keep the program quality.

Due to this, we are realizing the major reconstruction of the web in, focusing on removal of the mentioned problems. Interactive parts for students and teachers will continue their operation and their functions will be updated. The website will be expanded by means of tasks elaborated by students when applying knowledge and skills from the financial education area. Update of the website and the technical support for the integrated schools will take place regularly.

Teachers training. *Teachers training* of Get To Know Your Money program is crucial for the success of this project. Many teachers look for new active forms of work with children and young people and they lack necessary skills and knowledge for fulfilling these goals.

Training takes place in two phases:

- Training of new teachers
- Follow-up training

Up to this date, 140 secondary schools teachers were trained in 9 trainings, 6 follow-up 1-2 days trainings were held.

What other influence of trained teachers performance may be assigned to training?

- Overall *project design* was positively appreciated – its long-term sustainability, succession of its individual parts, follow-up training, other activities and appreciation from the organizers side.
- Planned *networking and cooperation* among teachers, particularly in area of project implementation in the teaching process, consulting, exchange of methods, procedures, experience and learning, was implemented by means of trained consultants and the website – in the *Recipe book* section.
- Training content and implementation is steadily very highly appreciated by its participants.
- They particularly like:
  - *Opportunity to use new methods in teaching.*
  - Opportunity to see the work of their more experienced colleagues (e.g. also in open lesson at follow-up trainings).
  - Interconnection to life skills.

Evaluation of project operation at schools

*Project evaluation* focused on:

- *Determining the level of satisfaction with the project among teachers* – content, process, restraints, material quality and technical equipment, proposals for improvement, exploitability of web tools – recipe book and teachers discussion, GKYM presentation, project's influence on personal life, ways of teachers remuneration.
- *Determining the level of satisfaction with the project among students (questions):*
  1. What did students learn in the program?
  2. What did they like the most about the program?
  3. Did students work with the program Internet application also at home or in an Internet cafe?
  4. Did parents of students take interest in the program?
  5. What do the students suggest needs changing in the program?
- *Parents opinion*
- *School management opinion*

*Analysis* is based particularly on outputs from:

- Final evaluation questionnaire at the end of school year.
- Conclusions of the focus group.
- Conclusions of the web discussion and the public poll at [www.poznaj.sk](http://www.poznaj.sk).

For the teachers, program's contribution was particularly in:

- Getting new information and personal experience from the financial area.
- Improved usage of new teaching methods.
- Improved skills in working with PC and the Internet.
- They appreciated contacts and experience exchange among teachers participating in the program (mainly through trainings, common meetings, www. poznaj.sk and communication with consultants).
- Teachers established closer contacts with their students, applied partnership approach to them.
- They felt joy working with motivated students.

#### Teaching form

- Non-compulsory subject.
- Hobby group.
- Other form (as a part of Economy subject IT subject).
- New form in 2007-2008 – project will be implemented like optional subject.

| Kind of activity     | Never | Sometimes | Often | Every lesson |
|----------------------|-------|-----------|-------|--------------|
| Presentation         | 0     | 47,61     | 33,33 | 14,28        |
| Www text part        | 0     | 11,9      | 50    | 30,95        |
| Www exercises        | 0     | 31,42     | 47,61 | 23,8         |
| Cooperative teaching | 2,38  | 40,47     | 28,57 | 4,76         |
| Discussion           | 0     | 4,76      | 50    | 38,09        |
| Role play            | 19,04 | 54,76     | 4,76  | 0            |
| Economical games     | 14,28 | 50        | 9,52  | 0            |
| Self-study           | 0     | 57,14     | 11,9  | 4,76         |

Tab. 1. Kinds of activities used in teaching, frequency in %

Other activities are field trips, obtaining practical skills, problem-oriented teaching, project method searching for data in economy newspaper, preparation and poll implementation.

Recommended grade:

- First – 7 times = 16,6%
- Second – 26 times = 61,9%
- Third – 21 times = 50%
- Fourth – 4 times = 9,52%

|   |    |        |
|---|----|--------|
| Work with the internet                  | 32 | 26,89% |
| Everything                              | 7  | 5,88%  |
| Program simplicity                      | 5  | 4,20%  |
| Tests                                   | 16 | 13,44% |
| Bank money                              | 1  | 0,84%  |
| Form of teaching                        | 7  | 5,88%  |
| It taught us to work with money         | 7  | 5,88%  |
| Topics                                  | 5  | 4,20%  |
| New information                         | 17 | 14,28% |
| Opportunity to express your own opinion | 16 | 13,44% |
| New terms                               | 2  | 1,68%  |
| Creation of money                       | 1  | 0,84%  |
| Questions and tasks                     | 4  | 3,36%  |
| Field trip                              | 1  | 0,84%  |
| Good teacher                            | 7  | 5,88%  |
| Calculating salaries and money          | 1  | 0,84%  |
| Discussion                              | 4  | 3,36%  |

Tab. 2. What students liked the most in the program?

We asked them how do they like to work with the Internet. Here are some of their answers:

- o Yes, Internet is full of new information.
- o It is a great program, but it should be held during regular teaching hours.
- o Everything is OK, Internet is a great thing, I can find everything instantly.
- o It is totally great; learning through Internet is much easier.
- o It is something fantastic, educating oneself in this entertaining way, as the work with PC and the Internet is easier and funnier.
- o Yes, I think Internet teaching is fantastic and very interesting. In today's computer world, it is especially useful to improve in operating PC. This form will certainly produce very good results.
- o Yes I like it. Internet is not only for games and surfing, but also for learning and getting knowledge.
- o Yes, I like it, only if I could have the computer just for myself.
- o It is OK, however, it should be applied everywhere and all the time.

Opportunities for development arise especially in:

- Changing non-compulsory forms of education to optional /requirement of teachers repeatedly appearing in the feedback/.
- Future quick update of the website.
- Cooperation with professionals having practical experience.
- Wider integration of students and teachers in program innovation and creation.
- Development of competitive forms of students' work.
- Motivating other schools to join the program.

### 3. CONCLUSION

*Generally it is inspiring to say that the project, in its entirety:*

1. *Implemented all steps of teaching process in complex and model way* – it started with the creation of curriculum, continued with educating participants and thorough application in practice. Methodology guidebook was published, consulting and program evaluation took place, systematic experience exchange among participants was in progress, and information was updated....
2. *Supported development of specific life skills.*

Acquired experience proves that the development of financial education in Slovakia is of great importance and it is necessary to deal with it more systematically. It is a long-term process because it forms the basis for life-long learning and education, it requires professional, emotional and also financial support of educators and educated.

#### Future goals

- To continue with the project.
- To create tools for more regular communication with teachers and students (to ask actual question at least once a month through recipe-book or the discussion).
- To support cooperation of pedagogues (involve them in dealing with partial tasks, projects).
- To keep the levels of energy, enthusiasm and devotion to the program in order to introduce the concept of financial education widely into work with children and young people.
- To look for further opportunities of this program's application (in schools for non-economics teachers, in a modified form also in the first year of university studies, for parents or other interested people).

### THE AUTHORS

**Tatiana Piovarčiová:** was born in 1959, graduated at the Comenius University in Bratislava, Faculty of Mathematics and Physics majored as general education subjects' teacher. Worked as a teacher at primary and secondary schools, externally also at universities. Participated in school management and worked as an expert of the State Pedagogical Institute. She is an author, co-author and coordinator of several innovative school projects. For 10 years, she participated in management of ITV educational center and other innovative programs. At present, she works as a Children of Slovakia (CSF) Program Manager, external methodologist for the Methodology and Pedagogy Center of the City of Bratislava and as a Susan Kovalik Association trainer. She engages in training, consulting publishing activities in the area of human resources and innovative educational programs. Currently heads the Educational Center project within the CSF activities.

**Erika Galanská:** was born in 1968, graduated at Comenius University in Bratislava, Faculty of Natural sciences. Worked as a project manager at non-governmental organizations. Participated in several educational projects. She is an author of several projects for non-formal education. At present, she works as a Children of Slovakia (CSF) Project Manager.

### ACKNOWLEDGEMENT

„Continuously, we need to spread the penetration of this program into the minds of young people in Slovakia and citizens of the country generally, in order to help them live easier. What we need to do is to give it our hands but foremost our heads. I hope we will succeed. Thank you.“

We thank our partners – Citigroup and Junior Achievement – Slovakia, who developed project with us.







countries were in English. It was already 3-rd year of this kind of meeting organized by the European group for popularization of particle physics EPPOG and the European physics session EPS. Videoconference was technically supported by the group of experts of virtual collaboration VRVS/ EVO – SK with wide support of the Californian technological institute (CALTECH, Pasadena, USA). The videoconference system of new generation, EVO, was used.

Our internet broadcasting is ideal way of popularization of science by modern information canal, therefore it is implemented in many projects of our University. At present it is the project „The center of internet education FMFI“. Besides this also other projects use it to communicate with teachers and students: “The innovations of professional skills of natural sciences teachers”, “Visual science education with impact on competences development for application in real life”, “The popularization of science in natural sciences education“, “Physics around us”, “Popularization in natural sciences education”.

### THE HISTORY OF VIDEOCONFERENCE

In the year 1994 begin development of „Virtual Room Videoconferencing System“ (VRVS). It was developed for the community of high energy physicists for purpose of low-expenses and easy widespread utility for videoconference connection and virtual collaboration using internet. Today it has 28 000 registered users from 140 countries and monthly it connects 7500 users through 1400 international meetings. VRVS system is compatible with 3 main platforms (Windows, Linux, Mac OS X) and supports more videoconference protocols, so the user can choose the appropriate one to connect to videoconference meeting.



Fig. 2. The first videoconference was held in 1964 during the World's Fair conference in New York.

Transfer in VRVS is composed of reflectors that connect participants of the meeting together and transports video and audio signal to each user. The video and audio signal

from one user is mixed into one data stream which is distributed to every participant of the virtual room. Reflectors are connected among themselves and there is always guaranteed the best connection between participants. At present there are 84 reflectors all over the world.

|             |    |
|-------------|----|
| USA         | 22 |
| Brasil      | 6  |
| Spain       | 5  |
| UK          | 5  |
| Slovakia    | 4  |
| Switzerland | 4  |
| France      | 3  |
| Italy       | 3  |
| Russia      | 2  |
| China       | 2  |

Tab. 1. Number of reflectors in 10 chosen countries

### THE HISTORY OF DIDACTICAL INTERNET BROADCASTING “DIV”

The list of all internet broadcastings that we made you can find: <http://fyzikus.fmph.uniba.sk/typo/index.php?id=387>. The number of VRVS users has increased quickly.



Fig. 3. Number of VRVS users in different countries

Now let's have a look how DIV began and how it has being improved. Our internet broadcasting began with simple

compartments that we had, and we have improved during the time. It all began with the first broadcasting on 28-th May 2004, which was not involved in project DIV. The name of broadcasting was “Electricity among us or from frog legs to electric power plants.” The lecture was given by prof. Jan Pisut and Mgr. Vincent Ciganik. We used two simple digital cameras and wireless microphone. In the next month we made another internet broadcasting an the next school year 2004/ 2005 we have started the project DIV, which is coordinated by Mgr. Miroslav Sedivy. To improve quality of broadcasting we have made some changes. PC and digital cameras were replaced by newer products. One camera was used for lecturer, one for details like presentation or experiment. We have used remote controlled cameras. The broadcasting was recorded on mini dv cassettes. How about broadcasting presentation? We began with a simple hyperlink. In VRVS chat there was a link on the website from which the presentation could be downloaded. Then presentation was recorded by camera and in real time broadcasted. It was not a bad way to broadcast presentation, we use it doing broadcasting outside our VRVS room where are limited conditions. After that we tried VNC server, which enables to share the lecturer’s desktop and also the presentation. And finally in the new system EVO is the broadcasting of presentations involved as a part of new technological advantages of this system.



Fig. 4. EVO- The Collaboration Service of the Future

And now we explain how we have mixed the signal. The first mix was very simple. It had two video inputs, for dividing signal we used video recorder. Later, thankful the project has started, we got audio- video VRVS mix, that really contributed to better quality of broadcasting. It has 3 video inputs, 4 video outputs, 4 audio inputs, 4 line in inputs and 4 audio outputs. We use it also now, but quality of video signal has been improved again by video mix. It enables to mix all video inputs using smooth transitions. Another advantage is to see on monitor all video inputs and choose one which will be broadcasted out. It enables to

broadcast window in window, which means to see e.g. lecture in main window and lecturer in small window at once.



Fig. 5. Room for internet broadcasting at FMFI UK

### PROBLEMS AND RECOMMENDATIONS FOR IMPLEMENTATION IN SCHOOLS

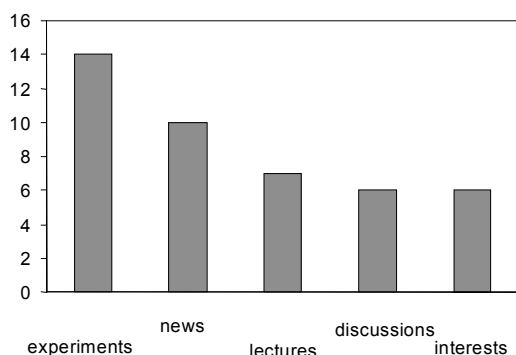
During the workshop of Slovak physics teachers in CERN in April 2007 we made a review about our internet broadcasting. We used a questionnaire with 6 questions. There were 43 teachers from the whole Slovakia who took part in the workshop in the European Centre for nuclide research CERN in Geneve. In the morning they had lectures about particle physics. Lecturers were either well known physics from Slovakia or Slovaks who work at CERN. In the afternoon the program composed of visiting interesting places at CERN- detectors in experiments Alice and Atlas on accelerator LHC or antimatter factory, teacher composed they own bubble chamber or had discussion how to bring new knowledge into their classes. After week full of Physics we handed out questionnaire. According to results 34 from 43 respondents were interested in our project DIV and want to get more information or cooperate with us. Some information about our activities had 30 teachers, only 8 from them watched one of broadcastings also with students. Two had technical problems but the others said it was really good activity. One of basic questions is the time of broadcasting. At present we broadcast 2 times a month, on Tuesday from 14.30 pm to 15.30 pm. According to teachers answers it might be better to broadcast in the morning.

| What is the best time for DIV? |        |
|--------------------------------|--------|
| Answer                         | number |
| It is not important            | 6      |
| In the morning                 | 16     |
| In the afternoon               | 13     |

|                |   |
|----------------|---|
| In the evening | 3 |
|----------------|---|

Tab. 2. What is the best time for DIV?

We asked the respondents also the question what should be the content of the internet broadcasting. We got a wide spectrum of the answers: The teachers expected mainly several experiments- simple, demo experiments, or those, that could not be done in the school (14 respondents). On the 2-nd place, there is a big interest in the newest achievements in science and engineering, including applications in real life (10 respondents). On the 3-rd place are interesting lectures and discussions with experts (7 respondents) and different interesting information from physics and science research. From other answers follows these topics: history of discoveries, interesting life stories from physics, works of students, make a broadcasting for grammar school, offer different views on one thing, build relations between different subjects, documents, show a model of lesson, promote science research and try to explain things, that are not clear for students and hard for teachers to explain.



Tab. 3. What should be the content of the internet broadcasting?

According to survey among the physics teachers we got the feeling that successful implementation of project to school practice interferes in these two problems. The first is that teachers don't know to realize broadcasting because of technical problems. There is a technical staff at school, but it is a problem to arrange with him. And the other problem is that some of the teachers have even not heard about it. Bigger advertisement about broadcasting is needed. We would like to arrange a seminar for high school teachers, where they could try to connect and realize broadcasting at our university. There should be a condition to realize next broadcasting alone in their own school with their students. If there occurs some problems we could solve it either by email, or somebody from our VRVS team could go to realize next broadcast

with them. The help of VRVS rooms at the universities could be used.

## CONCLUSIONS: THE FUTURE OF DIV

In the next time we want to devote our energy to improve our internet archive. The claim came from teachers, who watched one of the broadcastings and often asked us to publish the lectures on the internet, so they can use it during education process in the future. At present we have 35 lectures on dvd that were made during internet broadcasting and 10 more recordings on mini dv cassettes. From this material we would like to make internet archive that will be accessible for every teacher. We also would like to improve cooperation between our university and The University of P.J.Safarik in Kosice. At the end of this paper we should mention also the European Social Fund, which is financial support for our project The center of internet education on FMFI and for other projects, that use internet broadcasting.

## THE AUTHORS

### Mgr. Marián Danišovič



at FMFI UK

- fellow at Department of science education FMFI UK, Bratislava,
- teacher of the subject: "Didactical IT in Physics"
- employer of IT company
- responsible for videoconferences

### Mgr. Miroslav Šedivý



at FMFI UK

- fellow at Department of science education FMFI UK, Bratislava
- he helped with making electronic version of a schoolbook for the 4-th grade of high school
- coordinator of: "The center of internet education FMFI UK"
- responsible for videoconferences

### Mgr. Vladimír Plášek



- PhD student at Department of science education FMFI UK, Bratislava, 3-rd grade
- assistant teacher of subjects: "Mathematics 1,2"
- technical support for videoconferences at FMFI UK



## E-LEARNING AS A TOOL FOR TRAINING INNOVATIVE SMEs TO EFFECTIVELY USE ICT IN THEIR BUSINESS ACTIVITIES

Juraj Poledna

National Agency for Development of Small and Medium Enterprises, Miletičova 23, 821 09, Bratislava, Slovakia

telephone: +421 2 502 44 545, e-mail: poledna@nadsme.sk, <http://www.nadsme.sk>

*5<sup>th</sup> Int. Conference on*

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** Global economy has brought new challenges for all economic subjects. It represents a big opportunity for small and medium enterprises (SMEs) when they are able to take part on this process. Effective usage of ICT is a prerequisite for successful participation. Our research has shown that situation in Slovakia is not satisfactory in this respect. The aim of the of the Leonardo ICoTel project consortium has been to create the platform for e-learning and to develop training modules focused on the application of ICT in SMEs operation. There have been developed training materials that cover the most important activities of enterprise functioning. They include modules: Application of ICT in Company Management and Marketing, E-Commerce, English – Managers and Business Terminology, and Control and Diagnostics of Technological processes in Manufacturing Processes Based on Application of ICT organised in two pilot courses: ICT in Company Management and Marketing and Selected Applications of ICT in Enterprises, Institutions and SMEs.

**Keywords:** E-business, E-learning, Management, Training.

### 1. INTRODUCTION

It is generally assumed that the new economy appeared simultaneously with developing new Information and Communication Technologies (ICT). ICT is an efficient tool for reducing the time needed for bridging the growing distances of the global market environment. As a result, the new global network economy and Internet changing traditional business models and rules appeared.

Thus, the new economy is bringing two major outcomes: enlarging the market environment (globalisation), and introducing electronic business.

The outcomes have created conditions for applying new relationship models based on electronic relations which allow companies to make business global regardless their size. The success depends only on their ability to adapt to new market environment. Companies taking part on the new economy experience the following benefits: time economies, cost reductions (mainly transaction costs), and, thereby, bring on improvements of the productivity and quality of work.

Small and medium-sized enterprises (SMEs) create important part of national economy also in Slovakia. With their more than 99% share in the total number of companies, about 50% contribution to GDP and more than 70% contribution to the employment, they cannot miss the opportunity to participate in globalisation processes including effective usage of ICT.

### 2. CURRENT USAGE OF ICT IN SMEs

Recent trends suggest that complete restructuring of national economies, their integration and computerization

create favourable conditions for obtaining rapid growth in business productivity and resulting increases in profits for sophisticated production. In this regard, the transition towards the new economy and all related implications are believed to be the dominant factors providing economic agents with the guarantee of sustainable market competitiveness.

Growing competition and the surge of product and service innovations based on the most recent technologies will shorten innovation cycles even more.

The new situation will require developing and implementing competitive business strategies. They should address creativity, uniqueness and should reflect the ability to adapt to constantly changing market conditions through the innovation process.

Small and medium-sized enterprises comprise a significant part of the Slovak economy. As in other countries, they are a stabilizing force in the economic system and the sector with the greatest potential for growth.

In working together, NADSME with Institute for Opinion Polls and INFOSTAT, conducted a survey in November 2006 focusing on ascertainment of innovation activities and utilisation by small and medium enterprises of information technologies [2]. The target entities were micro-enterprises with 1 to 9 employees, small enterprises with 10 to 49 employees, and medium enterprises with 50 to 249 employees. The representative sample counted more than thousand companies – legal entities.

The most significant conclusions arrived at from the survey are the following:

Almost 70% small and medium enterprises approached claimed that permanent innovation activity is part of the long-term business strategy of their companies.

During the recent three years, approximately 10% enterprises introduced entirely new technologies, and

almost 430 % substantially upgraded their existing technologies.

An entirely new product was introduced within 2004- 2006 by 19 % of the companies, and almost 40% of the companies approached upgraded substantially their products.

Representatives of 83% small and medium enterprises approached use personal computers for business activities, at least one of them having Internet connectivity. One in twenty small and medium enterprises (5 %) does not utilize any information technologies.

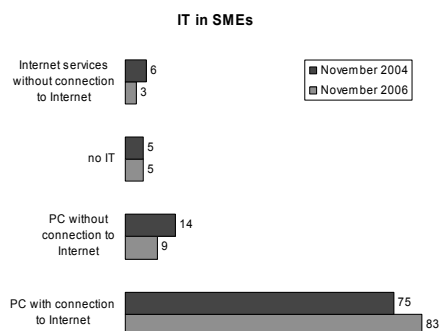


Fig. 1. Penetration of IT in SMEs

Similarly as in 2004, more than four in five enterprises (85 %) use information technologies to process the economic agenda. Almost 65 % of the companies use electronic mail and more than two in five companies (46 %) use information technologies for electronic business.

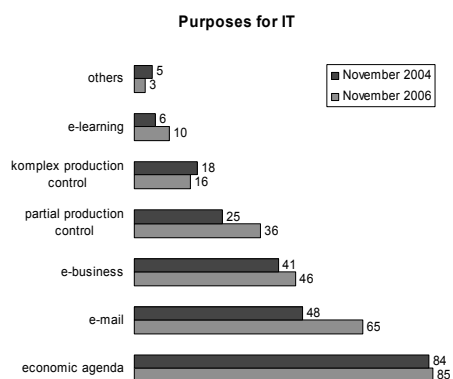


Fig. 2. Purposes for IT exploitation in SMEs

The respondents stating to use information technologies for doing electronic business specified the forms of how they use them. Almost two thirds of those approached (64 %) take the advantage of information technologies and the opportunities presented by them to look up commercial offers on the Internet. More than 61% of the respondents present their offer on their own website and use internet-banking (electronic bank payments), 38 % of the companies distribute their advertising e-mails, 53 % register their products or enterprise in databases accessible through the Internet, 46 % advertise their products on foreign websites.

Seventeen percent of the enterprises sell their own products or services to other customers, 15% to end-customers, 5 % organise special Internet-mediated marketing campaigns, and 22 % have their own customer Internet centre.

Based on this statistical data, it can be concluded that the qualitative level of ICT exploitation is not satisfactory and cannot be compared to other EU countries.

### 3. E-LEARNING TOOLS FOR TRAINING SMEs TO BETTER EXPLOIT ICT

The building of new information society requires not only modern telecommunication infrastructure but also knowledge development in the field of the application of modern information and telecommunication technologies. The rapid development processes of telecommunication and information technologies has called for the need of new education structure and concept in order to satisfy all the qualitative and quantitative needs for the education of the whole population from the basic level, through secondary and university level up to lifelong learning. This is especially important for life-long learning of entrepreneurs to boost up the economic development.

The aim of the of the Leonardo ICoTel project consortium has been to create the platform for e-learning and to develop training modules focused on the application of ICT in selected areas [1]. Furthermore, the idea of the integration of universities and top telecommunication companies and institutions from various EU countries comes into realization within the framework of this project. Thus, the strong network of partners and sub-partners has been established:

Slovak University of Technology in Bratislava - contracting and coordinating institution  
 Universitat Politècnica de Catalunya, Barcelona  
 Czech Technical University, Prague  
 University of Hradec Králové  
 National and Kapodistrian University of Athens  
 Alcatel Slovakia a.s., Bratislava  
 Siemens PSE, Bratislava  
 Alcatel SEL AG, Stuttgart  
 Bitmedia e-learning solution, Graz  
 Society for Lifelong Learning in Bratislava  
 Association of the Slovak Electrical Engineering Industry, Bratislava  
 Orange Slovakia a.s., Bratislava  
 National Agency for the Development of the Small and Medium Enterprises, Bratislava  
 Kenteq, Hilversum  
 Ericsson Slovakia, s.r.o., Bratislava

This project has addressed following issues that are the most important from the perspective of potential users – innovative SMEs.

The possibility of applying electronic environment has led to the creation of electronic/digital economy which represents an extension to electronic business applications

(used in production, commerce or other areas of economic, cultural and social life). Furthermore, the notion of the new economy or e-economy is closely related to the concept of the knowledge-based economy very often related to the transition from the information to the knowledge-based society. The knowledge-based economy is the economy, in which the priority is laid upon the ability of economic agents to evaluate their "knowledge capital" (i.e. creating added value by taking advantage of commonly gained knowledge and experience and their further development and exchange).

E-business - it represents an application of information, communication, and Internet technologies to all components and activities of the whole business world (within the global social and economic environment). From the company perspective, it is the application of Internet technologies into the chain of creating products' added value.

Moreover, e-business from the perspective of a given institution represents an integration of the process, organization and management system through the ICT and Internet technologies with the overall objective of creating new business values and competitive advantages for a given institution.

In this case, business processes should be understood as all internal processes that secure the implementation of company's mission with regards to its external environment. E-commerce is every business transaction carried out among trade partners through the ICT and resulting in transferring the ownership rights for using goods and services. Considering this definition, e-commerce represents a significant e-business component.

In general, one can talk about introducing e-technologies (e.g. e-banking, e-learning, e-business, e-government, etc.) that significantly promotes direct informing and participation of citizens, employees, partners and clients on the "business" of public institutions, commercial and non-profit organizations. From this perspective, e-business enhances the company performance mostly by the participation of the ICT on creating products' added value through the communication and application support of Internet, intranet (inside the organization) and extranet (cooperation with external partners).

E-business uses the whole range of concepts, methods and ICT tools such as Enterprise Resource Planning (ERP), Data warehousing, monitoring business activities and orders (Workflow), Customer Relationship Management (CRM), Supplier Chain Management (SCM), teamwork support (Groupware), Knowledge management (KM), client contact and selling centres (e Marketplace), etc. Open standards and Internet technology tools such as TCP/IP, HTML, WWW, XML, Java, CORBA, etc. secure the implementation and integration of e-technology benefits into organization's value chain.

Development tendencies mentioned in the previous section has gradually resulted in creating the framework of the "New economy" whose instruments and methods significantly depend on the ICT. From the perspective of production organization management (which is the subject

of our interest), it is mainly related to the new concept of competitive development strategies of a given organization/company. It must guarantee the long-term and sustainable development, i.e. the long-term competitiveness based on flexible reaction on market environment. If current production companies want to be successful, they must accept and gradually apply principles and methods proclaimed within the concept of "New/digital economy" focusing mainly on:

- functionality and controlling of the strategic management,
- active management of changes,
- focus on the core activity/production („leaness"),
- appropriate modifications of organization and management structures ("downsizing" towards "flat structures ") through the applications of distributed, network-based organization and management structures,
- transition towards network and virtual companies („Extend factory", E-technologies),
- process distribution, outsourcing of production processes and services, development of acquiring semi-finished products and services (SCM development),
- CRM development,
- creating object oriented companies etc.

Engineering of the outlined development trends fully exploits the ICT potential. It supports and facilitates the implementation of changes in a given organization by providing appropriate services/applications of the information system (IS). At the same time, however, the outlined trends in manufacturing companies bring development change priorities of corporate strategies by progressing from the principles of minimizing costs to principles of maximizing production and:

- Quality of products and services from the client perspective (B2C „Business to Customer Relations"),
- Partnership development with the partner organizations (B2B „Business to Business Relations"),
- Fast reaction (response) on market environment changes (including reaction on competitors, legislature changes, etc.).

Various development trends of competitive companies are supported by several academic concepts.

## TRANSFORMATION OF CORPORATE PROCESSES INTO E-BUSINESS

Critical factors of successful e-technology implementation into corporate processes and activities include:

1. Differentiated (individual) approach to every organization - selecting the most suitable and efficient solution;
2. Continuous education in the field of e-technologies, i.e. not only educating in the ICT, but also in other

appropriate methods and tools of regulating corporate processes and management activities;

3. Infrastructure of cooperating work environment - corporate culture supporting cooperation, knowledge sharing and mutual training.

Ad 1) Individual approach means accepting specific features of internal and external processes, internal and external relations during the transformation process. E-business solutions are tailor-made for specific needs of a given organization (company). However, while doing this we must consider what is the main subject of business activities (core business), and how the business activities are capitalized, i.e. what generates the "money" and profit. We can distinguish four business models of organizations and companies with e-business:

- Producers: organizations manufacturing products that are either "physically" marketed (selling computers, cleaning services, reparation of machinery, construction material), or delivered as information products through a communication channel (software delivery and maintenance, e-magazines, e-sites, etc.);
- Distributors: organizations distributing and supplying products of other producers (service producers or providers), such as online book stores (AMAZON);
- Brokers: organizations creating environment for implementing various activities of buying, selling and representing other companies, e.g. auction markets at e-Bay, on-line travel agent at Travelocity;
- Extractors: organizations offering services (tools, mechanisms) of presenting, searching and providing relevant information, such as ALTAVISTA, Yahoo, Lycos, Google, etc.

Ad 2) Knowledge-based organizations. The knowledge-sharing is an intrinsic component of modern organizational concepts creating favourable environment for cooperation of employees and business partners. These concepts result in creating "self-developing" or knowledge-based organizations, in which the information and knowledge-sharing (mainly through e-technologies) is a natural part of the corporate culture. Continuous education should be the inherent element of the company management. Every manager should share information and knowledge with his subordinates and, thereby, support their professional growth and career development. Since e-business, or in general e-technologies, rapidly develop, the sustainable growth of e-business organizations is unachievable without continuous training and education.

Ad 3) A radical change in organization's thinking and management should be understood as developing a working infrastructure and environment for mutual internal and external cooperation of employees, organization branches and partners that eventually leads to the corporate culture of a new quality. Creating a functional background of the efficient collaboration is related to the reengineering of the company's organization and management. It is usually related to designing

## INFORMATION AND MANAGEMENT SYSTEM OF AN ORGANIZATION

The transformation of business processes for e-business environment is always related to the radical "reengineering" of the corporate information and management system. Therefore, it is necessary to discuss its function, structure and security.

Information and management system (IMS) of a given organization is defined as a group of people, procedures and resources accumulating, transforming and distributing the information and available resources in order to achieve organization's objectives.

The information and communication technology (ICT) paradox means that organization can have fully operational and efficient MS that is more or less independent on the ICT. In this case, introducing or applying another methods and ICT components might considerably increase the reliability, efficiency and effectiveness of the previous MS. However, if the first MS (with or without the ICT support) is inefficient, it is more suitable to modify the existing MS or combine new ICT applications with the remodeling of the original version.

Current explanation of the IMS usually encompasses the notion of information system designed and developed with the support of ICT tools and methods. This is also appropriately emphasized in its name - IS/IT or IS/ICT.

IS/ICT can be defined as a group of people, resources and ICT components (hardware, software, communication networks, information technologies, information management) allowing to obtain, transform and distribute the information and know-how required by end users in order to perform the goal-oriented organization management. It emphasizes, with regard to the previous IMS definition, the principal connection of the information and information flows with the processes assuring the organization management and development in accordance with predefined strategic objectives.

It follows that the IS/IT is a product which guarantees, through its services, a reliable and efficient execution of business processes within various organizations. The process-related approach towards the IMS, and thereby to the IS/IT, becomes the major issue of their creation. The notion of business process represents the customer-oriented approach towards procedures assuring the organization performance.

The IS/IT of a given organization is used in three basic management areas:

- business operation support, i.e. the performance support (direct support and support of activity management)
- support of decision-making (managerial) processes
- support of strategic processes (decisions) and competitiveness.

The notion of business process represents the customer-oriented approach towards procedures assuring the organization performance.

Organizational business processes can be classified as follows:



- basic processes (with regard to internal and external customers or a process owner),
- managerial processes, including automatic and automated control of production (technological or manufacturing) processes,
- supporting processes (with regard to internal customers and process owners, or a partial process and external suppliers),
- networking processes (communication) (performing communication, information and knowledge flows, information logistics etc.).

As a result, the integration, optimisation and coordination of business processes represent the dominant aspect of the functional IS/IT of a given organization. Furthermore, ICT tools can support organization's restructuring and thereby improve the effectiveness of its business processes.

This concept has been fully developed in training materials in order to make use of modern telecommunication and information infrastructure based on converged technologies accessible to SMEs. There is a need to have knowledge of these technologies widely distributed (necessity to educate the professional and public community in the area of the application of information and telecommunication technologies), and on the other hand these technologies enable new education possibilities, methods and concepts such as distant education based on e-learning.

#### 4. REFERENCES

- [1] Podhradsky, P. (Editor): Information and Communication Technologies in Lifelong Learning ICoTeL. Leonardo da Vinci Community Vocational Training Action Programme Second Phase: 2000-2006
- [2] Inovačná kapacita malých a stredných podnikov, využívanie informačných technológií – štúdia, NADSME, (PDF format - 50 pp. / 430 kB / January 2007)

#### THE AUTHOR



**Juraj Poledna:** Graduated at Charles University, Prague in mathematic and computer science. Research of complex systems and mathematical modelling in Slovak Academy of Sciences, Bratislava. PhD and DrSc scientific degrees.

Consultancy for companies in optimising production processes and business performance. Analysis of business environment in National Agency for Small and Medium Enterprises, Bratislava.





## OPEN LEARNING PROBLEMS AND SOLUTIONS IN LATVIA AND RSEBAA

Olga Remez.

Riga International School of Economics and Business Administration, 3 Meza St., Riga  
olga.remez@rsebaa.lv, +371 29625439, fax +371 7500252, <http://www.rsebaa.lv>

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** In this paper, we have described the situation with open education in Latvia, which is based on e-learning technologies – new tendencies, implementations and substitution for conventional learning. The initial situation at the institution and country, participation in the EVENE project, our institute's provided modules, numbers of enrolled students, first teaching experience, later then experience with running the whole semester, evaluation, etc.

**Keywords:** e-Learning, open learning, adult education.

### 1. INTRODUCTION

Latvia is urbanized country, all Universities and High schools are mainly located in 5 cities – Riga (capital of Latvia) (more than 30), Valmiera (1), Daugavpils (2), Liepaja (2), Jalgava (2) – in brackets you can see the number of High Schools in each of the cities. So in many places in Latvia people are educationally challenged – they have no opportunities to go for full time educations, as it is situated in other region.

There are distance education possibilities in Latvia. Mostly, such services are not free of charge. Quantitative data on the number of people enrolled on distance education programmes are not available, but the popularity in general seems to be low because of the need to pay charges.

State supported Latvian Education Informatization System (LIIS) project started in 1997 and covered the whole information grid: education content, management, information services, infrastructure and user training at several levels – schools, school boards and Ministry of Education and Science.

### 2. THE INITIAL SITUATION IN LATVIA

As it shown in introduction - Latvian High Schools are mainly grouped in big cities. So the problem and possibility of distant or open education is a current one for this country. There is no national strategy in open learning. Some university try to start implementing open learning concept in educational process.

The Distance Education Study Centre at Riga Technical University [1] was established with PHARE support and today offers several distance learning courses. All these courses (thirteen) are included in subject's register of Riga Technical University (RTU) and can be used for teaching students. However, they are also offered to wide public as distance learning courses requiring payment. The majority

of them are even designed as interactive courses for lifelong learners rather than for fulltime students. Topics covered include ICT skills, business, English language, communication skills, and social studies. All courses are available not only through the Internet, but also on CD-ROM. After having passed the distance learning studies the user is awarded an RTU certificate.

'Latvian Education Informatisation System' (which is still in project stage) was developed by the University of Latvia [2]. One component is teachers training in ICTs. Training takes place at different levels - basic ICT skills, advanced ICT skills according to ECDL requirements, but taking into account special needs of teachers. This training is available on CD-ROMs as e-Learning courses. [3].

Distance learning is offered also by private high schools/companies.

In Latvia there also exists a black market for self-study courses on CD-ROM, but the government is taking strong measures in order to stop such trade.

In Latvia there is a possibility to get a double degree, but (by Law of Education) it is not possible to get a join-degree, or take interuniversity studies.

One of the branches of open education generates more interest in Latvia - Lifelong Education programs, for adult people. Today, staff training by enterprises (employers) is a common practice in Latvia, especially in order to help employees acquire the necessary ICT skills. Usually the ICT equipment (CD-ROMs, etc) is used in the same place where the training takes place. There are many private companies involved in this business. Quantitative statistics on take-up and usage patterns are not available.

Online, information is available from the state-run portal LVonline. It features extensive information on adult education offerings (where and what) providing Internet webpage links. The list contains 24 institutions representing

different education centres, higher education institutions, vocational schools and training courses. At the moment, however, most of these are still traditional courses requiring class attendance by every participant.

### **3. THE INITIAL SITUATION IN RSEBAA**

Riga International School of Economics and Business Administration (RISEBA) offers a lot of education possibilities, including first level of higher degrees, undergraduate programs, postgraduate programs, international courses and various other courses.

What concerns the utilisations of computers – RSEBAA has always been the first to start teaching the lading courses in computer development, the school and the faculty always tried to keep in pace with the technological development and implement new versions of programmes as well as redesign the study material so that it would correspond to the latest trends needed in the market.

Development of computer-assisted education at RSEBAA has gone through several phases:

#### Utilization of shared information sources (from 1996)

- Creation of shared disc space so called PUBLIC. Teaching staff can place supportive electronic study materials onto this space.
- Creation of shared disc space so called ANSWERS. Teaching staff can receive work from the students.

#### Support of the process of education with electronic tools (from 1996)

Consecutive implementation and improvement of particular tools supporting the process of education:

- Intranet
- Electronic timetable

#### Utilization of Internet to support the process of education (from 1997)

- Use of e-mail communication among teachers and students. The personnel automatically get their own university e-mail address and box at the start of their carier in RSEBAA.
- The information about students email addresses is updated each year, the communication between the faculty and students as well as the programme directors and the students is done via e-mail, students also receive time tables, marks and other important information via this communication facility.

#### Development of multimedia applications supporting the process of education (from 1999)

- Development of e-text books for students

#### First attempts with on-line courses (from 2003)

- Own study space on the Internet
- Creation of first on-line courses

### **4. FIRST STEPS OF OPEN LEARNING IN RSEBAA**

RSEBAA in Riga has been supporting e-Learning education methods since the beginning of 2005. It was based on web-based asynchrony and synchronic e-Learning tool.

The goal of this project is to develop a web-enabled learning system, to support new learning processes. At this moment we have started to analyze successful key factors that help in standard learning process and the ones that can help to create a new approach of exchange of information between teachers and students.

We are striving to develop a new methodology, design software, and enhance teaching methods.

As the result, the decision was to choose Moodle as LMS, to create a standard e-course structure - compulsory and optional elements.

#### e-Learning courses for further education (from 2005)

- Choice of Learning management system (Moodle)
- Creation and implementation of courses within supplementary activities

#### Preparation of e-courses for students (from 2005)

- Market analysis of Learning management system and selection of an appropriate tool for educational support of students (Moodle)
- Creation and implementation of supportive e-subjects for students of present and combined forms of study

#### e-Learning as a strategic priority at RSEBAA (from 2005)

- Started to develop e-courses in order to design a modern Distant learning system based on these first attempts.

#### Project cooperation with prominent European centres focused on e-Learning (2006)

- EVENE project (Erasmus Virtual Economics & Management Studies Exchange, is supported by the European e-Learning programme)
- Partner institutions - Tomas Bata University in Zlin - Czech Republic; Galway-Mayo Institute of Technology, Galway, Ireland; University of Huddersfield, United Kingdom; Savonia University of Applied Scieneces, Varkaus, Finland; University of Genoa, Italy; University of Hradec Kralove, Czech Republic; University of West Bohemia in Pilsen, Czech Republic.

### **5. IMPLEMENTATION OF OPEN EDUCATION AND RESULTS (EVENE PROJECT)**

Possible benefits of e-Learning [4]

1. Convenience and Flexibility
2. Offers Individualized Instruction
3. Self-paced

4. Broader Range of Opinions
5. Greater Range of Feedback
6. More Direct Control
7. High Level of Interaction
8. High Levels of Participation, Engagement and Concentration

Main aims of this project are to:

- Identify and exploit the potential of existing on-line courses
- Create e-courses
- Implement them in study processes
- Invite students to enrol on these courses
- Organize virtual student mobility as part of their usual education process
- Implement a virtual student mobility programme over the period of one academic year
- Create a network of traditional higher education institutions

This will serve as an alternative or complementary element to the physical exchange of students, through study sabbaticals at universities abroad realized within the context of the European Union's Socrates/Erasmus programmes. In this context, the following possibilities may serve for the realization of such virtual mobility projects as:

- The possibility of absolving an open learning course at a partner university may precede physical presence at the same institution.
- The possibility of absolving an open learning course at a partner university may be the continuation of a physical stay at the same institution.
- The virtual mobility can occur without any linkage whatsoever to physical mobility at one or more of the partner institutions.
- A student, who is a physically challenged student wishing to continue his studies abroad, may absolve a compulsory course in its open learning format at their alma mater university (i.e. as a side effect).

To implement these possibilities the university (RSEBAA) has created "Distant Learning Center". It works mainly in methodical and technological fields:

#### Methodical support

Seminars and courses specialized on:

- pedagogy of distance education (preparing teaching texts, leading distance course);
- specifics of preparing and leading e-Learning on-line courses;

Well-planned e-Learning could have built-in interactivity and testing so that student can measure their achievements. After long training sessions games and simulations may be added to the module, with the intention to provide both knowledge and relaxation [5].

Ideally, the first step towards developing an effective content for learners is to have a completely written module by a very experienced teacher of the subject. We try to follow this idea when choosing courses for implementations.

Several e-Learning models are available today [6]. We have a blend model which combines the face-to-face and technology mediated learning.

#### Technological support

Training and courses specialized on:

- creating e-Learning courses in Moodle environment;
- leading e-Learning courses in Moodle environment;

After the courses have been created, we start with 5 courses, namely – Operational Management, Marketing Research and data processing in SPSS, Corporate Financial Management, Management Accounting and Corporate Finance. Our courses are taken by 2 – 3 students from different partner institutions. One of the students studying on e-commerce bachelor program took a course offered by Tomas Bata University in Zlin "E-marketing", and thinks that it is a great possibility to understand and learn this subject on a higher level.

Other our students – from European Business Studies bachelor program are not so motivated to take course offered by other university.

The "problem of motivation" of the full-time students can be highlighted as one of the problems, it is really problematic to motivate them to take a part in virtual mobility exchange. Other problems are low activity in educational process of full-time students, because they, as becomes apparent are unwilling to take matters into their own hands and as a result wait for initiative from teacher. They can visit the on-line consultations ( i.e videoconferences ), still having read the basic material they pose questions of a general nature, that were already described in the materials they read.

Due to the reason that the study process involves only 2-3 students, from different places, in one course this study process look like individual teacher – student sessions. Communication is done via e-mail, skype as videoconferences, and Learning Management system.

## **6. CONCLUSIONS**

One of the outcomes of the project is a value-added effect of the invested human efforts and financial resources of all of the preceding activities leading to improvements in the quality of the educational processes of all of the participating institutions.

The analysis of good practices gives us chance to compile an overview of the same for transnational virtual campuses

building from the pedagogical, legal, organisational and technical perspectives.

The analysis of implemented results gives a base to evaluate this project.

Also, collaboration with government, private organizations and other universities is important to overcome the high cost involved in develop e-Learning. We also need to provide experienced personnel with technical skill needed to implement e-Learning. So, we could say that e-Learning is a good addition to conventional learning as it is able to solve most of the problems that exist in conventional learning.

## 6. REFERENCES

[1] Slaidins, I. Open and Distance Learning in Latvia - Current Situation and Prospects. Proc.

Int. Conf. "Open and Distance Learning: Way to the Information Society - WIS'99". October 28-29, 1999, Kaunas, Lithuania. p.32-36.

[2] [www.liis.lv](http://www.liis.lv)

[3] Treimanis, M. The Concept of the E-university and the University of Latvia. Baltic IT&T Review, No.2 (29), 2003, pp.64 -66.

[4] A. Kamsin, Is E-Learning the Solution and Substitute for Conventional Learning? , International journal of the computer, the internet and management, September - December 2005

[5] S. Bruminhent, eLearning: A Process that Must be Well Planned, International journal of the computer, the internet and management, Special Issue 4-7 August 2005

[6] S. O. Alhabshi, Content development: The Difference It Offers To Learning Effectiveness, International journal of the computer, the internet and management, Special Issue 4-7 August 2005

## THE AUTHOR



### **Olga Remez:**

September 2002 – present Lecture in e-commerce and „European Business Studies”. Responsible for distant learning project managing, IT and e-commerce courses teaching. Development and implementation of the e-learning education.

Participation in international projects:

EVENE - Erasmus Virtual Economics & Management Studies Exchange (Agreement Number - 2005 - 3837 / 001 - 001 ELE-ELEB 12 / P5) as project manager  
ESF project „IT professional bachelor program design and implementation for Vidzeme University College” (VPD1/ESF/PIAA/04/APK/3.2.3.2/ 0046/0122)

## ACKNOWLEDGEMENT

*This work was supported by the European Commission by eLearning program, Agreement Number - 2005 - 3837 / 001 - 001 ELE-ELEB12.*



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

## E-LEARNING ENHANCEMENT USING VOICE ENABLED APPLICATIONS MANAGEMENT FOR BLIND PEOPLE

Safaa S. Mahmoud  
Faculty of Specific education - Ain shams University  
E-Mail: Safaasms@yahoo.com

**Abstract:** Blind people have the right to learn and educate as many other seeing people. This is our main interest in this paper; that to enable and simplify the learning process through a voice controlled application. The voice control capability applies both the speech recognition and speech synthesis technologies in the interaction between the blind student and our application during the learning process. The application is intended to teach the computer course in Egyptian schools; it is evaluated and tested against a sample of blind students. The experimental results showed an enhancement in the learning process over the normal methods used in teaching the blind people.

**Keywords:** Speech Recognition, Speech Synthesis, Interactive Environment, Spoken Dialogue System.

### 1. INTRODUCTION

Every blind or short sighted person has a deficiency or weakness which leads to his inability to satisfy his basic needs in life. These are a group of society who has their special needs which must be covered by their handicap to make them feel that are an important part of this society. Hence the developments in the technologies of artificial intelligence must assist to minimize their suffering and raise their efficiency and education (Haroon, 1420 H.). The writing of the Braille language was and still is the main information media for the sight handicapped person for more than 150 years. *Braille* is a language that has been invented by the blind Frenchman **Louis Braille** and is composed of prominent points with each prominent points representing a character in the alphabet (Geruschat & Smith, 1997, p. 117) (Dobelle, 2000, p. 119).

The method of using the human voice in a heard manner helps the visually handicapped to transform the printed material into a heard sound (Osberger, and Rohaly, 2001, pp. 361-372). With the increase in developments in technology and the associated innovations during the last two decades, similar to what has taken place in other fields, the users of Braille have made use of the benefits that has accrued from these developments in technology (Farmer & Smith, 1997, pp. 121-123) (Al-Sharqawi, Neural computes, the sixth general of computers, 2001, p 7) wide application possibilities, which can be already seen (safaa, 2006).

In this paper we applied the speech recognition utility for receiving voiced commands from the blind then apply some statistical speech signal processing techniques for recognizing the articulated command. Then this command is translated into some kinds of spoken response for the blind using the speech synthesis utility.

The system presented in this paper was developed using Microsoft visual studio.net 2005; "C#", along with Access

database 2003 for handling the control commands, and the courses being learned by the students.

The limitations of this work can be summarized in the following points; A- It contains only one course; computer course, but can easily be extended to include many other courses. B- Only one language is used in the developed spoken dialogue system; which is English. C- The control commands can be spoken as a series of connected words. Despite of these limitations, we intend to include all the features that can make the blind enjoy and feel conform in learning and studying using these computer based technologies.

The paper is organized as follows; section 2 shows the speech recognition utility in more details, sections 3 covers the main idea of speech synthesis, section 4 discusses the usage of speech recognition and speech synthesis in developing our application, section 5 shows the experimental results, and section 6 presents the summary, conclusion and future work.

Attached with the paper four appendices; appendix A, contains the voiced commands used by the blind to control the application, appendix B contains the criteria used to evaluate the effectiveness of our approach in the learning process; appendix C contains screen shot of the designed spoken dialogue system, and appendix D contains the experimental results which are evaluated the proposed voice application effectiveness.

### 2. SPEECH RECOGNITION

The speech technologies are developing very rapidly and more often they are used in the practical applications. For example, Microsoft has announced the goal to make speech mainstream which means speech as a component of basic computer interface. Such objective shows the perspectives of speech technologies applications and their

### 2.1. Some of the Problems facing this technology are:

- I. The nature of speech (particularly Arabic language) such as the presence of the existence of characters that distinguish beginning and ending words.
- II. Speakers voice changes in accordance with his emotional and bodily state, in addition to surrounding voice.

### 2.2. Some of the Computers that Can Recognize Voice are:

#### I. The Kurweil Speaking Computer

Kurzweil has produced a talking computer machine that transforms written language to a spoken language. It can also limit the number of available words. It is issued into methods: written and spoken methods (Dodds, 1995, p. 222).

#### II. Zygo Communication Machine

This is a very useful as it has a number of calling boards that are used in the system of entering information and then transform it a spoken language (Bentzen, 1997, p. 9).

#### III. Sound Generating Machine (TRS – 80)

This machine works as a talking tool. It can be connected to any computer to transform the required information into a heard expression (Cha, Horsch, and Normann, 1999, pp. 1367-1372).

#### IV. Miniaturized Computer (Bord / Carba)

This machine is intended to transform frequencies or written words to a heard language (Se and Brady, 2000, pp. 535-540).

#### V. Voice Expression Machine (Express1)

This machine can be programmed to feed in information by different methods. It is characterized by its ability to transform information into written or spoken forms. Information is fed in by alphabetizing the words or sentences and entering symbols and words (Whitestock, Frank, & Haneline, 1997).

#### VI. Seeing With Sound

The voice system is one of applications of artificial intelligence to assist the blind. The latest application of artificial intelligence in the filed of assisting the visually handicapped is seeing by sound which makes the blind learn by seeing through their ears instead of their eyes by using a mobile telephone set equipped with a camera, the system which is invented by Dr. Peter Mayer in Phillips Research Labs in Holland (Safaa, 2006).

## 3. SPEECH SYNTHESIS

Speech synthesis is the process of generating speech signal from text, and commonly named as text-to-speech. This process involves many processing steps applied to the text before transforming it into speech.

Sakhr Computers Company has developed the talking Arabic Talking Text which provides the possibility of handling Arabic text and diatrizing it and then transform it into readable text which resembles a human voice (<http://www.nattiq/arabic.com>). The technology is based on three units: linguistic, vocal and auditory (Boyle, Maeder, and Boles, 2001 pp 85-88), which are as follows:

1. The linguistics constitutes the Arabic text. The words are then transformed into its sound description for each word.
2. The sound unit works on calculating the sound parameter to pronounce the sound in accordance with the sound description which the linguistic unit provides.
3. The auditory unit provides the talk in accordance with the specified parameters. Based on this technology is the reading instrument which is available as a laboratory sample oriented basically to the blind and those with low vision and is capable to read scanned documents in an audible manner.

## 4. INTEGRATION OF SPEECH RECOGNITION AND SYNTHESIS INTO A SPOKEN DIALOGUE SYSTEM

Speech technology is maturing rapidly and attention is switching to the problems of using this technology in real applications, especially application allow a human to use voice to interact directly with a computer-based information or control system. Apart from the simplest case, such systems involve a sequence of interactions between a person and a machine. They therefore involve dialogue and discourse management issues in addition to those associated with prompting the user and interpreting the responses. These systems are often called Spoken Dialogue System [SDS] (Steve, 1999).

The main components of a typical SDS are illustrated in Fig.1.

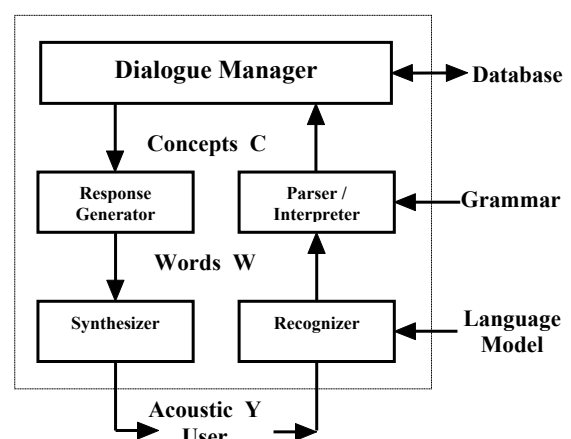


Figure 1: Architecture of a Spoken Dialogue System

In terms of data flow, the user's input is an acoustic waveform  $Y$  which is converted by the recognizer into a sequence of words  $W$ . the parsing and interpreting stage converts the word sequence into a concept sequence  $C$



which typically consists of tagged entities arranged in some predicated-argument structure. The recognition process makes use of a language model to constrain the search space of possible word sequences, and the parser makes use of a grammar to define the phrase, concepts are converted to words which are then converted to acoustic waveforms.

#### 4.1 Speech Recognition System Requirements

Operating Voice requires a PC, with the following specifications:

- Fast Pentium PC: 300 MHz at least – with sound card, head phones.
- Microsoft Operating Software: Voice works under windows environment: Windows 95-98-2000, Windows NT.
- Headphones with the capability *Hifi stereo sound*.

#### 4.2 Advantages of the Speech Recognition Software

The program provides a number of benefits to the blind. Some of these benefits are:

1. Includes the possibility of controlling by voice. It has a mute option using command (Deactivate; see appendix B) and so the blind person can switch the sound on or off, as required.
2. Contains a speech synthesis unit that transforms the written text into speech and play it to the blind when needed.
3. Has the possibility to navigate through the course and read certain paragraphs or even a complete page.
4. Can be considered as a simulation to the hardcopy reading and navigation, so that the blind will find that the reading and navigation through the course book is so easy and exciting.

### 5. EXPERIMENTAL RESULTS

To determine the extent of stability of the measuring tool, the list of questionnaire was presented to some professors of Education and professors in Computer and Information faculty at Ain Shams University in order to know the level of the clarity of questions, their comprehensives, the degree of stability of the measure used in this tool was calculated by depending on the sample of the current research, which its value was between 0.708 and 0.871 approximately, as chronbach 's alpha coefficient.

#### 5.1 Research Sample

The research sample was selected from a number of blind associations which are settled within Cairo governorate. It consists of 10 blind pupils at primary stage grade 6 at Al – Amal Association school for blind students.

#### 5.2 Presentation and Discussion of the Research Results

The results shown in table 2 represents the values of the Pearson's coefficients correlation for each of the variables shown in the table with the trends of the blind toward the use of the technologies of artificial intelligence in learning, with reference to the variables that have statistically

significant correlation with the trend of universities and organizations for the learning of the blind toward using the technologies of artificial intelligence. The research confirms the following:

- A) The existence of a positive correlation between trends of the blind toward the use of AI technologies in learning the blind and between the previous experience and training of the blind and on Braille language. This is the highest variable toward the use of the technologies of artificial intelligence in learning in the array of the coefficients of Pearson's correlation.
- B) The existence of a statistically significant positive correlation between the trends of the blind toward the use of artificial intelligence technologies in learning and between the efficiency of the voice application technology.
- C) The existence of a statistically significant correlation between the trends of the blind toward the use of artificial intelligence technologies in learning and between the support of schools and blind education centers for modern programs and equipment of artificial intelligence technologies.

These results are consistent with the studies of both Gregory (1998) and Shingledecker (1998) that has shown that Braille language was the main tool in the education of the blind, and that schools and associations and blind education centers have a major role in supporting the blind in learning.

In order to determine the independent variables that had the major impact on the trends of the blind toward using the technologies of artificial intelligence in learning, the techniques of multiple regression analysis was used to identify the variables that had a statistically significant correlation to the dependent variable. Results of the analysis of multiple regressions is shown in table 3.

The results in table 3 indicates to the existence of an impact of a statistically significant correlation between the independent variables of the blind trends toward the use of the technologies of artificial intelligence in learning as indicated in the value of **F**. This in addition to the multiple correlation coefficients **R**, which shows the existence of statistically significant position correlation between the independent variables and between trends of the blind in using the technologies of artificial intelligence in learning. The value of **R<sup>2</sup>** indicates that the percentage of variation in the trends of the blind toward the use of artificial intelligence technologies in learning that can be interpreted by means of the independent variables reached to 14.8%. While **T** values, shows that each independent variable had an impact on the trends of the blind toward the use of the technologies of artificial intelligence in learning, as follows:

#### A. The Impact of the Support of Blind Associations and Education Centers To the Blind For Using Modern Programs and Equipment in blind learning process:

Table 2 shows that the support of schools and blind associations and blind education centers for using modern

programs and equipment in blind learning process had a statistically significant correlation on the trends of the blind toward the use of the technologies of the artificial intelligence in learning. This was the variable with the most impact and had a value of T which was equivalent to 3.861. The percentage of its impact was 9.5%. This result is consistent with the results obtained by both Boyle, Maeder, & Boles (2003) and Humayun, Weiland, Fujii, et al, (2003), that has confirmed the importance of the role of universities and training centers for the blind in providing the equipment of artificial intelligence for the blind because these equipment are very expensive and required a lot of training.

### **B. Efficiency of the AI Voice Application Technologies For The Blind and Visually Handicapped:**

Table 3 shows the existence of statistically significant impact on the efficiency of the AI Voice Application technologies for the blind people and visually handicapped on the trends toward using the artificial technologies in learning process. This is the second variable in impact, its T value was equivalent to 3.351, and the percentage of impact reached 7.3%. This result came similar to the studies of Shoal, Ulrich, & Borenstein, 2000 and the study of Snaith, Lee, & Probert (2002) and the study of Boyle, Maeder, and Boles (2001) that confirmed the importance of the ease of the programs of artificial intelligence and the efficiency of its technologies for the blind.

### **C. The Impact of Experience and Previous Training of the Blind and the Short Sighted Person towards Using the Artificial Intelligence Technologies in Learning:**

The results in table 3 show the previous experience on Braille language and training of the blind and short sighted person had an important role that left a statistically significant impact on the trends of the blind toward the use of the technologies of artificial intelligence in learning. The value of T was equal to 2.102 and the percentage of impact was 3.1%. These results are consistent with the conclusions arrived by Molton, Brady, Se et al (1999), that confirmed that the blind and the short sighted person who does not have previous experience on Braille language will be deficient in learning and feels failure in front of his colleagues who have been trained on Braille. The results of the study also are consistent with the finding of the study Margait, Maia, Weiland, et al. (2002) which has confirmed the importance of experience and previous training for the blind and the person with low vision. This can be reasoned by connecting the use of computers and its intelligent programs.

Table 4 shows the post application of measurements tools which are used in the designed application for knowing the effect of the voice application in achieving its purposes. The cognitive achievements of the blind students are raised. The increasing difference reached to 32.66 as seen from t-test and the significance (0.01). This is indicated to the effectiveness of the designed voice application.

The voice application effectiveness is tested according to Blacke's ratio as seen in table 5. Blacke determined the effectiveness of the application if it is increased than 1.2 in case of applying the equation

$$\frac{y-x}{d-x} + \frac{y-x}{d} \quad \text{where } y: \text{ means of test mark (pro-rest)} \\ x: \text{ mean of test mark (pre-test)} \\ d: \text{ final mark}$$

Table 5 showed that the ratio of calculated updated gained is (1.23) which is more than the minimum ratio as determined by Blacke ratio. So, the voice application is acceptable regarding to the achievements test for the cognitive sides connected within the curriculum of computer for the pupils of primary stage grade six in Al Amal School for blind students, according to Blacke's ratio. So, the application is more effectiveness.

## **6. RESULTS**

- There are statistically significant differences between the mediums of marks for the achievements test for the pre application and post voice application for the experimental group and control group in favor of post application test.
- The voice control capability applies both the speech recognition and speech synthesis technologies in the interaction between the blind student and our application during the teaching process due to the spoken dialogue system..
- The experimental results showed an enhancement in the learning process over the normal methods used in teaching the blind student as seen in appendix D.

## **7. REFERENCES**

- [1] Ahmed, Mustafa Hassan, Simple Sensory and Physical handicaps and how to deal with them, the author, 1991, p. 277.
- [2] Al-Azaz, Abdullah Bin Sulayman, Computers in the Information Era, Riyadh, Dar Al Marikh, 1998.
- [3] Al-Salmi, Ala Abdulrazaq, Information Systems and Artificial Intelligence, Amman, Dura Al Manahig for publications and Distribution, 1998.
- [4] Al-Sharqawi, Artificial Intelligence and Neural Networks, Cairo, Artificial Intelligence Computer Centre, AICC, Al Maktab Al Masri Modern Printing Press, 2001.
- [5] Bentzen, B. L. "Environmental accessibility," in *Foundations of Orientation and Mobility*, B. B. Blasch and W. R. Weiner, Eds., 2nd ed. New York: American Foundation for the Blind, 1997.
- [6] Boyle, J. & Maeder, A. & Boles, W., "Static Image Simulation of Electronic Visual Prosthesis", Proceedings of the 7th Australian and New Zealand Intelligent Information Systems Conference, Perth, pp 85-88, 2001.
- [7] Boyle, J., Maeder, A. and W. Boles, "Can environmental knowledge improve perception with electronic visual prostheses?" Proceedings of the 4 World

- [8] Congress on Medical Physics and Biomedical Engineering, Sydney, 2003.
- [9] Cha, K. & Horch, K. and Normann, R.. "Mobility Performance with a Pixelised Vision System," *Vision Research*, vol. 32, pp. 1367-1372, 1999.
- [10] Cornsweet, T. N., *Visual Perception*. New York: Academic Press, 2000.
- [11] Davidoff, Linda, *Intelligence* (translation: Dr. Najeeb Al Fons Khuz'am and Dr. Mahmoud Omer) Cairo, International House for Cultural Investments, 2000.
- [12] Dobelle, W., "Artificial Vision for the Blind by Connecting a Television Camera to the Brain," *ASAIJ Journal*, vol. 46, pp. 3-9, 2000.
- [13] Dodds, A. *Mobility Training for Visually Handicapped People: A Person-Centred Approach*. London: Croom Helm, 1988.
- [14] Dodds, *Rehabilitating Blind and Visually Impaired People*. London: Chapman and Hall, 1995.
- [15] Fairhurst, M. C., *Computer Vision for robotic systems*. New York: Prentice Hall, 1998.
- [16] Farmer, L. W. & Smith, D. L. "Adaptive technology," in *Foundations of Orientation and Mobility*, B. B. Blasch and W. R. Weiner, Eds., 2nd ed. New York: American Foundation for the Blind, 1997.
- [17] Geruschat, D. & Smith, A. J. "Low vision and mobility," in *Foundations of Orientation and Mobility*, B. B. Blasch and W. R. Weiner, Eds., 2nd ed. New York: American Foundation for the Blind, 1997.
- [18] Geruschat, D., Turano, K. A. & Stahl, J. W., "Traditional Measures of Mobility Performance and Retinis Pigmentosa," *Optometry and Vision Science*, vol. 75, pp. 525-537, 1998.
- [19] Gregory, R. L. *Eye and Brain: The Psychology of Seeing*, 5th ed. Tokyo: Oxford University Press, 1998.
- [20] Safaa S. Mahmoud, "Criteria of Artificial Intelligence Technologies Management Blind Learning "Seeing with Sound", IMCL Conference, Amman, 2007
- [21] Steve, Young. "Probabilistic methods in spoken dialogue systems", Cambridge University 1999.

## Appendix A

### Intelligent Tutoring System for Blinds Version 1.0.1 EGYPT

This part provides a summary of the most important voiced commands mostly widely used by the Seeing With Sound Application, with explanations for executing these commands.

|                          |  |
|--------------------------|--|
| • Activate               | • This voiced command used to activate the speech recognition ability, for receiving more commands to control the application.                             |
| • Deactivate             | • Used to disable the speech recognition ability, once this command is executed, the only command that can be executed is "Activate".                      |
| • Open Chapter 1, 2, ... | • Used to open certain chapter i.e., to open chapter 1, you can say "open chapter one".  |
| • Read Left Page         | • Used to read ALL the paragraphs in the left page.  |
| • Read Right Page        | • Used to read ALL the paragraphs in the right page.   |
| • Read Left First        | • Used to read the FIRST paragraph in the left page.   |
| • Read Left Next         | • Used to read the NEXT paragraph in the left page.  |
| • Next                   | • This command is valid only after running the command "Read Left First" or "Read Left Next", and Used to read the next paragraph in the left page.        |
| • Previous               | • This command is valid only after running the command "Read Left First" or "Read Left Next", and Used to read the previous paragraph in the left page.    |
| • Read Right First       | • Used to read the FIRST paragraph in the right page.  |
| • Read Right Next        | • Used to read the NEXT paragraph in the right page  |
| • Next                   | • This command is valid only after running the command "Read Right First" or "Read Right Next", and Used to read the next paragraph in the left page.      |
| • Previous               | • This command is valid only after running the command "Read Right First" or "Read Right Next", and Used to read the previous paragraph in the Right page. |
| • Left                   | • Used to navigate to the left page of current chapter.  |
| • Right                  | • Used to navigate to the right page of current chapter.   |

The automaton that shows the controlling words constructs is shown in figure 2.

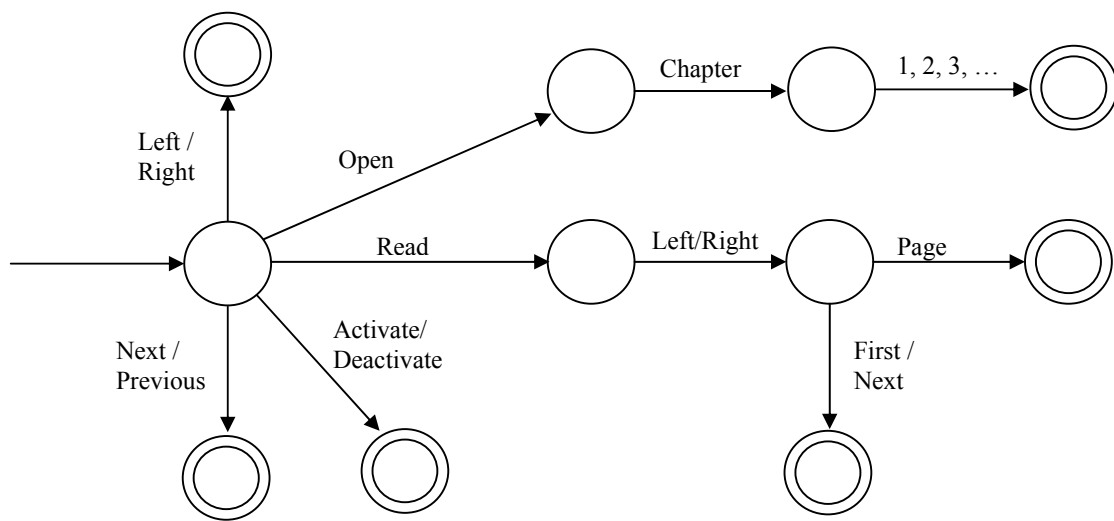


Figure 2: The Automaton for the controlling commands.

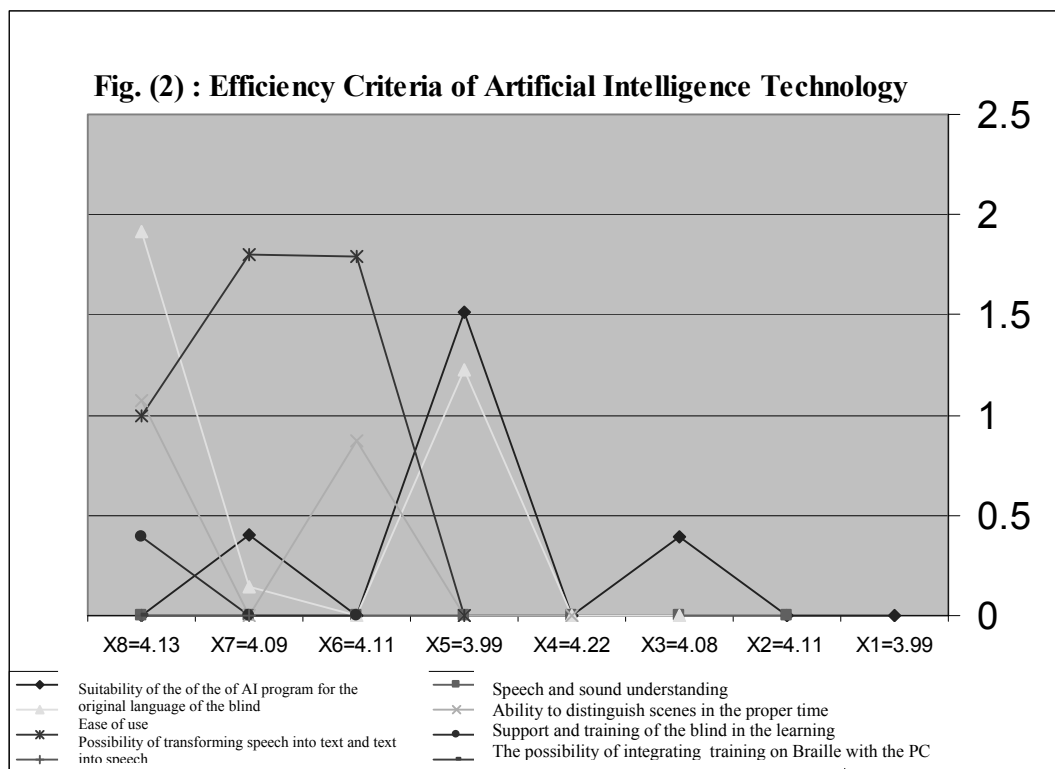


Figure 3: Efficiency of criteria of managing speech processing technology

**Appendix B**  
**Criteria Used To Evaluate the Proposed System and It is followed in our application**

**Table 1: Criteria of Managing Speech Processing Technologies**

| Criteria of Managing Speech Processing Technologies  | SD for each criteria | Mean (X general) | S.D. | Mean X |
|--|----------------------|------------------|------|--------|
| <b>1. Suitability of AI Programs for Blind and Visually handicapped learning</b>               |                      |                  |      |        |
| • Clarity of the information provided by the AI programs for the blind.                        |                      |                  | 0.89 | 4.26   |
| • Consideration of the time factor in providing the information                                |                      |                  | 0.98 | 4.11   |
| • Meeting the learning needs of the blind.   |                      |                  | 0.82 | 4.36   |
| • Assistance in the improvement of the blind's productivity.                                   |                      |                  | 0.74 | 3.29   |
| • Displaying information & commands in a suitable and effective manner.                        | 0.688                | 3.99             | 1.01 | 3.88   |
| <b>2. Recognition of Speech and Sound</b>  |                      |                  |      |        |
| • Translation of pictures into audible sound.  |                      |                  | 0.85 | 4.15   |
| • Distinguish sound properties for different persons at all times.                             | 0.693                | 4.11             | 1.02 | 3.95   |
| <b>3. Ease of use and speaking</b>   |                      |                  |      |        |
| • Ease of using the programs and the equipment.  |                      |                  | 0.98 | 3.97   |
| • Ease of recognizing sounds.  | 0.697                | 4.08             | 0.74 | 4.11   |
| <b>4. Ability to see by sound (ability to distinguish scenes)</b>                              |                      |                  |      |        |
| • Possibility of reading from the screen.  | 0.72                 | 4.22             | 0.91 | 4.06   |
| <b>5. Possibility of transforming text into speech and speech into text</b>                    |                      |                  |      |        |
| • Possibility of speaking and reading from the screen.   |                      |                  | 0.82 | 4.18   |
| • Transforming text into speech and speech into text.  |                      |                  | 1.22 | 3.98   |
| • Interaction with the blind in his natural language.  |                      |                  | 1.05 | 3.75   |
| <b>6. Support and Training for the blind in learning</b>                                       |                      |                  |      |        |
| • Availability of books and instructions to help the blind to operate and use AI.              |                      |                  | 0.74 | 4.31   |
| <b>7. using non-conventional AI equipment to raise the efficiency of the blind in learning</b> |                      |                  |      |        |
| • Do without the conventional mouse.   |                      |                  | 1.2  | 4.22   |
| • Talking computer with a sound card.  |                      |                  | 1.17 | 4.04   |
| <b>8. Possibility of integrating training the blind on with Braille</b>                        |                      |                  |      |        |
| • The possibility of talking to the computer through the application                           |                      |                  | 0.69 | 4.23   |
| • The possibility of browsing chapters.  |                      |                  | 1.08 | 3.93   |
| • The possibility of browsing the voice application services.                                  | 0.7                  | 4.13             | 0.81 | 4.24   |

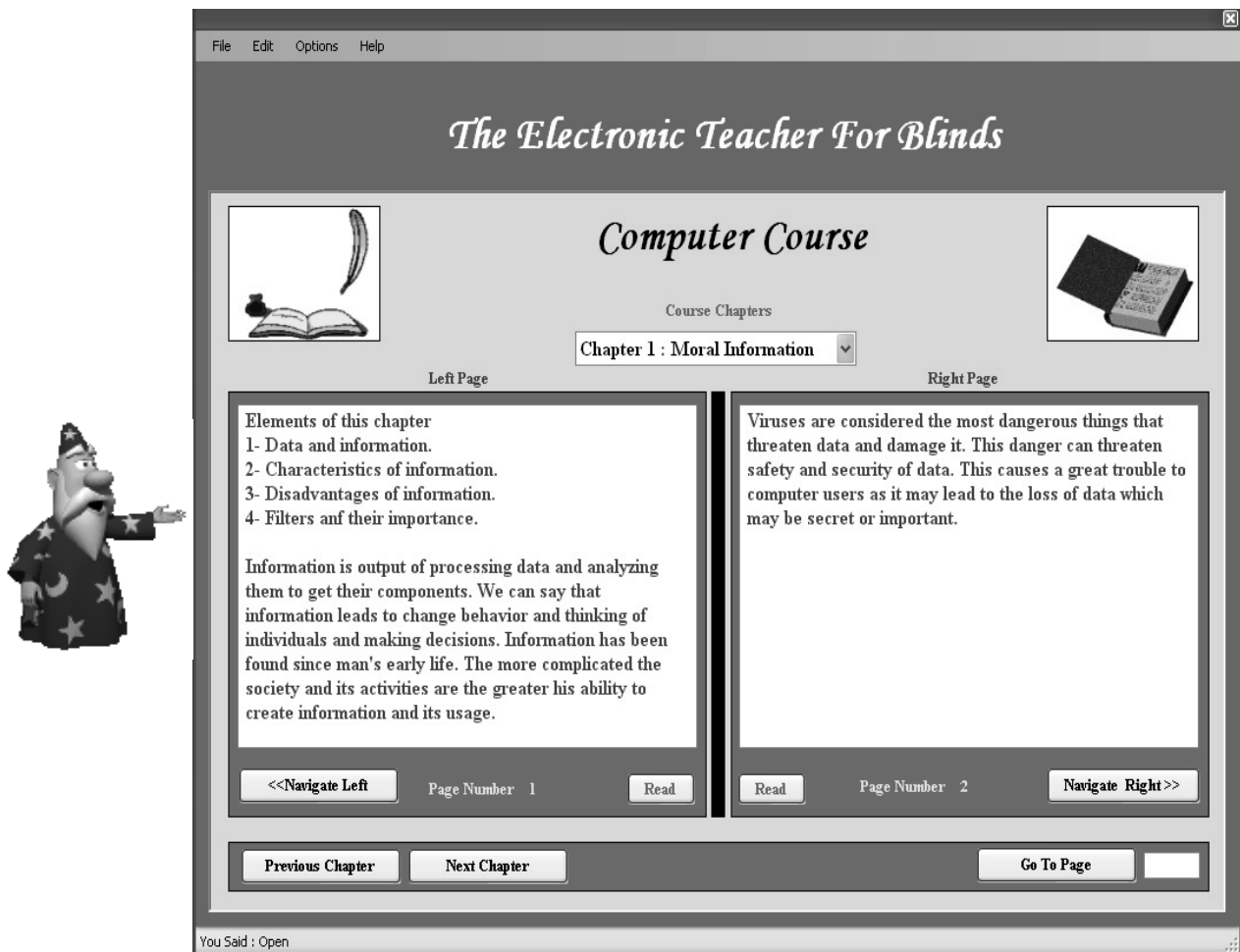
**Table 2: Efficiency Criteria of Speech Processing Technologies**

| Efficiency Criteria of Speech processing Technologies  |                      | X <sub>2</sub> =3.99 | X <sub>2</sub> =4.11 | X <sub>3</sub> =4.08 | X <sub>4</sub> =4.22 | X <sub>5</sub> =3.99 | X <sub>6</sub> =4.11 | X <sub>7</sub> =4.09 | X <sub>8</sub> =4.13 |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Suitability of AI programs to the original language of the blind   | X <sub>1</sub> =3.99 | --                   | 7.56**               | 0.389                | 4.02**               | 1.509                | 3.209**              | 0.405                | 2.15*                |
| Comprehension of speech and sound  | X <sub>2</sub> =4.11 |                      | --                   | 7.55**               | 3.29**               | 6.1**                | 4.23**               | 11.42**              | 3.7**                |
| Ease of use and speaking   | X <sub>3</sub> =4.08 |                      |                      | --                   | 3.94**               | 1.23                 | 3.02**               | 0.142                | 1.92                 |
| Ability to distinguish scenes at the appropriate time  | X <sub>4</sub> =4.22 |                      |                      |                      | --                   | 2.69**               | 0.875                | 4.05**               | 1.07                 |
| Possibility of transferring text in to speech and the speech into text                                       | X <sub>5</sub> =3.99 |                      |                      |                      |                      | --                   | 1.79                 | 1.8                  | 0.994                |
| Support and training the blind in the learning process   | X <sub>6</sub> =4.11 |                      |                      |                      |                      |                      | --                   | 2.93**               | 0.39                 |
| Use of intelligent non-conventional equipment to upgrade the efficiency of the blind in the learning process | X <sub>7</sub> =4.09 |                      |                      |                      |                      |                      |                      | --                   | 1.97*                |
| The possibility of integrating training of the blind on Braille with computer                                | X <sub>8</sub> =4.13 |                      |                      |                      |                      |                      |                      |                      | --                   |

**Table 3: The Blind Trends For Using AI Voice Application Technology in Learning Process.**

| Variable   | Partial determine | Significance level | T value | Beta value | Standard Error | Regression coefficient |
|--|-------------------|--------------------|---------|------------|----------------|------------------------|
| Experience and previous training of the blind and the short sighted person on Braille language.                              | 0.032             | 0.367              | 2.108   | 0.175      | 0.0604         | 0.125                  |
| The efficiency of AI Voice Application technologies for the blind and vision handicapped person.                             | 0.071             | 0.001              | 3.351   | 0.272      | 0.114          | 0.381                  |
| Support of schools and blind education centers for new artificial intelligence programs & equipment for educating the blind. | 0.0953            | 0.0002             | 3.862   | 0.306      | 0.101          | 0.392                  |
| F = 0.01 Significance level 4.971  |                   |                    |         |            |                |                        |
| R <sup>2</sup> = 0.148 Determining factor 0.382 Multiple Correlation coefficient   |                   |                    |         |            |                |                        |

### Appendix C Screen Shot of the designed Spoken Dialogue System



**Appendix D**  
**Statistical Tests For The designed Spoken Dialogue System Effectiveness in Learning the Blind Students**

**Table 4: The Voice Application Effectiveness According to t test**

| Sample | Pre test<br>Mean | S.D  | Pro test<br>Mean | SD   | t     | Significance<br>Level | Remark |
|--------|------------------|------|------------------|------|-------|-----------------------|--------|
| 10     | 18.6             | 4.50 | 51.4             | 1.71 | 32.16 | 0,01                  | Sig.   |

**Table (5) : The Voice Application Effectiveness according tp Black ratio**

| Students<br>no. | Final mark | Pre-test means | Pro-test means x | Black gain ratio |
|-----------------|------------|----------------|------------------|------------------|
| 10              | 30         | 11.2           | 25.4             | 12.23            |







*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

## **ORGANISING VIRTUAL EUROPEAN SEMINARS: CASE-STUDY THE VENUS SUMMER SCHOOL ON SOCIAL SOFTWARE IN EDUCATION AND BUSINESS**

Schreurs Bieke

EuroPACE, [bieke.schreurs@europace.be](mailto:bieke.schreurs@europace.be), <http://www.venus-seminars.net>

**Abstract.** The VENUS project, running from March 2006 until February 2008, gives students and citizens the opportunity to participate in seminars taught by some of the world's most famous experts, through virtual mobility. In VENUS the sustainability of two different models of international virtual seminars are being evaluated: a seminar series during the academic year 2006-2007, which has been running since September 2006, and a one-week summer which will be held from 3-7 September 2007 and can be followed at the ICETA Conference. The VENUS Summer School is one of the training activities organised in the light of the VENUS project. The focus will mainly be on the use of social software in education. The workshop will work around best practice examples and the view of experts in the field. Besides intensive hands-on training on the tools, discussions will be held on the feasibility and limitations of the implementation of these applications in the institutions of the participants.

**Keywords:** Virtual Mobility, Distance Education, Social Software

### **1. THE VENUS PROJECT**

Many universities nowadays have a mission to provide knowledge not only to their on-campus students but also beyond the "walls" of the institution. Lectures or seminars that have relevance for a wider audience and that go beyond the campus boundaries are often held in public and are open to all citizens. New media and ICT make it possible to involve citizens in these activities from virtually anywhere.

The VENUS project, subsidized under the eLearning programme of the European Commission (March 2006 until February 2008), gives students and citizens the opportunity to participate in seminars taught by some of the world's most famous experts, through virtual mobility.

In VENUS the sustainability of two different models of international virtual seminars are being evaluated: a seminar series during the academic year 2006-2007, which has been running since September 2006, and a one-week summer which will be held from 3-7 September 2007 and can be followed at the ICETA Conference.

The VENUS partners form an international cluster of educational institutions, each strongly embedded in regional networks, in order to stimulate inclusion of citizens. Through the elaboration of the contents on two levels (general European and region specific) the European identity is enhanced and at the same time the local aspects are being valued. VENUS aims to become a world-class example of cross-border collaboration between higher education organisations, businesses and citizens. The overall objective is to create a sustainable best-practice example of the "Faculty of Extension", extended both in the sense of methods and target public.

VENUS mainly aims to experiment with various seminar models, to create sustainable models that will support the implementation of a real "Faculty of Extension". These models will enable traditional mainstream educational institutions to extend their activities to foreign students, citizens and lecturers (physically or virtually). They also support the re-enforcement of international and regional networks. Finally, the models also include a study of the appropriate supportive forms of transmission and collaborative methods.

The VENUS Seminars can be considered an extension of the model of the traditional on-campus seminar (or guest lecture) where teachers or lecturers and learners meet physically within the boundaries of space and time, and where there is an asymmetric transfer of knowledge: this means that learners are for a large part of the seminar receptive, for a smaller part of the seminar actively engaging in discussion with peers, and for another part interactive with the lecturer. The seminars are supported with lecture materials (background reading materials, biography, possibly the lecture support materials) before the lectures, during the lectures the learners can participate in parallel discussions (via chat), and afterwards the possibility is provided to re-visit the seminar by looking at the recorded seminar again. There is also a possibility to extend the discussion in a forum.

VENUS has the following particular outcomes:

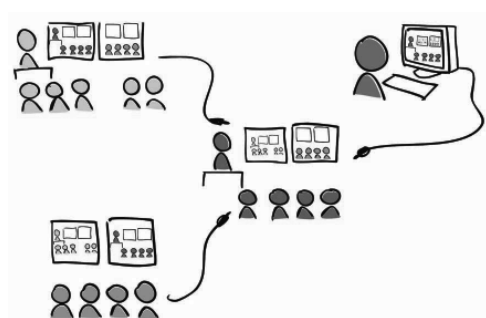
**Virtual Seminar Series:** Theme for the 2006-2007 seminars is "Global Issues for the European Citizen." The 7 participating universities throughout Europe are connected to each other and to an international speaker (a top expert in his domain) through several educational technologies (videoconferencing, live streaming, online instant text

messaging). At each location, there is a local moderator and a content expert from the own institution.

The seminars consist of 3 main parts:

- Preparatory activities: provision of information on the speaker, abstracts and additional supporting documents
- Seminar delivery:
  - Presentation by the international speaker, broadcast to all participating sites via videoconferencing and streamed live via the web. A moderated chat session about the topic is going on at the same time.
  - Local debate at each individual location with all the participants that are present, to devise a few questions for the international speaker
  - Summary of the debates by all locations (broadcast via videoconferencing / livestreaming), questions to and reaction from the speaker
- Follow-up activities: videorecordings of the presentation and the slides are available on the VENUS website for review by everyone.

The image below illustrates the Virtual Seminars Model:



Venus Summer School on Social Software in Education and Business: The Venus Summer School gives students, teachers and citizens the unique opportunity to familiarize themselves with internationalization of both education and business through the application of social software. Hands-on exercises and all-round practice are key features of this Summer School, using social software both as subject and as means of interaction between the participating European partners. The Summer School will also be organised from 3-7 September 2007. Participants of the ICETA Conference 2007 will also have the opportunity to participate on location.

Jointly developed training materials: All the templates, checklists, guidelines and theoretical background on virtual seminar organisation from a technological, organisational and pedagogical view, that have been created in the course of the project are included in the “Virtual Seminar Organisation Handbook” which will be published in the second half of the project. These materials offer practical tools and instruments to organising virtual seminars following the VENUS model.

Strategy for Higher Education Institutions and their partners in education on how to successfully organise self-sustainable, high quality and certified virtual mobility schemes,

Online module entitled “Europe in Focus”: This contains recordings and learning materials derived from the seminar series. They are available from the website. After each seminar the website is updated with all the materials.

A sustainable virtual mobility scheme will be developed in the last stage of the project.

Three or more training workshops will be organized for interested parties outside the partnership who want to replicate the models suggested by the VENUS partnership. They are planned in the second half of the project taking place alongside major educational events such as the annual Eden conference 2007 and Online Educa Berlin 2007.

The perceived **strength** of the project is the (mix of) competences and experiences available amongst partners who are strongly committed to the project. Knowledge sharing between less and more experienced partners is central in the project. Another strong side of VENUS is the topic of Virtual Mobility in itself, which generates lots of interest from top experts, university staff and students. However, while it is quite early in the project to formulate concrete lessons learnt, partners already indicate there are still quite some obstacles before being really able to fully implement virtual seminars into mainstream education, that target at the same time students and citizens. VENUS also suffers occasionally from technical vulnerability which needs to be further investigated in the second half of the project.

A permanent evaluation of project activities and outcomes will result in a complete overview of collected insights, lessons learnt and recommendations from the VENUS experiments.

All these experiences will be bundled in a Virtual Seminar Organisation Handbook that will be made available online and in print. This will allow Higher Education institutions to organise similar activities that are accepted in their mainstream educational offer.

## 2. THE VENUS SUMMER SCHOOL ON SOCIAL SOFTWARE IN EDUCATION AND BUSINESS

### Introduction

The VENUS workshop is one of the training activities organised within the framework of the VENUS project. The focus will mainly be on the use of social software in education. The workshop will work around best practice examples and the view of experts in the field. Next to intensive hands-on training, discussions will be held on the feasibility and limitations of the implementation of these applications in the institutions of the participants.

The aim of this workshop is thus to train interested participants in the use of social software, to disseminate information on best-practices on the use of social software in education to the participants and to collect valuable feedback from the discussions during the workshop. Real solutions will be sought for concrete problems when implementing social software technologies to enhance international collaboration.

The discussions will take place using the learning café method. Due to this technique all participants will be given the opportunity to take an active part in the discussion and to give their opinions or make statements on the topic.

#### Topic: Social Software

In the educational area we can witness a change in the view of how we engage with knowledge. The new generation of students (the so called “Net Generation”) has a different way of learning. They are characterised by impatience, learning by doing, social, interactive, multi-tasking, connected, mobile and media-smart. There is also a trend in knowledge sharing: there is a clear shift from the idea of the isolated individual ‘genius’ to the concept of communities of practice where reflection and feedback are important collaborative processes. [1] The new generation of technologies, the so called “Social Software” are all about the creation of communities, sharing, communicating and building together. Is it possible to use these new technologies in traditional education? What is the added value, the advantaged and the pitfalls? For what learning goals can we use social software applications and which tool is useful for which learning objective? These are questions we will try to answer during the Venus Summer School on Social Software in Education.

#### What is Social Software?

Broadly conceived the term social software refers to all software that enables people to rendezvous, connect and/or collaborate through computer-mediated communication - between two or more individuals. [2] This can range from emailing to virtual gaming where people can meet each other in a 3D world. Social software encompasses one or more (not necessarily all) of the following elements: conversational interaction between people or groups, support for social feedback, like e.g. the seller ratings in eBAY and the support for social networks.

The difference however between traditional and social software is that traditional online tools enable communication from a top-down perspective while social software has a bottom-up approach. In other words, social software gives people the opportunity to organize themselves into a network based on their own preferences. [3]

#### Social Software Tools in Education

Examples of social software are wiki’s, weblogs, skype, msn messenger... These are used daily for various purposes, by widely varying audiences.

During the Venus Summer School we will look at a number of social software, including the four described below. Our selection is based on both research papers as or own

experience. We selected the tools most used in education so far and with most potential to be used in educational circumstances. (With exception of MSN Messenger, as this tool is mostly known)

#### Weblogs

A weblog (“web log”) or a “blog” is an online, chronological collection of personal commentary and links. They can be easily created and used from anywhere with an Internet connection. Blogs are a form of Internet publishing that has become an established communications tool. Blogging has evolved from its origins as a medium for the online publication of personal diaries to a respected vehicle for editorials on specific topics. In their latest incarnation, blogs represent an alternative to mainstream media publications. The personal perspectives presented on blogs often lead to discourse between bloggers, and many blog circles generate a strong sense of community. The ability for readers to leave comments in an interactive format is an important part of most early blogs. [4]

Educators can blog to communicate and exchange ideas on their research or to create a community or a network (of educators in or outside of an institution) around a shared interest (course, research topic) Students can find the use a weblog interesting to communicate and exchange ideas on a school task (paper, thesis, Ph.D research, etc.). This can be done individually or in group (group task). It can also be used in the context of internships or student placements. Blogs have been found to be a useful tool to learn to search, find, analyse and synthesise information. Students learn to form an opinion to allow discussion and constructive criticism. They learn to cope with feedback (peer review, peer pressure) and write a concise and meaningful post with a good argument. On an institutional level, weblogs can be used as an alternative to a normal website: the typical categories of a weblog can be defined as menu buttons; the chronological posts give the necessary information often with an event calendar.

#### Wiki

A Wiki or WikiWiki is a collection of related webpages which are very easy to edit through an internet browser. The main features of a wiki are: they are open, dynamic, use simple format and unique names; they are traceable, flexible, they use hypertext navigation and have no predetermined structure. Educators can use a wiki for collaborative text writing (e.g. for collaborative course preparation or writing research papers). Students can find the use a wiki interesting for online drafting, collecting links or practicing their writing skills. They can also use wiki’s for preparing a paper together with other students, for making their own encyclopaedia of terms and phrases or creating an extended lexicon. They learn to search, find, analyse and synthesise information. Wiki’s can be used on an institutional level as well, as their user-friendliness and simple use of technology appeal to a broad audience. Institutions can use wiki’s to create a central knowledge base that can be updated by people across departments and research areas.

### Social Bookmarking

Social bookmarking is a web-based service to store and share your Internet bookmarks. As such they are accessible from everywhere. Social bookmarking sites today use an organizational strategy known as tagging. Tagging refers to the ability to add a short description to the website and some relevant keywords (a tag) in order to classify the website. Social bookmarking becomes highly interesting when many users apply similar tags or keywords for the same bookmarks: a user can then easily search for other related websites that have been tagged in the same way. This gives an indication and a classification of most "popular" websites for a particular topic: a site that holds useful information will be bookmarked by more people. If a person has made his/her bookmarks public, you can also search through his/her bookmarks. For teaching staff, social bookmarking can be interesting (i) to create a group of researchers or teachers with a common interest to share links, (ii) to rate and review resources of information, (iii) to create an "internet library", (iv) to unintentionally discover resources and information by following other people's similar tags, (v) to setup a group tag in order to share educational resources, etc. For students, social bookmarking can be used to create a group of students around a common research topic to share links with each other and to stimulate unintended and spontaneous learning opportunities. For a (research) institute, social bookmarking can be a powerful tool for knowledge management, to create a collection of resources around the (research) themes of the institute. This can be done through the creation of a network of individual accounts or through a common group account.

### RSS- Feeds

The abbreviation stands for several things, amongst which 'Rich Site Summary' and 'RDF Site Summary', but the most widely accepted is 'Real Simple Syndication'. RSS is an alternative means of accessing the vast amount of information that now exists on the World Wide Web. RSS technology turns around the usual practice of users visiting websites that they are interested in, to a practice where the information is directly from these websites to the user. The content is delivered automatically, instantaneously and without viruses, spam and other electronic nuisances. Users of RSS content use software programs called "feed readers" or "feed aggregators": the user subscribes to a feed by entering a link of the feed into the reader program. The feed reader can then check the user's subscribed feeds at regular intervals to see if any of those feeds have new content since the last time it checked, and if so, retrieve that content and present it to the user. RSS feeds often include the title of the article and a small excerpt or even the whole article. Viewing someone's feed is referred to as aggregation as you are gathering all of the latest entries. RSS has become extremely popular with weblogs as blog updates are irregular and the headline format comes naturally.

The main advantage of RSS is that it allows for 'web content customizability': getting what you want, when you want it! If instructors are already using weblogs with students, the use of RSS is a must. Instead of checking out

all students' weblogs every day, instructors can just collect their students' work in their aggregator using RSS feeds. Working with RSS proves to be very useful as well for students doing research on a specific topic and who want to be kept up-to-date.

### **3. CONCLUSION**

The VENUS project, subsidized under the eLearning programme of the European Commission (March 2006 until February 2008), gives students and citizens the opportunity to participate in seminars taught by some of the world's most famous experts, through virtual mobility.

In VENUS the sustainability of two different models of international virtual seminars are being evaluated: a seminar series during the academic year 2006-2007, which has been running since September 2006, and a one-week summer which will be held from 3-7 September 2007 and can be followed at the ICETA Conference.

The VENUS Summer School will deal with the use of social software in business and education. Social software is an encompassing term used to describe tools and technologies that enable people to rendezvous, connect and/or collaborate through computer-mediated communication. The VENUS Summer School at ICETA Conference will look at the use of social software in education. During the two-day workshop, the added value of social software in education will be discussed. Some existing best-practices will be presented by experts through videoconferencing and hands-on training will be given to the participants, to experience the potential of social software and international collaboration. The agenda for the two days is described below.

#### Agenda

#### **Thursday 6 September: Social Software in Higher Education (Day1)**

##### **9:30 – 10:00: Local Introduction:**

Local introduction to the use of social software in Education.

**10.00 – 10.45:** Explanation on tools: an introduction will be given on the tools that can be used.

##### **10.45-12.30: Practice on tools**

Participants are given an assignment to practice and discuss upon social software in education. The social software tools are practiced shortly so participants get acquainted with them.

##### **12:30-13:30: Lunch**

##### **13.30 – 14:00: Introduction of all European Sites:**

All European sites greet each other via videoconference.

##### **14.00 – 15.00: Lecture by Dr. Peter Scott (KMi - OU - UK) on the use of Social Software in Education**

From his background at the Open University of the U.K., Peter Scott leads us through the use of Social Software in the Educational practice. After a 25 minutes lecture through videoconference, participants can freely ask questions for another 25 minutes.

**15:00 -15:30:** Local round-up of experiences

**Friday 7 September: Social Software in Higher Education (Day 2)**

**9:30 - 10:00:** Local Introduction:

Local introduction to the use of social software in Education.

**10:00 - 10:35:** Sharing of experiences:

Participants of all sites share their experiences of the previous day through videoconferencing.

**10:35 – 11:35: Best Practice example**

**Hans Coppens** from the K.U.Leuven presents a best practice example of Social Software in education (Japanese Studies) during 25 minutes, also through videoconferencing. The other 25 minutes, all participants are free to ask questions.

**11:35 – 12:00:** Short introduction on afternoon activities ...by means of videoconference

**12:00-13:00:** Lunch

**13:00 – 14:00: *Learning café***

At each site, three topics concerning social software in education are discussed.

**14.00 – 15.00:** Reporting of discussions:

All sites formulate their findings on online platforms like wiki, weblogs, vlogs etc.

**15:00 -15:30:** Closing session

## 5. REFERENCES

[1] Owen, M., e.a.: Social software and learning. Futurelab, 2006

[2] Wikipedia, Social Software, 2007, ([http://en.wikipedia.org/wiki/Social\\_software](http://en.wikipedia.org/wiki/Social_software))

[3] Kaplan-Leiserson, E. We-Learning: Social Software and E-Learning. Learning Circuits, 2003

(<http://www.learningcircuits.org/2003/dec2003/kaplan.htm>)

[4] 7 Things you should know about Blogs, Educause, 2006 (<http://www.educause.edu/ir/library/pdf/ELI7006.pdf>)

[5] Richardson, W. RSS: A Quick Start Guide for Educators, 2005, <http://www.weblogg-ed.com/>,

[6] <http://www.venus-seminars.net>

## THE AUTHOR



**Bieke Schreurs** received the MA degree in Communication Science at the Katholieke Universiteit Leuven, in 2003. She also received the MA degree in Electronic communication at the Katholieke Universiteit Leuven, in 2004, with a thesis on Interactive

Movies . In the same year she was a Technical assistant for three months at the unit AVNet at the Katholieke Universiteit Leuven. Since January 2005, she is appointed as a research associate at the Unit AVNet and EuroPACE. She is doing research about the use of multimedia in education which results in an online course and an annual workshop for tutors of the Katholieke Universiteit . She is also doing research about digital communication tools for international cooperation in education which will result in three seminars about the use of streaming technology, weblog and wiki's and audio-, video-, and webconferencing. Since March 2006 she is also project coordinator of the European project Venus: Virtual and mobility for networking universities. Next to this project she is also co-researcher in the eLERU project.





## DIDACTIC PRINCIPLES APPLIED IN TEACHING LISTENING AND READING COMPREHENSION IN PROFESSIONAL ENGLISH

Ivana Šimonová

University of Hradec Kralove, Rokitanskeho 62, 500 04 Hradec Kralove

ivana.simonova@uhk.cz

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The distance form of education and electronic methods supporting the educational process are currently being emphasized. The article focuses on the ways of implementing information and communication technologies which became the standard level in university, especially engineering education. The necessary theoretical principles and their practical application are summarized and presented in the article. The University of Hradec Kralove, Faculty of Informatics and Management, has been providing more than 100 e-learning distance courses to their students since 2001. The experience in the use and proposed improvements in courses of professional English for bachelor combined form of study for Applied Informatics students are discussed here.

**Keywords:** professional English, reading, listening, comprehension skills

### 1. INTRODUCTION

The current situation in the society (economy, technical development, life style) requires new competences. The lifelong qualifications and professions are useless. All people in active age, both today's students and working people, have to meet new requirements. The information and communication technologies (ICT) and the general technical development cause substantial changes in the content and extent of demanded skills. To succeed on the globalized labour market, new competences, sometimes still unknown, must appear. The process of forming them is a longlasting one and not easy-going. The importance of education increases even with people who have already graduated and are highly qualified in any field.

### 2. TAILORED CONTENT

At the Faculty of Informatics and Management (FIM) University of Hradec Kralove (UHK) the subject of Professional English for bachelor combined students of Applied Informatics is taught in distance form. The six-term study is supported by six e-learning distance courses in virtual learning environment (VLE) WebCT tailored according to the curriculum requirements. The VLE offers wide range of tools which enable to simulate running the real educational process so students' experience is largely positive, e.g. [1], and others. Two courses in the first year of study aim at both increasing knowledge of weak students and keep advanced students interested in the subject. The former students often are of those who studied Russian at secondary schools and have had problems with English ever since because of various reasons. The latter students usually have experience in working in an English speaking country or company. It is desirable to use their experience and so is it. In the second year the objective is to master communication, both in written and oral forms. The course

on written communication contains writing various types of letters (professional vocabulary, layout), especially orders, complaints and handling complaints, letters of application, covering letters, responses to advertisements offering job positions, preparing professional curriculum vitae, writing motivation essays etc. Oral communication concentrates on strategy and vocabulary of activities as socializing, telephoning, negotiating, presenting projects and others. In the third year the courses develop reading and listening comprehension skills. The main topic is to work correctly with professional texts so that students were able to read (i.e. pronounce and present), understand and summarize the content.

### 3. DIDACTIC PRINCIPLES

Since the beginning of the process of ICT implementation into the educational process the technical point of view has been emphasizes and researched. Today it is high time the didactic principles had been applied. Not only technical improvements are to ensure running the process of instruction, i.e. teaching/learning. Effective gaining, forming and keeping knowledge, skills and positive affective attitudes must come under the rules which were set centuries ago but are neglected today, especially in situations when technical point of view has the leading role and is emphasized.

The main principles are as follows [2]:

#### Purposefulness

Teaching is a purposive activity which requires stating strategic and partial objectives, explaining them to students and thus motivating them to reach objectives defined at the beginning of the process. Motivation plays an important role in the whole educational process and strengthens the student's effort.

### Systematicness and systematic approach

Each educational activity must be structured in a logical system leading to methodical, systematic way of instruction, i. e. teaching&learning. "Let everything what comes after be an objective, everything what comes before be a means targeting to the objective" [3]. This principle forms the basis of programmed instruction where all information which is to be learned is presented in the system of logical steps, including feedback, continuous checking and controlling the process.

### Activeness

The principle comes from individual activity of a single student, arouses cognitive, emotional and volitional processes, stimulates interest and motivation, leads towards application of gained knowledge and to the use of creative approaches in all instructional activities.

### Clearness

The principle requires activating as many senses as possible, which enables students to research the real life in direct opinion, forming ideas on their own experience in indirect opinion, and thus continually and simultaneously develop the whole personality. As gnoseology shows the process of cognition begins with sensory perception and leads to general thinking and verification of conclusions. In practice this principle is applied in visual aids, explanatory examples, motoric training, using symbols and schemas, watching films and last but not least in a clear way of teacher's explanations supported by wide range of technologies suitable for the purpose.

### Awareness

The principle demands full understanding of all intentional activities and steps which influence a student during the educational process. The gained knowledge formulates clear terminology, views and judgements leading to thought operations (analysis, synthesis, induction, deduction), to the use of clearly defined terms and understanding why and how to use knowledge creatively in practice.

### Durability

The principle covers the field of knowledge, abilities and aptitudes. It is put into effect by practising and training. There is no doubt that practising not only strengthens the knowledge gained before but brings a new point of view. This rule results from keeping the principles mentioned above and results in the following ones.

### Adequacy

The principle requires adequacy in setting the learning content according to the student's age and level, and in pacing, i.e. studying at one's own pace. Haste makes waste. This principle was developed into following rules: when doing any explanations,

- start with a close topic and head towards a faraway one,
- start with a situation which is familiar to the student and head towards an unknown one,
- start with description of concrete things and head towards abstract terms,

- start with easy, simple examples and head towards difficult, complicated ones.

The successiveness of performed steps is a must. To be really able to apply these rules into the educational process it is necessary for every teacher to have information about age differences and individual differences of the students, consider their prerequisites, abilities, experience. To meet all the demands the teacher must be educated in diagnostics, be able to evaluate the situation and according to it adapt the content, methods, forms of the educational process. The adequate level of demands results into individual approach to each student.

### Emotionality

Warm communication, teacher's enthusiasm, awoken emotionality during the educational process contribute to its climate. All the factors of the educational process are concerned: the teacher, students, educational content, methods, forms, etc.

### Unified approval

and the consensus of the family, educational institutions and other organizations dealing with individual upbringing and instruction is required in activities of all the factors and phases which participate in the process. This results in pluralistic view of the society and real life, humanism, democracy and tolerance. Both setting rules and keeping them is necessary.

## **4. PRACTICAL USE**

All the above mentioned principles and rules must be applied during the educational process as Comenius published and practised several centuries ago. According to the curricula, the third-year syllabus of e-courses concentrates on professional vocabulary and reading and listening comprehension skills.

### Professional vocabulary

The professional vocabulary has been built and developed since the very beginning of the study as it is used for practising all the fields of grammar mentioned in e-courses one and two and expressions used for oral and written communication in e-courses three and four. Each vocabulary item can be found in the e-course dictionary and is supported by the link to the online dictionary [4] offering not only common functions expected from any other dictionary but also the Open Dictionary function which enables any user to submit a new item and share it with others. It makes the dictionary content updated in the field of both professional and common language. Above all the dictionary also provides recordings of pronunciation which is very useful service for every student, especially a distance one. All the described activities mentioned until now have been prepared by the e-course tutor. In the third year students start to participate in creating the e-course content. As combined students usually both study and work they are closely connected to the real situation in the field. So it is not difficult but natural for them to provide texts on topics connected to their work load and translate important professional vocabulary items in them. The function of



*Insert, Comments* is used in translations, and the whole file is submitted as an assignment to the e-course. Tutor's work is to evaluate if the text meets the requirements defined at the beginning of the course, i.e. total length of the text should not exceed  $\frac{3}{4}$  of A4 page format, the difficulty of sentence structure and grammar items used in the text, importance of the topic. Students are also asked to provide their names under the text so it is the matter of professional credit for them to present a suitable and interesting text. All the texts having been submitted each year, new vocabulary items are added to the e-course dictionary.

#### Reading and listening comprehension skills

Mastering these skills requires a certain level of knowledge in both vocabulary and grammar. Only then the real process of practising reading and listening can start. Before reaching the level, which is individual with every student, we agree that both activities are artificial even though necessary part of the process of studying foreign language - the real texts cannot be used but simple ones, adapted to the level of student's knowledge, which lowers the value of the activity. In the process of gaining reading comprehension skills the above mentioned dictionary and the tool providing the service of pronunciation play important roles. Students have possibility to check and correct the pronunciation and understand the content of the text correctly. It consequently influences the sentence intonation, pace of reading, level of volume etc. and vice-versa, when building listening comprehension skills, the same activities are used to decode the content heard.

In e-courses the reading skills are developed in recording the submitted texts by students and presenting the recordings in the e-course study materials where they are available to all students. By listening to the recordings students can correct their pronunciation and intonation of reading and develop the skill of comprehension. As the whole world is being globalised, in several cases international students are asked to read the text. It provides another possibility to understand not only standard British (received pronunciation) or American English but also Indian, Iraqi, Ukraine, Japan, Thai, Greek pronunciation as in 2006/7 academic term.

To describe the activities in principles presented above, we can say that:

Purposefulness is recognised in the main subject which all educational activities aim at, i.e. gaining skills in the field of professional English, resulted from student's job experience and resulted in their application in further work.

Systematic approach is presented by intentional implementing of single activities towards gaining professional skills during the whole course of e-courses.

Activeness means participating in the process of collecting, translating and using the texts by students.

Clearness forms specifying understandable conditions for meeting requirements set in the e-course.

Awareness shows the student's intention to master all requirements.

Durability is supported by using students' professional experience and intentions to succeed in studying.

Adequacy is demonstrated by excellent and very good study results.

Emotionality expresses the positive attitude towards required activities.

Unified approval is presented by using both professional experience and students' activity in participating in the educational process.

After four-year experience in running the process described above it can be notified that this way of instruction is one of those in which the principles defined by Comenius and requirements presented in the syllabus of the e-courses are met. The competences gained in the three-year study are

## 5. REFERENCES

- [1] Šimonová, I. Results of survey : graduates' opinion on distance courses in VLE WebCT. In *Sborník abstraktů z konference EMTECH 2005* [CD-ROM]. Praha : ČVUT, 2005. ISBN 80-01-03336-8.
- [2] Komenský, J. A. Didaktika velká. 3. vyd. Brno : Komenium, 1948. 252 s.
- [3] Komenský, J. A. Didaktika velká. 3. vyd. Brno : Komenium, 1948, s. 17.
- [4] Dostupné z <<http://www.webster.com>> [cit. 2005-05-02].

## THE AUTHOR

### **PhDr. Ivana Šimonová**

University of Hradec Kralove,  
Faculty of Informatics and Management,  
Applied Linguistics Department,  
teaching professional English in the field of ICT and Financial Management,  
working in the field of distance education – designing and tutoring e-courses since 2002, and distance education didactics.





## IMPLEMENTATION OF STUDY INFORMATION SYSTEM AT TU IN ZVOLEN

Milan Šorm<sup>1)</sup>, Miroslav Gecovič<sup>2)</sup>

<sup>1)</sup> Mendel University of Agriculture and Forestry in Brno, Zemědělská 1, 613 00 Brno, Česká rep., +420 545 132 818, fax +420 545 132 828, sorm@uikt.mendelu.cz, <http://is.mendelu.cz/>

<sup>2)</sup> Technical University in Zvolen, T. G. Masaryka 24, 960 24 Zvolen, Slovenská republika, gecovic@vsld.tuzvo.sk

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** University Information System means at most of universities only basic ERP system for pedagogical and/or science and research activities (together called productive system). This article try to explain one example of this information system, his architecture and structure and also experiences from implementation on selected Slovak university – Technical University in Zvolen. Together with upper information we try to introduce this information system also as CRM system – so not only system for B2B and B2E relationship visualization, but also as system for B2C relationship.

**Keywords:** Information system, study administrative, case study.

### 1. UNIVERSITY INFORMATION SYSTEM

Installed University Information System was developed during in-house development at Mendel University of Agriculture and Forestry in Brno since 1999. From the beginning there was conception to build web information system with aim to cover all needs of home university for product support (pedagogical and research activities). At present this information system is used on four universities with more than 50 thousand users and each day information system do 500 thousands of operations (one operation consist of data preparation and rendering one web page with result).

There are 30 developers who work on new functions of all modules, since 2003 these employees work in one central university department – Department of Conceptions and Development IICT. All team members analyze and construct maximal parameterized solution for individual processes in study, research or production area. Team must cooperate with key users on home and also on partner universities during the stage of analysis and also in testing phase of all new modules.

Information system communicates in three languages – Czech, Slovak and English. So whole environment of information system can be installed in national conditions in Czech and Slovak Republic and all applications can of course use international students and teachers on target universities.

Currently these are eight basic modules which construct whole University Information System (list exclude module Basis and Development which is needed for installation of any part of information system). All presented modules are currently in integration process on partner universities.

- Study Agenda
- Science and Research
- Technology
- eLearning
- eAgenda
- Public Information Portal
- Managerial Support
- Personal Management

Typical provided solution is mainly Study Agenda which is constructed over Bologna process based study system. We support four degree of study programs (Bachelor, Magisterial, Doctoral and Long-life degree), ECTS credits for study courses and individual study schedule for all students.

Information system introduces many functions and tools for applicants, students, teachers, study officers and management. These tools cover all needs from admission to diploma support print. Information system is not only collection of forms and instructions but live environment for communication between all users.

Each day about 20 000 users on many universities communicate through information system and use some functions which generate around 500 thousand complex operations a day (about 80 million used data records in central database each day).

There isn't any paper information of study process of any student at the university. All officers and management used only information stored in information system for solving students' problems and questions. Many of them told that they can't imagine process Bologna-compatible study system without administrative information system like current University Information System. Current information

system works as day-by-day tool for solving work problems.

We try to reach same state also on our partner universities – currently mainly at e.g. Technical University in Zvolen. Not only Study Agenda module is installed, we try to prepare for day usage also other our modules – Personal Management, eLearning, Science and Research and Managerial Support. All collected data and information can be stored in central data warehouse and this information can be published for potential students, students or teacher through Public Information Portal module. You can access to these information e.g. at web addresses [is.tuzvo.sk](http://is.tuzvo.sk) or [is.mendelu.cz](http://is.mendelu.cz) etc.

## 2. SOLUTION STRUCTURE

There was number of phases during implementation of our solution at Technical University in Zvolen. First phase we call analytical stage and main deal is to evaluate needs of our partner and prepare the implementation project with schedule and detail analysis of implementation each module in conditions of different country and of course university legal environment. Many time was spend to discuss with our partner and with collecting information from all four faculties. After successfully passing of this step we have gone to realization of set of modules.

First module installed on our partners' servers was Basis and Development which prepare environment for operation all other parts of information system including its future parameterization and optimalization for partner legal environment. After this module we implement modules Study Agenda, Personal Management and Public Information Portal in first phase.

Continuing through learning all key users (system integrators, study administrative staff, IT operation department) to supporting working installation leads to complete first phase in less than three months between modules installation and activation to evaluation operation with real data. If we look back we must say that this was period of three months hard preparation and IT work together with large self-study of all users at Technical University in Zvolen.

In future phases are counted with implementation of modules Science and Research, eLearning and eAgenda, in third phase we plan activate some functions from module Technology and start future individual development of University Information System by IT programmers at Technical University in Zvolen. Step by step Technical University get more experiences from operation currently implemented parts of information system and we get feedback from key users to make better assignment and improve module functions.

## 3. PROJECT AT TU IN ZVOLEN

Mendel University of Agriculture and Forestry in Brno was pleased to accept challenge to realize information system in conditions its longtime partner university in Slovakia, especially that study aims and targeting at both universities are same or similar. This is the reason why business and realization conditions of business contract are set up very friendly for both sides. We expect longtime partnership model of two cooperating universities.

Big accuracy was held especially for preparation of implementation project, realization of pre-implementation meetings which bring new point of view to needs analysis of Technical University in Zvolen. Very important thing was also creating operating part of implementation team and also establishing communication relationship between customer team and provider team. In regular meetings held directly in Zvolen and also by videoconference kit we discuss and consult project status and all preparation problems. We also consult all problematic parts, e.g. admission procedure (the most problematic part of each study information system). Last but not least thing are training for all key users.

A next large change which must be done on University Information System side was language localization and print and report outputs adaptation in according to Technical University practice. Many changes were made also in user documentation because not all application are in operation phase in these days. Nowadays may be thanks to many parameters of information system which can configure many applications so our partner universities can use information system which looks and operate in TU practice which full fit together with TU design and visual guidance.

Very good cooperation – at top layer between managers from both universities and also between consultants and key users from both realization team – leads to finish whole project in record time – preparation phase start after business contract signature in June 2006 and starting phase of implementation in September 2006, first module was finished in December 2006 and from 2007 system operate in evaluation status with real data. Six months after business contract signature first users can use new information system.

Evaluations operate finish in March 2007 by passing acceptance and integration tests. After this pass we start to solve new phase – implementation other modules of information system into Technical University in Zvolen environment. I hope that future part of implementation in accordance to great relationship between support and customer also leads to success and to satisfaction of all users of University Information System at Technical University in Zvolen.

At the end of my part I want to say big thank you to all TU employee for helpful will which help to realize so large implementation project in relative short time.

#### **4. EXPERIENCE WITH IMPLEMENTATION INFORMATION SYSTEM**

At the beginning it was not entirely clear what it is that we are implementing; is it an academic or university information system? As we gradually acquainted ourselves with the functions of the system, we decided to apply the word “university” because its capacity of integrating the data generated from all university activities exceeds the meaning of the word “academic”.

The most important implementation step has been to make its users comprehend the crucial change in their work with information – from the centralized approach to the distributed one; information that was until now accessible to only a few (usually to the Study Department officers or IT specialists) can now be accessible to all users, however, selectively based on their position in the university hierarchy. The advantage is that a similar approach to information administration was employed at the Technical University in Zvolen a year ago when content management was introduced while implementing and operating a new university web.

In the first few months the users could detect no changes; the installed hardware and the conversion of data were basically impossible to notice. After the address ‘is.tuzvo.sk’ has been made accessible, doubts arose – web pages were displayed, but they were empty. First noticeable reaction could be observed after the personal data, especially the photographs taken from the multifunction ID cards database, had been imported into the system. There was hardly a single user satisfied with their photos at that time. Another increase in users’ interest in UIS was associated with staff training, nevertheless followed by a dramatic fall – in terms of its data volume the information system was still at the beginning.

A turning point can be expected after UIS (or rather the information it contains) has been made accessible to the university teachers and the students, and further when new modules (e.g. Science and research) have been introduced, and when links to other sub-systems (e.g. Economic Information System, Library System, Canteen System, etc.) have been established.

From the beginning the implementation of the system brought a lot of extra work, not only to the Center of Information Technology’s staff. The concept of ‘system integrator’ has been entering the consciousness of the teachers and students at this university in a very similar way as the word ‘mobile’ at the end of the 1990s. The CIT staff and the system integrators are the first ones to see the benefits of the information system; it is because of their experience they acquired when dealing with UIS and the information it can offer. A similar process of benefits recognition can be anticipated with the other users of UIS, especially with the university employees, and the teachers in particular. As far as students are concerned, it is different; for those starting their first year at the university,

UIS will be a common thing used on a daily basis. It is vital to ensure that all users of UIS are provided with what they need most – information – quickly, reliably and where they need them.

UIS is also a thing that critically changes the activities performed by the CIT staff whose minds are now mostly occupied by words such as 24/7 accessibility, reliability, operation procedures definitions, etc. As the banks protect the ‘electronic’ money their clients consign them, we also have to ensure the accessibility and protection of the electronic information of our employees and students.

#### **5. USERS’ ATTITUDE TO THE NEW INFORMATION SYSTEM**

Perhaps each statistically processed large enough sample of users would present very similar results regarding their reactions to implementation of new information system (or innovations as such) as did the survey on implementation of UIS: “At last!”, “High time...”, “This was possible in the old system, but not in this new one.”, “I’m not logged in and I urgently need ...”, “It’s unnecessary!”, “I don’t need to learn it.”, “When will the access to ... be available?”.

Progress will not stop and the state of development of the information system at the Technical University in Zvolen in the past few years seemed to inhibit this progress. Therefore, there was no other way how to switch to new administration technology and to new attitude to employing information at the university. Users’ reactions to this solution gradually confirm the rightness of this decision.

#### **6. EXPERIENCE AND RECOMMENDATIONS**

There are several important points in time which critically affect the successful implementation of the information system:

- Since it is a strategic and long-term decision, it is essential that the consensus has been reached by various groups of users. However, the fact that the university management supports this decision and cooperates with the department responsible for the information technology at the university is also fundamental because the implementation process sometimes requires taking complex decisions.
- The implementation process needs to be regarded as a project with all its consequences – it must have a beginning, an end, stages, representatives for the individual project roles (project leader, supervisor, participants) as well as personnel and financial background.
- Cooperation with the contractor is the key factor in attaining success. It would be truly naïve to believe that everything will run smoothly; therefore, cooperation should be based on partnership characterized by searching for and presenting solutions. Implementation of such a complex system

with such a profound impact on the whole university would be unthinkable without such an approach.

- The information system is implemented by people and should serve people; mutual cooperation of the contractor, implementation team and future users is the foundation stone of their daily work.

## 7. CONCLUSIONS

To make any kind of conclusion would be premature. There are still several applications waiting to be activated or integrated into the University Information System – Science and research, Economy, Library, Canteen, Course attendance, Multifunction ID cards. Click on ‘is.tuzvo.sk’ and make your own conclusion.

## THE AUTHORS



**RNDr. Ing. Milan Šorm, Ph.D.:** head of DCD IICT department and also head of development team of implemented University Information System, currently working as a project consultant and also as instructor on Cisco Networking Academy.



**Ing. Miroslav Gecovič, CSc.:** head of The Centre of Information Technology, responsible person for project of implementing study information system at Technical University in Zvolen, also instructor of Cisco Networking Academy.



## MODELLING OF MULTILINGUAL E-LEARNING AND VIRTUAL LEARNING SPACE FOR R&D STAFF

Štefan Svetský

Faculty of Material Sciences and Technology in Trnava, Paulínska 16, Trnava, Slovakia

stefan.svetsky@stuba.sk

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The Research and Development Staff in European Research Area (ERA) is daily under the pressure of EU drivers (Policy, R&D calls, World Market). To be sustainable in the contemporary global multilingual environment there are for ERA-Individuals the new challenges related to E-learning, Technology Enhanced Learning, and Virtual Learning Environment respectively. In the contribution a multilingual background in the view of the R&D Staff environment is described, also in relation to Allison Littlejohn's interpretation of the design and delivery of technology-enhanced learning. In the cadre of a solved R&D Project the multifunctional supporting software is developed. It enables for the ERA-Individuals as non-programmers a self-generation of browser-based E-learning applications, personal library creation, internet retrieval, text processing, and other for informal learning typical activities (Open Source approach, freeware, internet browsers, search engines, free-educational portals). The user applications are tested in on-line and off-line mode and project outputs are directly implement for education of about one hundred student.

**Keywords:** E-learning, Research and development, Technology Enhanced Learning

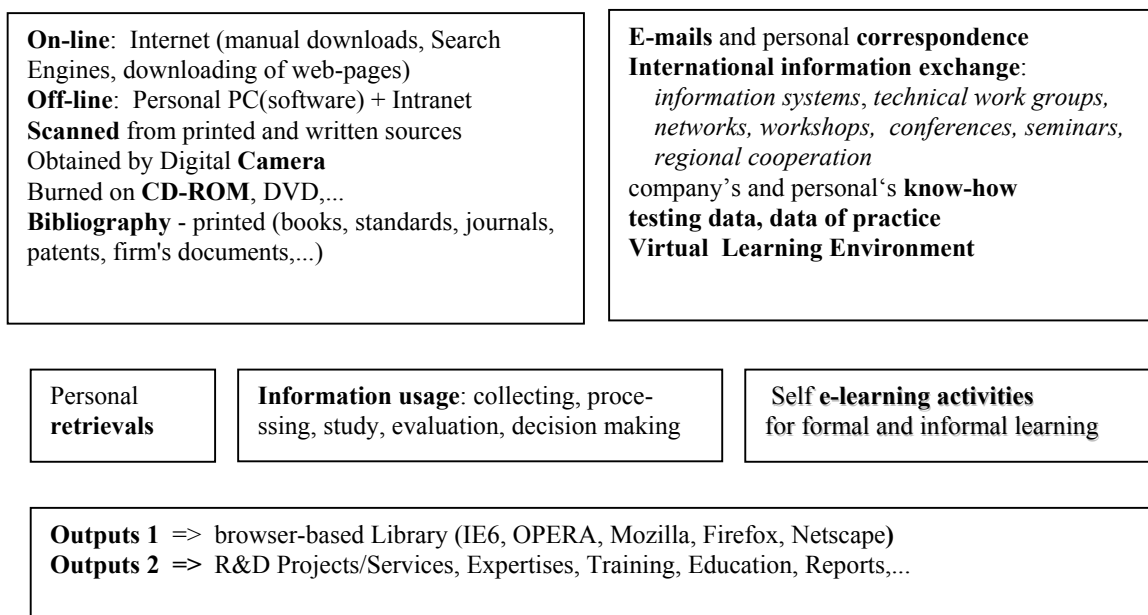
### 1. RESEARCH AND DEVELOPMENT STAFF IN THE VIEW OF THE ERA REQUIREMENTS

The Community technical and environmental policy, research and development (R&D) and daily EU market are the main drivers with impact on R&D Staff, especially the sustainable development with its environmental, social and economic pillars, EU Framework programs and world market competition (goods and services). Under the term R&D Staff is to be understood as the 'ERA-Individuals' from universities, governmental agencies, industrial institutes, centres and companies, including students. The R&D Staff must daily perform such activities as the project writing or solving, R&D services, expertises, education and training, reporting (technical reports, publications) or other industrial activities (quality testing, technology innovation, international cooperation). To meet the mentioned drivers pressure in the workplace, where everything is focused on performance and performance is everything, a permanently formal and informal learning, and self-study of the R&D Staff is required. To be sustainable it requires for the individuals particularly to use:

- personal expert knowledge base with the huge amount of steadily updated information (in a computer-readable and human-readable form),
- generic information flow (e.g. from CORDIS, Wikipedia or other EU/Regional portals),
- specialized expert information flow (e.g. concerning technology, standards, expertises, patents, case studies, information exchange, international collaboration,...),

- various information types and formats of the knowledge base (electronic, printed, audio, video, hand-written),
- various information sources (Industrial Practice, Internet, Libraries, Journals, Books, Standards, Personal correspondence or records, Educational portals, etc.).

Especially in the small R&D teams and by SMEs the knowledge base creation and information flow management is enormously time wasted. In addition R&D Staff in the ERA works daily in the *global multilingual environment*. Because knowledge sources from internet or enterprises' documents are mostly in English, and partly in German and French, due to other native language the ERA-Individuals from little countries are handicapped. Despite this the R&D Staff must perform in the multilingual environment simultaneously several expert activities, it requires permanently "switching" among the activities, e.g. he simultaneously writes a project, study, technical report, solves an expertise, performs internet retrieval, makes tests in a factory, etc. In this case the Technology Enhanced Learning [1] due to its co-design of technology and pedagogy for effective learning has great importance in the view of the R&D Staff performance increasing. The knowledge base and information sources structure, associated activities and outputs typical for R&D Staff are illustrated in following Table 1.



Tab 1: Knowledge base and information sources structure, associated activities and outputs

## 2. CHALLENGES FOR E-LEARNING AND TECHNOLOGY ENHANCED LEARNING IN THE CONTEMPORARY GLOBAL MULTILINGUAL ENVIRONMENT

In the Kaleidoscope newsletter (Kaleidoscope is the European research network shaping the scientific evolution of technology enhanced learning) a so-called U-learning is mentioned in the way as follows [2]: *„E-Learning is passé. U-learning is the new wave globally in higher education. Ubiquitous learning encompasses e-learning and emphasizes learning anytime, anywhere and anyway in both formal and informal lifelong learning environments‘.* Also Allison Littlejohn underlines the *E-learning is a term used in radically different ways by different people* [3]. Taking the position that access to digital content is not synonymous with e-learning but is an essential element of it, Allison Littlejohn illustrates the role of information access, sharing and use within the context of a constructivist model for e-learning design [3]. In the context of her contribution the E-learning is succinctly defined as *‘any technologically mediated learning using computers, whether in a face-to face classroom setting or from distance learning’* (University of South Dakota, n.d.). She also describes the supportive role of a number of virtual learning systems and underlines the need of integration with virtual learning environment (VLE) systems in order to use E-sources from internet (knowledge, information) in view of continued fusion of digital libraries and E-learning environments.

With reference to three practical scenarios in e-learning design and delivery, she highlights potential directions for the learning support contribution of the librarian, with impact on both educational development and student

learning. Mayes' Conceptualisation Cycle (Mayes, 1995) with its primary, secondary and tertiary levels is by Allison Littlejohn mentioned, as follows [3]:

*Primary stage* focuses on information dissemination:

- Information dissemination via learning resources (notes, articles, animations, video, etc.),
- Online library, Digital repository (E-tools).

*Secondary stage* focuses on Learning activity (involves students' mental processing of this information by carrying out learning tasks):

- Information usage: students performing a task to help them understand a concept,
- Shared workspace, E-portfolio (E-tools).

*Tertiary stage* focuses on Dialogue and feedback:

- Dialogue and feedback: two-way dialogue of students with tutors, peers or interactive systems Simulations and hyperworlds ,
- Discussion fora, Blogs, Online chat, Videoconferencing (E-tools).

All three levels of Mayes' Conceptualisation Cycle are essential for learning. As an example of commonly used, commercial VLE systems are by Allison Littlejohn WebCT ([www.webct.com](http://www.webct.com)) and Blackboard ([www.blackboard.com](http://www.blackboard.com)) introduced. These systems have the potential to support e-learning at the primary, secondary and tertiary levels of Mayes' Conceptualisation Model. She still mentions that *„Integrated virtual learning environments and online libraries VLE systems can be viewed as collections of integrated e-tools that enable the management of e-learning‘* (Britain and Liber, 2004).



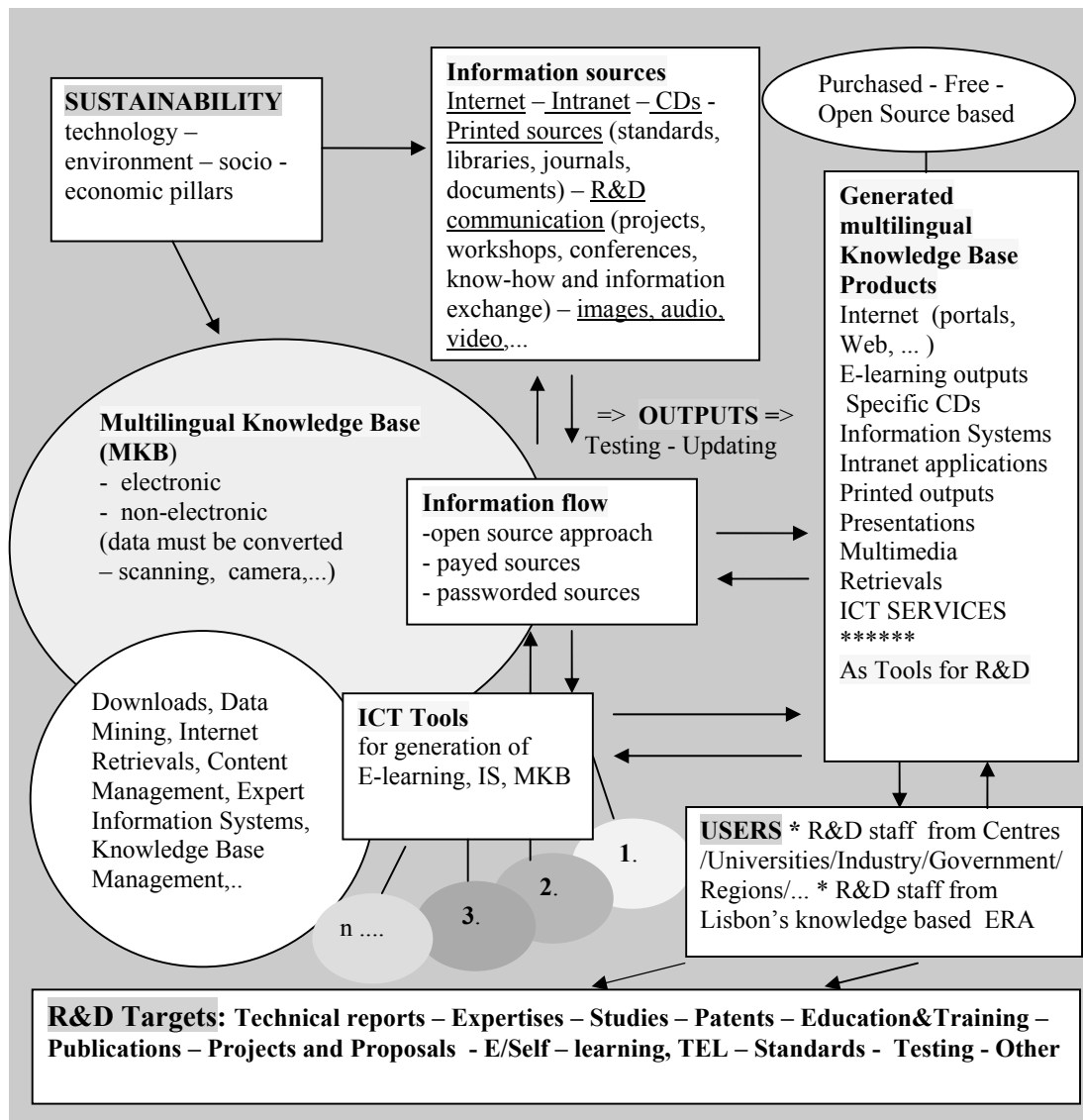


Fig 1: Illustration of multilingual background of VLE and TEL (application for Sustainability)

Note: VLE is a software system designed to facilitate teachers in the management of educational course for their students [[http://en.wikipedia.org/wiki/Virtual\\_Learning\\_Environment](http://en.wikipedia.org/wiki/Virtual_Learning_Environment)]

According to the Kaleidoscope FP6 NOE Network Report [5], “research in TEL is typically not supported in its own right. Researchers often target funding for either educational research or computer science research to gain funding for TEL research. Research in TEL needs both multidisciplinary teams, where research is led by one discipline, and supported by others, and laboratories, where innovative technologies can be developed and transferred to learning environments for testing a diversity of methodologies, for coverage of challenges set by TEL. In the daily practice of the R&D Staff the E-learning could be also understood as a multilingual support tool for self-E-learning. From the expert knowledge base (library, information system) should be processed via E-tools various tailor made on-line and off-line applications (needed for the R&D Staff to be sustainable). Basically, all by Allison Littlejohn described aspects of the E-learning,

Virtual Learning Environment, VLE system or Mayes’ Conceptualisation Cycle could be apply on the ‘global multilingual environment’. The multilingual background for this is shown in the Figure 1.

### 3. MODELLING OF MULTILINGUAL E-LEARNING OUTPUTS AND VLE

One of the subtasks of the technological R&D Project APVV P01905 is focussed on international networking in the field of machining life cycle and cutting fluids testing. The multilingual and interdisciplinary approach is here needed to solve the complexity of the whole machining life cycle. Basically, in the Table 1 and Figure 1 the priority elements are shown which can be selected for ICT support. It requires principally a *processing of expert knowledge via E- tools (ICT) into many outputs*, i.e. into various

E-learning applications or TEL support in general. But the final goal is to *use it for the R&D targets activities* as are depicted in Table 1 and Figure 1. You can see that the idea

is the same or analogical to the by Allison Littlejohn mentioned Mayes' Conceptualisation Cycle.

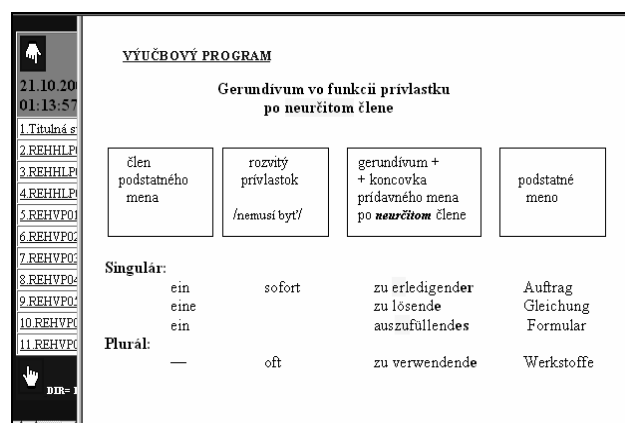
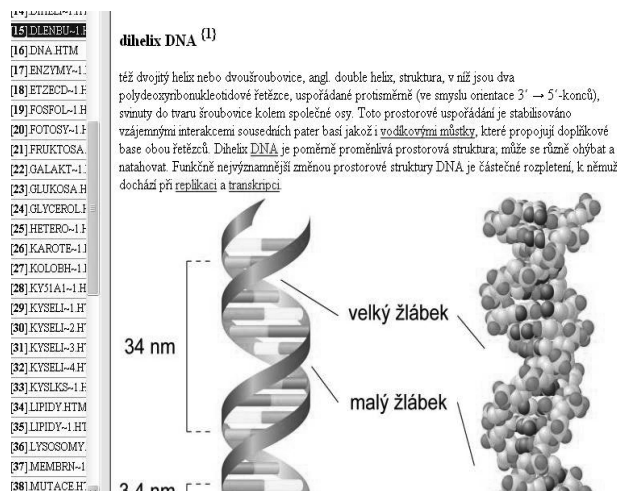
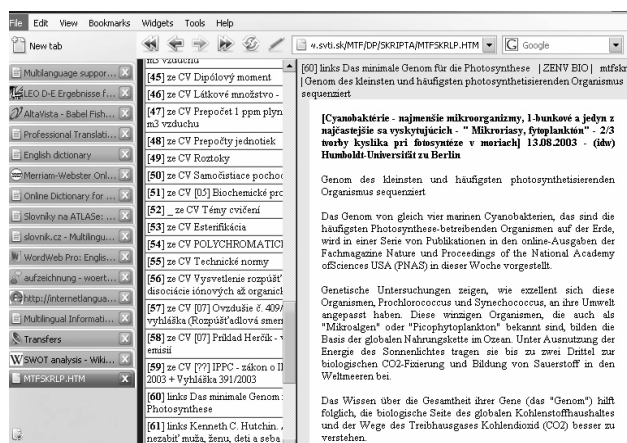
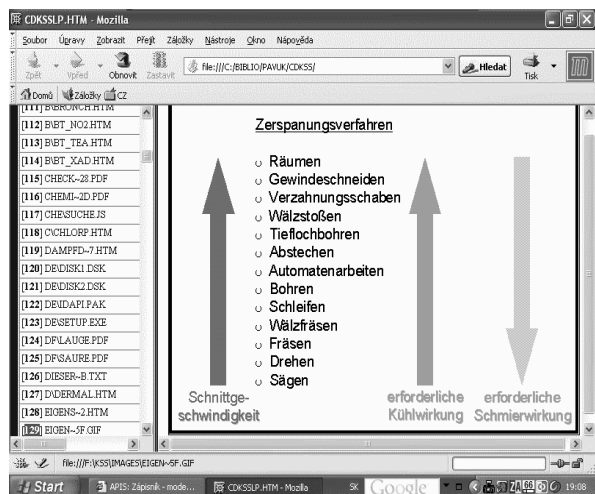


Fig 2: Examples from modelling of multilingual E-learning applications for VLE system

The first stage represents the *knowledge base*, the second stage represents the *knowledge and information flow processing* and the third stage represents *the using of the software* for high sophisticated R&D Targets activities. Based on an analysis of the all possibilities an idea arose to develop universal multifunctional software which should uniform all needed steps and requirements into one synergic solution [6]. It means the software are to build a VLE system, and the VLE could be capable to solve all three Mayes' Conceptualisation Cycle levels in one integrated step, and by one individual („All-In-On Approach“). Thus, by the acceptance of such strategy the software has been developing and there are still the first results. The mentioned software as „All-In-One tool“ for individuals (non-programmers):

- enables half-automatic generation of the browser-based E-learning applications,
- enables personal internet retrieval and library creating,
- supports text processing, half-automatic reports writing,
- create combined virtual online /offline environment for multilingual virtual space,
- supports files management, digitalisation of printed text, and other useful functions.

The mentioned multifunctional tool is very simple, and has the high efficiency thanks to collaboration with several Open Source programs, freeware, search engines, Google's technology, basic Internet browsers (OPERA, IE6, Firefox, Netscape), also due to good synchronisation with Windows operating system and other applications typical for area of the informal learning (the efficiency of informal learning is about three times more higher as for formal learning [4]). Till now the software was tested for R&D Staff and about hundred of students (the multilingual outputs of the project are implemented into educational activity on the Faculty of Materials Science and Technology). Some examples of outputs in various browsers are shown in Figure 2. Due to developed software user's applications the R&D Staff or students do not need informatics specialists in order to generate or perform the E-learning.

#### 4. CONCLUSION

The approach for modelling of multilingual e-learning and virtual learning space for R&D staff was briefly described. The learning activities are not to be understood as target, but as the important tool for implementation of obtained knowledge into R&D Staff's daily practice via TEL, in order to support his sustainability in the contemporary global multilingual ERA environment. It requires principally processing of expert knowledge via E- tools (ICT) into various outputs and using it for the above mentioned R&D targets activities. The user friendly software for R&D Staff, including students is being developed as “all-in-one” support tool for generating of E-learning or self-E-learning applications, and virtual learning

environment respectively. Several examples of multilingual approach were mentioned and shown.

#### 5. REFERENCES

- [1] Wikipedia, the free encyclopedia (TEL) [online]. [cit. 2007-03-20]. Available from: <[http://en.wikipedia.org/wiki/Technology\\_enhanced\\_learning\\_environment](http://en.wikipedia.org/wiki/Technology_enhanced_learning_environment)>
- [2] Kaleidoscope - FP6 NOE Network on Technology Enhanced Learning [online]. News, April 2007 [cit. 2007-04-11] Available from: <[http://www.noe-kaleidoscope.org/pub/lastnews/events/month-2007-04-13\\_read-349](http://www.noe-kaleidoscope.org/pub/lastnews/events/month-2007-04-13_read-349)>
- [3] ALLISON LITTLEJOHN. Key issues in the design and delivery of technology-enhanced learning London: Facet Publishing [Cit. -2007-04-11] Available from: <<http://www.facetpublishing.co.uk/Ch4.pdf>>
- [4] Wikipedia, the free encyclopedia (Informal Learning) [online]. [cit. 2007-03-20]. Available from: <[http://en.wikipedia.org/wiki/Informal\\_learning](http://en.wikipedia.org/wiki/Informal_learning)>
- [5] LAURILLARD, DIANA. A scientific vision statement for the Kaleidoscope network In Kaleidoscope News [online]. Dec. 2006 [cit. 2007-04-11]. Available from: <[http://www.noe-kaleidoscope.org/public/pub/lastnews/images/kal\\_vision.pdf?PHPSESSID=f711nc59gc7n57ts0vtcqedop6](http://www.noe-kaleidoscope.org/public/pub/lastnews/images/kal_vision.pdf?PHPSESSID=f711nc59gc7n57ts0vtcqedop6)>
- [6] Svetský, Š. ATVN-EU-GP - Warsaw, 2006 [online]. [Cit. 2007-03-11]. Available from: <[http://www.atvn-eu-gp.pl/broker/resource/stefan\\_svetsky.pdf](http://www.atvn-eu-gp.pl/broker/resource/stefan_svetsky.pdf)>

#### THE AUTHOR



**Štefan Svetský:** University teacher and project manager, FP5-FP7 participant with previously experiences in industrial R&D, as expert in editorial board Journal of Machinery, industrial societies and TCs (TWG STS EIPPCB Sevilla, SSPU, TNK 76). Leader of several R&D projects focused on interdisciplinary and multilingual approach (Knowledge and Information batch processing, LCIT – Testing, Surface treatment).

*This work was supported by the Slovak Research and Development Agency under the contract No. APVV-P01905*



# "LEARNING BY DOING" IN E-LEARNING COURSE ON CONSTRAINED PID CONTROL



5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia

Peter Ťapák, Mikuláš Huba.  
Slovak University of Technology in Bratislava, Fac. of Electr. Eng. & Info. Technology  
Ilkovičova 3, 812 19 Bratislava  
peter.tapak@stuba.sk

**Abstract.** The paper discusses the e-learning course on the theory of the PID control for the systems with constraints. The course is managed by the LMS Moodle. A batch of different plants is introduced as the tool on which the "learning by doing" approach to teaching is based.

**Keywords:** LMS, Constrained PID control, real experiment

## 1. INTRODUCTION

There is mostly the simulation used in teaching of the theory of automatic control. This approach is suitable for e-learning as well. However there is a slight difference between the theory and practice and the student have to be able to deal with the practical problems as well. Therefore several plants have been developed in our department to provide the students with the real-experiment to let them gain some experience of the applying the theory on the real problem. The course uses the LMS Moodle where the study materials, assignments and the test are available. So the students are supported by:

- the printed textbook [6] with many examples and exercises, summaries and reflection points,
- electronic course materials (available from the LMS Moodle) containing
  - Matlab/Simulink programmes for simulation and
- control experiments,
  - FLASH animations of basic problems,
  - e-books,
  - tests for self-evaluation, etc.,
- physical models of real plants to be controlled (Fig.1) that are either sent or given to each student or made accessible via Internet,
- face-to-face workshops (if required by students) and
- tutors.

## 2. COURSE IMPLEMENTATION

The SISO Control problems, the course deals with, are ordered from the simpler to the more complex ones. Higher complexity of some tasks is not only caused by considering the control design for more complex system dynamics but also by considering real world features (e.g. the measurement noise influence, disturbances, perturbations, or asymmetric properties of real plant) or by requiring

higher closed loop performance (e.g. in case of the time-delayed systems).



Fig. 1. The thermo-optical plant

The course represents the set of case studies devoted to constrained time-delayed PID control. Student can compare and verify the recommended solutions as well as many other well-known ones proposed by different authors and to construct his/her own opinion. As the course is supported by various types of materials typical for modern education (listed in section 1) including simulation tools and real plants, course participants can draw their own conclusions based on their own experience. In this constructive way – by solving real problems in a quasi-authentic environment and collecting personal experience – the transfer of the research results into practice is promoted and the gap between the theory and practice, characteristic for the present control theory, is well on the way to being decreased.

To enable each student to work actively and individually in a quasi-authentic framework with real time experiments, we need to have numerous plant models that guarantee:

- clear physical "visibility" of the controlled dynamics,
- time constants in the range ms-minutes,
- safety manipulation,
- reasonable price,

- availability of sensors and actuators,
- easy maintenance,
- connectivity to standard computers without special converter cards,
- possible approach via Internet,
- plants with different degree of “the control difficulty”,
- plants offering broader spectrum of dynamics to be controlled.

As a typical representative of a plant having all required features we can mention the thermo-optical plant (Fig.1). This product of several years of development offers measurement of 8 process variables (controlled temperature and its filtered value, ambient temperature, controlled light intensity, its filtered value and its derivative, the ventilator speed of rotation and its motor current). The temperature and the light intensity control channels are interconnected by 3 manipulated variables: the bulb voltage (the heat & light source), the light-diode voltage (the light source) and the ventilator voltage (the system cooling). The plant can be easily connected to standard computers via USB, when it enables to work with the sampling periods 40-50 ms and larger.

Within a Matlab/Simulink scheme the plant is represented as a single block, limiting use of costly and complicated software package for the real time control. So, the usual process-computer communication based on standard converter cards (that is also supported) is necessary just for more demanding applications requiring higher sampling frequencies.

For the student who prefer to use the real plant remotely, there is the internet access to the experiment prepared (Fig.2), managed by our system web-lab.

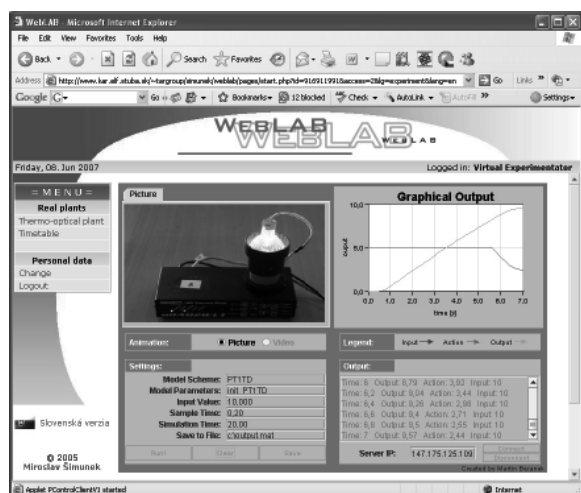


Fig. 2. Remote laboratory

So the course is based on the real experiments using the thermal optical plant (30 pcs) and other plants (as the 3 tank system, magnetic levitation, inverted pendulum, helicopter rack model, etc.) that are available in smaller amount. Nevertheless there are some other inseparable parts of the course mentioned above. Fig. 3 shows one of the many flash and java tools/animations. It is an example how the

constrained pole assignment control works. The student can easily set up the parameters of the plant and the simulation. Then the student has just to click somewhere in the phase plane and will see the simulation starting in that point. He will then understand the meaning of the closed loop poles and he will be able to better understand the behavior of the real plant when using this method for controlling it.

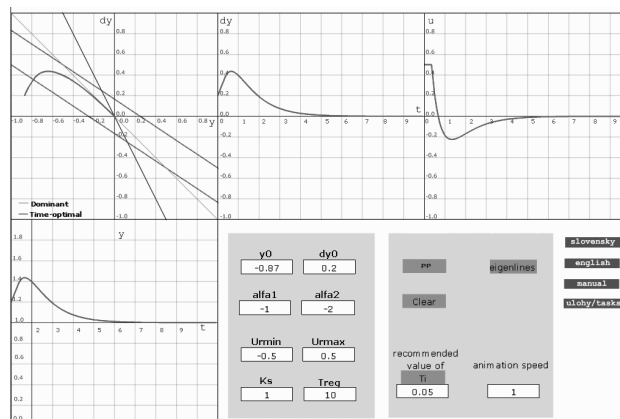


Fig. 3. Example of one of the flash animations used in the course

### 3. THEORETICAL BACKGROUND

From the theoretical point of view, the course aims to integrate the “mathematically” oriented optimal and robust control with the engineering approaches of the traditional PID control. It is e.g. focusing on solutions that in the case of negligible plant uncertainties, non-modeled dynamics and for a negligible measurement and quantization noise converge to the relay minimum time solutions.

Besides of this, it is based on the key words like:

- dynamical classes of control,
- fundamental solutions and
- base (generic) solutions.

#### Dynamical classes (DC) of control

By index of the dynamical class it is understood a non-negative integer denoting number of possible intervals with the limit control signal values that can occur under the limit case of the minimum time control. With respect to the Feldbaum’s theorem it is possible to conclude that the PID control corresponds to the dynamical processes from the dynamical classes 0, 1 and 2.

While in the DC0 the ideal control response following a setpoint step has also step character (Fig.4) and no saturation phase (therefore it can be successfully treated by the linear theory), the dynamical classes 1 and 2 (Fig.4 and Fig.5) are already typical by a period (periods) with saturated control and so they are already nonlinear.

Processes of the DC0 are typically used in situations, where the dynamics of transients may be neglected, i.e. it is not connected with a reasonable energy accumulation. Such

processes can e.g. be met in controlling flows by valves. After constraining the rate of control signal changes after a disturbance step, or also after a setpoint step, the transition to a new control signal value can be an exponential one (Fig.4).

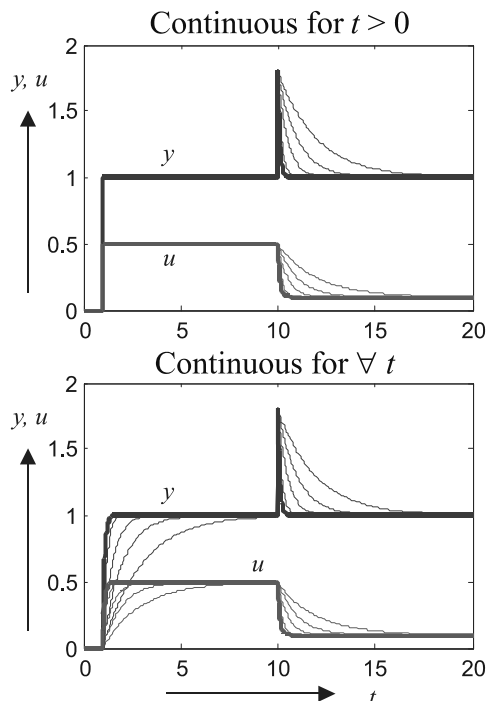


Fig. 4. DC0: Control signal reaction to a setpoint step; up – with the rate constraints just for the disturbance step; down – with a rate constraint also for a setpoint step

Within the DC1 the control signal reaction to a setpoint step change can involve one control interval with constrained control value (Fig.5) that is later followed by a monotonous transient to the new steady state value  $u_{\infty}$ . For the initial phase of control it is typical accumulation of energy in the controlled process. This is associated with a gradual increase (decrease) of the controlled output variable that is most rapid under impact of the limit control signal value. E.g. by charging a container with liquid, in the first phase of control the input valve will be fully opened and only close to the required level the control the input flow will decrease to a steady state value keeping the required level. Similar transients can be frequently met in speed control in mechatronic systems, in the temperature, pressure and concentration control, etc.

After limiting rate of changes during the transients, the span of the limit control action decreases, but the total length of transient to the new steady state increases. When constraining also the control signal increase after a setpoint change, the control signal does not catch to reach the limit value, since the necessary control decrease to the steady state has to start yet before it – the length of transient growths further.

With respect to one possible interval with constrained controller output for dealing with this dynamical class it is usually not enough to remain within the linear control.

Typical solutions for this dynamical class are frequently achieved with different anti-windup (aw) controllers.

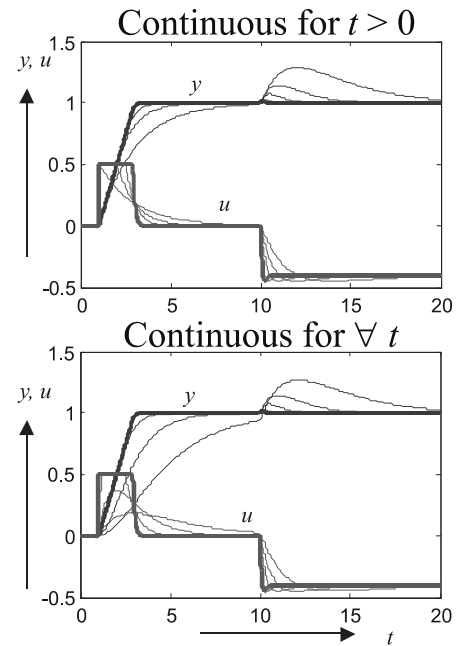


Fig. 5. DC1: Control signal reactions to a setpoint step parametrized by the closed loop poles; left – without rate constraints for  $t=0$ ; right – with a rate constraint for  $t=0$

Within the DC2 the control signal reaction to a setpoint step can already involve two control intervals with control value subsequently constrained to the upper and lower limit value (Fig. 6, or conversely) that are later followed by a monotonous transient to the new steady state value  $u_{\infty}$ .

According to the Feldbaum's theorem [8] the time optimal control is typical with two (rectangular) control pulses with limit control values (Fig.6). After introducing rate constraints for both the switching from one limit value to the opposite one and for transient to the steady state value  $u_{\infty}$ , the 2<sup>nd</sup> control interval is typically rounded, or even disappears. When the rate constraints allow the control signal to attack both the upper and lower control limit, also the majority of aw – approaches fail. The windup phenomenon is not only connected with the integral (I) action, but also with the controlled process, when it is denoted as the plant windup [5]. In the world literature simple and reliable solution for this dynamical class that could enable an arbitrary dynamics shaping ranging from the fully linear one up to the on-off minimum time control are still missing. For all that the needs on such solutions are very high: Let's mention just the automotive industry. Here, the historically known cascaded linear structures are not able to fulfil sufficiently the existing expectations [6].

#### Fundamental and "ad hoc" solutions

This notion was inspired by the works of Åström et al. [2],[3] that tried to develop general parameterized solutions which can be relatively easily adjusted to a particular situation by building on parameterizations as the sensitivity functions, or the complementary sensitivity functions

related to the robust control. Having clear-cut physical interpretation of the effect of such tuning parameters and clear picture of its appropriate default values, the tuning should be much simpler and reliable.

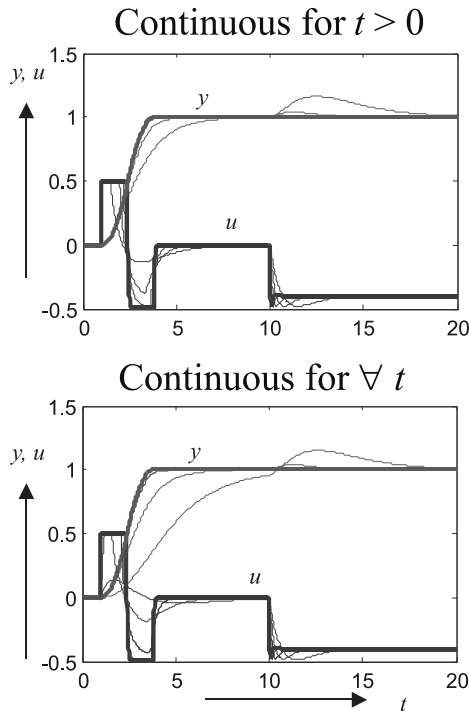


Fig.6 DC2: Control signal reactions to a setpoint step parametrized by the closed loop poles; left – without rate constraints for  $t=0$ ; right – with a rate constraint for  $t=0$

However, from the point of a more general point of view of the constrained control the sensitivity and complementary sensitivity functions do not represent an optimal solution. They e.g. do not match the natural expectation that by decreasing the range of possible parameter fluctuations, the effect of the non-modelled dynamics (parasitic delays) and

the amplitude of the measurement noise - when there are no other specifications on the control quality - the achieved solutions would converge to the results of the minimum time control.

Such a requirement was obviously followed using another way of the closed loop parameterization – the pole assignment method by Glatfelter and Schaufelberger [5]. The anti-windup PI controller they have analyzed was very close to the ideal control signal step reaction converging to the one pulse of the minimum time control. But not completely.

In order to introduce an effective controller classification, it is further important to introduce a new notion of “fundamental” controllers. Such a controller has to have the following properties:

1. For the nominal dynamics  $S(s)$  it must yield transient responses reaching from the fully linear up to the time optimal ones that can be simply scaled by the closed loop poles, (or other equivalent parameters as the time constants).
2. For a reliable controller tuning that guarantees monotonous responses the choice of the poles has to be restricted by identifying the perturbation (parasitic) dynamics  $\delta S(s)$ .

The first point involves the requirement to generalize the two limit solutions – the linear pole assignment control and the relay minimum time control to a compact set of responses that can be simply modified by the closed loop poles by offering properties that combine basic features of both limit solutions.

The second point is related to a reliable controller tuning. It tells that the system has to be approximated in such a way that besides of the nominal dynamics it is also determined by the always present parasitic time delay (perturbation

Tab.1. Table of the fundamental PID controllers

| Dynamic class | I-action | Dominant dynamics |             |                   |                              |  |  |                             |  |
|---------------|----------|-------------------|-------------|-------------------|------------------------------|--|--|-----------------------------|--|
|               |          | $K$               | $Ke^{-T_d}$ | $\frac{K_s}{s+a}$ | $\frac{K_s e^{-T_d s}}{s+a}$ | $\frac{K_{s1} + K_{s2}}{s+a_1} + \frac{K_{s2}}{s+a_2}$ | $\left[ \frac{K_{s1} + K_{s2}}{s+a_1} + \frac{K_{s2}}{s+a_2} \right] e^{-T_d s}$ | $\frac{K_s}{s^2+a_1 s+a_0}$ | $\frac{K_s e^{-T_d s}}{s^2+a_1 s+a_0}$ |
| 0             | N        | FF                | FF          | FF                | FF                           | FF   | FF   | FF                          | FF                                     |
|               | Y        | I                 | PrI         | PI                | PrPI                         | PID  | PrPID  | PID                         | PrPID                                  |
| 1             | N        | -                 | -           | P                 | PrP                          | P-P  | PrP-P  | PD                          | PrPD                                   |
|               | Y        | -                 | -           | PI                | PrPI                         | P-PI   | PrP-PI   | PID                         | PrPID                                  |
| 2             | N        | -                 | -           | -                 | -                            | -  | -  | PD                          | PrPD                                   |
|               | Y        | -                 | -           | -                 | -                            | -  | -  | PID                         | PrPID                                  |

FF – static feedforward control is involved also in all feedback controllers

Pr – abbreviation for predictive (dead time) controllers with the dominant dead time compensation



dynamics) that determines borders for the closed loop poles choice guaranteeing the expected properties.

Many of the known approaches do not fulfil the requirements on the fundamental solutions, since they do not enable to approach the minimum time transient responses, or they do not involve free design parameters at all. These approaches do not guarantee strictly optimal results and so they have reasonably contributed to the inflation of different “optimal” controller tuning. They further survive due to the conservativeness of practice despite the fact that the new digital controllers enable an easy dead time modeling and compensation. Of course, it has no sense to fight against their use, but it should be shown that they do not represent optimal solutions. In such a way, all the ambiguity of solutions reported e.g. by O’Dwyer [7] can be reasonably reduced.

#### Base (generic) versus equivalent solutions.

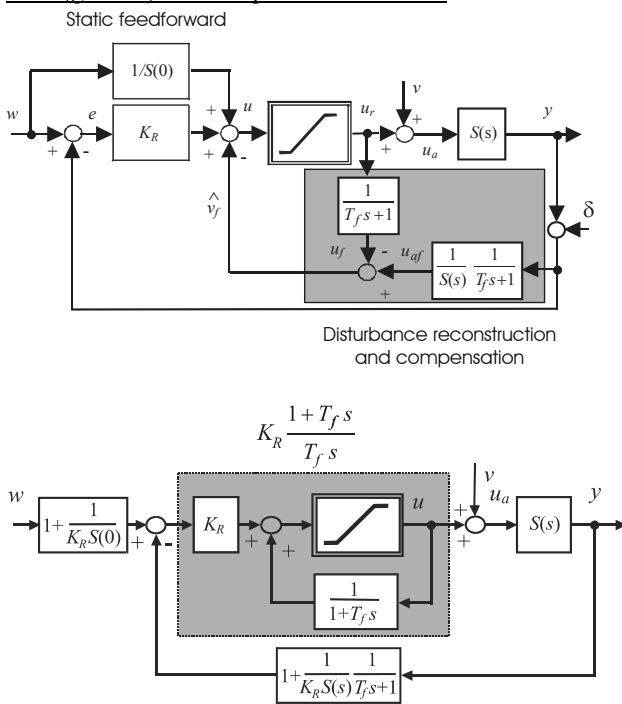


Fig.7 Base (generic) structure of the PI1 controller (above) and its equivalent scheme (below).

Many serious difficulties of the traditional approach to the PID control are also caused by use of oversimplified structures, as e.g. that one corresponding to the usual linear transfer function of the PI controller  $R(s)=K_R(1+1/(T_i s))$ .

Such a transfer function corresponds just to a fraction of a physically motivated loop with disturbance reconstruction and compensation (Fig.7, above) that is also fully compatible with the “modern” state space approach to control extended by an observer design. Close to the steady states, the core of its equivalent scheme can be represented by the transfer function  $R(s)=K_R(1+1/(T_f s))$  that can explain use of the above transfer function. But, starting with the simplified linear solution, it is problematic to come to the

complete solution globally optimal in the constrained control. The transfer function of the mostly used linear PI controller corresponds just to the shaded area within the proportional zone of control in Fig.7 below. Some textbooks (as e.g. [1]) are aware of this oversimplification, but they do not explain, how the problem should be solved.

The other principal advantage of the use of base control structures is that they can also be easily extended to more complex control situations, e.g. to those corresponding to loops with larger dead time values that traditionally represent “difficult” control problems.

#### 4. CONCLUSION

Some practitioners say: “Practice of control design is pure empirism.” or “Since PID controller has been invented, nobody has invented anything better.” These propositions, along with the fact that several hundreds of “optimal” tuning of PID controllers exist, indicate some not solved problems in the last few decades. A lot of engineers and scientists therefore prefer solutions of controllers (newer ones than PID controllers) that give better performance than PID. They are generally more complex, as e.g. the predictive controllers and controllers based on neural networks.

This course gives the chance to understand, to experience and to handle PID control design investigated from innovative points of view involving real plants properties and limitations. It is going back up to the origins of the first feedback structures of the PID controllers and besides of explaining their properties it derives also several new structures giving excellent results in other typical situations. Choosing a proper structure for a given situation can reasonably increase the design reliability and lead to a unique optimum. In this way, the multi-dimensional inflation of different optimal tuning formulas, anti-windup structures, discretizations and different controller forms are shown to be result of using not appropriate control structures that are not able to guarantee a globally optimal solutions to the problem.

Having a real plant, we try to bring our students to its analysis considering all important features that are dominant for this object. These are examined in order to conclude right findings usable in practice and theory. And that is the main difference against the frequently used approach based primarily on the mathematical rules, missing some empirism, that can be typically described by the formulation: “having a transfer function and given performance criterion, what are the optimal parameters of the PI(D) controllers?”

Our experience teaches us that we would formulate the problem by “having the process, the performance criteria and limits on the admissible process parameters, what is the optimal controller?”. This formulation leads us to new look at control design problems that we try to interpose to our students. They do not start with calculations of controller

parameters, but with measuring real process characteristics, deriving sequence of models of different complexity and then trying to propose and verify suitable types of controllers considering the dominant order of the system, the perturbation dynamics, the existing measurement noise, acting disturbances, performance criteria etc.

After several years of positive experience in carrying out our education in this new way we can summarize that:

The philosophy of the “learning by doing” or of the “experiential learning” makes relaxed and stimulating course atmosphere, in which students are generally more motivated to commit themselves to the control design and its verification actively.

Originally descriptive character of the control theory shifted to a more constructive one, characteristic by higher levels of abstraction based on comprehension, application, analysis, synthesis and evaluation of experience gained by particular approaches.

Blended learning student-centred approach is more effective and more interesting than the traditional teacher centred classroom based learning based on accumulating content. Most students consider deep mathematical background without practical experience with different solutions as not balanced, not attractive and not stimulating.

## 5. REFERENCES

- [1] Åström, K. J., Hägglund, T.: PID controllers : Theory, design, and tuning - 2. ed.. Instrument Society of America, Research Triangle Park, NC, 1995.
- [2] Åström, K. J., Panagopoulos, H. and Hägglund, T.: Design of PI Controllers based on Non-Convex Optimization. Automatica, 34, 1998, 585–601.
- [3] Åström, K. J., Hägglund, T. and Ingimundarson, A.: Criteria for Design of PID Controllers. 2nd IFAC Symposium CSD’03 Bratislava, 2003.
- [4] Feldbaum, A.A.: Optimal control systems. Academic Press, N.York, 1965.
- [5] Glattfelder, A.H. und Schaufelberger, W.: Control Systems with Input and Output Constraints. Springer, London, 2003.
- [6] Huba, M: Theory of Automatic Control 3. STU Bratislava 2006 (in Slovak).
- [7] O’Dwyer, A.. Handbook of PI and PID Controllers Tuning Rules. 2nd Edition. Imperial College Press. London., 2006
- [8] Pontryagin, L.S., Boltyanskij, V.G., Gamkrelidze, R.V., Mischenko, E.F. The Mathematical Theory of Optimal Processes. Pergamon Press Oxford, 1964

## THE AUTHORS

At the end of your paper write for each author:



**Peter Ťapák:** PhD student at the Slovak University of Technology in Bratislava, Fac. of Electr. Eng. & Info. Technology



**Mikuláš Huba:** Assoc. prof. at the Slovak University of Technology in Bratislava, Fac. of Electr. Eng. & Info. Technology, director of the university Distance Education Centre.

## ACKNOWLEDGEMENT

*This work was partially supported by:*

- *KEGA Project 3/3121/05 Network of Virtual Laboratories for Real Process Control,*
- *VEGA Project 1/3089/06 Development and Integration of Methods of the Nonlinear System Theory,*
- *ESF Project 13120200015 Human Resource Development in Automation and Control.*



5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## eFarmer - The Farmer's Gateway to EU Rural Aid Schemes

Milan Varga,  
Novitech, Moyzesova 58, 040 01 Košice, Slovakia  
varga\_milan@novitech.sk, www.novitech.eu

**Abstract.** Lack of up-to-date information and knowledge of the farmer communities on CAP, mainly in the less favoured regions of the new Member States, may become a crucial failure factor of Community-wide deployment of the policy with envisaged continuous reforms in the future (modulation). Novitech (Slovakia) has developed a basic set of on-line Farmer Communication Services (FCS) reducing this critical information and knowledge gap. Term Training refers to the acquisition of knowledge, skills, and competencies as result of the teaching of vocational or practical skills and knowledge that relates to specific useful skills. eFarmer FCS provides On-the-job and Off-the-job way of training e-Training. Access point to all services is eFarmer portal. A portal support for e-Trainings is powered by integration of eLearning, and context oriented help. User has also access to advisory services supported by intelligent assistant.

**Keywords:** e-Training, eLearning, Portal, Service, CAP, eFarmer, Knowledge, Skills, CMS, Learning, Online, Distance

### 1. INTRODUCTION

Lack of up-to-date information and knowledge of the farmer communities on CAP, mainly in the less favoured regions of the new Member States, may become a crucial failure factor of Community-wide deployment of the policy with envisaged continuous reforms in the future (modulation). Novitech (Slovakia) have developed a basic set of on-line Farmer Communication Services (FCS) reducing this critical information and knowledge gap by:

- Providing farmers with dedicated and structured on-line policy information flow about the relevant subsidiary schemes (direct-aids, rural development projects)
- Enabling farmers or their advisers to download CAP schemes and relevant instruments (policy updates, application forms, parcel maps, guidelines, ...)
- Granting access for updating their data at rural payments agencies (changes in the farm register, land use, animal stock, application data,...) via Internet
- Developing and granting public access to dedicated eLearning contents on basic farm advisory services (e.g. SAPS scheme application submission, ...)

### 2. TRAININGS AND LEARNING

Training obviously refers to the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relates to specific useful skills. Today it is often referred to as

learning and professional development. Popular areas for learning and development are:

- Coaching
- Continuing Professional Development
- E-learning aka Online Learning, Distance Learning, Web-Based Learning
- Management Development

Training is the field concerned with workplace learning to improve job performance. Such training can be generally categorized as on-the-job or off-the-job.

**On-the-job** describes training that is given in a normal working situation, using the actual tools, equipment, documents or materials that they will use when fully trained. On-the-job training is usually most effective for vocational work.

**Off-the-job** training takes place away from normal work situation, which means that the employee is not regarded as productive worker when training is taking place. An advantage of off-the-job training is that it allows people to get away from work and totally concentrate on the training being given. This is most effective for training concepts and ideas.

These two training general categories are supported in the eFarmer system services. eFarmer training services supports users or groups that are mostly geographically far away from each other. To ensure passing knowledge by the most progressive form the newest trends in e-Learning - Online

Learning, Distance Learning, Web-Based Learning was taken in account.

Training based on new technologies and provided through internet could be understood as e-Traning. e-Training services for users of eFarmer system is supporting interactive learning behaviours based on most modern web technologies and multimedia.

Challenging was finding methods, tools, and services for best e-Training support and knowledge transfer through such trainings for Farmers in complex area of common agriculture policy (CAP).

## **2. EFARMER PROJECT**

In conformity with the call of the European Commission focused on enhancement of access and use of public sector based information with specific orientation on transborder information services in the particular sector Novitech along with partners submitted the eFarmer project that was fully accepted by the European Commission. It is designed for demonstration and dissemination of effective services provided to the wide farmers' community within the V-4 countries.

The project successfully started on January 1, 2005, and terminates on February 28, 2007, then becoming a self-contained commercial unit. The project was submitted within the frame of the eContent Programme along with the co-financing of the European Commission, and is designed for the V-4 countries. The objective of the project is to enhance and improve the information flow within the Common Agricultural Policy (CAP) in relation to diverse scheme options for agriculture coming from state administration and aiming at farmers in the V-4 countries. The objective is also to provide farmers and authorised agents (consultants, banks, farmers' associations, organisations of the common market, etc.) with instruction how to use the web services for preparation, completion, formal check, and claim submission to national Rural Payment Agencies (RPA) via Internet.

The market financial analysis showed that if the eFarmer contributes to raise the awareness of farmers in the four demonstration countries by 10% only it would imply approximately 275 mil Euros of net profit for farmers a year. For better understanding of the project it is useful identify its detailed objectives:

### **Objective 1:**

Development of a system for CAP content transformation that shall produce up to date content services (eFarmer content) linked with farmer's aid. This content shall be maintained in structured database of knowledge and accessible for farmer's community through Internet. Sources produced this way shall contain relevant and respective country specific information necessary for preparation and submission of claims (regulations, directives, application forms, cadastre and land maps, and

the like) in Hungary, Poland, Czech and Slovak Republics. It is necessary to note that it is not a simple database of documents but it is the so-called structured content. It implies that if the farmer is interested in submitting his claim related to the single area payment scheme he needs not study the complete handbook but he can pose scheme related questions to the system, such as, what are the basic conditions, restrictions, and the like. The system returns useful information and, if needed, it may be added with explanation. As an example, the farmer informs the system that he possesses 12 ha of land, raises pigs and poultry, and the systems offers him all the potential aid schemes he might apply for. It is obvious that the information is always up to date.

### **Objective 2:**

Introduction of web services package for support of farmers and electronic claim submission. The stored eFarmer content is parallel accessible to sources of these services. The system enables simple and comfortable aid scheme related claim submission via Internet. It concerns mainly applications relating to SAPS, LFA, national Top-Ups, and the like. The application forms are completed with the personal computer using any kind of browser. The system navigates user to apply simpler way by means of the so-called "Wizard". Before claim submission to the payment agency the system performs basic checks of application forms to eliminate potential errors and forego return of the application form from the RPA.

### **Objective 3:**

Establishment of pilot groups of eFarmer user network. These groups shall demonstrate the eFarmer content and communication services for farmer's community. From official statistics of the European Union it is documented that the use of computer facilities and Internet in farmers' community is very low amounting to 3-4% only. The project sets an objective to increase this figure. For this reason the project identifies a new role of the so-called eFarmer being an agent of these services for the farmer. It is assumed that the future eFarmers shall also be consultants. That is just the eFarmers that shall use the system so that the farmers with no IT knowledge could use the services and benefits of the system. With the help of a notebook and wireless Internet connection the eFarmers shall visit farmers in their reach where they are known, and shall provide them with these services.

As a result the target group of farmers and future representative of farmers (agricultural association, farmers' consultants, and financial institutions) shall the following benefits:

- Obtain more entitled support by use of eFarmer services
- Less efforts and costs – electronic claim submission removes postal and travel expenses
- Faster response (lower penalties) thanks to feedback information by Internet in communication with the payment agency

- Reduction of operation costs relating to the payment agency resulting from lower error rate of submitted applications and thanks to electronic communication.

### 3. EFARMER CONTENT MANAGEMENT SYSTEM REQUIREMENTS

Previously described general requirements are customized to the eFarmer project real needs. The main objective of content model design is to define the scope and internal organization of the eFarmer content repository on object level (meta-knowledge). The model does not deal with the implementation aspects of the object instances (real content). The underlying implementation aspects are solved with usage of adapter pattern to standard database systems.

The real design process of the eCMS follows these steps:

**Step 1:** Defining core objects (classes) of the eFarmer content repository. For example: Farmer, Land, Commodity and Document classes to be recognized by eCMS, etc.

**Step 2:** Organizing object classes into subclasses, associations and hierarchies – taxonomy. For example: Natural person is a subclass of Farmer, Farmer is associated (using) with a Land, Region is part of Country, etc.

**Step 3:** Assigning attributes to classes and subclasses: first the atomic attributes (Farmer name, address, cereal name, etc.) and then the reference ones (like Farmer registration number, Parcel map number assigned to a Land, etc.).

The above steps created the “static” structure of the eCMS content repository. Now we shall follow the design process by defining dynamic structure of the content, the eligible behaviors, scenarios (ontology) of the objects in time. The Grant-1 (SAPS) is a typical example which defines an eligible combination of objects and even their instances: any Farmer growing cereals in land located in region R can apply to RPAX by completing forms related to the Grant-1. Additional fine eligibility rules can be stored in the Rule-Set object assigned to Grant-1. The Grant-1 is a dynamic relationship valid in a period of time form announcement of the Grant until the submission deadline. Several Grants and other scenarios can evolve in course of time.

**Step 4:** Defining and maintaining of current scenarios (this is a permanent process as the real-life situation as CAP evolves both on Community and on Country level).

**Step 5:** Defining Methods (actions, operations) which can be performed on each class association and scenario. (e.g. Farmer: add new farmer, show all farmers, show farmers registered in region R, show all farmers eligible for Grant-1, etc.)

**Step 6:** Defining physical boundaries of your Content repository. For example: the Parcel register, Farmer register classes and Claim composition operations are external to the Repository (stored and/or provided by external systems

to eCMS). Define the way (so called Messages between sender and receiver objects) how your eCMS will communicate with these external objects or outsourced operations (claim composition in the claim submission system)

Support for design and implementation of previous six steps is in web based design tool which is integral part of eCMS. This tool supports consistent maintenance of content model.

The eFarmer CMS (eCMS) in general has to support the following core functional domains:

- To maintain accurate and easy to find content
- To control and maintain the look and feel of the presentation layer of the content
- Process of approving content before publication (content delivery)
- Control over who updates, sees and what content (security and personalization)

### 4. EFARMER SYSTEM HAS SERVICE ORIENTED ARCHITECTURE

If we want to look more closely to relations of eFarmer system parts we need to explore composition of architecture firstly. eFarmer is complex system which consists of three main functional parts:

- **Content System** – serving for information management and access: documents, handbooks, help, and other CAP and Common CAP related information for users, and claimant data (eFarmer, Farmer, farm forms completed, etc.)
- **eFarmer portal services** – ensuring creation, management and submission of claims
- **eLearning services** – through which the user gets access to study materials and tests on the claim submission process and entitlements related to rural-aid schemes.

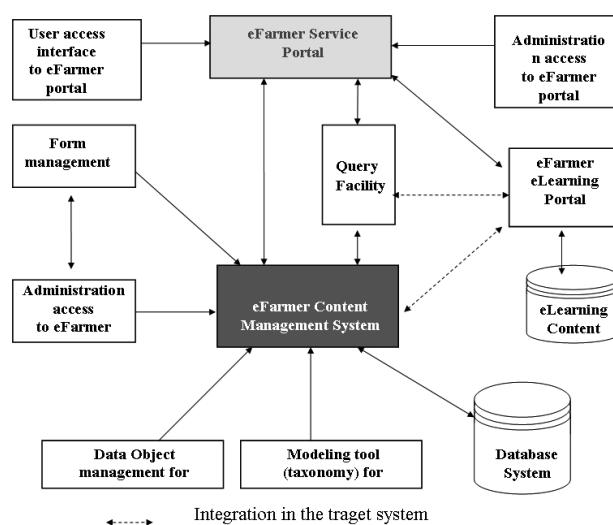


Fig. 1. eFarmer System Architecture

Fig.1. depicts all modules of system. Links are showing integration and functional dependencies between these modules. System is distributed and service oriented. Service Oriented Architecture approach was used by development of this system. Web services an integration of these services make this system flexible and prepared for future enhancements of provided services or functionalities.

## 5. ELEARNING AS PART OF EFARMER SYSTEM

To provide support for e-Training for users eFarmer system consist special dedicated module for these purpose. eLearning module is integrated with context oriented help functionality of web portal to support on-the-job learning and training. Learning and training materials are also provided in process of claim preparation or for knowledge or know-how transfer in area of payment schemes.

The eFarmer „eLearning” is based on the MOODLE Open Source Learning Management system. The eLearning system is multilingual which allows it to operate and display in several world languages. The primary language is English. Localization for other non-English speaking countries is available (Including Slovak, Czech, Hungarian and Polish). The list of courses is displayed at the homepage of the eLearning. Two types of courses are available:

- eFarmer Education Materials
- eFarmer Generic System

eLearning homepage also contains discussion forum along with users contributions. eFarmer Learning portal provides an additional calendar service with the functionality to browse, search, show the latest news, or a list of users which have signed in recently. The main and added value for the project is the eFarmer self-study course developed for four countries and in four languages (Slovak, Czech, Hungarian and Polish).

e-Training for eFarmer users is also powered by multimedia Showcase. This showcase can be characterized as a learning material, which combines a text interpretation with animation, video, audio, graphic, and flash presentations. In production of these learning material many aspects have been considered - the profile of the potential user, level of knowledge, strengths and a weaknesses, technological resources, interests. The educational process supports off-the-job learning because it explains real situations by showing how to do it.

## 6. INTELLIGENT SCHEME EXPERT ASSISTANT

Another very useful functionality for decision making in claiming process is expert guidance and advisory provided by special service of eFarmer system. User can set up scenario for payment scheme claiming by choosing from previously created entries of farmers and farms. Expert Assistant service helps to find schemes that comply with

data entered by eFarmer user. If user has no selected scenario for payment scheme claiming, Expert Assistant can be used as general searching tool for schemes which complying entered data. If scenario (farmer and farm) is selected, Expert Assistant enables user to select and process complying schemes for these scenario.

Expert Assistant technology is built on current best practices from artificial intelligent field. Expert Assistant provides functionality that is known from experts systems. An Agro expert with knowledge engineers builds knowledge base. This knowledge base is used for guided choosing and searching of schemes that are complying data entered by eFarmer users.

### Scheme Rules extraction process

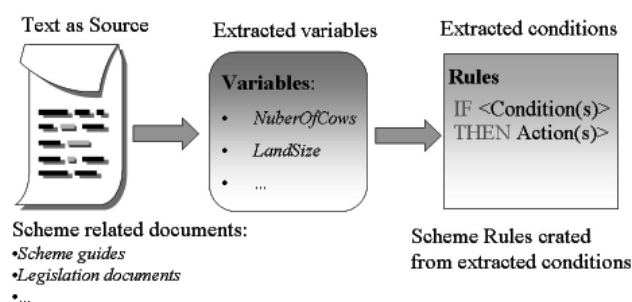


Fig. 2. Rules extraction process

Expert Assistant use rule based approach to store knowledge. To explain what are the Rules and what they allows to service developers.

#### ❑ Rules are:

- Declarative statements for capturing changing policies
- Represented as:  
IF <Condition(s)> (*NuberOfCows*>10 AND *PremiumRights* >=10)  
THEN Scheme Match Result = (*True / False*)
- Logically grouped into policies (*Rule sets*)

#### ❑ Rules allow service developers to:

- Define payment schemes policies without hard coding or involving application developer
- Change payment schemes policies in real time without rebuilding or redeploying applications

Rules extraction process is depicted on previous picture. Knowledge engineer with assistance of agro expert transforms text sources and other related documents into set of variables and conditions which use them. Matching result of these conditions are evaluated and explained to user in untreatable way. This additional explanation dimension of assistant functionality enables better decision making and give advice to user how to match mandatory conditions of payment scheme. Advisory functionality is supported with partial match results of each condition and with the final scheme matching result. eFarmer user can learn from this

results or try to do some corrections or adjustment to better match scheme conditions.

Example of Expert Assistant questionnaire is shown on Fig.3. and example of condition matching result is shown on Fig.4.

**Expert Assistant**

Expert Assistant service helps you find schemes that comply with data entered by you.

If no farmer and farm (see upper frame "Selected scenario" on the right side of the page) is selected, you can use Expert Assistant as general searching tool for schemes complying entered data.

If farmer and farm is selected, Expert Assistant enables you to select and process complying schemes.

You can select following domains:

**Plant production   Animal production**

---

**Assistance to animal production**

**Are you breeding cows ?**

- How many suckler cows and heifers do you apply aid for?
- What is the claimed number of suckler cows of it?
- What is the claimed number of heifers of it?
- How many premium rights do you have for breeding suckler cows and heifers?
- Are the suckler cows and heifers raised in farm at least 3 months before claim submission? ☐ Yes ☐ No ☒ Don't Know
- Are the suckler cows stabled separately from other beef cattle? ☐ Yes ☐ No ☒ Don't Know
- Are the animals (suckler cows, heifers) in the farm whose applicant is registered as owner/co-owner? ☐ Yes ☐ No ☒ Don't Know
- Are the animals (suckler cows, heifers) registered and identified as per the applicable regulations? ☐ Yes ☐ No ☒ Don't Know

**Are you breeding ewes or goats ?**

- How many ewe hogs and ewes older than one year do you apply aid for (claimed number)?
- How many goats older than one year do you apply aid for (claimed number)?
- How many premium rights do you have for breeding ewe hogs and ewes?
- How many premium rights do you have for breeding goats?
- Are the animals (ewe hogs and ewes) registered and identified as per the applicable regulations? ☐ Yes ☐ No ☒ Don't Know

Fig. 3. Expert Assistant questionnaire

## 7. CONCLUSION

Cross-border service portal of the eFarmer system exists in four international versions [www.efarmer.sk](http://www.efarmer.sk) (.cz, .pl, .hu) and has been developed within the frame of the EDC 11221 Project of the European Commission. Users from Slovakia, Czech Republic, Hungary, and Poland can find useful information and services on eFarmer portal pages. eFarmer project results are for example:

- Support for many users :
  - Farmers and their associations,
  - Agriculture chambers and non-governmental organizations,
  - Interest groups and other stakeholders including government and academia engaged in agriculture.
- Bring big benefits :
  - Time and money savings by claim submission
  - Fast and easy error correction
  - Easy Access to up-to-date information – CAP content
  - Achieving higher benefits from EU funds

Novitech as eFarmer project coordinator and implementer is a dynamic innovative company active on the field of the

development and implementation of large scale information systems and provide of project management services since 1989. The award of the Quality Management System Certificate in accordance with STN EN ISO 9001 in 2001 for information system design, development, delivery and project management is the evidence of the quality and positive evaluation provided by Novitech.

**Assistance to animal production**

**Scheme : Platby na chov dojčiacich kráv**

Description : Platby na chov dojčiacich kráv

State : You can claim

**Scheme conditions:**

- ✓ You raise sufficient number of suckler cows and heifers (at least 3 in total).
- ✓ You have sufficient number of premium rights for suckler cows and heifers.
- ✓ You raise sufficient number of suckler cows compared to the total number (required more than 60% suckler cows of the total number).
- ✓ You raise sufficient number of heifers compared to the total number (at the most 40% heifers of the total number).
- ✓ Suckler cows are stabled separately from other beef cattle.
- ✓ You meet the requirement that all animals (cattle) are in farm whose applicant is registered as owner/co-owner.
- ✓ You meet the requirement for registration and identification of animals (cattle) as per the applicable regulations.
- ✓ You meet the requirement of raising suckler cows and heifers in farm for at least 3 months before claim submission.

**Scheme : Platby na chov bahníc, jariek a kôz**

Description : Platby na chov bahníc, jariek a kôz

State : You can't claim

**Scheme conditions:**

- ✓ You raise sufficient number of ewe hogs and ewes older than one year or goats older than one year (at least 10 ewe hogs, ewes, and goats).
- ! You do not have sufficient number of premium rights for ewe hogs and ewes.
- ! You do not have sufficient number of premium rights for goats.
- ! You do not meet the requirement that all animals (ewe hogs, ewes, goats) are in farm whose applicant is registered as owner/co-owner.
- ✓ You meet the requirement for registration and identification of animals (ewe hogs, ewes, goats) as per the applicable regulations.

Fig. 4. Example of Expert Assistant result

This work was supported by VEGA Project N 1/2176/05: Technologies for Agent-based and Component-based Distributed Systems Lifecycle Support.

## 8. REFERENCES

- [1] T.Sutoris, A.Toth : eFarmer communication services, Project Annual report 2005.
- [2] T. Halpin: Information Modeling and Relational Databases: From Conceptual Analysis to Logical Design, Morgan Kaufmann, 2001
- [3] Lorin W. Anderson, David R. Krathwohl, Peter W. Airasian, Kathleen A. Cruikshank, Richard E. Mayer, Paul R. Pintrich, James Rath, Merlin C. Wittrock: Taxonomy for Learning, Teaching, and Assessing, A: A Revision of Bloom's Taxonomy of Educational Objectives , Allyn & Bacon; Complete E edition , 2000
- [4] G. C. Bowker, S. L. Star: Sorting Things Out: Classification and Its Consequences, The MIT Press, 2000
- [5] Wikipedia, the free encyclopedia







## DIFFERENCES AND SIMILARITIES: CZECH AND US ONLINE LEARNING

Jana Vejvodova, Susan M. Zvacek

<sup>1)</sup> Institute of Lifelong Learning, University of West Bohemia Univerzitni 8 306 19 Pilsen CR  
tel: +420 44 76 77 e-mail: vejvod@kcj.zcu.cz

<sup>2)</sup> Instructional Development & Support, The University of Kansas 1455 Jayhawk Blvd, Lawrence, KS 66045-7604, USA, tel: (785) 864 2600 e-mail: szvacek@ku.edu

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia*

*September 6-8, 2007*

**Abstract.** This paper discusses differences and similarities between the Czech Republic and United States in the evolution of e-learning, specifically in the areas of economic perspectives, tutor-student interaction, interaction among students, and course development.

**Keywords:** E-learning, teaching, collaboration.

### 1. INTRODUCTION

The rapid growth of e-learning, coupled with increasing globalization in commerce, industry, research, education, and more, offers opportunities (often disguised as challenges) to provide education and training across national borders. However, in order to take advantage of these trends, greater understanding among educational professionals is required regarding how e-learning is perceived and developed in other cultures. This paper will discuss differences and similarities between the Czech Republic and United States in the evolution of e-learning, specifically in the areas of economic perspectives, tutor-student interaction, interaction among students, and course development.

### 2. ECONOMIC PERSPECTIVES ON E-LEARNING

Two very different streams of online course offerings exist in the Czech Republic: higher education/universities and commercial sector/companies. Initially, efforts within the corporate arena focused on the technical aspects of e-learning -- on choosing the best Learning Management System, for example. The result was frustration and decreasing interest in e-learning for commercial purposes. Somewhat later, a few universities began developing online instruction but focused, instead, on its pedagogical aspects. These institutions (Charles University, University of Ostrava, University of West Bohemia, University of Hradec Kralove) soon took the lead and became known for their work in this field.

E-learning has often been viewed as a tool for economization in the CR and as a way to save money when providing education or training. Obviously, online courses with tutor support are expensive to implement when a small number of students are enrolled. That is why companies in the commercial sector engaged in developing e-learning products prefer to market non-tutored "eL courses" that rely on the student's self-study. These programs are easier to sell than those requiring human interaction and fewer

enrollments. This is not to say that those programs are ineffective, but that many content areas are better served with didactic models involving a high degree of interaction among participants. Nevertheless, the most frequently asked question during seminars about the development of online courses is as follows: "How can I design an online course with tutor support for 80 or 100 students?" According to experienced tutors in the CR, the ideal number of participants ranges from 15 to 25, depending on the nature of the content and instructional strategies incorporated. Clearly, there are conflicting priorities between those who see e-learning primarily as means to generate revenue and those whose interests focus on learning outcomes.

In the United States, e-learning grew out of a long tradition of distance education involving text-based correspondence study, classes delivered via radio or television, or other media formats. However, with the advent of the Internet and the subsequent ubiquity of online service into the home, distance learning with online resources was lauded as new means for outreach and access to higher education, especially for under-served populations.

Unfortunately, it was also seen by some individuals as a money-making enterprise for financially-challenged universities, and major ventures were initiated to jump on the e-learning money train. Most of these projects sputtered out quietly, but a few created headlines with crash-and-burn finales, serving as a warning to schools still thinking about making a quick dollar from e-learning. "Prominent universities like New York University and Temple rushed in with the creation of for-profit subsidiaries that promised to blend ivory-tower class and dot-com nimbleness. But by 2001, most of those highly touted experiments had failed. Columbia's for-profit program, Fathom, which offered online courses in partnership with institutions like the University of Michigan and the University of Chicago, folded early last year." (Schwartz, 2004) The promise of riches prompted typically conservative university administrators into uttering such giddy statements as, "We're aiming to be the Amazon.com of technology-

mediated education in California.” (Rich Halberg, California Virtual University. (Macavinta, 1998)) Less than one year later, headlines would read, “California Virtual University Has a Collision With Reality,” and the big dream was over. (Weiss, 1999)

The question everyone asks is, “What went wrong?” Succinctly stated, universities were distracted from their mission by dollar signs. Interestingly, the advisors to these institutions weren’t distance education specialists or even educators. For the most part, the university administrators were listening to financial analysts and corporate sector forecasters who predicted an e-learning boom worth millions, if not more. All the while, distance education professionals were warning that e-learning, if done well, was unlikely to become a source of untold wealth for any school. (See, for example, Bates, 2000; or Hezel, 2001.)

Ideally, other countries (especially those contemplating the development of large-scale e-learning programs as a way to generate revenues) can learn from the mistakes made in the US. Replacing visions of riches with more modest, realistic expectations could move programs forward in a natural evolution that is supportable and scalable. Online courses may not be a goldmine, but with careful planning and strategic growth they can break even financially while also meeting the educational needs of students lacking opportunities for higher education.

### 3. TUTOR/STUDENT INTERACTION

In the Czech Republic, online courses are designed to include tutor support, especially in fields that benefit from the incorporation of problem-oriented tasks. This is an effective instructional model from the didactic viewpoint, because students are expected to consider different solutions and seek the most appropriate one for the situation. The tutor then reviews the results, prepares individualized assessments based on those results, and sends them to the students. In courses with large numbers of participants, the authors may, in turn, incorporate feedback within exercises and self-tests to reduce the labor-intensity of the course for the tutor.

When an online course is designed to include extensive tutoring, a wide variety of instructional elements can be used, including problem-solving, discussions, and other strategies requiring frequent communication. Some of those communicative activities could be:

- Welcoming the course participants,
- Encouraging and motivating them,
- Providing information and explanations,
- Offering students feedback on learning activities,
- Facilitating communication among course participants,
- Providing technical help and advice, and
- Concluding the course.

The tutor-student relationship progresses stepwise throughout the online course. Before opening the course, the

tutor addresses course participants, prepares them for the learning process, points out the role of his/her supervision and provides advice on how to study. While working on individual study activities, the student maintains permanent contact with the tutor. Messages to students are planned to be delivered at certain times and represent the cornerstone of the communication. The tutor solves students’ problems individually, supports the transfer of the learning contents to students’ practice and promotes sharing of experience among students.

Although the teaching model is slightly different in the US, the focus on interaction between the tutor/teacher and the students is, like in the CR, considered extremely important. This is partly due to the increasing awareness of the importance of active learning. There remain many faculty members who cling to an outdated model in which information dissemination = teaching, but these are typically not the individuals who are involved with online instruction. Not surprisingly, a significant portion of the research being done about e-learning in the US is on the topic of interaction.

### 4. INTERACTION AMONG STUDENTS

A similar emphasis on interaction exists in the US regarding student-to-student communication. Many universities have launched initiatives related to problem-based learning or collaborative learning, including a focus on students working together. As online communication tools become more readily available and easy to use, many teachers are moving student group-work online and using blogs or wikis, even in face-to-face courses. The convenience of doing group-work in the virtual environment, paired with technical features enabling a teacher to view each student’s contributions to the final project individually, alleviate many of the hurdles that have discouraged collaborative student work.

Students are frequently required to participate in online discussions, chats, or other communication activities, as well. As one professor explained, “If I require my students to do something, it sends a clear signal that I think it’s important. I think it’s important that my students learn to share their ideas with others and listen to what others have to say, so it’s part of the course, just like reading the book or taking a test.”

Finally, an example of how important interaction is to e-learning in the US can be found in an “Exemplary Course” competition, originally sponsored by WebCT (now Blackboard, Inc.). Applicants for these awards are informed that any course that does not show evidence of communication activities will be automatically disqualified, and past winners of this competition have included extensive interaction elements.

Some problems with interaction among students arise from Czech traditions in face-to-face teaching. Collaborative forms of work have rarely been included in face-to-face learning and teaching. Few teachers and trainers in the

Czech Republic work collaboratively and most of them are reluctant to share their knowledge or to hold lessons together. Consequently, if teachers are not well-versed in collaborative work, it is unlikely that they will incorporate these types of activities into their instruction. However, managers of Czech companies often complain that when students graduate and begin their jobs they are not well prepared for teamwork.

Experiences from well tutored online courses show that an initial unwillingness among students to cooperate and collaborate can change; participants who are not keen initially on working collaboratively frequently evaluate this type of work when submitting final evaluation questionnaires as very useful and successful. There is also a different style of moderating discussions in the CR in comparison to countries with a long tradition of collaborative learning. Czech learners like discussing as well, but generally discussions are not so easy-going and contributions are rather short.

In the European Net-Trainers online course Czech participants had an opportunity to change to a different national learning group during one module. One Czech participant stated that discussions were the biggest difference between the Czech and English online courses. It was surprising for her that long contributions to the discussion (a minimum of 20 lines and three contributions in one thread) were expected. When she added just two contributions to one thread she was warned by an e-mail. This student felt that being forced to participate in a hypothetical discussion (in what seemed to her an activity simply for the purpose of creating interaction among students) was a stressful experience and would likely be so for other Czech people.

There are some courses where students rarely participate in discussion. On the other hand, there are courses where lively discussion is very difficult for a tutor to steer. Much of this depends on the initial discussion assignment formulated by the author (whether it inspires students to express their ideas, for example) and how experienced the moderator is. Generally speaking about one-third of students take part in discussions. One-third will follow discussions without participating, while the remaining third of students neither take part in nor follow any discussion.

## 5. COURSE DEVELOPMENT

At the beginning of the e-learning movement in the Czech Republic, only a small number of teachers worked on designing online courses. The number of enthusiastic teachers involved in e-learning did rise gradually; however, teachers frequently are not motivated to develop online courses. They typically get a special reward for developing an online course, mostly paid from grants, but they are not paid extra for tutoring online courses. As a result, it is seen as extra work for them.

Several universities in the CR eventually set up e-learning centers. The subsequent development of high-quality online

courses is an example of extensive collaboration among experts in the content area as well as in technical design, instructional design, tutoring, technical support, and administrative support. On the other hand, many university teachers develop their online courses themselves and play each of the above-mentioned roles.

Course development in the US is done almost exclusively by the instructors themselves. The two most common exceptions to this are corporate sector training departments and private universities offering fully-online programs. Corporate training courses are frequently created by a development group but taught by trainers whose primary responsibility is working with learners. This enables a division of labor that can be more cost-efficient, with materials developed by instructional designers, professional graphic artists, and videographers, while trainers remain undistracted by the need to create materials or plan instruction. Private universities specializing in fully-online programs often follow a similar model, with courses developed by one group and taught by another. In this case, however, the teachers frequently are professionals working in a field related to the topic about which they are teaching (business or teacher education, for example).

Czech educators sometimes have the mistaken notion that preparation of an online course is a matter of simply transforming lecture notes into an electronic form. An online course represents a brand new type of communication with completely different and specific features. Therefore, the character of the text should be different as well. The main purpose is to shift the focus of the study from passive reading towards active work to provide both knowledge and applicable skills. This is a problem because the Czech learning tradition is heavily content-based and focused very much on the "power of experts".

Educational traditions in the US are only slightly less content-focused, but the major obstacle to online course development is the lack of instructional design skills among university faculty. Only a small percentage of postsecondary instructors have any background in teaching, instructional design, learning theory, or assessment prior to stepping into a classroom. Considering this, most of them perform admirably by simply imitating the professors they had as students. Unfortunately, even fewer of these same instructors have ever taken an online class, so the option to imitate is no longer available. As a result, many universities have established faculty development centers to assist faculty members with course design for online delivery and face-to-face teaching.

## 5. SUMMARY

So, why is it important to learn about the differences and similarities of e-learning between countries and cultures? There are (at least) three significant reasons for doing so, including facilitating the use of sharable repositories of content, marketing of programs, and learning from one another about teaching and learning.

**Marketing** – There is no doubt that the education and training offerings of the future will be global in character, and this is quickly becoming the case in the area of e-learning. We can expect that the number of institutions entering into interuniversity consortia will rise, resulting in a need for intercultural awareness and understanding. Concurrently, to broaden their outlook and improve their marketability, students will look for opportunities to study courses in foreign countries, and from foreign countries. As this “virtual mobility” of students expands, universities that are ready to provide appropriate coursework will have a distinct advantage. Cross-boarder collaboration of e-learning experts will be a key component of those successful programs.

**Sharing Content** – The use of content repositories and reusable learning objects is relatively common within countries, but the development of international storage and access would provide an even greater benefit to e-learning programs. In order to do this, however, we must understand the nature of content development among differing cultures and clarify our terminology to ensure clear communication. Additionally, the development of compatible standards to facilitate access and transfer of resources will ensure interoperability.

**Learning** – The study of e-learning (within the broader context of instructional design, learning theory, and curriculum development) requires that we take advantage of as many opportunities as possible to learn from one another. Although the roots of e-learning are embedded in much older forms of distance education, the multimedia aspects of online coursework present new challenges for creating coursework that simultaneously retains the rigor of traditional forms of instruction, while taking the changing nature of today's (and tomorrow's) learners into consideration. The more we share our successes, as well as our frustrations, with one another the more we will all gain.

To summarize, it is clear that globalization has already begun to influence e-learning. We have the choice either to cling to our own ways, ignoring the work of others or to embrace the challenge and grow. One of these options leads to a brighter future.

## 6. REFERENCES

[1] Vejvodova, J. – Han, J.: Online tutors: different roles, difficult tasks. In: eLearning for international markets: development and use of eLearning in Europe. - Bielefeld: W. Bertelsmann Verlag GmbH & Co. KG, 2004, p. 115-121.

[2] Cerna, M. - Han, J. – Poulouva, P. - Safrankova, H. - Sramkova, H – Zimola, B.: E-learning courses and their process management. In: Information and communication technology in education: proceedings of the 2006 ICTE annual conference: Roznov pod Radhostem 5<sup>th</sup> – 7<sup>th</sup> September 2006. - Ostrava: Ostravska univerzita, 2006. p. 43 - 48.

[3] Vejvodova, J.: Challenges of European Net-Trainers: Transnational Online Course. In: Information and communication technology in education: proceedings of the 2006 ICTE annual conference: Roznov pod Radhostem 5<sup>th</sup> – 7<sup>th</sup> September 2006. - Ostrava: Ostravska univerzita, 2006. p. 75 - 81.

[4] Coufalikova, A. – Hruby, M. – Mazalkova, M.: Net-Trainers – The First Impression. In: Information and communication technology in education: proceedings of the 2006 ICTE annual conference: Roznov pod Radhostem 5<sup>th</sup> – 7<sup>th</sup> September 2006. - Ostrava: Ostravska univerzita, 2006. p. 56 - 59.

[5] Bates, A. Distance education in dual mode higher education institutions: Challenges and changes. 2000. Retrieved April 6, 2007 from: <http://bates.cstudies.ubc.ca/papers/challengesandchanges.html>

[6] Hezel, R; Dominguez, P. Strategic planning in e-learning collaborations: A Recipe for optimizing success. In: Ed at a Distance, April 2001 (15) 4, p.11-17.

[7] Weiss, K. California Virtual University Has a Collision With Reality. In: Los Angeles Times: April 8, 1999. Retrieved April 6, 2007 from: <http://pqasb.pqarchiver.com/latimes.html>

[8] Macavinta, C. “Virtual university” gets boost. CNET News, July 27, 1998. Retrieved April 6, 2007 from: <http://news.com.com/2100-1023-213885.html> Used with permission from CNET Networks, Inc., Copyright 2007. All rights reserved.

## THE AUTHORS



As a member of the E-learning Center, Institute of Lifelong Learning, at the University of West Bohemia in Pilsen, Dr. Jana Vejvodova is responsible especially for pedagogical aspects of developing online courses. As a lecturer at the Department of Czech Language and Literature at the Faculty of Education of UWB she specializes in Czech Language Teaching Methodology. Her publications focuses mainly on pedagogy, online courses developing and tutoring. She took part in two European grants - Transnational delivery of telelearning processes combined with knowledge management in virtual expert circles – GreTel and Net-Trainers 2.

Susan M. Zvacek is the Director of Instructional Development and Support at the University of Kansas, coordinating instructional design and development consultation, overseeing classroom technology support, and offering seminars and workshops related to instructional technology. In 2006, she spent a semester at Charles University in Prague, Czech Republic as a Fulbright Senior

Scholar. Her scholarly work has been primarily in the field of educational technology, with publications and presentations at national conferences on topics such as distance education, faculty development, and the assessment of learning using online tools. She is co-author of a

popular textbook, *Teaching and Learning at a Distance* (now in its third edition) and the recently-released *Blackboard for Dummies*





**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**New Role of University**







5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

## EXPERIENCE WITH INTERNATIONAL INTERUNIVERSITY STUDIES AT THE UNIVERSITY OF HRADEC KRÁLOVÉ

Libuše Bažantová

Univerzita Hradec Králové, Fakulta informatiky a managementu, Rokitanského 62, Hradec Králové,  
500 03, Czech republic

Tel: 493 331 270, email: libuse.bazantova@uhk.cz

**Abstract.** In this paper we will sum up the current situation of interuniversity studies of students of the University of Hradec Králové, Faculty of Informatics and Management, supported by the project EVENE – Erasmus Virtual Economics & Management Studies Exchange. An inseparable part of the paper are also the results of questionnaires which were distributed to students of University of Hradec Králové studying on-line in summers semester of the academic year 2006/7.

**Keywords:** E-learning, Information and Communication Technology, Interuniversity studies, Learning Management System, Virtual Classroom

### 1. INTRODUCTION

Students' mobility in the frame of single European countries is natural and taken for granted. Recently also virtual mobility has been put into practice. Similarly as in traditional mobility students also study at other universities abroad - in this case via distance eLearning systems.

Since summer semester 2006/7 thanks to international project EVENE (supported from the sources of EU within the frame of eLearning), students of FIM UHK have the opportunity to study at foreign universities namely in Italy, Great Britain, Ireland, Finland and Lithuania. Studies are carried out in English.

## Learning

### 2. EVENE (ERASMUS VIRTUAL ECONOMICS & MANAGEMENT STUDIES EXCHANGE)

The main objectives of the EVENE project is: To create an core network of traditional European higher education institutions operating in the specialised field of Economics and Management studies able to effectively contribute to the better quality pan-European educational initiatives through virtual student mobility realised through distance forms of study using an eLearning approach [1].



This project focuses on the following specific objectives:

- To create the organisational, legal and technical conditions and mechanisms essential for the provision of pan-European virtual student mobility on the basis of a rigorous complex analysis of good practices (such as the results of the previous Minerva and eLearning projects, European virtual and open universities, EC documents, etc.).
- To identify and exploit the potential of existing on-line courses (e-products and services) with an emphasis on the pedagogical specificity of distance, eLearning, and on-line learning; and, based on their

rigorous academic presentation and defence - to improve the quality of their provision.

- To implement a virtual student mobility programme over the period of one academic year; and to evaluate its viability, quality and attractiveness through assessments provided by the students, teachers, managers, and administrators involved.
- To prepare the requisite documentation for future pan-European joint degree study programmes whose realisation would follow on beyond the conclusion of this project [3].

#### Main Activities

The key global activity corresponding with the aims and objectives of the project is the creation of a core virtual campus specialised in Economics and Management studies which would serve to facilitate the provision of the possibility of virtual student mobility (VSM) through the effective integration of information and communication technologies (ICT) in education and training systems in Europe and the actual realisation of such a mobility programme, i.e. the start up of a project for the proposed European VSM programme in the fields of Economics and Management.

Within the overall framework of these global activities, more specific work packages and activities have been identified. The project has been divided into seven work-packages - where some work-packages 6 are repeated - (thereby forming a reflexive feedback loop in the project's workflow schema. Each of the work-packages has a clearly defined content and designated leader. The content of each work-package is further sub-divided into its integral individual activities [3].

The project supporting on-line learning namely interuniversity studies started on March 1, 2006 and according to agreements and documentation it should be finished on February 29, 2008.

Funding Programme: eLearning program, Agreement Number - 2005 - 3837 / 001 - 001 ELE-ELEB12.

Co-ordinating organisation:

- Tomas Bata University in Zlin, CZ.

Co-beneficiary organisations:

- Huddersfield University (UK),
- Galway-Mayo Institute of Technology, Galway (IE),
- Savonia Polytechnic, Varkaus (FI),
- Riga International School of Economics and Business Administration (LV),
- University of Genoa (IT),
- University of Hradec Kralove (CZ),
- West Bohemia University, Plzen (CZ).

### 3. THE OFFER OF THE E-SUBJECTS FROM ALL UNIVERSITIES

|   |  |   |
|---|--|---|
| <i>University of Genoa</i>  | <i>Galway-Mayo Institute of Technology</i> | <i>Savonia University of Applied Sciences</i> |
| Industrial Production Management I  | Entrepreneurship and Innovation            | Human Resource Management                     |
| Maintenance Management I  | Computerised Business Applications         | Advance Use of Office Programmes              |
| Industrial Plant I (Plant Project Management)                             | Internet Technology                        | Budgeting and Budgetary Control               |
| Industrial Plant Management I   | Finance                                    | Business Research Methods                     |
| Industrial Plant Management II  | Celtic Studies                             | Intercultural Competence                      |
| <i>Riga International School of Economics and Business Administration</i> | <i>West Bohemia University</i>             | <i>University of Thomas Bata</i>              |

|  |                                      |   |
|--|--------------------------------------|---|
| Marketing Research and Data Processing in SPSS | Marketing Study Cases                | Business-to-Business Marketing                      |
| Operational Management                         | Simulation in Mechanical Engineering | E-Marketing   |
| Corporate Financial Management                 | Basics of Enterprise Management      | DTP and Electronic Publishing                       |
| Corporate Finance                              | Economics and Financial Management   | Computerised Data Processing                        |
| Management Accounting                          | Human Resources Management           | Quantitative Methods for Managerial Decision Making |
|  |                                      | Enterprise IS                                       |
|  |                                      | Advanced Economic Analyses                          |

**Tab. 1 - The offer of the e-subjects**

We could see that every partner afford at least 5 e-subjects, except Huddersfield University (UK).

### 4. THE PRESENT STATE AT THE UNIVERSITY OF HRADEC KRÁLOVÉ (THE FACULTY OF INFORMATICS AND MANAGEMENT) – STUDENTS AND THEIR STUDIES

Basic information

Education of the mentioned project started in summer semester 2006/7. There were 57 students' applications from FIM UHK, some students applied for more than one course, it means that there are 104 student/courses. In the first semester it is the far biggest number of participants compared to other schools participating in the project. Such a high number is very flattering for us. We can see that students are willing and eager to get new information and experience that they are not scared of either on- line learning or studies in the English language.

We asked ourselves the question: *Where and how were the students motivated. Motivation differed:*

- students were motivated not only by credits but also by acknowledgement of Czech courses as long as the guarantor recognizes the course content.
- “Testing“ the course was also stimulating; this means that if the student gives up the e-course within the semester he/she shall not be penalized in any way in his/her school results.
- It was also tempting to compare the system of education at various colleges.
- One of the key factors might have also been the experience with on-line learning in interuniversity studies at 3 different Czech universities (University of Hradec Králové, West Bohemia University and Tomas Bata University in Zlín) through *RIUS project*.
- Other reasons stated by the students will be mentioned in the following chapter.

Our students were offered 32 e-courses at universities abroad.

#### Selected e-subjects

Students of the Faculty of Informatics and Management chose 20 e-courses. The most popular e-courses were: Internet Technology - Galway (27 students) and Advanced Use of Office Programmes - Varkaus (19 students).

As for countries students found the biggest interest in courses in Ireland (40) a Finland (34). They found the least interest in e-courses in Italy (6) a z Lithuania (3). For further details see the following table.

| Providing institution | Module title  | HK | Total |
|-----------------------|---|----|-------|
| Zlin                  | Advanced Economic Analyses                          |    |       |
|                       | Business-to-Business Marketing                      | 2  |       |
|                       | Computerised Data Processing                        | 1  |       |
|                       | DTP and Electronic Publishing                       | 3  |       |
|                       | E-Marketing   | 3  |       |
|                       | Enterprise Information System                       |    |       |
|                       | Quantitative Methods for Managerial Decision Making |    | 9     |
| Huddersfield          |   |    | 0     |
| Galway                | Celtic Studies                                      | 10 |       |
|                       | Computerised Business Applications                  |    |       |
|                       | Entrepreneurship and Innovation                     | 2  |       |
|                       | Finance   | 1  |       |
|                       | Internet Technology                                 | 27 | 40    |
| Varkaus               | Advanced Use of Office Programmes                   | 19 |       |
|                       | Budgeting and Budgetary Control                     | 2  |       |
|                       | Business Research Methods                           |    |       |
|                       | Human Resource Management                           |    |       |
|                       | Intercultural Competence                            | 13 | 34    |

|              |  |            |            |
|--------------|--|------------|------------|
| Riga         | Corporate Finance                              |            |            |
|              | Corporate Financial Management                 |            |            |
|              | Management Accounting                          | 1          |            |
|              | Marketing Research and Data Processing in SPSS |            |            |
|              | Operational Management                         | 2          | 3          |
| Genoa        | Industrial Plant I (Plant Project Management)  | 1          |            |
|              | Industrial Plant Management I                  |            |            |
|              | Industrial Plant Management II                 |            |            |
|              | Industrial Production Management I             | 3          |            |
|              | Maintenance Management I                       | 2          | 6          |
| Plzen        | Basics of Enterprise Management                | 5          |            |
|              | Economics and Financial Management             | 2          |            |
|              | Marketing Study Cases                          | 2          |            |
|              | Programming Techniques                         | 3          |            |
|              | Simulation in Mechanical Engineering           |            | 12         |
| <b>Total</b> |  | <b>104</b> | <b>104</b> |

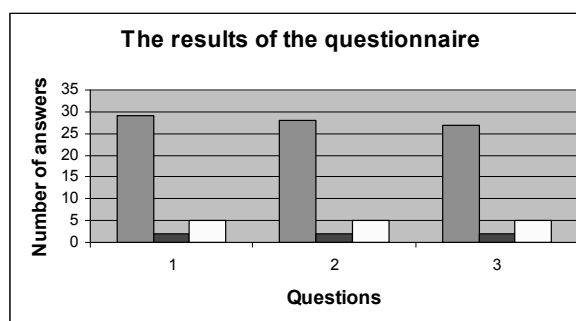
**Tab. 2 - The chosen e-subjects by students of the Faculty of Informatics and Management**

## 5. STUDENTS' QUESTIONNAIRES

Students received the following questionnaires thorough e-mail and were expected to send it back via email. Regretfully we have received about half of the questionnaires back so far.

Here are the questions from the short questionnaire:

1. Have you started studying?
2. Do you go on with your studies?
3. Do the studies correspond with your expectations?
4. Comments and incentives:



**Fig. 1 - The results of the questionnaire**

#### *Detailed explanation of the chart:*

- Bars in No1 mean No 1 question.

Blue bar means yes, I study, the dark red one – I don't study, but I intend to and the yellow one I don't study and have no intention to do so.

- Bars in No 2 mean No 2 question.

Blue bar means yes, I go on with my studies, the dark red one – I do not study, but I intend to do so and the yellow one I don't study and have no intention to do so.

- Bars in No3 mean No3 question.

The blue bar means yes I study and the studies are carried out as I expected, the dark red one means not everything runs as I expected and the yellow one means the studies do not correspond with what I expected.

#### *Selected students comment the course of study:*

- The tutor's approach is excellent. I appreciate very much their work enthusiasm and interest in their professional areas, but first of all I like their friendly, open and helpful approach towards students
- Yes, the communication with tutors is wonderful. We have been contacted through email several times, the tutor explained in great detail how to register to the virtual university. He/she even helped to solve problems and pointed out difficulties with confirmation mails (these were automatically transferred to spam section). He/she adjusted the course and postponed the task deadlines.
- I have already started the project for finishing the course and I intend to finish it. I welcome the opportunity to sign up for a course at a university abroad (also because of the English language). I will take up some more in future. I would like to add one thing: I would have welcomed more interaction: at the beginning of the course we were given instructions where what to find what and that was all. I would appreciate more work via Interface similar to OLIVA, where the tutor added material or tasks which were later analysed in discussion. I have no other comments.
- Interesting eLearning environment ☺
- Due to the approaching final state exams, it is beyond my powers to study all courses as they started later than I expected. I understand it is the first year where schools get used to working together. Anyway, the idea of EVENE is very interesting and beneficial for the students who will make use of it in future.
- It could have started a bit earlier when there was time enough
- No contact to course tutor is stated in the given environment, just study material. I would like to ask for the tutor's email address and ask for some additional information namely in section Assignments. Thank you.

It is evident from the students' comments that they enjoy their studies via on-line learning at universities abroad.

Some comments dealt with the commencement of their studies.

What a pity not all students have reacted on the questionnaire: I will try to assess the answers I have received so far. 5 students have not finished the course: the reasons were various: lack of time due to late commencement of the tuition compared to full-time studies, or due to lack of information. This was also caused by the fact that some of the emails from abroad were transferred directly to spam section and were left unnoticed. As this is a pilot interuniversity study programme with the participation of several foreign universities, the communication is without doubts more complex than in the previous RIUS programme with the participation of three Czech universities. It is also evident that many partners have no previous experience with this kind of education (interuniversity studies). In the next semester all partner universities should improve the preparation phase of the programme – commencement of the new semester namely spreading information to both students and tutors, more flexible communication, implementing videoconferences earlier tow in the semester, better communication between tutors and students. Some students were also disappointed with foreign LMS – orientation, complexity and tools. One of the partner universities could not due to organisational problem at the university use LMS Moodle and they used Internet or email instead. In their reactions students commented on the communication with the tutors: some were enthusiastic, some disappointed. It goes without saying that the right tutor can to a great deal influence the success of studies.

## **6. CONCLUSION**

The results of the questionnaire as well as the students comments show that students of the Faculty of Informatics and Management find the on-line studies in the academic year 2006/7 convenient.

In the following semester all partner universities should focus on factors which the students of interuniversity studies find discouraging – this means first of all improved information as well as communication in all aspects.

The interuniversity studies should be supported by a bigger number of registered students from partner universities. Little team work can be implemented if 2-3 students register in the e-course: their results cannot be compared, experience in single countries exchanged, knowledge assessed.

## **5. REFERENCES**

- [1] <http://www.uhk.cz/fim/projekty/1740>
- [2] <http://www.uhk.cz/fim/evene/>
- [3] <http://www.fame.utb.cz/evene/>



## MANAGEMENT OF E-LEARNING DEVELOPMENT AT A LARGE UNIVERSITY

Jitka Brandejsová, Michal Brandejs  
Computer System Unit, Faculty of Informatics, Masaryk University, Brno  
Tel.: +420 549 493 233, fax: +420 549 493 593,  
brandejsova@fi.muni.cz, brandejs@fi.muni.cz

5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
  
The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** For Masaryk University, which houses nine faculties attended by more than thirty-eight thousand students, e-learning currently represents an indispensable teaching tool. However, designing e-learning applications covering most fields and specializations as well as preparing the conditions in which these will represent an asset rather than a hindrance even for IT laymen is by no means an easy task to solve. The major factor affecting the form the e-learning applications had in the past was a group of devoted developers whose products were of limited coverage as regards the number of students using these. While this small-scale development may work for a small school, a large university requires that a more sophisticated infrastructure in terms of technology, methodology, and personnel be deployed. Masaryk University has given rise to new and unique projects that have proved fruitful and that can be put into operation in both small and large universities.

**Keywords:** Blended learning, Rapid e-learning, E-learning, Digitization, Distance education, Information and Communication Technology, Information system, Multimedia, Portal, University, Learning Management System, World Wide Web, Internet, Services, Interactive objects, Hypertext.

### 1. HISTORY OF E-LEARNING AT MASARYK UNIVERSITY

The largest number of e-learning tools, which spawned the so-called *Learning Management System*, was developed under the Information System of Masaryk University (IS MU) during the period of 2004–2005. Besides the *Learning Management System*, some other services and authoring tools were also added to it, which is the reason why the term currently used at the University to refer to the whole product is that of *EPV* (an abbreviation standing for *Czech Elektronická podpora výuky*, i.e. *Electronic Support of Education*).

In 2004, the University authorities decided to incorporate complex e-learning modules in the Information System, which currently contains communication utilities, applications for personal use and which is also utilized for managing students' and staff's records, research-related data and other information. The reason why this decision was made is that the System's reliability and efficiency had been repeatedly tested since 1998 by forty thousand users of the University's faculties. One of the pre-requisites for integration of the e-learning utilities in the System was its adaptability as regards varied pedagogical approaches and faculty-specific needs.

In 2005, the Information System was awarded the **EUNIS ELITE AWARD**.

Advantages of the e-learning applications being part of the Information System of Masaryk University

- Making the e-learning applications part of the System is cheaper than the development and maintenance of it

as a separate entity, or several faculty-specific entities.

- Both students and teachers can use the e-learning tools directly via the System they are already familiar with.
- Each course is created automatically without a system administrator or teacher having to do anything in this respect. This also applies to the course-related set-up, i.e. specifying enrolment pre-requisites, what teachers or seminar tutors are going to teach the course, etc.
- The other utilities incorporated in the Information System such as communication tools (e-mail, electronic *Notice Board*), applications used for managing students' records, grading their performance, scanning their answer sheets and finally uploading their scores into an electronic notebook, course enrolment, etc. facilitate the work with the e-learning part.
- The e-learning applications allow teachers to considerably customize their tests via the *ROPOT* (an acronym for *Revision, Opinion Poll and Testing*) section since it offers a wide range of testing tools developed to suit the needs of individual faculties, the fields they offer education in, different types of teachers, teaching styles, etc. The development of this section is done in co-operation with its users, who can also contact a technical support team provided the need to do so arises.
- Students can post their learning materials on the System and thus share them with the others. Moreover, they can post test questions, create discussion threads, and perform all the other operations their teachers can do.
- The System keeps the history of the University courses enabling its users to look up all the information posted on it in the past.

- It is also possible to arrange for courses to share each other's materials through an elaborate system of links. Hence, part of a course can be made accessible to students enrolled in some other courses as well.
- Accessibility, reliability, and security: The accessibility rate of the System in 2005 was 99.7 per cent. Despite occasional highly increased workloads, the e-learning applications run smoothly. When it comes to security, it is ensured via a complex system of access rights and such measures as, for instance, automatic assignment of a different test to each examination date, etc.
- The e-learning system also supports an anti-plagiarism application that can be utilized for looking up instances of plagiarism in the data pool comprising theses, assignments, answers to questions as well as other sources of information.

## 2. TECHNICAL RESOURCES

The Information System of Masaryk University offers numerous e-learning services, which are provided by a wide range of utilities tailored to satisfy the needs of individual faculties, the fields they educate their students in as well as their teachers.

### Study Materials section

The *Study Materials* section represents part of Information System (further on just *IS*) into which files of varied types are uploaded. After the upload, these are automatically converted into plain-text and .pdf versions and subsequently checked for viruses. Moreover, the section has an elaborate system of administration based on numerous types of access rights, which can be assigned to specific groups of users.

### Homework Vaults

The *Homework Vaults* are used for collecting students' assignments their teachers are to mark. They also support discussion amongst the students and assist the teachers in efficient administration of large courses, i.e. those with hundreds of students enrolled in. They do so in that they allow the teachers to import into the System and export from it batches of various materials as well as the folders containing these, set and assign appropriate access rights to them, transfer the teachers' evaluation of their students' work to *electronic notebooks* (part of section titled *Teacher's Notebook*), etc.

### Course Discussion Groups

This part of *IS* facilitates the communication between a teacher of a course and his/her students in that he/she may use it, for instance, to discuss the problems related to what is being taught in classes at that particular stage.

### Interactive Syllabi

The *Interactive Syllabus* represents the place a student goes to when he/she needs to enter the individual e-learning applications. It has either a time- or topic-based structure accompanied by information that can be found in a regular course syllabus. Provided a teacher wishes to create exercises he/she wants his/her students to go through at a

certain stage, he/she has an opportunity to, for instance, divide the *interactive syllabus* into as many sections as there are weeks making up the term. Similarly, the teacher may divide the syllabus into sections named after topics, some problems to solve, seminar groups, etc. that he wants these to be dedicated to.

### ROPOT

The *ROPOT* tools (*ROPOT* represents an acronym standing for *Revision Opinion Poll and Testing*) serve the purpose of testing students in multiple ways:

First, teachers themselves have an opportunity to create utilities to be used for a wide range of tasks. For instance, they may design the so-called *self-tests*, i.e. sets of questions for their students to work with and thus practice the newly acquired knowledge without the teachers having to supervise them.

Second, they may use the *ROPOT* applications to test their students by means of electronic tests.

Third, they may design learning materials interlaced with questions for their students to answer.

Fourth, they may conduct an opinion poll whose aim may be, for example, to find out whether their students have encountered a certain problem and, if they did, how they solved it. Such a survey may also be used to collect students' opinions on an issue.

Last but not least, the *ROPOT* tools may be utilized for other purposes as well such as writing a work or working on a common project.

### Scanning answer sheets

The use of answer sheets, which can be scanned and subsequently automatically evaluated, prove to be an asset particularly in the courses with large numbers of students enrolled in. This often applies to those offered to freshmen and other students in Bachelor's degree programs. Even if the students are examined in writing, it is not only the preparation of examination papers and their marking that are time-consuming, but also the students' consultations related to these. Nevertheless, the MU staff have recently started tackling this issue by using the so-called scannable answer sheets, which the students fill in and teachers get scanned afterwards. Thus, using this method, it is currently possible to correct 250 answer sheets in about two hours.

### Anti-plagiarism services

The storage of students' theses in an accessible database as well as the development of information technologies and those supporting e-learning call for the means of preventing acts of plagiarism and copyright violations. The demand in this respect, mostly expressed by teachers, resulted in the development of a special software tool capable of tracing instances of plagiarism.

What makes this service unique is the way it has been integrated into IS MU including the extent to which this has

been achieved. Details regarding the algorithm behind its efficiency are, however, kept secret since they represent the IS Development Team's intellectual property.

The anti-plagiarism service works with languages most frequently used at Czech universities, i.e. Czech, Slovak, and English.

### 3. HUMAN RESOURCES

Since universities are not usually commercial institutions, the use of their e-learning systems by their teachers is not obligatory. Therefore, one might get the impression that getting their staff to work with such systems might seem virtually impossible as there is nothing to motivate them in this respect. Nevertheless, apart from the technical, financial, and methodological means deployed to create a new system and maintain the existent one, Masaryk University also offers technical support, whose aim is to assist the Information System users in their work with it. That is also the reason why the following projects involving human resources have come into existence:

#### Direct support provided by the Information System representatives

- development of new applications and adding functionality to the existent ones
- reacting to users' feedback and implementing the features they call for
- provision of help documentation and manuals
- support of other projects

#### E-technicians – support staff for e-learning activities available at every faculty

- proposing solutions meeting teachers' requirements
- instructing teachers in the use of IS MU
- answering teachers' questions
- answering students' questions (chiefly the technical ones so that their teachers do not need to do so)
- providing technical assistance during the examination stages
- mediating the contact between users and development team

#### Service Center – S-technicians

- designing special interactive and multimedia objects to be used in teachers' classes whose aim is to make the latter richer, easier to comprehend, and more attractive
- using special authoring tools
- processing *textual material* and converting it into *ROPOT* applications such as tests (including those where texts are interlaced with graphics), exercises, opinion polls, Web pages, etc.
- processing *graphics* and converting them into diagrams, animations, photographs, slideshows, videos, etc.
- processing *audio material* (processing audio recordings, speaker commentary on lectures)
- handling innovative suggestions concerning new teaching aids and testing them in practice

### 4. METHODOLOGICAL RESOURCES

Apart from the aforementioned means (both technical and supportive), there must be a place where the System users have an opportunity to get acquainted with what they in fact have at their disposal in order to be able to start utilizing it.

Winning a teacher over for the idea of e-learning and, most importantly, for using the e-learning tools boils down to his/her motivation to do so. While, on the one hand, there are computer enthusiasts eager to test every single novel application, there are, on the other, those who are somewhat reserved in this respect. For the latter, however, one of the motivating factors may be their colleagues' positive experience of how a certain e-learning tool proved its worth in their courses, how it boosted the efficiency of their teaching process, made their work easier, or improved their students' results.

Another factor that enters the scene here and that should by no means be overlooked is that of the teacher's willingness to invest some of his/her time into mastering the e-learning tools. Since not all teachers are ready and willing to immediately delve into the pool of e-learning and explore its depths thoroughly, it may sometimes prove fruitful to get started with some simple tools (exercises) and gradually advance to the more complicated ones.

One such method, called *rapid e-learning*, has been deployed at Masaryk University. Its primary objective is to allow the teacher to get his/her learning objects up and running as quickly as possible, divide his/her course into several small elements, monitor their efficiency, and consequently modify these according to some findings. *Rapid e-learning* requires that a needs analysis be conducted for the course, which subsequently provides helpful tips as regards what areas the electronic tools should target.

For teachers to be able to share their experience of the e-learning applications, a portal named *Elportál* (available at <http://is.muni.cz/elportal/>) was set up in 2006. Teachers (and students) can search it for useful tips while the general public may also learn through it about the development of e-learning at Masaryk University.

*Elportál* is divided into the following logical parts:

#### Inspiration

- Teachers' experience
- Tips on what to do with students
- Multimedia and interactive object demos
- What is new in IS MU

#### Getting started

- E-technicians
- Service Center
- Step-by-step guides
- Help documentation
- What IS MU can do
- Enter course-unrelated electronic applications

### Other:

- Principles of e-learning in IS MU
- Articles
- Frequently asked questions
- Statistics related to learning materials: overview, details

### Tutorials:

The tutorials represent part of *Elportál* as well. These are electronic publications accessible to the general public acquainting its members with the latest findings in the field. Being part of Elportal, which has its own ISSN, such publications can be referred to with this number – a fact some teachers may appreciate and, at the same time, an element inhibiting violation of copyright in connection with the work, which has become freely accessible. The works available via *Elportál* target some of the courses taught at the University.

The teachers' feedback concerning the e-learning tools has been collected into the following case studies:

- Activities during the term
- Testing students' knowledge
- Strategies of evaluating students' performance during the term
- Opinion poll, research, views
- Ease of student's work in the course

### Examples of tools designed by teachers:



Fig. 1. Syllabus of the course titled *Introduction to Cultural Studies*, Jiří Pavelka, Faculty of Social Studies, MU

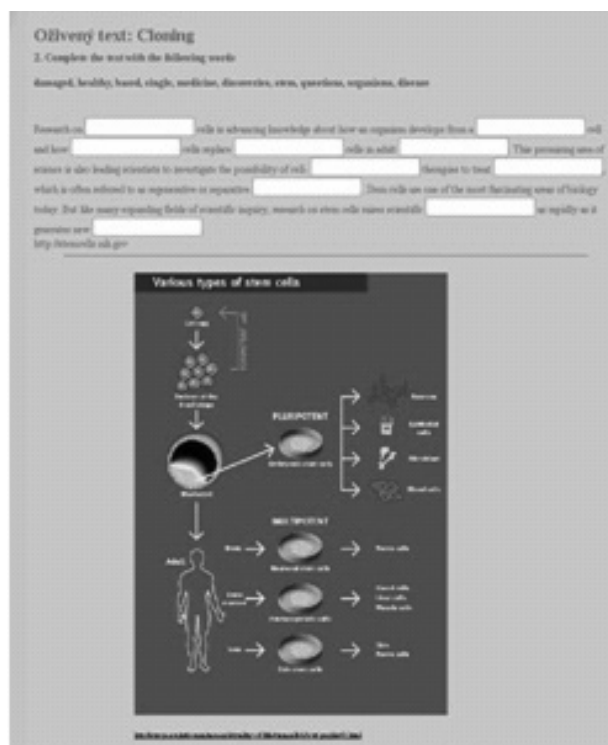


Fig. 2. Interlaced text - *Cloning*, Hana Němcová, Center of Foreign Languages, MU



Fig. 3. Tutorial (Streamed video, hypertext) *Cross-country Skiing* Pavel Korvas, Faculty of Sports Studies, MU



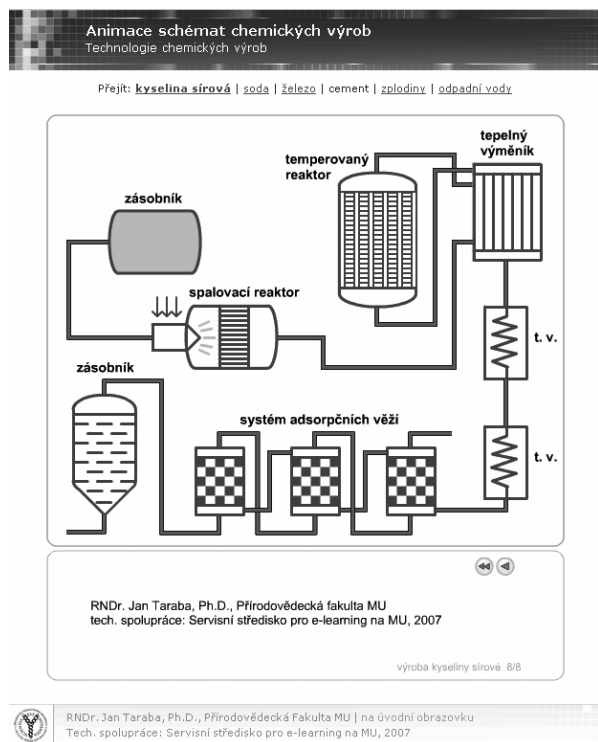


Fig. 4. Animated diagrams depicting chemical production processes, Jan Taraba, Faculty of Science, MU

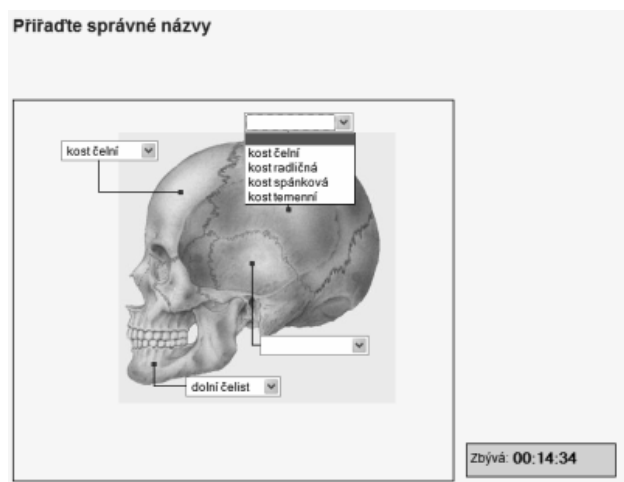


Fig. 5. Example of picture-based combination of multiple-choice questions

## 5. REFERENCES

- [1] Brandejsová J., Brandejš, M.: Rozvoj multimediálních objektů na Masarykově univerzitě. Seminář k výsledkům projektu spolupráce VŠ při tvorbě Standardizovaných multimediálních vzdělávacích pomůcek, Praha, 2007
- [2] Informační systém Masarykovy univerzity: E-learning na Masarykově univerzitě. Elportál: E-learning na Masarykově univerzitě [online], 2007
- [3] Informační systém Masarykovy univerzity: K čemu je e-technik? IS MU: Nápořád [online], 2006
- [4] Informační systém Masarykovy univerzity: K čemu je servisní středisko? IS MU: Nápořád [online], 2007
- [5] Brandejsová J.: Odhalování plagiátů na Masarykově univerzitě. *Ikaros* [online], 2006, roč. 10, č. 11. URN-NBN:cz-ik3676. ISSN 1212-5075
- [6] Brandejsová, J., Brandejš, M.: Elportál – e-learning na Masarykově Univerzitě. Konference Alternativní metody výuky 2007, Praha, 2007

## THE AUTHORS



**Jitka Brandejsová** graduated from the Faculty of Electrical Engineering and Communication, Brno University of Technology, specializing in electronic computers. She first worked as a system programmer and, from 1999, in managerial positions of several IT companies, where she specialized in electronic signatures, CA, and security policies managing state-funded projects. In 2005, she became a project manager for projects connecting e-learning at Masaryk University with Information System of Masaryk University.



**Michal Brandejš** graduated from the Faculty of Electrical Engineering and Communication, Brno University of Technology. From 1986, he was working at the Faculty of Science and later began to work as a senior assistant for the faculty of Informatics, Masaryk University. He specializes in UNIX as well computer and network architecture. He has been managing the Computer System Unit since 1995. In 1998, he was entrusted with the implementation of the Information System of Masaryk University (IS MU), which was awarded the EUNIS Elite Award in 2005.





## INITIATION OF THE INTERUNIVERSITY STUDY IN THE CR

Jan Hán<sup>1</sup>, Petra Poulová<sup>2</sup>, Bedřich Zimola<sup>3</sup>

<sup>1)</sup> University of West Bohemia, Univerzitní 8, 306 14 Plzeň, Czech Republic; hanjan@ucv.zcu.cz

<sup>2)</sup> University of Hradec Kralove, Rokitanského 62, 500 03 Hradec Králové 3, Czech Republic; petra.poulova@uhk.cz

<sup>3)</sup> University of Thomas Bata, Mostní 5139, 760 01 Zlín, Czech Republic; zimola@fame.utb.cz

Contact: Jan Hán, +420 606 665 119, hanjan@ucv.zcu.cz, <http://rius.zcu.cz>

5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

**Abstract.** The paper describes the initiation of interuniversity study/virtual mobilities in the frame of the selected universities network. It contains information about basic principles and processes of interuniversity study realised with the help of eLearning. The authors also present basic statistics of IUS realisation in academic year 2005/2006 and they show any results from IUS evaluation. At the end of the paper the possibilities of IUS network expansion are described.

**Keywords:** Distance education, Evaluation, Training network, Virtual mobility, Virtual university

### 1. INTRODUCTION

At the joint meeting of three universities (University of Hradec Kralove, University of West Bohemia and University of Thomas Bata) in January 2005 (after several foregoing meetings) the basic requirements for reciprocal offer of study subjects and students were formulated. These requirements put basic frame for joint cooperation on the field of education.

It is possible to categorise the basic discussed possibilities of mutual cooperation to following categories:

- the students exchange on the base of Socrates Erasmus similar platform,
- the system of mutual offer of paid lifelong learning courses,
- interuniversity study on the base of optional study subjects.**

At the same time the following requirements were formulated:

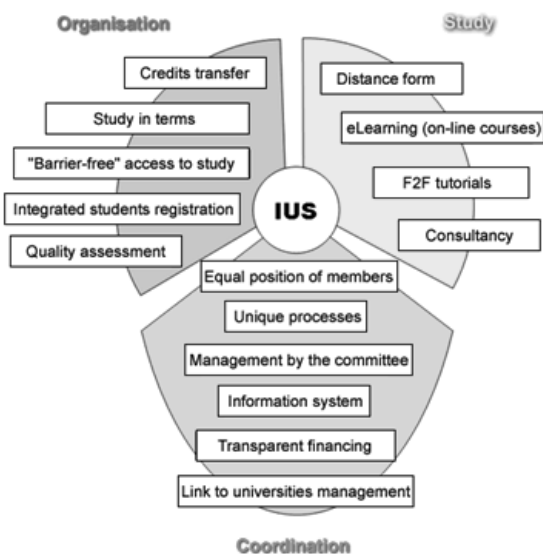


Fig. 1. Requirements for an interuniversity study

The meeting result is the agreement with the variant of interuniversity study on the base of optional study subjects.

#### RIUS project

Interuniversity study was started among UWB, UHK and UTB in the academic year 2005/2006 in the frame of the RIUS project realisation. The RIUS project ("Initiation of the interuniversity study in the network of selected universities in CR") is financed in the period 2005-2007 from ESF (project registration number: CZ.04.1.03./3.2.15.1/0067, web: <http://rius.zcu.cz>).



The project has following objectives:

- To create the base of universities network in the Czech Republic for the purposes of interuniversity study (IUS) realisation
  - To prepare and stabilise the infrastructure (organisation, processes) suitable for IUS in the network of selected universities
  - To describe a verified IUS model for the purposes of the IUS network expansion
  - To create suitable conditions for the expansion of IUS network
- To enable the initiation of IUS in the created network of selected universities
  - To support the financing of realisation of interuniversity educational activities (initiation phase) in the blended and distance study form – kick-off tutorials, tutoring, study aids modification
  - To prepare both pedagogical and administrative workers for IUS realisation
- To enhance the quality and attractiveness of study programmes and subjects offered at particular universities

- a. To share study subjects guaranteed by leading experts on the field
  - b. To extend the offer of study subjects at particular universities
  - c. To reduce the number of low level study activities
4. To increase the effectiveness of sources given to the realisation of distance form of study using tools and methods of eLearning
    - a. To share study aids (especially eLearning aids), educational infrastructure and tools
    - b. To reduce the development of similar study aids
    - c. To increase the number of students at educational activities in blended and distance form of study
  5. To prepare Czech universities for more intensive cooperation with similar organisations in other EU countries
    - a. To prepare conditions (infrastructure, processes, know-how) for the connection of created Czech IUS network to similar networks in other EU countries for the purposes of IUS

## 2. IUS SYSTEM

The study activities are realised by the distance form except kick-off, synchronising and assessment tutorials (meetings). Students meet face to face a teacher (tutor) from the partner's institution realising relevant subject at the start of the term. At this meeting students obtain information about the objectives and the structure of the study subject, the way of communication in the course, the requirements for successful passing an exam etc. Students obtain access to an internet on-line course, in which study documents are distributed, study tasks, exercises, selftests and tests are prepared, a discussion forum for joint communication is opened. The kick-off meeting starts up the study, which is hold in the internet by a distance way. The teacher has the possibility to organise minimally one synchronising tutorial per a term. The goals of this tutorial are especially both to synchronise information about the progress of students in the course and to solve personally potential problems and lacks in the content and the form of study. Synchronising tutorials can be realised several times in a term according to needs of students and teacher(-s). Assessment tutorial is the third type of IUS tutorial. It contains especially the assessment of the study results of particular students. The assessment is done by the way prescribed in the syllabuses of particular study subjects. The student evaluation of a subject realisation is realised also at this tutorial. The IUS results are accepted in students total study results including credits. Particular tutorials can be realised by both the face to face and videoconference way.

The IUS organisation is managed by the developed process model. The model describes hierarchically particular processes up to the level of particular activities, responsibilities, terms and recommended tools. The model is described at approximately 100 pages of A4 format. The synchronisation of processes and tools is the due condition for effective IUS organisation. The synchronisation is

linking different information and management systems of particular universities in the network.

The IUS coordination is provided by a steering committee. The steering committee consists of responsible representatives of particular universities.

## 3. REALISATION OF IUS IN THE CZECH REPUBLIC

The students interest in the IUS is higher than the "suppliers" expectation in the initiation phase. In the half period of the RIUS project the project goals (indicators) were almost achieved.

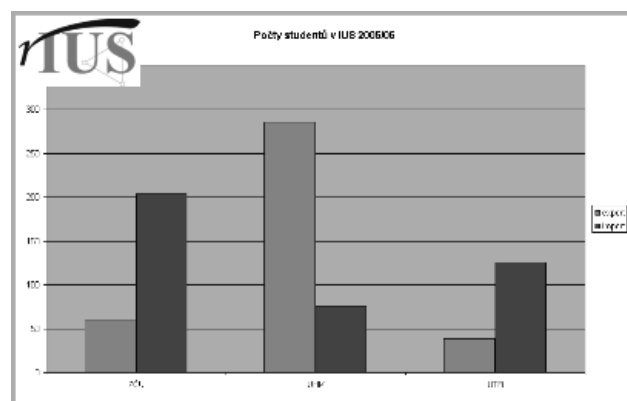


Fig. 2. Number of IUS students in 2005/2006 – export, import (columns: UWB, UHK, UTB)

It motivates particular IUS subject suppliers to the subjects offer extension.

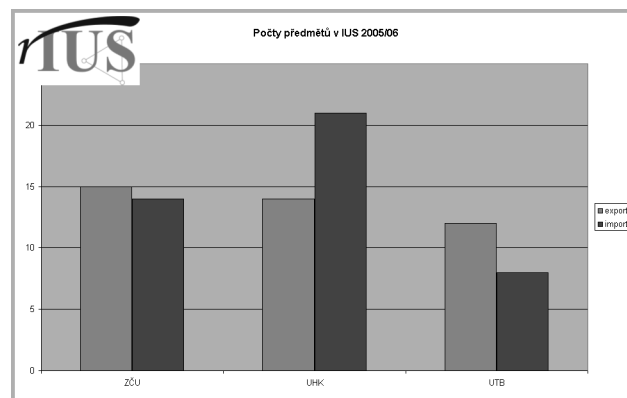


Fig. 3. Number of IUS study subjects in 2005/2006 – export, import (columns: UWB, UHK, UTB)

The offer of study subjects cover actually the wide spectrum of study fields – technology, economy and management, natural sciences, humanistic sciences, arts etc.

## 4. IUS EVALUATION

In the frame of the RIUS project the evaluation system has been set up. The system monitors both the level of educational services (teaching and learning) and the IUS organisation. The system is based on:

- 1) Concurrent evaluation questionnaires for tutors (teachers),

- 2) Final evaluation questionnaires for tutors,
- 3) Final evaluation questionnaires for students (both successful and unsuccessful students),
- 4) Evaluation interview at the end of a term.

Particular project partners are creating the evaluation statistics for their universities at the end of each term. Concurrently they are proposing modifications to reduction of potential system lacks. At the end of an academic year the final evaluation report is created by every partner in the network. The reports are accessible at <http://rius.zcu.cz>.

The evaluation results related to the academic year 2005/06 contains among others the following data:

- 80% of participated UWB teachers do not consider the work in IUS on-line course to be more difficult than the classical teaching
- 90% of participated UWB teachers obtains additional motivation to participate at the preparation of the distance and blended form of study
- 100% of participated UHK teachers have not any technical problems in the frame of their course
- 100% of participated UHK teachers would recommend the IUS to other students and teachers
- 74% of participated UWB students declare: a teacher was able to strengthen their motivation to study the subject
- 92% of participated UWB students declare: the study materials (sources) were presented by the well arranged and systematic way

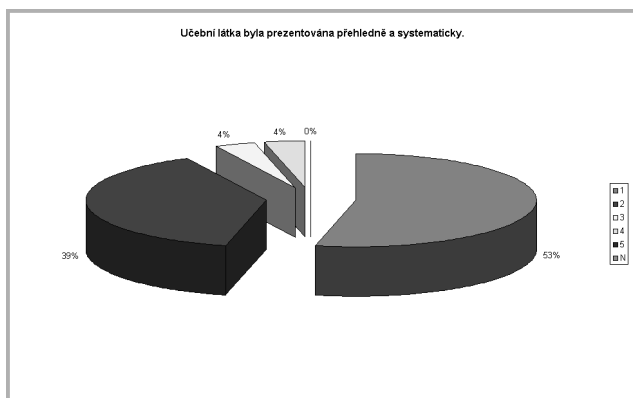


Fig.3. Study materials were presented by the well arranged and systematic way (1 – best, 5 – worst)

- 68% of participated UHK students declare: the study of a subject requires an adequate work occupation
- 80% of participated UWB students declare: the technology do not requires additional effort
- 96% of participated UWB students consider learning in the frame of IUS to be contributive
- 57% of participated UHK students will use the possibility to study in the frame of IUS again in the next academic year

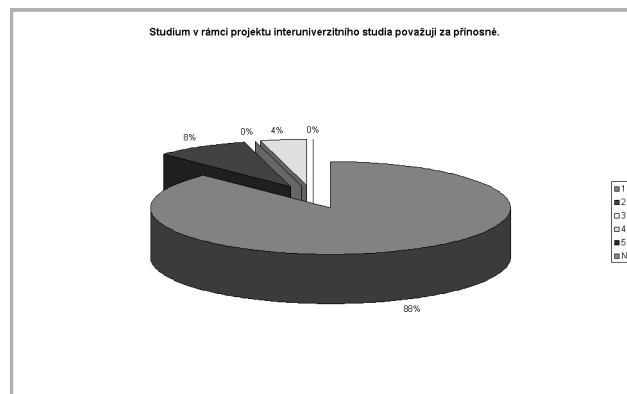


Fig.4. Participated UWB students consider learning in the frame of IUS to be contributive (1 – best, 5 – worst)

## 5. EXPANSION OF IUS NETWORK

The mentioned network realising pilot activities of IUS in the Czech Republic is extending by new partners not only from the Czech Republic, but also from other EU countries. The good example can be the expansion by several foreign universities in the frame of the EVENE project – see <http://www.fame.utb.cz/evene/>.

In March 2007 the IUS seminar determined for other Czech universities representatives was organised at the University of Hradec Kralove. The seminar was visited by the representatives from 7 other Czech universities. All participated universities express the strong interest to enter to the created network. This entrance is possible to realise from 2008 – thanks to processes demands. The project coordinators suppose to expand the network in 2008 for the most of Czech universities.

Similar effort to expand the network are realised also in the European space. The network developed in the frame of the EVENE project has further European candidates. It is actually in the phase of the project proposals agreement process.

The initiation of IUS network is financed by national and international projects grants. Following maintenance of IUS network will be based on the model of a mutual payment. This one and other topics will be coordinated by the steering committee of IUS association.

This committee will coordinate among others following topics:

- intention and strategy of IUS,
- offer x demand of particular universities study subjects,
- unique processes of IUS,
- IUS information system,
- links to other European networks,
- models and sources of IUS financing etc.

The association will be open for both all Czech and foreign universities.

## 6. REFERENCES

- [1] H án, J., Poulová, P., Zimola, B.: Evaluation of Interuniversity Study Realisation in the Network of Selected Universities - First year experiences. Information and Communication Technology in Education 2006. Ostrava: 2006. s.246-251, ISBN 80-7368-199-4
- [2] H án, J., Poulová, P., Zimola, B.: Interuniverzitní studium v síti vybraných univerzit ČR. Sborník příspěvků ze semináře a soutěže eLearning 2006. UHK, 2006. s.204-209
- [3] H án, J.: Výsledky hodnocení IUS na ZČU v Plzni, ZČU, 2006, <http://rius.zcu.cz>
- [4] Poulová, P.: Výsledky hodnocení IUS na Univerzitě Hradec Králové - Fakultě informatiky a managementu, UHK, 2006, <http://rius.zcu.cz>

## THE AUTHOR(S)



**Jan H án:** the head of the Institute of Lifelong Learning at the University of West Bohemia in Pilsen.

His Ph.D. was realised on the field of the development and implementation of eLearning tools in industrial companies. He is the

founder of eLearning centre at the University of West Bohemia. Jan H án is the coordinator of national and international projects focused on eLearning and lifelong learning.



### Petra Poulová

Univerzita Hradec Králové,  
Fakulta informatiky a managementu  
Rokitanského 62  
Hradec Králové, 500 03  
[Petra.Poulova@uhk.cz](mailto:Petra.Poulova@uhk.cz)

### Work experience:

2002–Vice-dean, Faculty of Informatics and Management,

University of Hradec Králové

1998 – 2002 Head of the Institute of Further Education, Faculty of Informatics and Management University of Hradec Králové

1991 -1998 University of Hradec Králové

Several international eLearning projects in various EU programmes (TEMPUS, SOCRATES/MINERVA, Grundtvig, eLearning). Over 100 academic and professional publications.

Currently active participation in the EUNIS-CZ (European University Information Systems Česká republika) as member of executive committee and ČADUV (Czech Association of Distance University Education) as member of the board.



**Bedřich Zimola:** Vice-Dean for International Affairs, Director of the Centre for Further Education, responsible person for developing of distance learning and eLearning at the Faculty of Management and Economics, coordinator of the EVENE Project, institutional coordinator of the RIUS Project.

# MBA IN MARKETING VIA A WORLD-WIDE VIRTUAL UNIVERSITY



5<sup>th</sup> Int.  
Conference on  
Emerging e-  
learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8,  
2007

Jozef HVORECKÝ<sup>1</sup>, Vladimír BURČÍK<sup>2</sup>, Ivan ZARY<sup>3</sup>

<sup>1</sup> Department of Information Technologies, Vysoká škola manažmentu v Trenčíne  
Panónska cesta 17, 851 04 Bratislava, Slovak Republic, [jhvorecky@vsm.sk](mailto:jhvorecky@vsm.sk)

<sup>2</sup> Department of Psychology, Faculty of Arts, Comenius University in Bratislava  
Gondova 2, 801 00 Bratislava, Slovak Republic, [burcik@fphil.uniba.sk](mailto:burcik@fphil.uniba.sk)

<sup>3</sup> Department of Marketing, Communications and Commerce, Vysoká škola manažmentu v Trenčíne  
Panónska cesta 17, 851 04 Bratislava, Slovak Republic, [izary@vsm.sk](mailto:izary@vsm.sk)

**Abstract:** An e-learning project funded by the European Social Fund enabled Vysoká škola manažmentu (College of Management, the first Slovak private university offering programs of City University of Seattle in USA) to prepare ten e-learning university courses related to marketing. All of them can be studied in both English and Slovak languages. Taking complete set of courses (and meeting additional conditions) enables their students to acquire the title MBA awarded by the City University of Seattle.

Our article describes process of the creation of these courses to meet requirements for modern virtual university courses.

**Key words:** e-learning, human resource, qualification, adult education, distance education, learning style, MBA in Marketing, virtual university, virtual classroom

## 1. INTRODUCTION

Slovakia does not have enough marketing experts. Although our continuing economic growth requires similar expert knowledge in many positions, there are no complex studies enabling university graduation via the most modern electronic form – by means of virtual university – i.e. as 100-percent e-learning education [1].

Similar ways of learning are especially welcome as a part of lifelong education of specialists who already work in marketing positions. These people travel a lot. At many times, the request of a client emerges at a very last moment before their departure. Such a style of work and life builds a serious barrier to the expert's regular education in its classic form – with daily classes and/or consultations requiring personal presence on the university campus. Accessing his/her virtual classroom from a hotel room or an Internet café placed anywhere on the Globe is therefore an optimal solution for these people.

Having these needs in mind, Vysoká škola manažmentu in Trenčín, Slovakia, decided to offer a series of e-learning courses for this educational market segment. In this article we describe the process of selecting the virtual environment, projecting and creating courses, and implementing them – including first experiences of our students.

## 2. VIRTUAL UNIVERSITY

History of distance learning is relatively long. Its forms have been changing a lot during its existence. Until

recently, distance education was understood exclusively as way of learning using regular commuting between the school and a workplace, i.e. visiting it frequently and periodically but “from a distance”. The students attended the school according their time schedule, mostly during evening hours or weekends. They formed permanent groups (classes).

The first university which has modified this principle was British Open University. During the 60's of the last century it established correspondence courses enabling to graduate individually. Despite of initial skepticism of the academic community, correspondence courses quickly grew, numbers of students become enormous, and the accreditation commission officially recognized these courses as an alternative to standard ones.

Nowadays, the number of universities offering this form of studies counts hundreds. Some of them offer it as their sole study format, other keep it simultaneously with more traditional classroom formats. Vysoká škola manažmentu (VSM) in Trenčín, Slovakia, and its founder City University of Seattle, USA, also belong among the latter group of tertiary institutions. As private institutions, they are looking for innovative methods allowing them to expand their market and attract the attention of as many potential students as possible.

In the Information Age, teachers and students usually correspond via Internet. As a result, they need not be close to each other geographically. Nevertheless, there is a disadvantage of correspondence courses. The students are isolated and all problems must solve directly with their teacher. Such a practice increases the teacher's teaching load which consequently raises the study costs. What is

even more important, the students have no possibility to experience some basic social attributes of the classic education – collegiality, knowledge competition, creating life-long working and social partnerships, etc.

To minimize these negative factors and decrease the teachers' load, "virtual classrooms" are emerging on the Internet. Their concept consists of creating a team which proceeds following a synchronized pace. The semester gets a fixed number of weeks; the assignments must be delivered on exact dates.

The students get a virtual room to "meet" and share their knowledge and experience. These activities become key. The students' participation on them contributes to their grades. To enhance their progress and develop their soft skills, "discussion topics" are added atop of classical assignment. Here student must show not only ability to solve the problem, but also develop the standpoint to other solutions and understanding for his/her classmates' views. He/she may ask colleagues for help – and their responsibility is to give an advice. Asking for help is not penalized; percents are added to those who help.

The position of the teacher has changed essentially and is expressed also by the change of his/her title to "facilitator". His/her task is not to "teach" but to "facilitate learning" by providing an appropriate and meaningful content of education and supervising its execution. He/she steps into it especially when discussion stagnates or head into a wrong direction. Even in these moments the teacher does not command but rather proposes: *What if you think also about...? Is there another way of solving the problem...? Would you agree with such a solution...?* „Teachers" in its original meaning are more experienced and smarter classmates. At many occasions, it is almost impossible to speak about teacher's presence – everybody teaches everybody according to what he/she has understood (or thinks has understood).

In pedagogically well-designed, properly organized, and cautiously administrated environments, distances between them stopped playing a role. The virtual university can cover the entire planet. One of the authors teaches for the University of Liverpool from Bratislava and has got students from all corners of the World starting from Hong-Kong through Middle East and Europe to Canada and Caribbean islands.

His experience was exploited in VŠM's project. If such a project should (at minimum) address the students of both partner institutions – VŠM and CUS – then it should have all attributes of the world-wide virtual university. Even if all students were located in their universities' locations, the time difference between the places is 9 hours. Creating real-time communication between such places would cause extreme problems to both students and lecturers. For that reason, virtual universities function world-wide using the principle of asynchronous visits of classrooms.

### 3. SELECTION OF THE STUDY FIELD

Not all study fields fit to the virtual classroom's educational methodology equally. Unless the technology radically improves, it is hardly applicable in the fields where training is based on knowledge of experts and acquired by reproducing their skills (e.g. surgery). Still, there are many areas where it can be applied – mainly those, where ideas, thoughts, concepts, views, and attitudes can be verbally disseminated and exchanged. As we wanted to build a large set of courses, our first criterion was to specify an area in which one can efficiently apply asynchronous electronic exchange of information and knowledge at the contemporary level of technology progress.

The second criterion of our selection related to the application of knowledge and practical experience of our future students. It is a matter of fact that student's previous command of area and of its terminology is an imperative for richer discussions and peer-to-peer information exchange. To reduce frustration and workload, each student has to be capable of finding him/herself occasionally in a position when he/she is more skilled and experienced than the most of his/her class. In that moment, he can feel "a teacher" and communicate the content to the others in accordance to his/her understanding. Public demonstration of similar knowledge and experience increases his/her self-confidence and satisfaction and, consequently, leads to higher motivation to study.

The third criterion addressed our educational market. The production of the courses took 18 months and required an intensive involvement of many people – authors of software, experts in on-line teaching methodology, authors of modules, reviewers, administrators, etc. The number of potential students should be large enough to guarantee a return of the investment. As we mentioned earlier, the project was sponsored by the European Social Fund, Project Number 13120120182 "Rozvoj e-learningového vzdelávania na VŠM" (Developing e-learning-based education at VŠM).

After long discussions we adopted Marketing as our preferred study field. Notice that it satisfies all three criteria very well:

- *Marketing* is an environment in which the ideas, thoughts, concepts, views, and attitudes can be verbally disseminated. Pictures and videos are here predominantly used in the form of examples i.e. for the idea exemplification. Many of proposed ideas do not require face-to-face communication. Often, the opposite is true – a longer period between posting the concept and the other person's response offers an opportunity to appreciate the concept, to build the partner's own argumentation pro or contra, and to formulate a decent answer.
- As our addressees are marketing managers of Slovak and foreign companies, it is rather natural to expect certain level of knowledge in the field. On the other hand, as their knowledge is mostly based on their individual experience and no previous regular study,



it is unlikely systematic and consistent. Thus, the main aim of the course will be to offer them a systematic structure of the field, its topics and subtopics, a complete review of methods of marketing, advertising, promotion, and field research.

- Finally, the study should be organized in a flexible manner. The set of courses is to be build as a mosaic. The students should be capable of picking up just selected items of it – but also to comprehend their particular role in the entire picture. For that reason, each course can be taken individually without any prerequisites. The applicant will be consulted on the appropriateness of a particular course for him/her, but the responsibility an accepting or refusing the offer is on him/her. It is not our intention to force our students to enroll courses in which they are not interested or which they have already covered at other occasions/trainings.

As a base for our course structure, 10 courses of MBA study program of the City University of Seattle were chosen. Our consideration and their selection have a very natural motivation. If the student is interesting not only in these specific courses but also in gaining the MBA degree later, by completing them, he/she covered two third on his/her way to the degree. The graduates would become the very first MBA in Marketing professionals in Slovakia – and possibly in the Central Europe.

The offered package consists of the following graduate (i.e. master) level subjects:

- *Marketing Fundamentals*
- *Advertising*
- *Advertising and Promotional Strategies*
- *Marketing Research*
- *Advanced Marketing Research*
- *Marketing Strategy*
- *Advanced Marketing Strategy*
- *Marketing and the Internet*
- *Global Marketing*
- *International Marketing.*

#### 4. DESIGN AND DEVELOPMENT OF E-LEARNING COURSES

In accordance with the trimester organization of the studies at the VSM, each course is divided into ten blocks. The duration of each block is one week.

In the beginning of the given week, instructions to the students are posted in the virtual classroom. There standard duties for each week are:

- To read the current week's lecture.
- To participate in class discussions.

To evoke the discussions, the instructor posts 1-2 topics to be discussed. Their choice depends on the lecturer and in parallel classes does not be same. Its role is to point to the most important concepts in order to deepen their comprehension.

Other student duties are optional and depend mostly on the course and educational style of the lecturer:

- Many lectures end up with self-evaluation tests. The tests may contain “yes-no” questions, “one-correct-answer” questions, “many-correct-answers” questions and “fill-in-the-blank” questions. They serve for self-assessment of the students. They are evaluated instantly so the students can see his/her progress in gaining knowledge.
- Students can be asked to write assignments or to analyze case studies. The text of the case study is publicly presented and its due date is set up. Often, the students outputs are publicly presented and evaluated/discussed by the rest of the class.
- Midterm and final examinations can also be completed over the net. As there is a risk of cheating, students are supposed to complete proctored exams i.e. there should be a lecturer or a public official with the student. The proctor guarantees the identity of the participating student(s) and the validity of the exam conditions.

Due to the lack of appropriate professional literature, lectures are relatively long – from ten to fifteen pages. Many lectures have self tests added.

There are strict regulations on how students should react to the discussion topics and how to respond to other students:

- The first student's response should be generally posted within 2 days from the publication of the topic. From the moment when the standpoint of certain student is published, anyone else may react to it – regardless he/she already published his/her initial posting. „Original“ standpoints are not required – meaningful development of a partner's idea, its critical analysis, merging of several views into a new one, different argumentation in favor of some point of view or against it – those are examples of ways how to join the discussion and “earn points”.
- The discussion must be done in a friendly and collaborative atmosphere. Its aim is not to compete. It should rather demonstrate “the entire pool of knowledge” collected by the class from literature, Internet resources, personal experience, generalization of individual observations etc.
- Each response must be polite and friendly. Differences in opinions must be solved by discussions and argumentation, not by personal offence. One of the roles of the lecturer is guarantee these qualities.

Discussion is not held in the real time. Everybody joins when it the best for him/her and reacts only to those contributions he/she is personally interested in. The responses are therefore formed without a time pressure inevitably appearing whenever there is a need to react instantly. This helps to develop students' analytical skills, rational argumentation as well as composition skills. (The students are recommended to read their response at least once before sending.)

## 5. SCHOLASTIC HONESTY

Critical question is honest behavior of students. Under given circumstances it is not possible to completely avoid cheating – copying of the assignment solution or helping of the third person. VŠM has developed a sophisticated system of verification of scholastic honesty [2] to prevent such behavior. Its violations are strictly penalized up to the expulsion from studies.

From this point of view, discussions are the best guarantor of the regularity and authenticity of the studies. Asking somebody to sit under the different name in front of the computer screen for two-three hours a day during ten weeks is hardly achievable. Somebody substituting the student only for a few days can be easily disclosed. In fact, virtual classrooms are “real” in the meaning that after a few first days everybody can predict who will react in which way, how many contributions a day he/she will send and when, in what fields he/she is an expert, in what blunders, etc. So, the lecturer can easily complete the evidence if a suspicious case appears.

## 6. ELMS U-LERN AS IMPLEMENTATION ENVIRONMENT

Selection of the environment was also determined by several criteria. The goal was to get environment offering all typical services of e-learning managerial systems and at the same time enabling to work with Slovak texts. As VŠM is a relatively small university we did not want to develop ELMS itself. We were interested in product created by professionals who after the inserting of the learning programs would care also of virtual university operations.

From among several candidates we have selected ULern [2] as the most appropriate e-learning management system. Its main advantages are:

- Several years of positive experience with ULern made by several users.
- Its compatibility with BlackBoard – the ELMS used by our partner City University of Seattle. The compatibility will allow us an easy and simple exchange of e-learning programs, study materials and tests.
- The existence of the authoring tool ULern Producer enabling off-line preparation of courses.
- Regular and systematic consulting assistance done by the ULern developers for the authors of the educational programs.

Practically each step of the development started by related consultations. As all authors were novices in the field of e-learning sessions development, their load was thus lower – they could concentrate on knowledge and facts needed for the core activity. Thanks to these consultations all works were completed on time.

In the first stage study materials for the courses were collected, case studies created, control tests developed and further documents were gained – similarly as during the

development of the new subjects in traditional forms of studies. The only difference compared to traditional marketing courses at Slovak universities was our preference to the “open-end” assignments, i.e. to case studies and discussion topics. Our ambition has been to create equivalents to the modern contemporary courses at prestigious universities abroad.

Another aim of ours was to create courses that could also be implemented internationally. Such an idea is quite natural in any 100-% e-learning environment. If successfully done, it could expand the range the VŠM reaches. For that reason, all courses were created in English. After completion of English versions, their translation into Slovak was accomplished. Nowadays, all courses are available in both language mutations.

During the next stage, these materials were inserted into the authoring environment of ULern Producer, where students’ view of materials can be simulated. The courses were tested on proper functioning, on the tests completeness and correctness, etc.

During the very last stage, all materials were transferred to the Internet in the form protecting them against unauthorized copying.

In the meantime, the test runs of four courses are undergoing: *Marketing Fundamentals*, *Advertising*, *Marketing research*, and *Marketing strategy*. The structure of students is in accordance to our presumptions and the orientation of courses – they are marketing specialists with several years of experience in the field and seemingly eager to extend their knowledge. To minimize their load, no one is allowed to take more than two courses at once. To simplify their Internet access, the students have been offered an opportunity to borrow VŠM laptops and to use its resources (computer labs, library, textbooks and journals, etc.)

All courses will finish within the next two months (in the last days of June). So, during the ICETA 2007 conference we will be able to share our experience with its participants.

## 7. CONCLUSIONS

Based on our experience, we can propose directions that might be followed by organizations that want to implement large sets of e-learning courses gradually.

- *Use an existing and professionally-supported E-Learning Management System.* There is no reason to start designing and developing a new ELMS with every new e-learning course production task. This “disease” is typical for Slovak universities. It results into numbers of incompatible ELMS with very specific and advanced features but with a minimum of real e-learning courses. The international trend is to have a few ELMS with hundreds (even thousands) of courses about them. Compared to it, a typical Slovak ELMS hardly has dozens.
- *Use the same ELMS for a long period of time.* The development of an e-learning application is costly. Once

it is done, it should be used for a prolonged period of time otherwise you waste human resources as the new system usually requires large modifications in all existing applications. Small improvements of ELMS are cheaper than big changes.

- *Think about comforting your students.* All courses belonging to the same study field should be written under the same ELMS (or, in the case of extreme necessity, under two compatible ones). The reason of creating e-learning programs is teaching and learning of the subjects, not the manipulation and navigation within different ELMS's. The unification of tools substantially decreases students' load as they do not need to think how to operate the particular program.
- *Coordinate the course structure.* The students should follow the same or very similar methodology in all courses. The style of individual lecturers may differ but the layout of the courses, access to the materials, formulation of tests should be as close as possible. This requires an intensive cooperation among the course authors.
- *Exploit students' previous knowledge and experience.* E-learning works well with mature, self-motivated and disciplined students. For that reason, it is very appropriate for adult education, in particular for further development of professionals. When they feel being treated as valued sources of information, they will like their classes better. The consultation in e-learning functions better than drill and memorizing. The aim should be teach the students to comprehend the content, to analyze it critically, to express their opinion openly but friendly and to learn from their own experience as well as of experience of others.
- *Build a pool of would-be authors.* Preparing on-line courses is a difficult task. Once people become trained, their skills and experience should be exploited in creating next courses (in the same or close field of expertise). With their growing knowledge and experience, the quality of courses will also gradually grow. The authors should also learn to cooperate and to apply the experience of their peers.

## 8. REFERENCES

- [1] Hvorecký, J.: Virtuálna trieda (Virtual Classroom). *Matematika – fyzika – informatika*, vol. 12 (2002/2003), pp. 442–444
- [2] Hvorecký, J., Kročitý, P.: Vychovávať eticky mysliacich a konajúcich manažérov (Educating ethically thinking and acting managers). *Zborník konferencie Manažment: Teória, výučba a prax 2005*. Akadémia ozbrojených síl, Liptovský Mikuláš, 2005, pp. 198 – 205
- [3] Peter Košč, Juraj Sinay, Dušan Kocur, Stanislav Benco: Institutional Implementation of e-Learning Technologies in Higher Education, ICETA 2004

[4] Dušan Kocur, Peter Košč, :Doporučenia pre inštitucionálnu implementáciu e-learning technológií, BELCOM 2005

## AUTHORS



**Jozef Hvorecký:** Graduated Numerical Mathematics at the Comenius University in Bratislava. Later, he completed his PhD. (in Computer Programming) at the Academy of Sciences of the USSR in Moscow. During more than 30 years of his educational career he lectured at many universities around the World – sometimes in rather exotic countries as Papua New Guinea, India, the United Arab Emirates, Macao, and Mexico. Currently he is the head of the Computing and Information Science Department at the College of Management in Bratislava, the oldest Slovak private university. He also teaches on-line courses for the University of Liverpool's Laureate Program. His research is oriented to Management of Tertiary Education, Computer Education, E-learning, and Use of Computers in Education. He is the author and coauthor of more than 20 books and textbooks.



**Vladimír Burčík:** Director of the Academy of Communication, Slovakia <http://www.wsis-award.org/content/displayContent.php?ct=img&ID=841> Director of Academy of Communication, a multimedia projects consultant at graphic studio Mr.Design. He lectures at the Department of Psychology at the Faculty of Arts of the Comenius University, and at the Department of Design at the Faculty of Fine Arts in Bratislava; specializes in Corporate Image (CI), Corporate Communication, Human Computer Interaction and www design; co-author of a book *Internet v riadení a obchode firmy* and of a textbook *Psychodiagnostika dospelých*, author of many studies and programs on CI published in Slovakia and abroad. He worked on creating a corporate identity for the companies Slovakofarma, Milex Schärtinger, Slovenské design centrum, Palma, Rajo, Volkswagen, Všeobecná úverová banka, Ludová banka, Západoslovenská energetika, Telenor Slovakia, Eunet, EuroTel a S&T Slovakia. He was the member of the jury of EUROPRIX in 1999.



**Ivan Zary:** Graduated Journalism at the Comenius University in Bratislava. Later PhD. – History of Journalism, PhD. – Arts and docent of Public Relations at the same university. He worked as a journalist in a daily newspaper and an automoto magazine, after as the Spokesperson and Director of the

Press and Information Dept. of the Slovak Government. In 1992 he established the ProPublicum company, the first public relations agency in Slovakia and was its co-owner and Director General. He later established the Association of Public Relations of the Slovak Republic and was its first president. Now teaches Marketing, Global Marketing and Public Relations in Slovak and English at the Vysoka skola manazmentu (College of Management) in Bratislava. Author of the first book featuring public relations in Slovakia and of the continually renewed virtual book named Public Relation. The book is available at <http://www.zary.sk/english/vbook.html>.

## **ACKNOWLEDGEMENT**

*The authors express their gratitude to other colleagues cooperating in their development David Griffin, Mathias Suthe, Hideki Takei, Johan Winbladh, Maria Billova and all other lecturers and administrators of VŠM who participated in the project.*

*Our gratitude also goes to the European Social Fund for sponsoring this project.*



## E-LEARNING USAGE FOR PURPOSES OF THE BACHELOR STUDIES AT TECHNICAL UNIVERSITY IN LIBEREC

Hana Pařilová, Karel Petroszki  
Technická univerzita v Liberci  
hana.parilova@vslib.cz, karel.petroszki@centrum.cz

5<sup>th</sup> Int. Conference on

*Emerging E-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract:** e-learning and its forms. Computer usage in the extramural education. Use of e-learning in the Textile marketing line.

**Keywords:** e-learning, student, e-course, teaching

### 1. E-LEARNING - ONE OF THE MODERN WAYS OF TEACHING

To define E-learning expression is almost impossible nowadays. It's quite a new term. It's official definition hasn't been stated and single authors they use it in their own – the most suitable for them – way from various points of view of their professionalism or ideology. This term arised in 1999 in Europe but it has an American origin. Unfortunately even American authors' definition varies.

Palan (2002) defines e-learning like a way of education using computers and computer networks. There is an advantage of accessibility for organizations and every single person. It allows to educate a lot of professionals in a very short time and low running costs. It's a modification of extramural education using the hi-tech information technologies in the cast of distributed education. It hasn't any high premises requirements and it could be updated with ease.

There contributes to modernization of education with no doubts usage of IT at the beginning of the 21<sup>st</sup> century – especially electronic educational systems. They have almost unlimited potential especially in communication technologies. Production of educational programs is becoming a primary affair at universities. Pedagogical and didactical comprehension is getting to be a serious problem. A computer program on-line creating is very a complicated process. Difficulty of its physical realization combined with the fact that creators have mainly absolutely no practical experiences with e-learning systems. They usually tend to set their teaching materials in electronic edition to the computer network. In the next stage some other components [such as various pictograms, study guides, conclusions, aim explanations, comments etc.] – typical for extramural studies – are usually attached. Unfortunately a real feedback of electronic education is very often missing. The one which is supposed to indicate actual quality and fruitfulness of this education form.

One of the biggest problems of e-learning system remains in their 'adapt to the particular student' incapability. As there was written by Mazak (2004) in the international professional conference E-learning 2004 – to write a good E-learning course is much more difficult than to teach this

specific one in the common way. Lector can see during a convectional educational process immediate acceptance of students such as their reactions, various forms of agreement or disagreement and is able to evaluate if students mostly understand or not. In case of convenience he can change straight away the way of teaching, add explanation or correct a mistake he has done as well. Author of an e-learning education system has to predicate or prevent from all of those situations and also has to assume everything is implemented to e-course is certainly found by students later.

In simplified way we can say e-learning is just effective IT usage in educational system. From this point of view there is a need of effective IT usage for education purposes.

So the question of an effective IT level in education at the particular school, company, organization or individual person remains. Especially with an entry of Inter/intra net technologies and the progress of the telecommunication market there is almost every time a successful possibility of finding solution in contemporary circumstances when IT makes education cheaper, faster or better.

E-learning alias electronic education support presents a usage of specific e-learning activities in an educational system. There is sometime not necessary to create vast complex courses or to create purely distant fully computer-aided activities (massive e-courses are usually developed during months by expert teams). Some tactics and mechanisms helping to simplify routine, improving and enriching education are supported as well – according to the particular situation in a specific course.

### 2. FORMS OF E-LEARNING

The purpose of using e-learning is the most often following nowadays: E-learning is an educational method (technology) specific in the way where information is shared using a computer. E-learning could have two following forms, then:

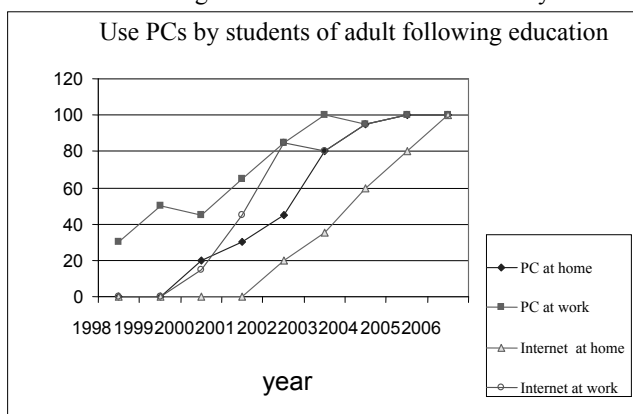
1. Off-line – an internet access is not a necessary condition of using information. There are to available various electronic media (such as CD-ROMs, DVDs, etc.) containing multimedia information.

- fundamental and additional text for printing or direct study using PC screen, completed by illustrations, audio-tracks, videos and/or examples coming from practice
- activities (test, tutorials, etc.)

2. On-line – information accessible using internet and at the same time is internet used for student-lector communication.

### 3. BOOM IN THE COMPUTER USAGE

Establishment of the E-learning education considerably depends on student technical equipment. There have been watched technical facilities of working students at the moment of entering the educational course for nine years.

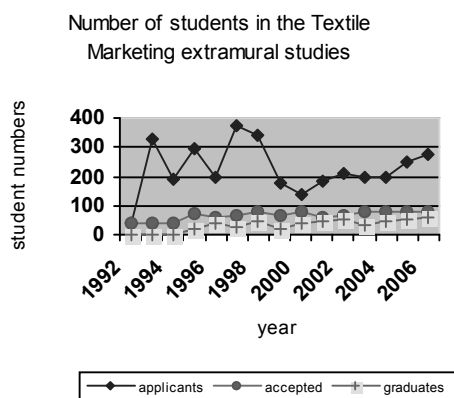


Graph #1

There is obvious in the Graph #1 that during a couple of years there had 100% student internet access at home and at work as well. There follows from the Graph #1 that a technical equipment has not been a problem any more nowadays. Consequently there is a suitable time to set up e-learning education to the following extramural education for adults.

### 4. E-LEARNING USAGE FOR BACHELOR STUDIES PURPOSES

Students' interest in bachelor extramural studies permanently exceeds capacities. There follows from the research at Technical University in Liberec, Textile Marketing (Graph #2) there has been much more applicants then accepted every single year.



Graph #2

E-learning education establishment in the first levels of studies would allow to study to all applicants. But transformation of all subjects of the first level into electronic form is essential. In the mentioned transformation there is emphasis set in to feedback and activation of the students for their studies. For working students in extramural forms of studies the most convenient way of creating e-learning courses is using of examples from praxis and communication with the tutor. Very important part is training of tutors and their active relation with students. From the next research regarding extramural student follows that e-learning education would be welcome because of assumption that number of applicant is staying increasing (Graph #3).



Graph #3

E-learning course creating demands cooperation of the team of experts from the particular branch, teachers and PC software advisors.

There was chosen freeware Moodle for e-learning course creating which had been already tried at the universities in the Czech Republic such as Karlova Univerzita in Prague and Technical University in Liberec. Undisputable advantage of this software environment is that experiences of various E-learning software creators could be consulted with ease. Moodle is a software pack of programs for education systems and electronic courses creating at internet. Moodle is provided free of charge like Open Source Software. Moodle could be used on each computer. Moodle abbreviation means Modular Object Oriented Dynamic Learning Environment. This information could be useful for programmers and theoretical teachers. It could be regarded as a verb describing contemplating process from the one to the other, doing things in own way, playfulness which leads up to problem understanding and supports creativity. In this sense it concerns the born of Moodle itself and the point of student's or teacher's view to an education in on-line courses.

### 5. KNOWLEDGE OF TEXTILE GOODS E-LEARNING COURSE

There is being designed the E-learning programme named 'Knowledge of textile goods'. This software is going to have a massive range of use not only in Textile Marketing

line but also in the other lines of the Technical University in Liberec, courses for working people as an sufficient extramural course. Educational goal is distinguishing of textile goods, standard nomenclature, features and use in practice. Target group are extramural students of Textile Marketing line and – in the future – daily students as well. To fulfil all points of e-learning education, suggested course has to contain following parts:

1. Necessary feedback in the course:

- Self tests – student checks knowledge on his own using possibility of jumbled order of the questions. There should be used quantity of textile goods in micro/macro pictures. Self tests are one of the most important part of self studies. Necessary part of self tests is feedback which can show mistakes and suggest a correction.
- Test examples – useful for the real exam student's preparation. Feedback is not necessary in here – it's just orientation guide.
- Tasks sent to comprehension check – supplant typical half-term works.

2. Student's activity planning, calendar:

- Tutorials – seminars, exams, deadlines. Student should always know in time.
- Dictionary of used terms – some specific used terms and their explanation.
- Syllabuses – abstract of the course components. This is very useful for effective planning of self-studies. It considers all deadlines and important dates.
- Searching tools – graphics icons usage is very convenient for easier use of the software

3. Structure of the Knowledge of textile goods subject

- Contents mainly digital pictures of the taught textiles. Outstanding amount of micro/macro photos is required.
- List of the teachers, contacts (at least e-mail addresses). Actual teachers' photographs are very suitable as well. This is very convenient to prevent from misunderstanding in the possible personal contact in the future.

This course is temporarily accessible at <http://turbo.cvd.tul.cz/> for free.

## REFERENCES

- [1] FOJTÍK R.. *Soutěž e-learning a jeho vlivy na tvorbu kurzů*. Sborník příspěvků ze semináře a soutěže eLearning 2005. Hradec Králové : Gaudeamus, 2005. ISBN 80-7041-595-9
- [2] MAZÁK, E. *Některé problémy e-learningu*. Vystoupení na konferenci "E-learning 2004". Praha. Kongresové centrum. 16. března 2004.
- [3] MU, *Zkušenosti s e-learningem na MU*. Brno: MU, 2006 [cit. 2006-12-1] dostupné z <http://is.muni.cz/elportal/zkusenosti/>
- [4] MUDRÁK, D. *Co je Moodle*. Praha :Univerzita Karlova, 2006 [cit. 2006-11-4] dostupné z [http://docs.moodle.org/cs/Co\\_je\\_Moodle](http://docs.moodle.org/cs/Co_je_Moodle)
- [5] PALÁN, Z. *Lidské zdroje – výkladový slovník*. Praha : Academia, 2002  
ISBN 80-200-0950-7

## THE AUTHORS



**Hana Parilova**

- born in Liberec 1957, graduate in VŠST in Liberec
- 4 year praxis in Retex, a.s. in Ivančice
- 1 year in National Textile Research Institute
- since 1987 expert assistant in Technical

University in Liberec

- guarantee of extramural 'Textile Marketing' studies, 'Enterprising in Textile' and 'Knowledge of textile goods' subjects – all in Technical University in Liberec
- PhD. student of University in Hradec Kralove



**Karel Petroszki**

- born in 1980 in Usti nad Orlici, graduate in Technical University in Liberec
- PhD. student in Textile Faculty, Technical university in Liberec

## APPENDIX – FURTHER INFORMATION

*The article is mainly based on analysis of 'Textile Marketing' line system and at the same time on e-learning courses preparation.*





## COMPUTER LITERACY AND NEW UNIVERSITY STUDENTS



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

Petra Poulová<sup>1)</sup>, Miloslava Černá<sup>2)</sup>.

University of Hradec Králové, Faculty of Informatics and Management, Rokitsanského 62, Hradec Králové, 500 03, Czech republic

Petra.Poulova@uhk.cz<sup>1)</sup>, Miloslava.Cerna@uhk.cz<sup>2)</sup>

**Abstract.** Plenty of universities offer students e-courses even in the first year of their studies. The point is whether students coming from secondary schools are ready to use offered e-learning and its potential to the full. Faculty of Informatics and Management has carried out a questionnaire survey for over a decade to collect as much relevant information about students' access to the Internet, their abilities to use it and e-learning awareness. Data gathered and worked out in this survey are demonstrated in this contribution.

**Keywords:** CBL (Computer Based Learning), Digital Literacy, E-learning, Internet access, Web-based courses

### 1. E-LEARNING PREREQUISITES

To succeed in implementation of e-learning concept into of process of education it is necessary to run several procedures.

Series of significant steps have been made to facilitate a successful implementation of e-learning at the Faculty of Informatics and Management, University of Hradec Králové (FIM UHK).

Purchase of a modern **learning management system** (LMS) was the first step. This system offers e-subject designers a wide scale of tools for creation and running their courses.

Faculty academic staff dispose both **hardware and software** modern **equipment** at their workplace moreover they can borrow a notebook anytime they need it. To be precise there are at present 70 notebooks that academic staff can borrow for their work outside faculty.

**OLIVA seminars** (On-Line Výuka meaning On-line education) have been regularly organized for academic staff since 2001. These seminars deal with *methodology of writing distance learning materials and designing e-learning courses*. They try to reveal the great potential that is offered by LMS called WebCT. Except for OLIVA seminars there is a wide **variety of courses** that teachers can attend. These courses are focused on the issue of information and communication technologies in education; either they are organized by the faculty: *Internet in Education, Modern Presentation and Education, Adobe Acrobat 7.0, Macromedia Flash, Creating html Documents for WebCT, Preparation and Production CD/DVD, Audio Processing*, etc., or they are organized by external subjects like University of West Bohemia in Plzeň or Centre of Distance Education, Palacký University in Olomouc. University of West Bohemia runs the following relevant courses: *NetTrainers, Introduction into Distance Education, Copyright and On-line Course Design, How to Become a Successful On-line-Tutor*. For several years a course *Distance Minimum* organized by Palacký University has

been quite popular with academic staff. Another possibility where staff can improve their computer literacy is in *ECDL* courses (European Computer Driving System) that are run at the faculty that means at their workplace.

Design, implementation and running of e-courses are backed by a **motivation system** which is embedded in a dean statement.

From 2001 to 2006 over 130 e-subjects were prepared for students of FIM UHK. This number represents the best evidence of efficiency of taken steps into e-learning space.

### 2. SURVEY

Students meet with e-subjects already in the first semester of their study at the faculty.

*Are they prepared from their secondary schools for this modern kind of education?*

*Do they know possibilities that Internet provides, do they use it?*

These questions are among others that can be found in the questionnaire survey which has been regularly given to students enrolled into the first year. The faculty has collected data from this survey for eleven years.

**Questionnaire** is divided into a few logical parts. The first one focuses on the interest in studying at the faculty and on information sources that played their role in making decision which faculty to choose. The second part tries to find out which information channels students followed to get results of their entrance exams. From the perspective of future e-learning use the third part of the questionnaire seems really important because it identifies current possibilities of students to the access to the Internet. Last part deals with the e-learning experience.

The questionnaire was used for the first time in 1996 (the part focusing directly on the e-learning phenomenon was added later).

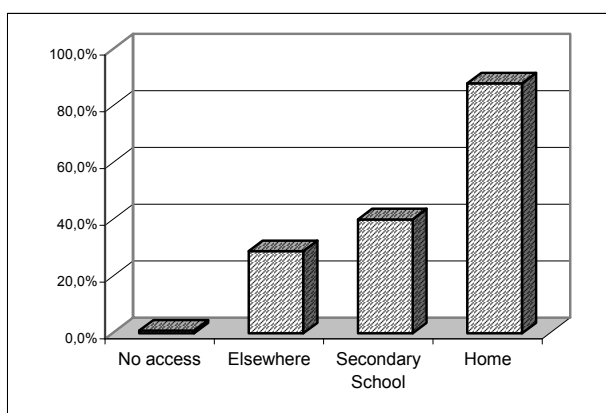
|           | Number of accepted students | Number of filled in questionnaires | Return of the questionnaires |
|-----------|-----------------------------|------------------------------------|------------------------------|
| 1996/97   | 274                         | 195                                | 71%                          |
| 1997/98   | 328                         | 287                                | 88%                          |
| 1998/99   | 346                         | 267                                | 77%                          |
| 1999/2000 | 292                         | 238                                | 82%                          |
| 2000/01   | 384                         | 311                                | 81%                          |
| 2001/02   | 338                         | 321                                | 95%                          |
| 2002/03   | 430                         | 350                                | 81%                          |
| 2003/04   | 615                         | 498                                | 81%                          |
| 2004/05   | 654                         | 525                                | 80%                          |
| 2005/06   | 637                         | 517                                | 81%                          |
| 2006/07   | 693                         | 500                                | 72%                          |

Chart 1. Questionnaire Return

### The Internet Accessibility for Students Coming from Secondary Schools

From the perspective of a possible future use of e-learning there are essential questions in the questionnaire dealing with the accessibility to the Internet by new students entering the faculty.

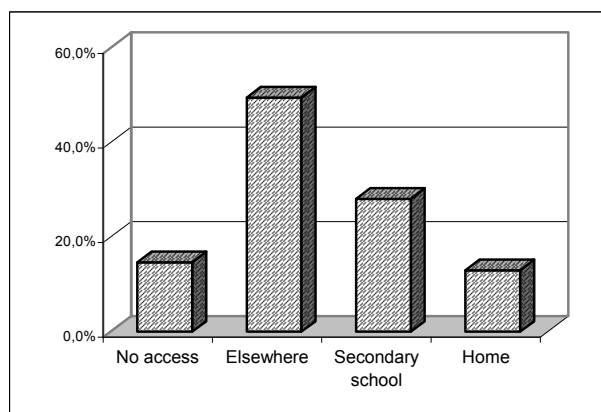
One of the questions tries to find out whether students had possibility to use the Internet from home, from the secondary school, from some other place, or they had no chance to use the Internet at all. Students choose proper answers from four offered possibilities.



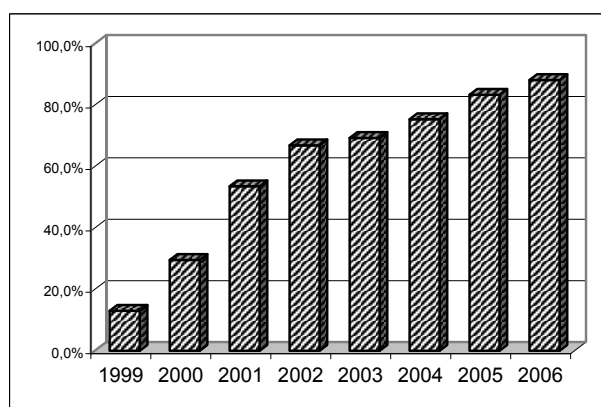
Graph 1. Access to the Internet in 2006

The findings relating to the academic year 2006/07 show that 88% of students have access to the Internet from home, 40% used the Internet at the secondary school, 29% of students had the access to the Internet from somewhere else and only 1% of students stated that for the time being they had no access to the Internet at all. (Graph 2)

Thanks to long-time observations it is possible to detect distinctive expansion of the Internet accessibility from home from only 13% to current over 88% of students entering the faculty. (Graph 3)

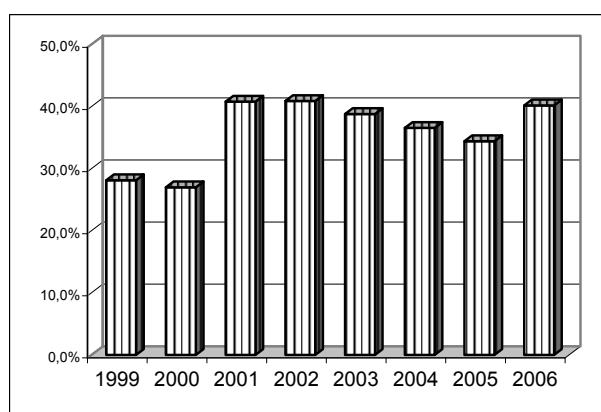


Graph 2. Access to the Internet in 1999



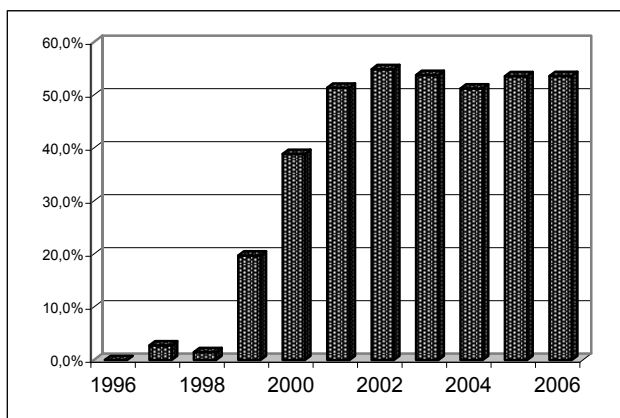
Graph 3. Access to the Internet from Home

The Internet accessibility from secondary schools does not prove such an expressive tendency, nevertheless from the original 28% it moved to over 40%; the most distinctive growth came in 2001, since that time it has stayed at the nearly same level.



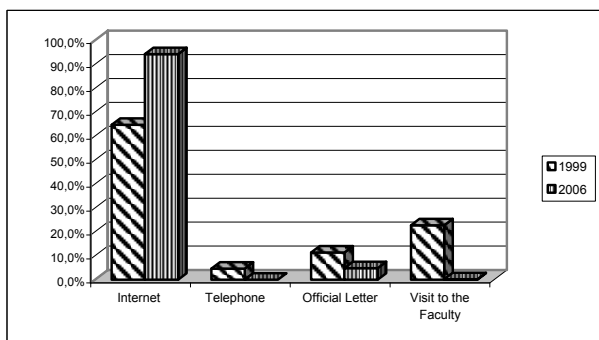
Graph 4. Access to the Internet from the Secondary School

Rising importance of the Internet is reflected in questions focused on finding sources used by students when they try to choose their university or how they get to the results of their entrance exams.



Graph 5. Searching for information about the faculty via the Internet

In 1996 none of the students searched information about the faculty on the Internet but in 2006 the Internet was the most dominant source, information about studies at the FIM UHK was searched by 54 prospective students. Since 1999 results of entrance examinations have been published on web sites of the faculty. Students earlier used except for the Internet telephone calls or they came to the faculty to get required information. At present the Internet is the prevailing information channel, the others are fading.



Graph 6. Finding the Results of the Entrance Exams

It is apparent from the previous graphs that the access to the Internet and the Internet utilization has significantly increased in recent years. It means that e-learning utilization already at the beginning of their university study should not represent any obstacles usually arising from lack of experience with the Internet.

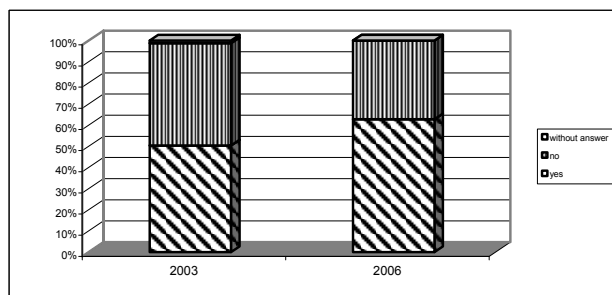
#### E-learning awareness

The number of e-subjects designed and implemented for FIM students is increasing, due to this growth new questions focusing on experience with e-learning of new entering students have been added since 2003.

From the perspective of implementing e-subjects into the process of education it is important to know whether they met with this modern phenomenon in education before

entering the university or whether they participated in some of e-learning courses.

63% of students said that they had met with e-learning phenomenon in 2006. Four years earlier only 50% of students knew this expression.



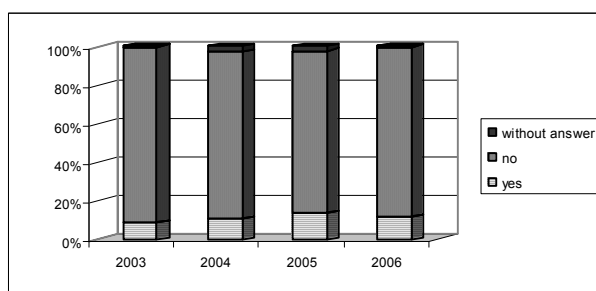
Graph 7. Comparison of E-learning awareness in 2003 and 2006

Students are to write what they think the e-learning expression means. The possibility to comment upon the word e-learning was taken by 227 students in 2003.

The most frequent answer was "Learning/teaching via the Internet" with 102 occurrences. Other opinions are following:

- *Education via the Internet* (47 occurrences)
- *Learning/teaching by means of modern information technologies* (computer, the Internet) (11 occurrences)
- *Access to materials and tests on the Internet* (9 occurrences)
- *Courses via e-mail, communication with school by e-mail* (9 occurrences)
- *Selfstudy (education) by means of computer, alternative form of studies when common form of study, common attendance is not possible* (6 occurrences)

Practical experience with e-learning has not spread distinctively in recent years, only about 10% of entering students have some experience with e-learning.



Graph 8. Participation in an e-learning course

#### Experience with computer assisted teaching/learning languages

Students of full-time form of studies at FIM are supposed to study a compulsory subject Professional English for 6 semesters. This subject is taught/learned in the way of blended learning for 4 semesters in the first and second year of their studies. This means students attend weekly 2 classes and moreover their school studies are supported by an e-course of Professional English which is run on the platform of WebCT. Students entering university start with a subject of Professional English in the first year of their university studies. Due to implementation of the supportive e-course they experience e-learning phenomenon in the very first semester of their language studies at the faculty. Because studying on the Internet differs from the traditional way of learning, it was desirable to find out students' experience with computer assisted learning/teaching.

At the beginning of the first semester in 2006 eighty-four students attending the subject Professional English were asked to answer the following questions:

- *Do you use a computer when you prepare for language lessons?*
- *Do you search for English articles and news on the Internet?*
- *Do you use any on-line dictionary?*
- *Do you use translators?*
- *Do you use educational language programmes?*

Results of the questionnaire were surprisingly quite optimistic. Out of 84 students only 12 did not use a computer for their language studies, either they resisted intentionally or did not have opportunity to enrich their language studies this way. 38 students were used to browsing on the Internet to find appropriate English articles and news. 35 students looked up words in an on-line dictionary and 18 used translators. 10 students practiced language by means of educational language programmes, for example Langmaster edition.

#### 4. CONCLUSION

Collected learnt data authorise us to state that in spite of the fact that future faculty students do not have much actual experience with e-learning, they know this phenomenon. On the other hand the Internet is accessible to the entire

majority of them before entering the faculty; using the Internet is a common activity of the everyday life.

#### 5. REFERENCES

- [1] POULOVÁ P., HYNEK, J. Application of Information and Communication Technologies. Education and Information Systems: Technologies and Applications. Orlando: International Institute of Informatics and Systemics. 2003. s.80-85.

#### THE AUTHORS

RNDr. Petra Poulová, Ph.D.

Univerzita Hradec Králové, Fakulta informatiky a managementu, Rokitského 62, Hradec Králové, 500 03  
Petra.Poulova@uhk.cz

Work experience:

2002 – Vice-dean, Faculty of Informatics and Management, University of Hradec Králové

1998 – 2002 Head of the Institute of Further Education, Faculty of Informatics and Management, University of Hradec Králové

1991 -1998 University of Hradec Králové

Several international eLearning projects in various EU programmes (TEMPUS, SOCRATES/MINERVA, Grundtvig, eLearning). Over 100 academic and professional publications.

Currently active participation in the EUNIS-CZ (European University Information Systems Česká republika) as member of executive committee and ČADUV (Czech Association of Distance University Education) as member of the board.

Mgr. Miloslava Černá.

Univerzita Hradec Králové, Fakulta informatiky a managementu, Rokitského 62, Hradec Králové, 500 03  
miloslava.cerna@uhk.cz



## UNIVERSITY COLLABORATION AND VIRTUAL MOBILITY TOWARDS INTERNATIONALISATION AT HOME

Bedřich Zimola, Jan Hán, Petra Poulová

Tomas Bata University in Zlín <sup>1)</sup>, University of West Bohemia Plzeň <sup>2)</sup>, University of Hradec Králové <sup>3)</sup>, zimola@fame.utb.cz, hanjan@kpv.zcu.cz, petra.poulova@uhk.cz

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** This contribution describes two ongoing projects in the field of eLearning and distance learning. The first project is entitled: RIUS - Initiation of Inter-University Studies in a Network of Selected Universities in the Czech Republic, is a Czech national project supported by the European Social Found in the Czech Rep.; the second is EVENE - Erasmus Virtual Economics & Management Studies Exchange, is supported by the European eLearning programme. The main aim of both projects is to create a core university network which will be widespread in the future, and where courses and teachers are shared for provision them partner institution's students. The objectives, key activities, expected results and outcomes are discussed. The current results and experiences with inter-university cooperation are also summarised

**Keywords:** distance education, eLearning, university network, virtual campus, student virtual mobility.

### 1. INTRODUCTION

The Faculty of Management and Economics, Tomas Bata University in Zlín has devoted its attentions to the problems and issues associated with eLearning since the beginning of 2000. As early as then, voices could be heard calling for cooperative and collaborative ventures between university-level institutions in the creation of distance eLearning courses, or - unified study programmes.

One of the first subjects for collaboration was arriving at a consensus on a Learning Management System for Czech higher education institutions. The reasons for this were both strategic as well as financial.

Notwithstanding the above, and for a variety of causes, no agreement on the purchase and use of a uniform system/platform was arrived at between the above-mentioned institutions and as a consequence, each of the institutions ended up by individually buying and implementing systems like WebCT, LearningSpace, Tutor 2000, eDoceo, EDEN, Unifor, and others.

Despite running into a range of problems like for instance, the need to respect standards, or the lack of uniformity of the environments and appearances, or structures, user interfaces and so on; collaboration and its further development did come about.

The initial one was the eDILEMA project, supported by the European Union's Socrates/Minerva programmes (2001-2003), and whose participant institution was the Faculty of Informatics and Management of the University of Hradec Králové, and a component of which was the establishment of the DILEO "library" of educational objects.

At this point, mention should be made of the highly successful, (Czech) Fund for the Development of Universities supported, VIRTUNIV project – a joint venture between a group of North Moravian higher educational institutions and involving University of Ostrava, the University of Mining - (of the) Technical University in Ostrava, and the Silesian University in Opava, which has been up and running for a number of years.

Another possibility for collaboration was identified at the eLearning in Higher Education 2003 Conference organized by Tomas Bata University in Zlín [1], which involved the sharing of courses - including the relevant teaching staff, and providing these to the students of partner institutions, leading to the exchange of students through the intermediary of eLearning-supported distance courses. The fulfillment of such a plan for collaboration is by means of the two projects mentioned below.

### 2. RIUS - "THE START-UP OF INTER-UNIVERSITY STUDIES IN A NETWORK OF SELECTED UNIVERSITIES IN THE CZECH REPUBLIC" PROJECT

From European and non-European experience, the effectiveness and quality of higher educational institution study programme using distance learning supported by eLearning elements is greater where this is implemented within a network of universities - i.e. a virtual university in the organisational sense.

#### Inter-university Studies

Currently, the Inter-university Study (IUS) System is realised in the form of the above-mentioned RIUS project, in which the University of West Bohemia in Plzeň is the

coordinator, and the University of Hradec Králové and Tomas Bata University in Zlín are partners.

It involves the sharing of both the courses and teaching staff of the universities participating in this project - thereby providing with the possibility of absolving part of their study programme at universities other than their alma mater university.

The courses are provided in a distance education form with eLearning support. This distance learning course is organised in the form of an introductory meeting in the presence of both teachers and students at the students' alma mater university, directed self-studies supported by a virtual educational environment and the Internet - and, as may be required, by further interim live, face-to-face meetings, combined with live examinations - or as the case may be, by a classified course credit.

The live face-to-face meeting may be replaced by synchronous video-conferencing using the Internet. Depending upon prior agreement with a partner university, students can choose these courses within the context of their compulsory elective subjects. The credits acquired by the student then duly count as a part of the fulfilment of their standard study duties.

Through making the best use of the range of inter-university studies on offer to them, students can not only enrich their own study plans with topics attractive to them, but also get to know new educational methods and instruments, and have a share in the genesis of an expanded system of inter-university studies in the Czech Republic, enabling mutual sharing of study subjects and experts across this university network.

#### Aims and objectives and activities of the RIUS project

The key aim of the RIUS project is to support the genesis of inter-university studies, and which can be fulfilled through the completion and attainment of the following subsidiary aims and objectives:

- To prepare and stabilise its infrastructure (i.e. its organisation and processes) suitable for inter-university studies within a selected network of universities.
- To create an organisational and process model of inter-university studies within the framework of this project.
- To create favourable conditions for the expansion of this network of higher education institutions in order to realise this IUS within the Czech Republic.
- To prepare suitable conditions for the linkage of this network of Czech universities to similar clusters of educational institutions providing IUS (i.e. to virtual universities) in other EU countries.
- To prepare Czech higher educational institutions for more intensive collaboration within the Czech Republic, Europe - and eventually, elsewhere.

In order to be able to fulfil the above-mentioned subsidiary aims and objectives (and this is not an

exhaustive list of the project's aims and goals), the following key activities were formulated:

- The specification of an inter-university studies model (i.e. its infrastructure, organisation, processes, etc.) on the basis of an analysis of the prerequisites and demands on partner universities, and their ability to adapt themselves for the realisation of such an IUS.
- The training of administrative staff (e.g. in the study agenda, the organisation of face-to-face events, in evaluations of outcomes and results) and of pedagogical staff involved in the realisation of the IUS - i.e. through methodological seminars, training courses, etc.
- The preparation of an evaluation and assessment system (i.e. student and pedagogue questionnaires, and structured discussions with the pedagogues).
- The preparatory phase for the realisation of this IUS would involve:
  - The mutual provision of courses offered by one to the others.
  - The processing (here, narrowing down) of external offers for one's own students such that these would fit into existing elective subject structures.
- The realisation phase of this IUS would involve:
  - Pre-registration of students in elective courses within the context of institutional customs.
  - The organisation of introductory meetings (face-to-face, video-conferencing, etc.).
  - Directed self-study - as required, further interim meetings.
- Regular semester by semester assessments of the realisation and provision of the IUS (i.e. questionnaire-based evaluations by students and pedagogues, and structured discussions with these pedagogues).
- The summarisation of the partial assessments for course modifications and the modification of the initial IUS model.

#### Some experience drawn from the course of the project to-date

After approximately one year's duration (the project was launched on 1<sup>st</sup> November 2005), the facts and experiences can be summarised as follows:

- In the academic year 2005/06, 42 courses in total were offered by the participating partners and in which a total of 524 students actually studied.
- The actual representation of students from the individual institutions was markedly different and reflected the ways in which and the extent to which these external courses had been promoted, the degree to which eLearning has been implemented within each institution, and the awareness of students of eLearning.
- A positive experience was, for instance, that some students (predominantly from full-time study programmes) chose external courses above and beyond the framework of their study obligations (i.e. essential credits), in order to gain an idea of this form of studies.

- A negative impact was the high degree of “die off/away” in courses where these students were not unconditionally forced to complete them in a due and proper fashion - and who simply, over the course of time, “evaporated away”.

### 3. THE EVENE - ERASMUS VIRTUAL ECONOMICS & MANAGEMENT STUDIES EXCHANGE PROJECT

The EVENE project is supported by the European Union’s eLearning programme, and planned to cover a 24 month period, was inaugurated on 1<sup>st</sup> March 2006.

The project’s consortium is composed – apart from three Czech higher educational institutions - the same ones as in the RIUS project; of another five European partners, these are: the Galway-Mayo Institute of Technology in Ireland, Huddersfield University Business School in Great Britain, the Savonia University of Applied Sciences in Varkaus in Finland, the Riga International School of Economics and Business Administration in Latvia, and the University of Genoa in Italy. The project coordinator is the Faculty of Management and Economics, at Tomas Bata University in Zlín in the Czech Republic.

In essence, it can be said that the content of the EVENE project is virtually identical to that of the RIUS project. The core aim of this project is, once again, the creation of a seminal impulse for a network of traditional higher education institutions for the purpose of a mutual exchange and sharing of courses and pedagogues and the possibility of providing these to students in a distance education supported by eLearning format.

The differences can be recognised at first glance - they will be implemented in the context of a network of selected European partners, be delivered in English, involve a more numerous partnership consortium, and these will be separated by even greater distances - meaning that these differences the EVENE project has a different slant.

The sense and main aim of the EVENE project is to create a foundation for a network for inter-university studies in the fields of economics and management studies conceived in the form of “virtual student mobility”.

This will serve as an alternative or complementary element to the physical exchange of students through study sabbaticals at universities abroad realised within the context of the European Union’s Socrates/Erasmus programmes. In this context, the following possibilities may serve for the realisation of such virtual mobility projects as:

- The possibility of absolving a distance learning course at a partner university may precede a physical stay at the same institution.
- The possibility of absolving a distance learning course at a partner university may be the continuation of a physical stay at the same institution.

- The virtual mobility can occur without any linkage whatsoever to physical mobility at one or more of the partner institutions.
- A student, who is physically engaged in an exchange stay abroad, may absolve a compulsory course in its distance learning format at their alma mater university (i.e. as a side effect).

The precondition is that all the partners already have, or will have, closed bilateral contracts for students and teachers within the context of the Socrates/Erasmus mobility projects. The basic principles underpinning these programmes is recognition of studies undertaken abroad which enable students not only to absolve compulsory elective courses, but even compulsory (core content) courses with the “same” content, or similar ones that vary in line with the customs and usages of the individual institutions (this of course does not hold true for situations like Czech students studying at Czech partner universities).

The flagship subsidiary aim for achieving the main (core) aim is, once again, the creation of a model (i.e. an organisational, legislative, technical and process-related framework) for the realisation of virtual mobility. This will be based upon:

- An analysis of good practice and experience of European projects that have already been undertaken within the context of the eLearning and Socrates/Minerva programmes (e.g. REVE, EVU);
- An analysis of existing national virtual universities (e.g. Finnish, Bavarian).
- Interim, partial experiences with the ongoing RIUS project.

Still within the context of this project, the possible expansion of the university network is anticipated (i.e. to new partners but without financial support from the project).

Upon conclusion of the project, the network will – of course, be open to other interested European and even non-European universities. Above and beyond the actual framework of this project, consideration is being given to the creation of a joint distance study programme in the fields of Management and Economics, which would harmonically integrate the unique contributions each of the partners could offer.

### 4. CONCLUSION

The project herein presented, can be understood as the logical continuation of activities at Czech higher educational institutions within the framework of the development of distance and combined forms of studies supported by eLearning.

In both projects, it is clearly stated that they shall continue to operate once the project is concluded. In its final consequences, it is anticipated that it will result in a value-added effect of the invested human efforts and financial

resources of all of the preceding activities leading to improvements in the quality of the educational processes of all of the participating institutions, improvements in the quality and qualities of graduates of these courses, and improvements in their chances of successful insertion into the domestic and even pan-European labour markets.

## 5. REFERENCES

### *Conference paper*

Zimola, B., 2003. Possibilities for Collaboration between Higher Educational Institutions - Virtual Mobility, the Czech Virtual University of Economics. *Proceedings ELearning in Higher Education Conference*. Zlín, Czech Rep., pp. 267-269.

Hán J., Zimola B., 2005. Initiation of an Inter-university Study Programme in a Selected University Network. *Proceedings of Information and Communication Technology in Education Conference*, Ostrava, Czech Rep., pp. 260-265.

### *Projects*

RIUS - Rozběh interuniverzitního studia v síti vybraných univerzit ČR, (RIUS\* is the Czech abbreviation standing for: "The Start-up of Inter-University Studies in a Network of Selected Universities in the Czech Republic") *ESF project No. CZ.04.1.03./3.2.15.1/0067*

EVENE – Erasmus Virtual Economics & Management Studies Exchange, *eLearning project Agreement Number: 2005 - 3837 / 001 - 001 ELE - ELEB12*.

## THE AUTHORS



**Bedřich Zimola:** Vice-Dean for International Affairs, Director of the Centre for Further Education, responsible person for developing of distance learning and eLearning at the Faculty of Management and Economics, coordinator of the EVENE Project and institutional coordinator of the RIUS Project.



**Jan Hán:** the head of the Institute of Lifelong Learning at the University of West Bohemia in Pilsen.

His Ph.D. was realised on the field of the development and implementation of eLearning tools in industrial companies. He is the founder of eLearning centre at the

University of West Bohemia. Jan Hán is the coordinator of national and international projects focused on eLearning and lifelong learning.



### **Petra Poulová**

Univerzita Hradec Králové,  
Fakulta informatiky a managementu  
Rokitanského 62  
Hradec Králové, 500 03  
Petra.Poulova@uhk.cz

### Work experience:

2002 – Vice-dean, Faculty of Informatics and Management, University of Hradec Králové  
1998 – 2002 Head of the Institute of Further Education, Faculty of Informatics and Management, University of Hradec Králové  
1991 -1998 University of Hradec Králové

Several international eLearning projects in various EU programmes (TEMPUS, SOCRATES/MINERVA, Grundtvig, eLearning). Over 100 academic and professional publications.

Currently active participation in the EUNIS-CZ (European University Information Systems Česká republika) as member of executive committee and ČADUV (Czech Association of Distance University Education) as member of the board.

## ACKNOWLEDGEMENT

*This work was supported by the European Social Fund in the Czech Republic and by the European Commission by means of the ELEARNING Programme.*





**5<sup>th</sup> International Conference on Emerging  
e-Learning Technologies and Applications**

**Cisco Networking Academy Program**





## NETACAD – SUCCESS IN PREPARING NETWORK PROFESSIONALS USING E-LEARNING TECHNOLOGIES

Július Baráth, Ľubomír Dedera

Department of Informatics, The Academy of the Armed Forces of Gen. M. R. Štefánik

Demänovská 393, 031 01 Liptovský Mikuláš, Slovakia

E-mail: Julius.Barath@aoslm.sk, dedera@aoslm.sk

*5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** The paper deals with effective approaches for utilizing NetAcad materials for preparation of both instructors and students. It deals with activities and resources which are helpful in keeping interest in the NetAcad program and which improve skills in the area of networking technologies.

**Keywords:** Network, Web-based courses, Learning style, Instructor, NetAcad.

### 1. INTRODUCTION

The Cisco Networking Academy Program is a comprehensive e-learning program that provides students with the Internet technology skills essential in the global economy. The Networking Academy delivers web-based content, online assessment, student performance tracking, hands-on labs, instructor training and support, and preparation for industry standard certifications.

Launched in October 1997 with 64 educational institutions in seven states, the Networking Academy has spread to more than 150 countries. Since its inception over 1.6 Million students have enrolled at more than 10,000 Academies located in high schools, technical schools, colleges, universities, and community-based organizations.

The Networking Academy Program continually raises the bar on e-learning and educational processes. Through community feedback and electronic assessment the Academy Program adapts curriculum to improve outcomes and student achievement. The Academy infrastructure is designed to deliver a rich, interactive, and personalized curriculum to students around the world. The Internet has the power to change the way people learn, work, and play, and the Cisco Networking Academy Program is in the forefront of this transformation [1].

### 2. WHY IS THE PROGRAM ATTRACTIVE FOR THE TEACHERS

The CCNA instruction focuses on how to install, configure, and operate simple-routed LAN, routed WAN and switched LAN networks. To fulfill those requirements Cisco networking academies teach their students in the four-semester Curriculum in the NetAcad project. For each semester objectives are defined, and to achieve them, study materials and supporting tools are available for both the students and the teachers. The instructors (usually university and secondary school teachers) join the project on a voluntary basis and their motivation is to improve his/her skills and knowledge in the area of computer

networks, computer and network security, IT essentials, operating system configuration, IP telephony or wireless communication.

Every instructor must undergo instructor training with the aim to get to know in detail with the curriculum content he/she is going to teach. His/her level of theoretical knowledge is verified in a test and practical skills in practical labs. This is the first step towards the interest in teaching the subject.

During the training the instructors gain access to professionally designed and prepared curricula and other supporting tools and materials for instructors: PowerPoint presentations suitable for individual lessons, electronic tests and supporting software. In this stage it is very important for the instructors to be in contact with the existing community of experienced instructors who are willing to help with either the common problems coming up in the process of education or more challenging lab configurations.

Besides the common community of instructors from both the Czech Republic and Slovakia the instructors can utilize professional non-stop support from the NetAcad supporting team, which is available through the global E-learning management system of the NetAcad Program (in English). The team is capable of resolving problems with student accounts and rosters, tests, and access to course materials.

All what have been mentioned so far is a very strong background which provides for quality education without the need of additional demands on preparation of course materials or operation of the E-learning management system.

In the case of update of the content of the curriculum the instructors must undergo further training to be able to continue in teaching.

The NetAcad project as the biggest known global E-learning initiative goes further than a traditional approach to E-learning. The instructors meet each other at regular

annual conferences with both the social and technical program. During the conferences the instructors can discuss in a pleasant, informal atmosphere the specifics and details of the implementation of the project in particular conditions, they can get to know each other personally, which helps to break internal barriers for mutual communication and makes the electronic communication easier during a school year. The technical part extends the knowledge horizons of the instructors and informs about news in the program and technology in a very attractive form.

The interest in participation in the community activities is also supported by the electronic Newsletter where various topics from the everyday life of the NetAcad community, tips for exercises, labs, and self-preparation of instructors. The publication of the Newsletter is centrally coordinated by its editorial board and editor-in-chief.

Each year a competition on the best

- Regional academy
- Local Academy
- Regional academy instructor
- Local academy instructor
- Activity of the year the

in the Slovak (Czech) Republic is organized, where the nominations in each of the categories come directly from the instructors and schools.

The list of activities above mentioned completes the summer NetAcad School. The aim of this summer school is education of NetAcad instructors not only in the way of intensive training, but also through various social, cultural, and sport activities.

### 3. WHY IS THE PROGRAM ATTRACTIVE FOR THE STUDENTS

Those students who are interested in computers and computer technologies usually come to laboratories on a voluntary basis and during their free time in order to learn to use the up-to-date networking technology. They utilize their free time at home in order to cope with the theory necessary to master the work with physical devices. In order to verify and test their knowledge and skills the students can utilize electronic tests and very popular emulators of routers, switches, and other devices, which enable to simulate on a home computer various physical interconnections of both WAN and/or LAN networks, to configure individual devices and to verify in simulation and real-time modes correctness of his/her configuration. Moreover the students can observe the details of transfer and processing of information in the network because the emulator can visualize the content of headers of the protocol data units transferred by a network, as well as the content of routing tables and a lot of other information for correct understanding of key phenomena and processes.

Proposals for labs are professionally prepared and lead the students step by step to achieve their goals. It showed to be useful to assign new, unpublished problems, which test skills even of the most talented and highly motivated students. A noticeable improvement of results can be achieved by opening the lab facilities to the students outside the regular instructor-lead lessons. Since the lab facilities are also equipped with other up-to-date technology the students can grow professionally and prepare for his/her professional carrier in the IT environment. Their experiences with the preparation for industry standard certification exams can help them in their professional growth and to achieve attractive, well-paid positions.

During the lab exercises the students create working teams which consequently compete among themselves in the school, regional, national, and international rounds of the Cisco Olymp competition, where they can meet and compare their skills with the other students and to win attractive prizes. Cisco Olymp is a competition of students who joined the NetAcad project which consists of:

- Theoretical part – students go through carefully prepared theoretical test similar to the tests in the Academy Connection
- Practical (skills-based) part – students solve challenge lab assignments in a limited time period.

There are several categories:

- HS1 – students of secondary schools - individuals
- HS3 – students of secondary schools – teams consisting of 3 members
- UNI – universal category (open for university or secondary school students)
- PT – competition of individuals with the use of simulation software instead of physical devices.

The fact that in the year 2007 is going to be organized the international round of Cisco Olymp implies that this competition is the right way to keep interest of the students in the NetAcad program.

### 4. CONCLUSION

If we want to sum up the pieces of knowledge we gained during our participation in the NetAcad project, then its success is based on the following basis:

- Course materials (Curriculum) prepared and updated professionally in versions for both students and instructors
- Professionally prepared labs, exercises, and tests
- Central global E-learning management system for administration of students and classes
- Working communication within the instructor community in the way of discussion forums
- Regular personal meetings of instructors with both professional and social content
- Competitions of students with attractive prizes and rewards

- Electronic newsletter publishing news and information for the whole NetAcad community
- Rewards for the best instructors and schools which joined the project
- Close collaboration between education and practice
- Very good chance to get a good (well-paid) job on the job market.

Quality, up-to-date lab equipment (computers, networking devices, tools, accessories, and software) is a necessity in this project [2,3,4].

All those tools and materials positively impact CCNA training and use attractive way to help the students understand covered topics and be prepared for real life. Beside the tools mentioned above there exist other interesting supporting projects and initiatives in the Cisco Learning Community, e.g. the Virtual Lab project [4]. Because the CNAP project is oriented mostly on the young generation, the Peter Packet Game was introduced to the community, giving the participants time for relax and fun.

Created by industry and education professionals, the curriculum prepares students for the demands of the workplace and motivates them to continue their education and learning. Delivered globally in multiple languages, the Academy program uses assessment data to adapt and improve lessons, labs, and teacher training. The program recognizes multiple learning styles of students with Web-based, multimedia content; online assessment and evaluation throughout the course; hands-on labs; and instructor training and support. Upon completion, students have the opportunity to take a certification exam [1].

## REFERENCES

[1] <http://www.netacad.net>

[2] Packet Tracer, electronic manual and help file, available at <http://cisco.netacad.net/cnams/content/tools/CCNATools.jsp>, (site requires valid username and password)

[3] Cisco router security, available at <http://cisco.netacad.net/cnams/content/tools/CCNATools.jsp>, (site requires valid username and password)

[4] Michlík, J., Kapová, L., Jakab, F., Galba, J: Virtual Lab, In: Conference Proceedings of ICETA-2004, 16.-18. 9. 2004, Košice, Slovakia, pp. 541-542

## THE AUTHORS

### Július Baráth



Senior assistant at the Department of Informatics, the Academy of the Armed Forces, Liptovský Mikuláš, Slovakia. Graduated in 1991 at VVTŠ Liptovský Mikuláš, specialization in Military radiolocation, PhD in Technical cybernetics and artificial intelligence in military (1994). Since 1994 senior assistant with orientation to theory of operating systems, computer networks and partially computer security. Main contact and RCNA instructor.

### Ľubomír Dederá



Associate professor at the Department of Informatics, the Academy of the Armed Forces, Liptovský Mikuláš, Slovakia. Graduated in Computer Science from the Comenius University, Bratislava. Since 1991 he has been working in various CS teaching positions (assistant, senior lecturer, associate professor) at the Department of Informatics, the Academy of the Armed Forces, Liptovský Mikuláš, Slovakia. RCNA instructor.





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

## LOCAL CISCO NETWORKING ACADEMY HIGH SCHOOL ROKYCANY: IMPLEMENTATION, HISTORY, EXPERIENCES AND FUTURE PLANS

Jaroslav Burda  
Gymnázium a střední odborná škola Rokycany  
Svazu bojovníků za svobodu 112, 33701 Rokycany, Czech Republic  
Tel/fax: +420 371 722 237  
e-mail: a95225@seznam.cz  
<http://www.gasos-ro.cz>

**Abstract.** The article describes the evolution of Local Cisco Networking Academy High School Rokycany. In article are described experiences with implementation of Cisco NetAcad program, history of Cisco academy in Rokycany, review of present stage and showed future vision and progression.

**Keywords:** blended learning, classroom training, high school, LCNA, learning style, NetAcad, school, teaching.

### 1. INTRODUCTION

High school Rokycany (czech name: Gymnázium a Střední odborná škola Rokycany) is most leading high school in town Rokycany. It is divided into two parts: Gymnázium, it is pure grammar school and secondary school, where field of study is electronics, computers, information technology and management of small business and trade. The part of structure of High school Rokycany is shown in Fig. 1.

Automation. Also specialization Management will be next year replaced with another one: Economics seminary. This changes will be with no impact to activity of LCNA.

Cisco NetAcad program is implemented just in one part of high school, in secondary school and for technical study programs (Electronics and Computer systems) only. For students of field Electronics in third year of study, and for students of field Computer systems in both of third and fourth years of study.

### STRUCTURE OF THE HIGH SCHOOL ROKYCANY

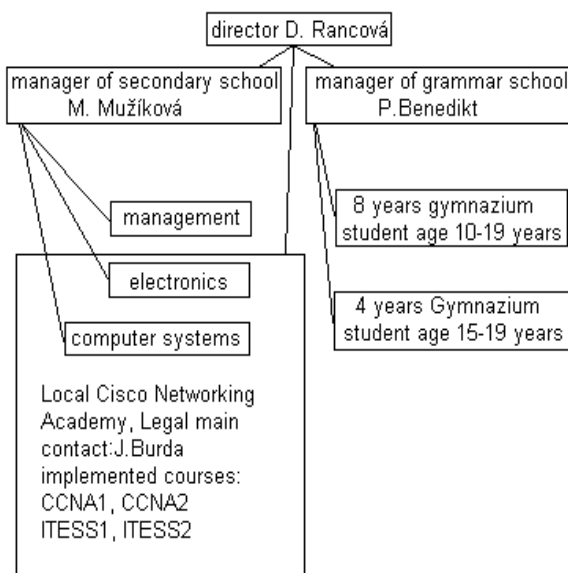


Fig. 1. Graphical chart of the organizational scheme of The High School Rokycany

Since school year 2006/07 has been specialization Electronics inactivated and replaced with other one named

### 2. HISTORY OF ACADEMY

Local Cisco networking academy High School Rokycany was founded in 2001 by Gymnázium s Střední odborná škola Rokycany in cooperation with University of west Bohemia in Pilsen by initiative of LMC RCNA University of West Bohemia Vladimír Rudolf and Area Academy Manager Dag Jeger.

Academy starts with this structure, personal constitution and relationships:

**Area Academy Manager:** Dag Jeger

**Sponsoring academy:** RCNA University of West Bohemia in Pilsen

**Legal Main Contact:** Petr Hlávka

**Instructors:** Pavel Kraus, Ludoslava Kozelská

In September 2002 was been opened first two classes of CCNA1 with curricula version 2.1 and in spring of 2003 the first seven students achieved certification. After instructor L. Kozelská leaving her employment in the school and school management was reformed in 2003 LCNA Rokycany become a sleeping academy for three years. Reversion occurred with coming new AAM Karol Kniewald and after his intervention to the new school management. In February 7<sup>th</sup> 2006 three new instructors been certified: Jaroslav Burda, Jaromír Háka and Robert Harnoch. Jaroslav Burda has been ordained for a new LMC.

Also certification for CCNA2 was been passed and new curricula ITESS1 and ITESS2 has been added into portfolio of our Local Cisco Academy in spring of 2006. The RCNA Secondary school of applied cybernetics Ltd. in Hradec Králové become sponsoring academy for curricula ITESS. In autumn 2006 was been ordered Fluke learning centre kit for demonstration of practical measurement and troubleshooting of LAN. In January 2007 been engaged into classwork.

Graphical diagram of LCNA Rokycany history is shown in Fig.2.

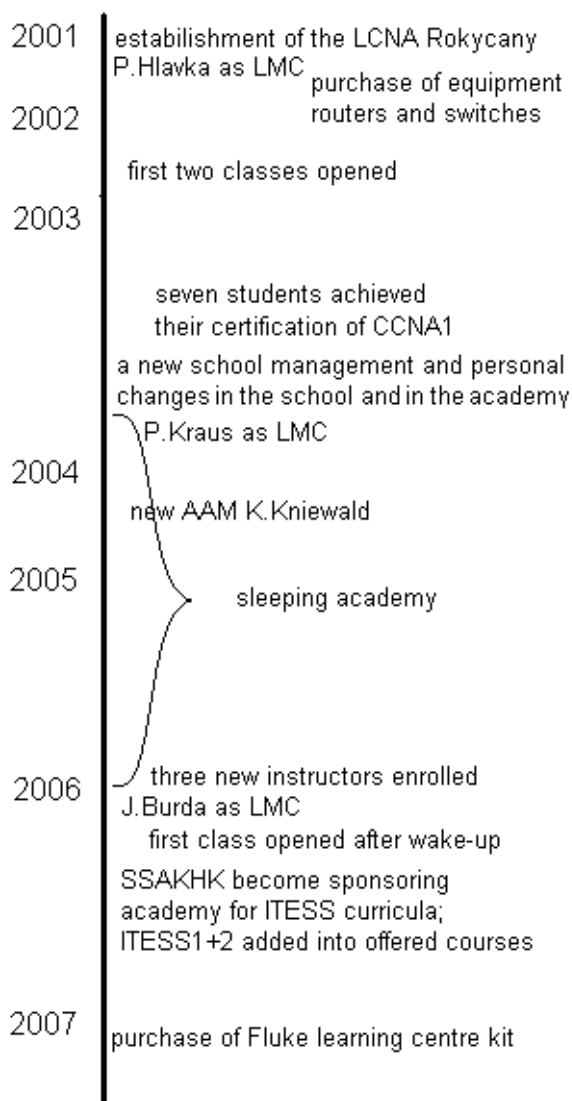


Fig. 2. Diagram chart of timeline history of the Local Cisco Networking Academy High School Rokycany.

### 3. ACADEMY EQUIPMENT

LCNA Rokycany holds and is able to dispose with following items:

- Five Cisco 2500 series routers

- Two Cisco Catalyst 1900 series switches
- Fluke learning centre kit (include linkrunners and digital multimeters and optiview software) bought in January 2007
- Hand tools for assembling and maintenance of computers (include screwdrivers, pliers, multimeters, tools for crimping and testing cables, etc.)
- Three computer labs with approximately 15 PC each. (shared with other courses in the secondary school) typical 1.5 GHz CPU, 256MB of RAM, Windows XP
- Computer hardware lab with obsolete computers for beginners assembling training. Typical AT computers with Pentium 100 MHz CPU

### 4. THE WAY OF TEACHING

NetAcad courses are implemented into standard courses taught in school. CCNA1 into Computer networks (POS, počítačové sítě in Czech language) and ITESS1 into Electronic computers (EPO, elektronické počítače in Czech language).

Lab exercises of both courses is realized within scope of theme Praxe (PRA) in groups of equal or less then ten students. In several first lessons is practise labs executed in hardware lab with rejected obsolete computers. It is profitable for low cost of equipment, so there is no economic damage if something is broken. When students gain basic skills and best practises, training will relocate into ordinary computer lab, where students gain skills about assembling, installing, troubleshooting and maintenance of modern computers.

Theoretic education classes proceed in usual classroom based on lecture with projected presentation by way of dataprojector.

Examination passes in two hours per two weeks in a way where students passes thru theme of each module (learning chapter) by clicking electronic-based tests on the Cisco web portal. Alternatively students can pass equivalent paper-based test in Czech language in case of fail to reach success for reasons of language barrier.

In case of disagreement with proposed classification additional conversational examination will be performed.

Students have to make their own notes of lecture. They have access to Czech technical publications and to Internet and intranet information resources. Students also have available course curricula online from their home on cisco web portal or on school intranet.

In time above training they have possibility of tuition, however this potential is not usually exploited.

### 5. LANGUAGE BARRIER

In CCNA curriculum, students are allowed to choose learning language from English and German, but the most of students choose English independently of their primary foreign language.



Students gets support also in foreign language education. In English language lessons teachers mulls over technical NetAcad papers like an additional subject matter, but not from technical perspective, just for a lingual aspect. This concept is very popular for students and helps him to surmount language barrier in non localized education system NetAcad.

Students which are not able to pass exams by reason of poor knowledge of English language still have chance to be examined in Czech language, but just for perform their obligatory study subject (EPO or POS) only, without potentiality to gather NetAcad certificate.

## 6. INSTRUCTOR CAPACITY UTILIZATION

For education of CCNA and ITESS courses is reserved total of 15 hours per a week from that is 4 in common classroom, and 11 in the computer lab, but all students not participated at all lessons of them. In students scheduling is reserved 8 hour per a week for both CCNA and ITESS. 4 hours of all is theoretical in common classroom and 4 hours is in the computer lab.

Structure of division of reserved learning hours is following:

- Two lessons per a week learned subject EPO (ITESS theory), all students participate on schooling, whole class in classroom.
- Two lessons per a week learned subject POS (CCNA theory), all students participate on schooling, whole class in classroom.
- Two lessons per two weeks (reserved for exams ITESS and CCNA combined), student class is divided into two parts, called J1 and J2. Both parts pass exams in two hours once per two weeks. J1 in the odd week and J2 in the even week.
- Three lessons per a week learned subject PRA (practise labs exercises in computer laboratory), student class is divided into three parts.

From teacher perspective is structure as following:

- Two lessons per a week taught subject EPO (ITESS theory), all students participate on schooling, whole class in their classroom.
- Two lessons per a week taught subject POS (CCNA theory), all students participate on schooling, whole class in their classroom.
- Two lessons per a week just one part of class depended if there is odd or even week. This lessons is not educational, but is intended for examination. Role of instructor is to manage tests, supervise and monitor going of examination.
- Nine lessons per week is taught subject PRA, which is intended for practise labs exercises. Instructor role is to give advice, consult and help students with exercise. Also ensure that students keep safety at work.

In Fig. 3. is shown example of scheduling for instructor teaching CCNA and ITESS.

|    | 1                  | 2         | 3         | 4 | 5   | 6 | 7         | 8         | 9         |
|----|--------------------|-----------|-----------|---|-----|---|-----------|-----------|-----------|
| Mo |                    |           | POS       |   |     |   |           |           |           |
| Tu | POS + EPO<br>exams |           | EPO       |   |     |   |           |           |           |
| We |                    |           |           |   |     |   | PRA<br>s2 | PRA<br>s2 | PRA<br>s2 |
| Th | PRA<br>s1          | PRA<br>s1 | PRA<br>s1 |   |     |   | PRA<br>s3 | PRA<br>s3 | PRA<br>s3 |
| Fr |                    |           | EPO       |   | POS |   |           |           |           |

Fig. 3. Instructor timetable for school year 2006/07

So from mentioned above results that total load for student is 8 hours per a week and total load for instructor is 15 hours per a week.

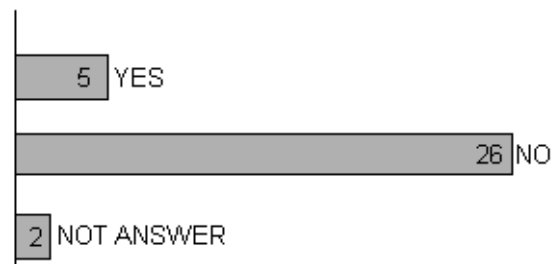
## 7. RESPONSE OF STUDENTS

Students are not at all motivated if they are forced to pass exams with ITESS and CCNA courses. It is tough work to keep their attention.

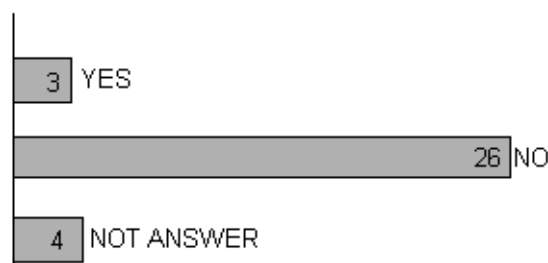
Students have disrespect to resources. Weak motivation and enhanced strain is reason for frequent attempt for cheating. There has been made questionnaire with students in June 2007 after deadline of classification. Among other they have been asked for following questions:

- 1) Would you be allowed with next study of NetAcad in your free time?
- 2) Would you be allowed with next study of NetAcad for fee?

Outcome of questionnaire is shown in following Fig. 4. and Fig. 5.



Would You be allowed with next study of NetAcad in your free time?



Would You be allowed with next study of NetAcad for fee?

Fig. 4. Outcome of questionnaire made with third year students.

Total count of informants is 48. In third study year is 33 informants. Similar situation is in last study year with 15 informants.

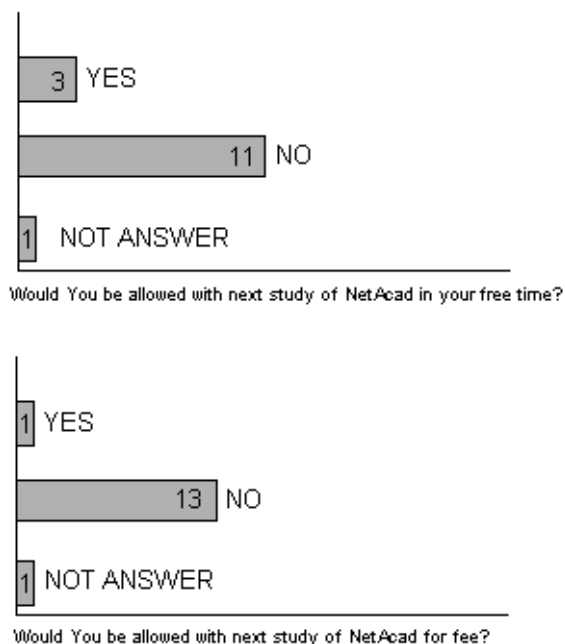


Fig. 5. Outcome of questionnaire made with students of final year of study

## 8. FUTURE PLANS

On the basis of experiences with students motivation and their test results we consider all possibilities and decide that offered courses in NetAcad program will be an elite business, just for the best students and enthusiasts only.

Other courses will be implemented. Soon CCNA3, CCNA4. In far future also Fundamentals of Java Programming, Wireless LAN, Panduit Network Infrastructure Essentials, IP-telephony.

Also would be good to enlarge instructor personal base, because LCNA Rokycany had four instructors, but in fact it is one man show. We will consider to training more instructors for implemented and new courses and divide teaching between them.

## 9. CONCLUSION

Our experiences with NetAcad program is whit a thin in the meantime. But we can say that we started for unconventional way, when we include Cisco certified courses into classwork like a mandatory part in contrast to other local Cisco academies. It produced effect that student perception of offered courses like something hard, forced, too ambitious, needless and their motivation is very weak.

Maybe result will be better if certified courses will be optional for students, because it's not good idea to force somebody to learn anything if he don't really want it. This model will be implemented into next school year.

## THE AUTHOR



**Jaroslav Burda:** born 1977,  
2000 Ing. at Faculty of Applied sciences,  
University of West Bohemia in Pilsen,  
field of study: Biocybernetics.  
2004 Bc. at Faculty of Electroengineering,  
University of West Bohemia in Pilsen,  
field of study: Electronics.

Since 2004 teacher at The High school Rokycany.  
2005 enrolled to NetAcad and become Legal main contact of LCNA Rokycany.



5<sup>th</sup> Int. Conference on

Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## AUTOMATIC WAN TOPOLOGY INTERCONNECTION AND IT'S USAGE IN CNAP NETWORKING LABORATORIES

Petr Grygárek, David Seidl

Regional Cisco Networking Academy

Faculty of Electrical Engineering and Computer Science

Technical University of Ostrava, Tř. 17. listopadu, 708 33 Ostrava, Czech Republic

Tel.: (+420) 597 323 263, Fax: (+420) 597 323 099

E-mail: petr.grygarek@vsb.cz, <http://www.cs.vsb.cz/grygarek>

### Abstract.

In practical education in networking laboratories it is useful to be able to interconnect various WAN topologies quickly and efficiently. In the article we present our hardware devices and architectures we developed for such automatic interconnection of WAN topologies - either in the scope of a single laboratory or fully distributed. Basic experiences gained during practical usage of developed prototypes in CNAP teaching and planned improvements are also described.

Keywords: Communication Technologies, Virtual Laboratory, CNAP

## 1. INTRODUCTION

During practical education in networking laboratory, it is necessary that students work on various topologies of networking devices. Unfortunately, the process of physical connecting of network topology is both time-consuming and error-prone and commonly prevents students to concentrate on the configuration of particular protocol or technology which is the main objective of the respective lesson. Our experience revealed that although it is inevitable to let students connect network topologies manually at the beginning of their study to give them concrete idea about WAN/LAN interfaces usage, it is much more effective to concentrate on upper-layer protocols and don't waste time with repeated physical layer troubleshooting later.

The another issue with frequent topology changes reported by many LCNAs is that students often do not manipulate network interface connectors with enough care. This often results to mechanical damage of rather expensive WAN interface cables or router's connectors and a need of their replacement. This problem is most serious in cases of non-modular routers often present in earlier CNAP bundles, where damaged interface cannot be easily replaced. The frangibility of new Cisco Smart Serial connector types is also an issue.

To avoid the above mentioned problems, we searched for methods how to interconnect network topologies automatically without physical human interaction. Although the original motivation of our research was the need to automatically change topologies in our Distributed Virtual Networking Laboratory [7] which resulted to the Virtual Crossconnect architecture [2], we soon realized the potential of developed prototypes to solve problems described above.

For Ethernet ports interconnection, we use standard LAN switches and VLAN-based interconnection. Using VLAN tunnelling (also called dot1QinQ sometimes), we are even

able to interconnect trunk links of various devices and have the switching element be completely invisible for the laboratory devices [8]. This way we can transparently pass CDP, STP, VTP, PAgP/LACP and other L2 protocols discussed in CNAP curriculum between connected devices. Unfortunately, there exists no similar commercially-available and cheap solution for WAN links. This is why we decided to develop a series of our own devices for WAN port automatic interconnection. The basic ideas, architectures and experiences with these devices will be discussed in the following article.

## 2. THE FIRST GENERATION CROSSCONNECTS

All WAN port crossconnect prototypes we finished and use up to now have the similar philosophy (fig. 1). All network devices' WAN ports are connected to interfaces of a single crossconnect which can be configured to interconnect arbitrary pairs of connected ports. The configuration is accomplished via RS-232 console port using a simple "IOS-style" command line interface (CLI) available to instructor or lab administrator or possibly directly to students. As in Cisco IOS, command completion, command abbreviations and context-based help system were implemented. The configuration is maintained in RAM but may be also stored into internal flash memory so that it can be loaded automatically when the crossconnect device is powered on. The device is controlled by Atmel 8051ED2 microprocessor which acts as a CLI command interpreter and configures switching array according to user's requirements. The CLI allows instructors or other authorized person just to Cut&Paste one of the previously prepared topology configurations into the crossconnect using HyperTerminal, Minicom or similar terminal emulator program.

In some cases, it is useful to be able to control the crossconnect not only by directly connected RS-232 terminal, but also remotely via intranet or Internet. It allows

us to share access to the crossconnect's control port by multiple users. In this way students may modify crossconnect configuration by themselves using connection over laboratory LAN, which is useful especially during unattended practicing of groups of CNAP students. Our solution for RS-232 to TCP conversion was to use relatively cheap commercially-available modules, in this case Charon II [5] for mutual RS232 to Ethernet conversion and Sollae EZL80c [4] for RS-232 to WiFi (802.11b) conversion, as can be seen at fig. 1. Our current aim is to extend function of Charon II module by a simple proxy authentication capability, which will authenticate the user before giving him/her an access to the crossconnect's control port. The Web-based GUI to isolate user from crossconnect's text-based configuration language might be also implemented into Charon II module quite easily.

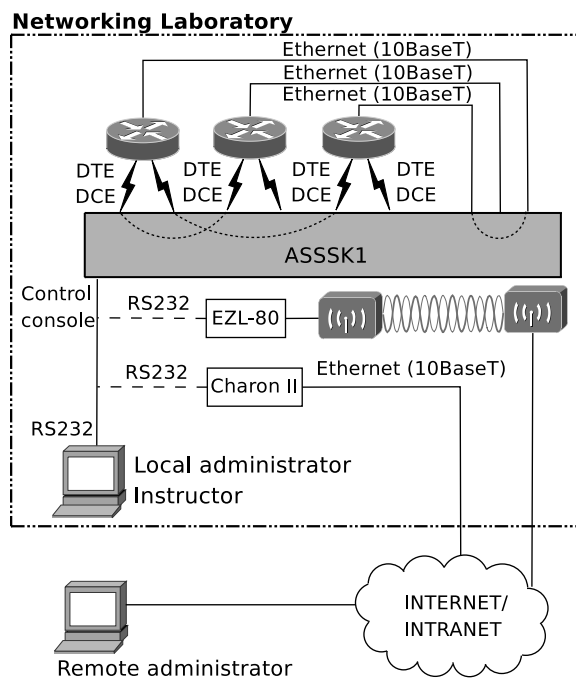


Fig. 1. Basic Crossconnect Philosophy

As will be described in detail later, we subsequently tested and implemented various approaches for actual signal switching, but the substantial part of controlling software has always been reused in the individual prototype devices.

## 2.1 WAN INTERFACE TYPE SELECTION

One of the main issues of crossconnect design was a selection of physical WAN interface type our device should support. Since we use our crossconnect primarily to interconnect WAN ports of Cisco routers which can provide multiple physical interfaces and let the user to choose the required one only by usage of an appropriate WAN cable, we could choose from ITU-T X.21, ITU-T V.35, EIA/TIA RS-232 and EIA/TIA RS-499 (all synchronous). Since we wanted to limit a number of signals to switch and also take the interface's connector availability into account, we chose

to use RS-232 because it doesn't use symmetrical signals neither for data nor control and it's CANNON DB-25 connector is cheap and easily available. The Cisco DB60/SmartSerial to RS232 DTE cables are also typically much more cheaper than other WAN cable types. Since we use "null modem" interconnection we need only to switch Rx/D and Tx/D signals and provide clock signals, as will be discussed later.

Another important issue we had to solve was the problem of clocking. In reality, routers at both sides of the leased line provided by telco act as DTEs and are connected with synchronous modems using „DTE cable“. Clocking signal for both routers is provided by respective modem. Since it is inefficient to have so many modems in the laboratory, most people commonly connect WAN interfaces of Cisco routers directly, using a pair of two different cables for DCE and DTE side. The router connected with a "DCE" cable provides clocking for both directions of the communication if instructed to do so by an IOS command. It means that for that type of direct interconnection we are only able to connect a pair of interfaces if one interface is connected with a DCE cable and another one with a DTE cable. So we have a problem with cable type to use between router's WAN port and crossconnect port if we want to be able to connect arbitrary pairs of connected WAN ports by the crossconnect.

To allow our crossconnect to connect arbitrary pair of WAN ports, we decided to take completely different approach, which much more resembles the real usage of leased WAN links. All WAN ports are connected to the crossconnect using DTE cables and the crossconnect itself provides clocking for all devices, exactly as would a modem at the end of leased line do. In the newer prototype, we are even able to set various clock rates for individual pairs of connected ports. From the student's perspective, the crossconnect may be viewed as a telco cloud which provides leased line services including clocking and he/she does not have to take care about clocking at all the router side.

## 2.2 THE ANALOG CROSSCONNECT

The very first version of our crossconnect (called ASSSK-1) was developed by David Seidl in his MSc. thesis [1]. The general aim of the thesis assignment was to develop a crossconnect based on analog switch array core suitable for connecting of signals of various networking technologies. Individual WAN ports are attached to the switching core via interface modules, which adapts various electrical interfaces' signals to the voltage range suitable for the switching core. The device (fig. 2) may accommodate up to 16 modules.

The switching core is composed of two Zarlink MT8816 analog switch array integrated circuits [6], which together form a 16 x 16 matrix. The matrix allows to connect each of 16 Tx/D signals to any of 16 Rx/D signals, so that arbitrary 8 pairs of modules may be connected together. It is even possible to loopback any interface for testing purposes.

Various interface modules may be developed to switch signals of individual interface types. The only limitation is the frequency range of the used switching array (30MHz).

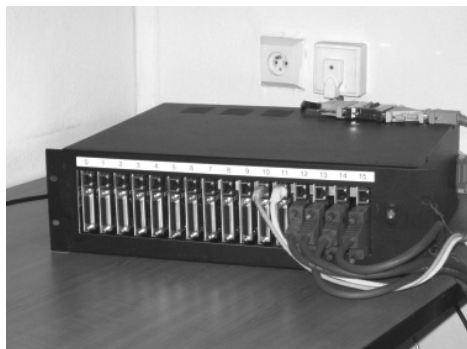


Fig. 2. ASSSK-1: The Analog Crossconnect

That range proved sufficient for 10BaseT Ethernet and synchronous RS-232 up to 2 Mbps during our extensive testing. We developed a double-interface modules, which allows to connect either RS-232 WAN port or 10BaseT Ethernet. Because of different electrical characteristics and processing of RS-232 and Ethernet signals, it proved most effective to use a small mechanical relay to choose which of the two interfaces available at the module will be really connected to the switching core. The reachable bitrate of switched serial WAN interfaces is somewhat limited by RS-232 to TTL convertors (the capacitor-based charge pump used to create  $\pm 12V$  for RS-232 interface), but we currently plan to provide external 12V DC supply to avoid this problem.

The block diagram of the ASSSK-1 device is depicted at fig. 3. The Control Processor interacts with user using CLI and configures analog switching array accordingly. We decided to use separate microprocessor (the Clock Processor) to provide clocking for individual WAN lines.

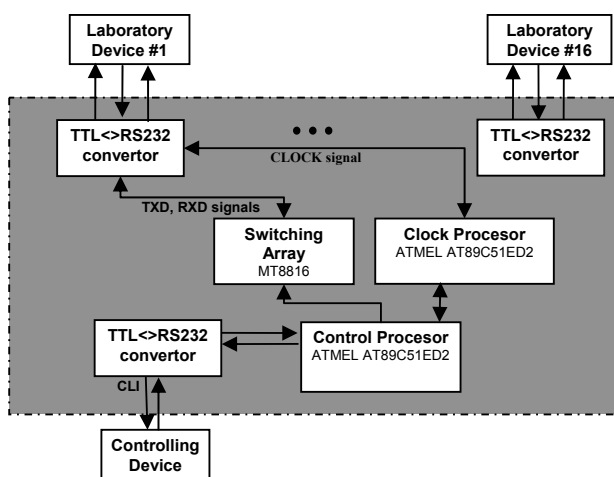


Fig. 3. ASSSK-1 Block Diagram

To support potential future extensions, we decided to provide I2C bus implemented by ATMEL microprocessor for the usage at the interface modules. It means that various

I2C-enabled devices may be attached the similar way as interface modules and accessed from the control microprocessor. Currently we assess the attachment of external Flash memory to let instructors to store multiple pre-defined interconnection configurations and easily choose one of them when a need to change topology arises during laboratory work. By implementation of a simple user interface consisting from a numeric keyboard and LCD display, we also plan to provide a mechanism to let the instructor change configurations very quickly and efficiently without an external control terminal (most probably PC).

The cost of electrical components and other material to produce the ASSSK-1 crossconnect was about 12 thousands CZK.

### 2.3 FPGA-BASED CROSSCONNECT

After a period of usage of ASSSK-1, we decided to redesign an architecture based on the experience with the original prototype. Switching of Ethernet ports proved inefficient, because we need to switch faster interfaces than 10BaseT today, which is not possible because of frequency limitation of the used analog switch array. This is why we decided to concentrate on WAN interface switching in the future hardware development and interconnect Ethernet ports using standard VLAN-aware 10/100/1000 Ethernet switches and VLAN/802.1q tunnelling approach, as mentioned above.

The main aims of the new crossconnect version was to make the device more replicable and compact, decrease its production cost and increase flexibility. It also turned out unnecessary to be able to switch various WAN physical interface types, since RS-232 proved most efficient during usage period of the ASSSK-1. This is why we abandoned the modular architecture and decided to implement interface circuitry on the baseboard instead of on modules. We also used FPGA technology and VHDL to implement the device much more efficiently. The most important change is that the FPGA-based switching core is now fully digital. Except the switching function, the FPGA circuit also provides clocking for individual ports, based on the frequencies preset to its configuration registers by control microprocessor. This way we can easily simulate WAN links of various speeds which is necessary in many labs and case studies of CNAP courses, especially CCNP1 and CCNP2.

The prototype (fig. 4) was developed by Petr Sedlar in his master thesis [3], produced and successfully tested. Much higher bitrates are reachable with digital switching matrix than with the previous analog one. Up to twenty interfaces may be made available at the chassis. This allows us to interconnect up to 10 2-WAN-port routers, which is more than enough for a single CCNP bundle. In real teaching, the experience shows that it is often better to use the crossconnect to switch ports of multiple smaller and independent lab pods. The FPGA-based crossconnect is very easy to modify because of its capability of in-system reprogramming of both Atmel control microprocessor and FPGA core. The block diagram of the FPGA-based device called ASSSK2 is depicted at fig. 5.

Because of implementation of interface circuitry on the baseboard instead on interface modules in ASSSK-2, the number of mechanical contacts was reduced considerably



Fig. 4. ASSSK-2

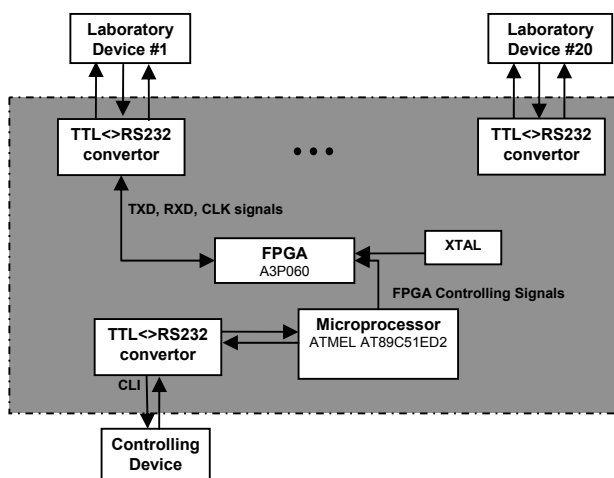


Fig. 5. ASSSK-2 Block Diagram

so the new crossconnect is not only cheaper and more compact, but also more reliable. It is important in particular in case of lab pods accessible for CNAP students remotely all the day without any instructor attendance. The material expenses to construct ASSSK-2 are about 8 thousands CZK.

In the future, we intent to integrate the whole logic (i.e. the switching array and control processor) into the more advanced type of FPGA integrated circuit. We expect that it will further decrease the cost, improve reliability and extend the flexibility of the crossconnect.

### 3. PASSING TRAFFIC BETWEEN MULTIPLE CROSSCONNECTS

The limitation of first generation of our crossconnect solutions was that there was no possibility to switch traffic across multiple crossconnect instances. Although there is 16 or 20 ports at the available models, the scalability is somewhat limited because even if we produce multiple crossconnect instances, we are only able to connect WAN ports of network devices connected to the same crossconnect. This is why we searched for solutions how to

let traffic pass across multiple crossconnects connected together.

The first idea was just to reserve some number of standard crossconnect ports for interconnections between crossconnects. Unfortunately, this solution would be rather inefficient because 4 ports in total would have to be consumed for a single interconnection of two WAN ports connected to a pair of different crossconnects. It would be even more in case of a longer chain of crossconnects linked together. A non-trivial issue of clock synchronization between multiple crossconnect devices would have to be solved also. Although it is of course possible to connect crossconnects into more efficient hierarchical structures than a simple chain, we decided to take completely different approach.

The solution for passing traffic between multiple crossconnects we are working on now was influenced by a need to pass traffic between crossconnects located at various, physically distant sites. This requirement first appeared during our Distributed Virtual Laboratory development ([7]), but we also found useful to be able to connect together laboratory equipment located in multiple networking laboratories for some laboratory tasks, like CNAP final exams. The general idea is not just to interconnect physical signals, but read the content of passed PPP/HDLC frames, encapsulate them and tunnel over intranet or even Internet. Frames are decapsulated at the receiving side and sent out of the particular serial port to the WAN interface of the network device they are destined to. This approach scales well because the interconnections between individual crossconnects forms a logical full mesh and in case of sufficient capacity of the underlying LAN/WAN the number of interconnections of network devices connected to different crossconnects is potentially unlimited. We denote solutions adhering the approach described above as a second-generation crossconnects.

#### 3.1. LINUX-BASED CROSSCONNECT

The simplest way to implement handling of HDLC/PPP frames and passing them between multiple switching devices is to use software-based approach. We decided to utilize PC with Linux for that purpose. The architecture we are now experimenting with is described at fig. 6. The PC is equipped with multiport synchronous serial card, which allows to connect WAN interfaces of network devices to be interconnected. We investigate now how standard Linux PPP/HDLC drivers could be used to allow a switching software developed for that purpose to switch PPP/HDLC frames between logical ppp/hdlc interfaces. The switching software will also be able to tunnel frames between multiple crossconnect PCs in UDP datagrams, so that we will be able to create virtual WAN links over campus LAN or the Internet. The remote configuration using Telnet is planned in the first prototype. We denote the above mentioned Linux-based crossconnect architecture as ASSSK-3.

The only serious limitation of this approach we encountered up to now is that commercially available synchronous serial cards are both costly and typically do not provide more than two ports. For this reason, we started to work on our own

FPGA-based card with a higher port density (8 ports as a minimum).

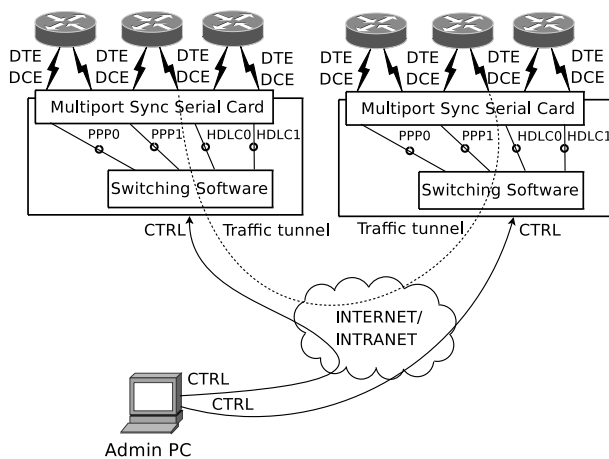


Fig. 6 –ASSSK3: The Linux-based Crossconnect

### 3.2. EXTENSION OF FPGA-BASED CROSSCONNECT

Another possible approach we are assessing now for processing of PPP/HDLC frames and tunnelling them across the Ethernet is to integrate frame processing intelligence into the current FPGA-based crossconnect (ASSSK-2). The frame separation logic capable of recognizing frame flags and handling bit stuffing seems to be relatively simple to integrate into FPGA. We plan to use some commercially-available embedded module for synchronous serial to Ethernet conversion in the prototype, such as above-mentioned Charon II module. The frame separation logic could be also implemented at this module if the processing power will suffice. The general idea is to reserve a couple of ports of FPGA-based switch array (denoted as internal ports) and connect them internally to the serial-port side of the serial-to-Ethernet conversion modules. The way how the modules will handle frames incoming from switch array and Ethernet interface will be programmed to the modules by crossconnect's control processor. In fact, only destination/source MAC (or IP) address to internal switching array port mapping will have to be configured. The FPGA switch array will then switch frames coming from another crossconnects through Ethernet LAN and Ethernet-to-serial module to it's internal port the same way as if it came from the regular port. Multiple serial-to-Ethernet convertors can be integrated together to limit the size and cost of the construction or a more-powerful convertor capable of handling multiple serial ports could be utilized. The architecture proposal is depicted at fig. 7. Although the number of ports that can be tunnelled via Ethernet is limited by a number of implemented internal ports in this approach, it requires relatively minor changes in the current ASSSK-2 crossconnect design. Except of the integration of convertor modules, only some changes in the control software will be required. We also expect that the controlling RS-232 console will be converted to Ethernet so that we will be able

to control multiple crossconnects from a single control entity, which is useful for centralized creation of distributed virtual WAN topologies for education purposes.

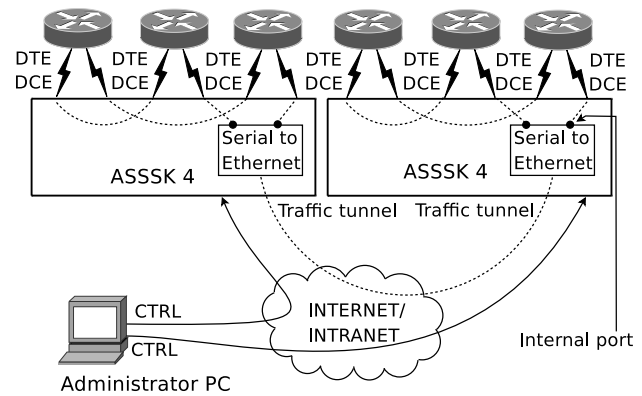


Fig. 7 – Basic Idea of Extension of ASSSK-2 for Frame Tunelling

### 4. FULLY DISTRIBUTED CROSSCONNECT ARCHITECTURE

As a natural extension of the above mentioned architectures, we proposed a fully-distributed crossconnect architecture, which we believe to be more flexible and cheaper in the practise, particularly for creation of virtual topologies built from equipment scattered in multiple rooms of the campus or even multiple LCNAs.

The architecture is based on a big number of small remotely configurable bidirectional synchronous serial to Ethernet convertors (fig. 8). These convertors are connected to individual WAN ports of network devices (one convertor may potentially handle more than one WAN port). Every convertor may be programmed remotely to which address it has to tunnel PPP/HDLC frames coming from the serial port. Ethernet ports from the convertors connected to WAN ports of network devices at the lab site will be connected together via standard Ethernet switch. Multiple independent lab sites may be connected together via Internet. The architecture requires a controller entity which will create and upload configurations into individual convertors based on the required virtual topology. The convertor modules may be built to provide clocking (i.e. behave as DCE) or to accept clock from the router, so the direct serial interconnection can be completely simulated. We can also pass additional information between modules, such as physical layer up/down state of the respective serial interface.

It is expected that there will be some troubles with passing traffic through firewalls of individual lab sites, so we plan to include proxy capability into convertor modules so that only a limited number of conduits will have to be configured at firewalls.

As depicted on fig. 8, our effort is to build a serial-to-Ethernet modules in such a way so that they can also just pass the serial interface signals through. It will allow to have these convertors connected to WAN ports of network devices permanently, so that students will be able to

connect network devices physically during laboratory work. At the same time, we will be also able to connect topology automatically if necessary. The positive side effect of that solution is that serial ports on the routers will be protected from mechanical damage by relatively cheap convertor modules.

The described approach will also allow to tunnel traffic between Ethernet ports of network devices the similar way as for serial lines, so that we will be able to automatically connect the complete topology with the single technology. The only difference will be the interface type at the router's side of the convertor modules.

The experimental prototype of serial-to-Ethernet modules are just being constructed using commercially-available Charon module.

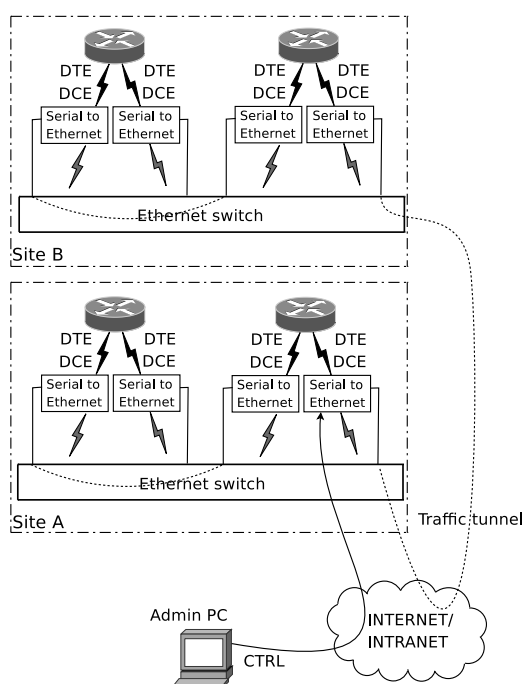


Fig. 8 – The Fully Distributed Crossconnect

#### 4. CONCLUSION

In the article, we presented a couple of architectures and hardware device prototypes for automation of WAN topology interconnection. Lot of approaches presented here proved useful to make practical education in CNAP laboratories more efficient, to support integration of equipment of multiple laboratories and allow remote laboratory access for the purpose of distant learning. Some of the technologies presented here also form a technological basis of the Distributed Virtual Laboratory [7] developed at our university and piloted in cooperation with Silesian University of Opava with support of Czech Educational Scientific Network (CESNET), who provided funds to let LCNAs specialize on particular advanced technologies. This way we can share equipment between LCNAs and create high-quality CNAP virtual lab pod, particularly for CNAP security courses.

We also believe that the proposed technologies which promise to connect laboratory topologies both directly and remotely at the same time will make the lab device usage more efficient, since it will be no longer needed to maintain separate lab pods for direct and remote access.

#### 8. REFERENCES

- [1] Seidl, D.: System for Automatic Network Configuration Management. Master's Thesis, Faculty of Metallurgy and Materials Engineering, VŠB-TU Ostrava, 2005. [In Czech]
- [2] Grygárek, P., Practical Experience with Implementation of Virtual Computer Network Laboratory and Proposed Ways of its Further Development. Proceedings of Technologies for E-Learning conference, FEL ČVUT Praha, 2006, ISBN 80-01-03512-3, pp.58-68. [In Czech]
- [3] Sedlář, P.: FPGA-Based Crossconnect for Serial Lines. Master's Thesis, Faculty of Electrical Engineering and Computer Science, VŠB-TU Ostrava, 2007. [In Czech]
- [4] EZL-80 and EZL-80c: converter modules description [http://www.hw-group.com/products/sollae/ezl80\\_en.html](http://www.hw-group.com/products/sollae/ezl80_en.html) [online, April 2007]
- [5] Charon 2 Ethernet embedded Ethernet module. [http://www.hw-group.com/products/charon2/index\\_en.html](http://www.hw-group.com/products/charon2/index_en.html) [online, April 2007]
- [6] Datasheet of analog switch array [http://www.ortodoxism.ro/datasheets/zarlinksemiconductor/zarlink\\_MT8816\\_MAR\\_97.pdf](http://www.ortodoxism.ro/datasheets/zarlinksemiconductor/zarlink_MT8816_MAR_97.pdf) [online, April 2007]
- [7] Grygárek, P., Milata M., Vavříček J., The Fully Distributed Architecture of Virtual Network Laboratory. 5th Int. Prepared for publishing at proceedings of Conference on Emerging e-learning Technologies and Applications, The High Tatras, Slovakia, September 6-8, 2007
- [8] Gaura, J., Vavříček, J.: Tunnelling of VLANs and Auxiliary Layer 2 Protocols in Provider Network. Semestral Project of Routed and Switched Network subject, <http://www.cs.vsb.cz/grygarek/SPS/projekty0506/QinQ.pdf> [In Czech, online, May 2007]

#### THE AUTHORS



**Petr Grygárek** (Ph.D, MSc., CCNP) is Main Contact and CCNP/CCNA/NS instructor at RCNA VŠB-TU Ostrava. He also coordinates development group of Distributed Virtual Networking Laboratory used both in CNAP and for standard university networking courses.



**David Seidl** (MSc.) is a professor-assistant and Ph.D student at VŠB-TU Ostrava. He helps our RCNA with special hardware





## THE SYSTEM OF CAREER PROMOTION OF PROFESSIONALS IN THE FIELD OF COMPUTER NETWORKS BASED ON INDUSTRIAL CERTIFICATES

František Jakab<sup>1</sup>, Marian Bučko<sup>2</sup>,

Cisco Systems Slovakia<sup>1</sup> /Technical University <sup>1,2</sup> in Košice, Letná 9, 04200 Košice, Slovakia  
fjakab@cisco.com, marian.bucko@tuke.sk

5<sup>th</sup> Int. Conference on

*Emerging e-learning  
Technologies  
and Applications*

*The High Tatras,  
Slovakia  
September 6-8, 2007*

**Abstract.** This report is dedicated to the issues related to the system of career promotion of professionals in the field of computer networks based on industrial certificates. The EU member countries face a serious shortage of professionals in development and care of information and communication technologies. It is expected that by 2008 the EU countries could be short of as many as 22 thousand professionals in the field of computer networks and the Slovak Republic of more than 3 thousand professionals. This are the conclusions of a study made by IDC, prominent company involved in the market research that was worked out in cooperation with EU and OECD. The study results are alarming for individual member countries and represent a serious challenge to the companies. The shortage of professionals will hamper competitiveness and growth in Europe as modern technologies would not be used in an optimum way. This report is dedicated to the results of this study and also to the successful concept of education of professionals in the Slovak Republic - network academic program Cisco (NetAcad) that effectively uses modern communication technologies also for the organization of the educational process itself.

**Keywords:** career promotion, computer networks, certificate, NetAcad Program

### 1. INTRODUCTION

At the Lisbon summit of the European Union several years ago the member countries agreed that if the European Union is to compete successfully with the most developed countries, especially with the USA and Japan as the technologically most advanced countries, then it should become “the most competitive knowledge-based economy in the World” by 2010. Since then the concept of the “knowledge based economy” has become a part of the European Union vocabulary it started to manifest itself dynamically in various areas, especially in the frequent use of the concepts such as research and development. Slovakia is currently a full-fledged member country of the European Union.

IDC, World’s prominent analytical company prepared a study in September 2005 that maps the current situation and trends on the labor market in the field of information technologies in all EU countries. With regard to the needs of the knowledge-based economy and the orientation on information society the study focused on professionals in the field of network solutions and internetization. It points out that individual countries of Europe, including the Slovak Republic, should be short of tens of thousands of vitally needed professionals by 2008. The shortage of professionals will hamper competitiveness and growth in Europe as modern technologies would not be used in an optimum way.

Based on the results of IDC studies ICT institutions in EU were short of almost 160 thousand qualified employees in 2005. If this trend continues the difference between the

supply of and demand for IT specialists will grow to as much as 500 thousand persons within the next three years. The also study pointed out that especially in the new member countries of the EU the shortage of qualified labor force may lead to impairment of the economic competitiveness and to deceleration of market introduction of new technologies in general. The acute shortage of professionals is perceived especially by most Slovak companies doing business in the field of information technologies.

**Importance of certificates:** The results of this study have shown that apart from practical experience the respondents consider qualification certificates of the job seeker to be very important. Certificates directly from the IT industry have decisively an added value as compared with the certificates issued by the government. Cooperation of employees, ICT industry and of the public sector represents the most valuable approach to education and training of new qualified labor force.

The IDC study shows that in both in Western as well as Eastern Europe the demand for qualified labor force in the field of IT and network administration exceeds permanently the supply of such labor force. The difference between the demand and supply is the most striking as far as the advanced network technologies are concerned. The growing shortage of qualified labor force has its impact on the ability to adopt the latest technologies that would increase effectiveness and productivity. If we do not take an active approach to solution of this situation we may seriously impair competitiveness of Europe on the World market.

## **2. CURRENT SITUATION IN EDUCATION OF PROFESSIONALS IN ICT**

The educational institutions are currently under pressure as they have to take effective steps to ensure that their students acquire knowledge which is necessary in the twenty-first century. One of the objectives of a modern educational institution is to make sure that their graduates are not only able to apply ICT in their future jobs on the basis of acquired ICT literacy but also that they are able to make use of these technologies as a tool and as an environment for the educational process itself. The current knowledge-based economy necessitates unprecedented flexibility of education, but also an effective offer of various options and solutions of knowledge acquisitions in various fields. The educational institutions cannot meet these tasks on the basis of classical forms of education only. Educational institutions all over the world started to integrate extensive resources available on internet and use internet environment also as an environment for education. In this way the internet environment is becoming a tool to increase the effectiveness of educational process administration and management.

Also the view of organization of the education process itself is changing and new methods and procedures are continuously introduced using the ICT as a major and suitable tool in the educational process. These new methods are in their essence different from the classical methods based on use of paper forms of educational materials. In general they presuppose wide use of various elements and components of educational process that enable to organize the educational process more effectively and they are frequently designated as “blended learning” with ICT playing an essential role within the high performance network infrastructures (most frequently designated as “e-learning”). Studies of this sort take place within the network environment that enables effective sharing of educational materials, administration and management of the educational process itself, assessment of the acquired knowledge and operative communication between teachers and their students. This means that the educational material is made available to students within the communication environment (mostly through the internet) and the students are organized in the virtual study groups – classes. They can study during their meetings in the premises of the educational institution coordinating the educational process, but also when and where it suits them best, as long as they have access to internet. If necessary the studies can be complemented by practical exercises in specialized classrooms and laboratories, by projects, case studies, presentations and consultations with tutors.

Educational materials and the organization of education may consist of multimedia presentations, simulations, combination animations, video, sound and text presentations, and last but not least, of the tests to verify the knowledge of students. Various LMS systems (Learning Management Systems) are used to provide specific managing functions of the education oriented in this way. The LMS systems frequently use also many other supporting features and functions, such as: chats,

videoconferences, IP video-streaming solutions, application sharing, virtual class organization etc.

Experience with the use of ICT in education so far shows that the methods and tools of “e-learning” cannot be looked upon as a medicine to cure all problems related to education and these methods and tools can be fully replaced by classical methods of education relying upon ICT to much lesser extent. Surely the role of the teacher/educationalist remains significant and as a matter of fact this role will grow in its significance as the more effective the use of ICT in education and the better teachers/educationalists master these technologies, the higher will be the appreciation of their work they will receive. Therefore, the tools that enable the most effective communication and the requisite personal contact of the teacher and student independent of their location play more and more significant role in these new forms of education.

The means and tools of “e-learning” liberate the teacher from everyday repetitive reading in the class and at the same time, depending on the situation they enable the teacher to use various forms of information presentation to facilitate mastering of knowledge. E-learning enables the teachers to become tutors that pay attention to problem issues only, to improve their courses, to create new communication approaches with their students and to pay attention to other activities they had to neglect because of time pressure.

## **3. SUCCESSFUL MODEL OF COOPERATION OF THE STATE AND PRIVATE SECTOR WHEN INTRODUCING NEW FORMS OF EDUCATION BASED ON ICT**

Cisco Networking Academy Program (NetAcad) is a modern educational program aiming to promote professionals especially in the field of design, building and administration of computer networks. The history of this program goes back to 1993 when the management of Cisco Systems Inc., the world leader in the field of communication technologies, started to be aware of the shortage of network specialists and decided to get involved in preparation of these specialists in cooperation with the academic sphere (Stanford University in USA). These studies were organized on a distant basis and met with a very positive response. An important precondition was to create an effective system of education based on use of internet environment. In this way the curricula came into being that took into account the latest trends in the network technologies. It became obvious that the concept of utilization of the so-called Learning Management System (LMS) based on internet enables effective management of the educational process as well as distribution of the educational materials and their effective sharing. Therefore, based on the prepared concept of cooperation with the academic sphere this system was released for the public in 1997 and ever since it has been developed all over the world as a global educational initiative involving some 11 thousand educational institutions and almost 500 thousand students (almost two million students have been involved in this program so far).

In the Slovak Republic this NetAcad Program has been implemented since 1999 with the Technical University in Košice being the pioneering educational institution in this process. Major development started in 2001 when based on positive response from the academic sphere the Memorandum of Cooperation (MoU) was signed between the Ministry of Education of the Slovak Republic and Cisco Systems. In the Slovak Republic this agreement has become historically first and at the same time very successful example of new public private partnerships based on principles of mutual advantage.

Based on this MoU the partners agreed to cooperate in the implementation of NetAcad Program in the educational system of the Slovak Republic with Ministry of Education supporting suitable implementation of the program in the curricula of secondary schools and universities in the Slovak Republic. In general this program is taken as a suitable complement of the existing system of education in the field of professional education focusing on acquisition of internationally recognized industrial certificates.

In 2002 this MoU was signed also by the biggest financial institution in the Slovak Republic, the bank Slovenská sporiteľňa, a.s. as the general partner of the program in the Slovak Republic. Accession of the bank Slovenská sporiteľňa to the MoU even more strengthened the partnership of the private and public sector and this bank has become the first financial institution in the European region to support in such a significant way currently the most successful global educational initiative.

Based on the assessment of the results of cooperation the involved parties signed a new MoU in 2007 declaring their readiness to change over to a new level of strategic cooperation in the field of education of IT professionals.

In the last 8 years innovative and strategic partnership models were created in Slovakia in the field of new information and communication technologies not only in education but also in the infrastructures of communication solutions of national significance. This strategic partnership is in general referred to as an example of possible mutually beneficial cooperation of private institutions in support of education of young generation.

The objective of implementation of the NetAcad Program in the Slovak Republic is to contribute to development of needed technological skills of future generations of professionals. New progressive educational technologies are made accessible to schools. Very significant is also the contribution to technological support of top educational resources and the complementation of restricted funding from the government. Introduction of the program into schools enables the student also in the Slovak Republic the access to professionally very important preparation for the entry in the economy which is becoming more and more dependant upon technologies.

The NetAcad students in the Slovak Republic are in general very successful. Their employability reaches practically 100% and so far we did not receive any information that a successful graduate of the NetAcad Program would face problems when looking for a job. The NetAcad students are

very well prepared professionals for the area of network technologies.

In the field of preparation of network specialists based on NetAcad Program the Slovak Republic is the top country of Europe with regard to the quality of the system, the number of students, successful graduates and preparation of interesting network projects based on the initiative of NetAcad students. Out of more than 140 countries implementing this program the Slovak Republic is among the most successful ones and its results have been internationally awarded many times.

The results of students and of the schools of the Slovak Republic involved in the NetAcad Program are really excellent and have received high appreciation also abroad. So for example the Slovak Republic received an award at the international conference of the program in the EMEA region (Europe, Middle East and Africa) that was held in Valencia, Spain, in 2005. The winner of the "Project of 2005" was the project "IP telephony for the academic sphere" prepared by the Technical University in Košice, Slovak Republic. One of the most significant appreciations of the NetAcad Program is also the „IT Project of the Year" awarded to the NetAcad Program in the Slovak Republic in 2004. This appreciation was awarded by the informal association of the Slovak journalists and members of professional associations in the field of ICT and the academic community. Table 1 illustrates the development of the program in the Slovak Republic.

|            | RAs | LAs | Instructors | Current number of students |
|------------|-----|-----|-------------|----------------------------|
| Sept. 2000 | 2   | 10  | 24          | 120                        |
| Sept. 2001 | 3   | 20  | 40          | 360                        |
| Dec. 2002  | 4   | 36  | 126         | 1 800                      |
| Mar. 2004  | 4   | 44  | 141         | 2 640                      |
| Dec. 2005  | 4   | 47  | 158         | 3 229                      |
| Sept. 2006 | 4   | 48  | 162         | 3 600                      |
| July 2007  | 4   | 51  | 170         | 3 980                      |

**Table 1:** Development of the NetAcad Program in the Slovak Republic

The schools involved in the NetAcad Program are gradually becoming recognized centers of preparation of ICT professionals in the Slovak Republic. The Regional Network Academy at the Faculty of Electrical Engineering and Informatics of the Technical University in Košice was the first in history to be receive prestigious international award the Academy of the Year in the EMEA Region out of more than 400 regional academies active in this region ( in Paris in 2000 and in Copenhagen in 2002).

Based on the results and experience achieved so far we can state that this program is considerably contributing to preparation of professionals in the field of network technologies that are currently in short supply. Before this program was introduced there was no similar targeted and systematic preparation of network professionals in the

Slovak Republic. Based on the available information, 100% of the program graduates found a job without any problems in their field of studies. Especially big IT companies are interested in the successful graduates of the NetAcad Program and offer them better than standard conditions of work.

Career promotion model in the field of computer networks  
During its implementation in the Slovak Republic the NetAcad Program has reached a significant position not only in the field of standard education of computer network professionals, but also in the field of retraining. Inclusion of this program in the curricula of secondary schools and universities in the Slovak Republic represents an effective and perspective step in the use of technologies of electronic education (e-learning).

Retrospectively we can say that this program is a progressive educational initiative based on advanced technology using new forms of education. Educational institutions benefit from the support of the Ministry of Education that enabled them to join this progressive initiative. The objective of this initiative is to contribute to transformation of the traditional school into a modern and creative school of the third millennium on the basis of information and communication technologies. No doubt NetAcad makes significant contribution to this objective also due to the fact that it interconnects the educational environments of secondary schools and universities using university teachers to guarantee the quality of the whole process. At the same time it is a practical contribution to the quality preparation of students for their future professional or school career. As a part of the program the institutions have access to educational materials and the management system using the portal <http://cisco.netacad.net>. All portfolio modules are designed as a preparation for acquisition of internationally recognized certificates in specific areas.

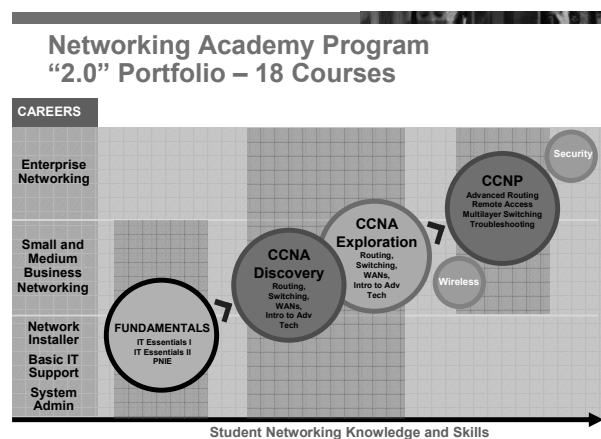
The institutions that are involved in this program are currently a part of the integrated system of lifelong education in the Slovak Republic and are recognized educational centers in their regions. The long-term objective of the NetAcad Program in the Slovak Republic is to have at least 300 network specialists completing the program every year with the international certification of their knowledge.

Based on this program the academic sphere in the Slovak Republic was offered an opportunity of sponsored integration of progressive multimedia educational system and use of internet in their curricula (high quality study materials oriented on the issue of communication of infrastructures). Implementation of the above program in the educational system in the Slovak Republic enables students to acquire major competitive advantage on the labor market and significantly improves their chances of future employment. The existing gaps in this area of education are filled in this way. NetAcad plays an important role also as far as the issue of employment is concerned. Based on the program materials the teaching at secondary

schools and universities is oriented on computer networks and informatics in general.

The program enabled to the Slovak schools concrete improvements because it made available for them new educational and internationally recognized technologies based on internet. As a result top educational centers of e-learning technologies, laboratories for teaching of the program were built at each involved institution.

The program made accessible to secondary schools and universities the latest knowledge and know-how in the field of information technologies thanks to the certified system of education and increased their competitiveness on the international scale. The educational institutions in the Slovak Republic have acquired complex educational system based on internet including specialized educational contents that is continuously updated and its price cannot be practically calculated as the relevant institutions in the Slovak Republic do not have sufficient resources to develop similar system of education. A very significant factor is the option of international certification of the education acquired on the basis of studies within this NetAcad Program. This certificate is understood to be an internationally recognized tool for evidencing acquired skills and knowledge.



**Picture 2:** The system of career promotion based on the NetAcad Program

#### 4. CONCLUSION

Based on the results and experience achieved so far we can state that this NetAcad Program is considerably contributing to preparation of professionals in the field of network technologies that are currently in short supply. Before this program was introduced there was no similar targeted and systematic preparation of network professionals in the Slovak Republic.

Especially big IT companies are interested in successful graduates of the NetAcad Program and offer them better than standard conditions of work. Recently the following companies have employed number of NetAcad Program graduates and cooperate with the NetAcad Program in order to educate their own employees: T-com, IBM, AT&T, T-System, Alcatel, Soitron, Siemens, Dell, Telenor.

The Slovak Republic is currently an interesting country also for investment activities that require large number of top network specialists. This is evidenced also by the activities of major IT companies that expect that the Slovak Republic would have sufficient number of highly qualified network and IT specialists, such as Soitron, a.s. (HP) and its Managed Services Delivery Center in Bratislava.

Currently several other international investors providing outsourced IT services analyze the possibilities of opening similar companies in the Slovak Republic. Availability of well prepared graduates of the NetAcad Program is an important criterion of their decision-making concerning future investments.

Current initiatives focus on support of professional standard of teachers of secondary schools and universities in the field of ICT based on implementation of recognized industrial certificates in education. This objective is directly set in the National Lisbon Strategy as the priority field of "Education and Investments into the People". As a part of this objective the concept was designed to educate teachers of secondary schools and universities in the field of ICT on the basis of NetAcad Program. This conception will enable the teachers to acquire globally recognized industrial certificate. Education based on this concept will become a recognized part of their professional growth within the system of promotion of their qualification. These activities will be coordinated by selected university work stations that are already successfully involved in the NetAcad Program.

The NetAcad Program significantly contributes to building of basic pillars of development of the knowledge based economy in Slovakia, especially in the field of introduction and effective use of new communication technologies and their solutions. In this way basic precondition for development of competitive knowledge based economy was created.

## 5. REFERENCES

- [1] Cisco Networking Academy Program, <http://cisco.netacad.net>
- [2] IDC study, 2005, 'Networking Skills in Europe: will an increasing shortage hamper competitiveness in the global market'
- [3] F.Jakab, I.Sivý, J.Genči: Concept of progressive e-learning services, Virtual University, 5<sup>th</sup> International Conference, December 16 - 17, 2004, Bratislava, Slovak University of Technology, pp. 52-57, ISBN 80-227-2171-9

## THE AUTHORS



**Frantisek Jakab** was born in 1959. He received the MSc.degree in Systemotechnic engineering from the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Dept. of Computers and Informatics, Technical university of Kosice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modelling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in Slovak Republic ([www.ctf.sk](http://www.ctf.sk)).



**Marian Bucko** was born in 1959. He received his MSc. Degree from Technical university of Kosice in 1984 and PhD. Degree in area of using complex fuzzy systems in 1992. He is employed as an researcher at the Department of Cybernetics and Artificial Intelligence, Technical university of Kosice, Slovakia.





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## NETACAD CURRICULA TRANSLATION TOOL

František Jakab, Jozef Janitor, Ján Genčí, Karol Kniewald, Vladimír Sidimak.

Computer Networks Laboratory, Department of Computers and Informatics, Technical University in Košice, Contact: +421-55-602-7075, {name.surname}@cnl.tuke.sk, <http://www.cnl.tuke.sk>

**Abstract.** Learning materials for the ICT are in most cases written in English language. Students at high school may have difficulties studying from English materials if they are not native speakers. Some of them rather don't choose classes taught with English learning materials, even if those classes are interesting for them. This paper shows how to easily provide to the community of people around Cisco's NetAcad program a user-friendly tool which uses Web 2.0 technologies to enable a collaborative process to create a good translation of English learning materials.

**Keywords:** Social networks, Web2.0, Wiki, NCTT, NetAcad, Curricula.

### 1. WIKI

Wiki is kind of a social software that enables people to easily collaborate on content creating and changing, mostly just through a web browser interface. Wiki as a technology is often used inside organisations or by communities of practice/interest. The power of Wiki based applications is in the Metcalfe's law: The more people who use something, the more valuable it becomes [2].

A Wiki is commonly known as a collaborative website which can be directly edited by anyone with access to it. Such a website is [www.Wikipedia.org](http://www.Wikipedia.org), the most known Wiki website on the World.

A Wiki enables documents to be written collaboratively, in a simple (markup) language using a web browser. A single page in a Wiki is referred to as a "Wiki page", while the entire body of pages, which are usually highly interconnected via hyperlinks, and is "the Wiki". A Wiki is essentially a database for creating, browsing and searching information.

A defining characteristic of Wiki technology is the ease with which pages can be created and updated. Generally, there is no review before modifications are accepted. Many Wikis are open to the general public without the need to register any user account. Edits, however, can be made in real-time, and appear almost instantaneously online. This can lead to abuse of the system. Private Wiki servers require user authentication to edit, sometimes even to read pages [1].

#### 1.1. Wiki as collaborative way to create (learning) materials

While creating the content of learning materials, we mostly write those materials in our favorite text editor (MS Word, TeX, ...). Then these documents are sent for a review to other people in our editor team. Some people write down some comments to our documents, some people change some text, but at the end, when they send us back they feedback and changes, we have to merge all those comments and changes together. While working in a small team this can be pretty easy work, but as our editor team is

getting bigger then this kind of collaboration on content creating can be definitely difficult. A Wiki is just in place for this kind of applications - collaborative creating of content. Creating of content in a Wiki based application at the beginning simply means just creating the first version of content. Then additional changes to the content are tracked by a versioning system. This approach enables anyone to write down their comments to the content, change some parts or the whole content to fit their ideas or needs. Changes done by a single user are automatically published, so other users can continue in the editing process on the newest version of content, or if they like, they can edit any of a previous versions. Changes between different versions of the some content are showed in a user-friendly way by creating a diff view.



Fig. 1 – Diff view in Wikipedia

In more sophisticated Wiki like systems, multiple people can view and make changes at the same time. There may be an on-screen chat window for a document and revisions shows exactly who changed what, and when [3].

This all enables a very easy and yet more effective collaboration, while having a powerful tool in the background.

#### 1.2. Quality issues

Quality of a content created in a Wiki like systems may be sometimes a heavily discussed subject. Many discussions may be on the formatting of the content, i.e. using bold fonts or italics? Or using a flow layout or a delimited?

These issues can be addressed and solved by creating simple guidelines to define how the content has to look like. Other discussions on the quality may be on the content itself. This is more problematic; because some editor may think that his version is better than the others. This case can be solved automatically by having users to vote between two different versions, or by having a moderator or a reviewer who will decide which version is better.

The evolution of the content in Wiki systems, also with the helpful input from discussions, is almost always converging to the best. This process can be viewed and monitored by checking a history or/and a diff view with highlighting the changes between two versions.

### 1.3. Security issues

Wikis are generally designed with the philosophy of making it easy to correct mistakes, rather than making it difficult to make them. Thus, while Wikis are very open, they provide a means to verify the validity of recent additions to the body of pages.

[1] The open philosophy of most Wikis, allowing anyone to edit content, does not ensure that all editors are well-meaning. Vandalism can be a major problem. In Wiki sites, vandalism can go unnoticed for a period of time. Wikis by their very nature are susceptible to intentional disruption, known as "trolling". Wikis tend to take a soft security [4] approach to the problem of vandalism; making damage easy to undo rather than attempting to prevent damage. Larger Wikis often employ sophisticated methods, such as bots that automatically identify and revert vandalism and JavaScript enhancements that show how many characters have been added in each edit. In this way vandalism can be limited to just "minor vandalism" or "sneaky vandalism", where the characters added/eliminated are so few that bots don't identify them and users don't pay much attention to them. In larger Wiki systems, such as Wikipedia, where in the background a huge community of people and editors, this community is working as a system to control the vandalism issues.

The amount of vandalism a Wiki receives depends on how open the Wiki is. For instance, some Wikis allow unregistered users, identified by their IP addresses, to edit content, whilst others limit this function to just registered users. There is one drawback of this authentication: a big group of users can be hidden by a single IP address which is commonly used in MAN networks. What most Wikis do is allow IP editing, but privilege registered users with some extra functions to lend them a hand in editing. Basically, "closed up" Wikis are more secure and reliable but grow slowly, whilst more open Wikis grow at a steady rate but result in being an easy target for vandalism.

To provide the fast growing system, while having the official content on a high quality level, it worth to consider other approach: allow doing changes in a content to everyone, but deny automatic publishing and replacing of the official content with the just uploaded edited content. All changes will be available for everyone to view in a special moderator queue. In this case the moderator role has

to be implemented. Moderator has the privilege to say that the changed content is really better than the actual official content and it can replace it. This approach can be combined with other solutions which were described above. The pros of this solution is the high quality level of the content, on the other hand the cons are in a single point of failure - in a human moderator, and this solutions also brings a huge amount of responsibility on moderators.

## 2. NCTT

Cisco provides within its NetAcad program learning materials called curricula. Generally the curricula are available in English language and some courses are also available in other world languages (6 other languages). Unfortunately some students, who do not speak English as their mother tongue, have difficulties to study in English. The ideal situation would be to have the curricula translated into all languages. The translation process of curricula is very difficult to do on the official basis. First it requires a company which can provide a technical English translation, and then it requires constant upgrading when the original text changes and it all costs a huge amount of money.

NCTT (NetAcad Curricula Translation Tool) has been created to address this issue. NCTT is a set of applications and tools which allow easy and user-friendly translation process of a text part of the Cisco NetAcad official curricula. NCTT provide an easy way to view, create, edit and manage the translation of a curriculum text. The translation process is based on a Wiki like technology and generally every member of the NetAcad community can be a translator. The tool and the translations are provided as supporting materials for NetAcad students, not as a replacement of the original English curricula. Therefore the implementation of NCTT is tightly integrated to the original GUI of English curricula, and at the same time provides text in booth languages - the original English and the translated version.

### 2.1 NCTT Practical implementation

While having a nice idea of the NCTT tool, it was not easy to integrate it into the current GUI of curricula as much as it is possible. First ideas were to create just a web page where the translations will be stored, so if a student wanted to see a translated version, he would open a new browser window and locate the required translated text. This idea is not very user-friendly, therefore other ideas were developed.

The curricula are in their current version a HTML/CSS/JS based web pages (fig. 2). Adding our own HTML/CSS/JS code into these pages would allow adding our own GUI parts to the original GUI. Because we don't have access to servers where the curricula are stored, we generally cannot change the source code of curricula to implement our own GUI parts. Fortunately modern web browsers support plugins which can do almost anything with the displayed web page. Developing a browser plugin enables injecting our own code into the original HTML/CSS/JS code of the curricula. The NCTT web browser plugin was developed for Microsoft Internet Explorer and Mozilla Firefox web



browsers. The Mozilla Firefox version is platform independent and can be used by Microsoft Windows, Linux or other operating system users.



Fig. 2 – NetAcad curriculum

The plugin detects if the displayed page is a NetAcad curriculum, and if it is, then injects the NCTT code to the end of this page. After the NCTT code is loaded, new GUI parts are added to the original GUI. First just the language selector box is displayed (fig. 6). This box is used to select the required language of a translation. When a user selects a language from a language selector box, the original text part is horizontally divided into 2 same size parts. In the top part remains the original English text, and in the bottom part the required translation is downloaded (fig. 7) from the NCTT server. NCTT server generates the page which contains the translation and functional controls to edit and create a new version of the translated text.

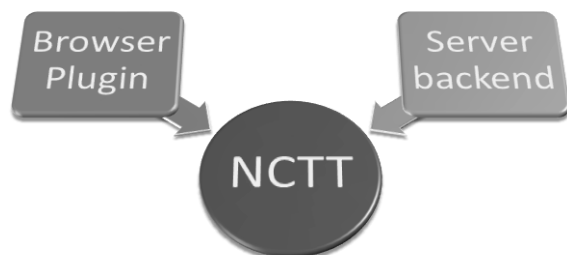


Fig. 3 – NCTT structure

Providing this service for all NetAcad members on the World means providing service with high availability (HA). The NCTT servers run on the Linux operating system, which has great clustering and HA possibilities. The NCTT server is connected with 100Mbps to the GEANT network. The application code on a server side is written in PHP5 and served by Apache web server. As a database backend the MySQL5 is used.

## 2.2 User friendly implementation

From the begging of the NCTT project the aim (goal???) was to provide a user-friendly implementation of the translation process. Then users don't have to spend much time by learning a new functionality, but they can easily and intuitively control this new tool.

After a successful install (Fig. 4 and 5) of the NCTT browser plugin for Mozilla Firefox or Microsoft Internet

Explorer (requires Administrator rights), the language selector box will be displayed in the supported NetAcad curricula (fig. 6).

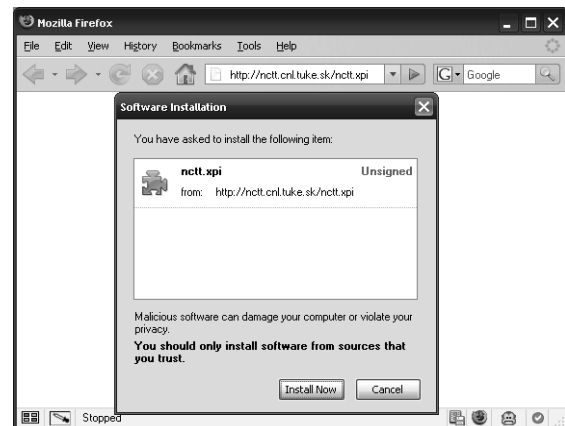


Fig. 4 – NCTT extension for Firefox

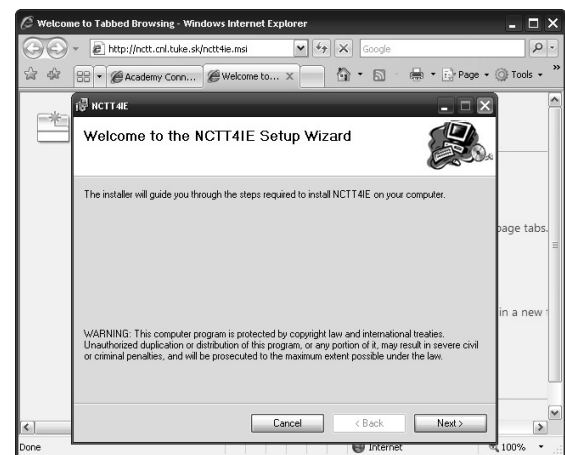


Fig. 5 – NCTT plugin for IE

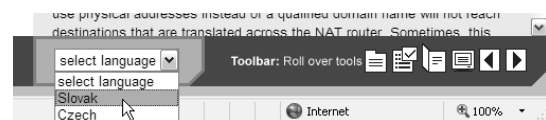


Fig. 6 – Language selector box

The injected NCTT code constantly monitors the displayed page, and after selecting the required translation from the Language selector box the text part of a displayed page is split into 2 parts and it was described below. Into the bottom part a new web page is downloaded from the NCTT server which contains the required translation with control buttons (fig. 7). To provide a tight integration with the original GUI the same formatting style are used also in the translated text as are in the original text.

After clicking to the edit button ("Edituj text" @ fig. 7) the displayed text is available to edit in the editor mode. To provide the formatting possibilities special tags are used. Most of this tags comes directly from the HTML specification ([b] for bold, [i] for italic, ...) and some are

NCTT specific as a star character ' \* ' which is used to create a list.

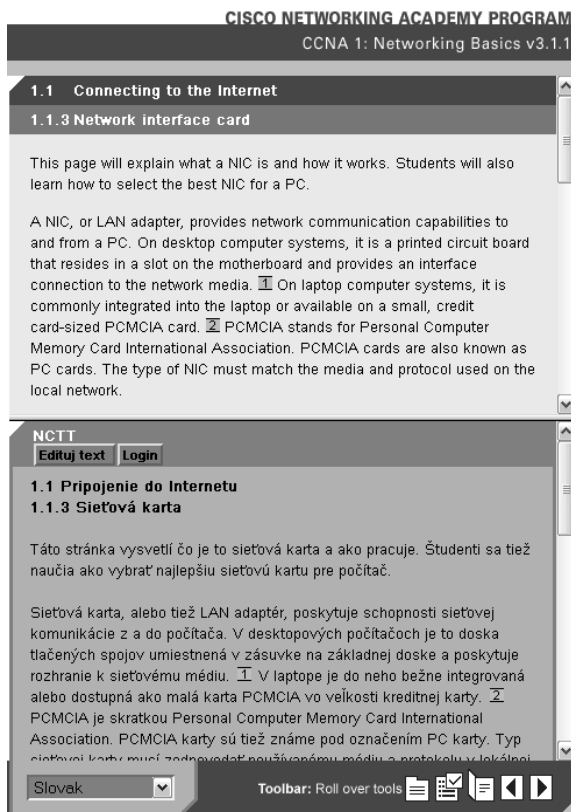


Fig. 7 - NCTT view mode

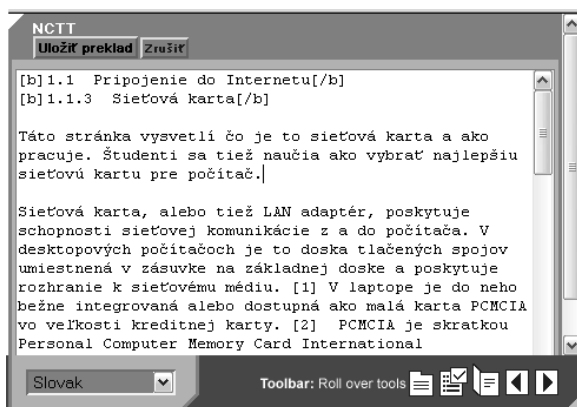


Fig. 8 – Editor mode

The new version which was written in the editor mode can be saved by clicking on the Save button ("Ulozit preklad" @ fig. 8) or canceled by clicking on the Cancel button ("Zrusit" @ fig. 8).

Users can login to the NCTT with their Academy Connection Username and Password to sign their translations and to access the moderator mode which is available only for privileged users (moderators). Big advantage is that users don't have to have a new authentication username and password but they can directly use their username and password used on NetAcad. The

actual development process around the authentication is now about a single sign-on solution.



Fig. 8 – Login

After clicking on the Login button, the provided username and password is authenticated against the Academy Connection (fig. 8). After a successful authentication a welcome message with a user privileges is displayed on by the NCTT text (fig. 10).

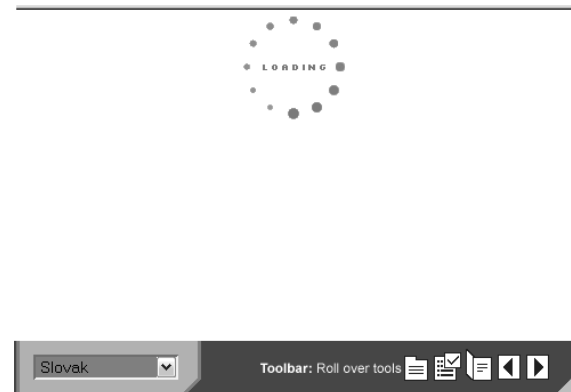


Fig. 9 - Validating the username and password

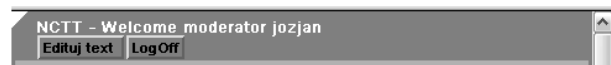


Fig. 10. - Welcome message

When a new version of a translated text is created in the editor mode, it's not directly published as a new official version as it is in traditional Wiki systems (e.g. Wikipedia), but it is put into a moderating queue (fig. 11). This queue then contains all edits which were saved and now are waiting for a moderator to accept and make official the best version. Viewing translations is the queue is available for every user, but only a moderator can approve them.

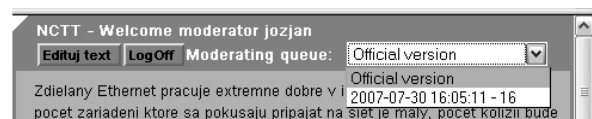


Fig. 11 - Moderating queue

After selecting a new version from the Moderating queue menu, the requested version is displayed for viewing. An additional button is then displayed which allows to switch to a diff view. Diff view highlights the changes between the officially approved version and the new version (fig. 12). If the logged in user has a status of a moderator then another button is displayed which is used to Make the just displayed version an official version. After clicking on this button, all other versions which were created are put into an archive.

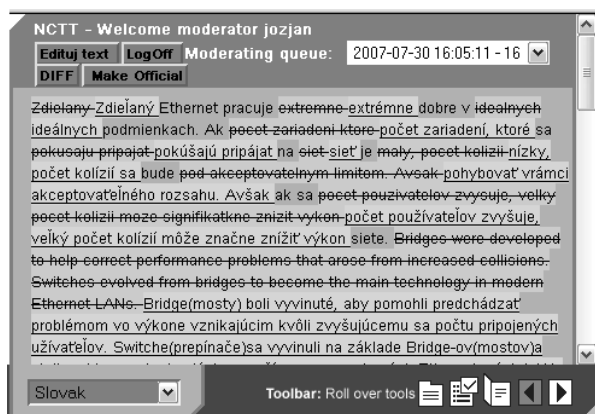


Fig. 12 - diff view

### 3. NEED FOR A MODERATION

The open philosophy of most Wikis, allowing anyone to edit content, does not ensure that all editors are well-meaning. This issue can be addressed with sophisticated systems which can detect bots or malicious inputs. In huge communities, the community itself is able to maintain the Wiki clean as much as possible. Most of these solutions are based on generating some diff views between submitted versions and comparing them. If everyone can directly publish changes in content, then it can lead to huge changes of content, because some editors may think that their version is better than the others. Some companies may also require not publishing their own intellectual properties or information or even advertisements to other companies. To provide this level of quality of officially published content the moderators role and the moderation process has to be defined.

There is one drawback of the moderation, and it is a slower growing of a created content. When a moderator is a human, he has to check every day the new changes (or this information can be delivered to his email by an automatic system) and then he has to choose which uploaded version in his moderator queue is better, which will be published as a new official version. This makes the whole system slower, the reaction time depends on the moderators, but on the other hand, the officially published content is always (or at least in most cases) valid without malicious inputs.

#### 3.1 NCTT Moderation process

At the begging of the NCTT project, the edited translations were automatically published as new official versions, like it is implemented in conventional Wiki systems. After a testing phase of this open system, the moderation process was implemented to protect the already created translations and to provide some level of control of the translation process.

When a new version of a translated content is created in the editor mode, it is not anymore directly published as a new official content, but it is put into the moderating queue.

Access to this queue is implemented in a GUI of NCTT as a dropdown menu. This menu is visible and available for all users, so everyone can review the text waiting for a moderator. To highlight the changes between the just viewed version and the official version users can enable the diff view which provides this feature. On the same way as the official content version, the content versions in the moderating queue can be directly edited by clicking on the Edit button and enabling the editor mode. After saving the changes, the edited text is saved as a new version to the moderating queue. If a user was logged in to the NCTT, while doing a translation working with the editor mode, every change is signed with his username. This may be useful information while generating some statistics of the translation process.

When a moderator is logged in into the NCTT, he has an additional functionality enabled - he can approve which version in the moderating queue will be published as a new official version. If he decides to do some changes in the viewed version, he can edit in by switching into the editor mode and saving his changes as a new version to the queue. After selecting and approving a new official version from the queue, all other versions which were created prior to the moderating time are placed to the archive.

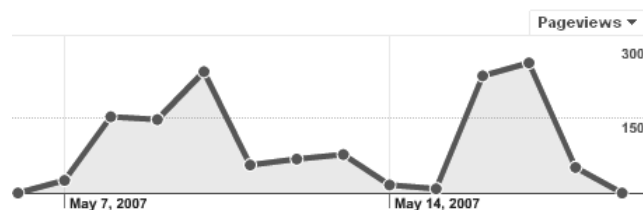
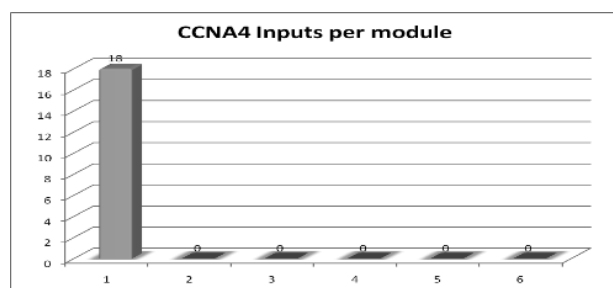
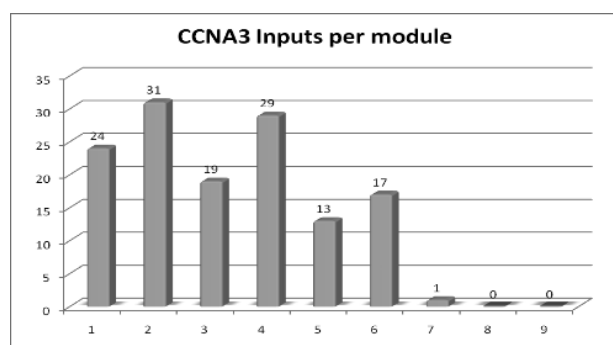
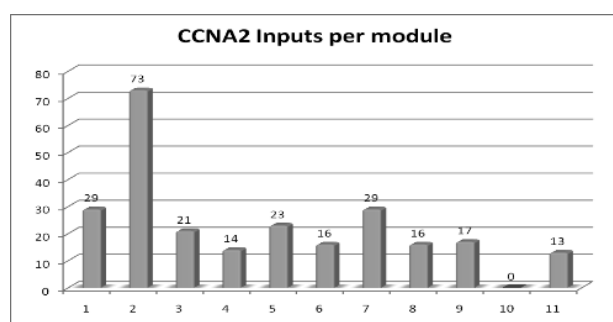
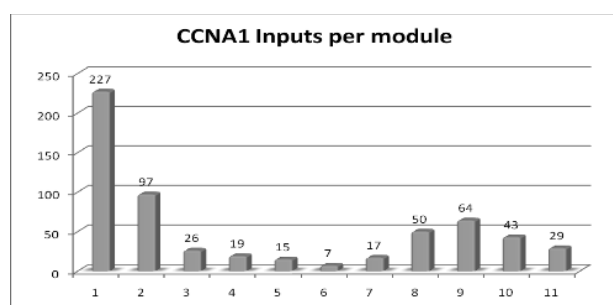
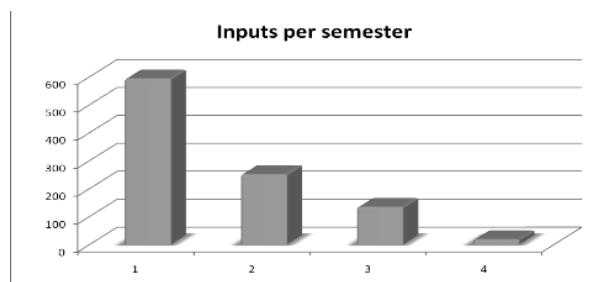
### 4. EVALUATION OF NCTT

Information about NCTT tool was officially presented to the NetAcad community on Annual NetAcad conference in Prague (12.-13.4.2007) and academics showed great interest become involved in project. Afterwards information about project was send to all schools involved in NetAcad program in Slovakia (54 schools). They obtained access to the NCTT tool and they received instruction about usage.

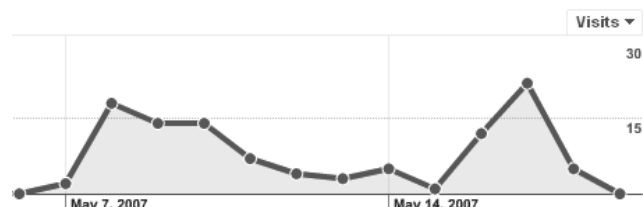
The 1st phase of the NCTT tool implementation was realized from 15th April till 15th May in Slovakia. During this phase only the CCNA curricula were supported. Totally 21 academies were involved in testing phase. They informed us about testing process (they send us information on which part of the curricula they take part). Mostly NetAcad program instructors were involved in this particular phase. Instructors together with students tried to create subsidiary translations of the NetAcad curricula in past – to make study easier. This pilot phase allowed legalizing prepared translations and making them available via NCTT tool to all NetAcad community. In four academies they allowed students use the NCTT tool in study, even if it was not the 1st phase main goal. The student's reactions which encounter the translation tool were very positive.

The primary intention was concentrate on translation of the CCNA1 materials; however during the evaluation of the project 1st stage it turned out that also other semesters (CCNA2, CCNA3 and small part of CCNA4) were translated.

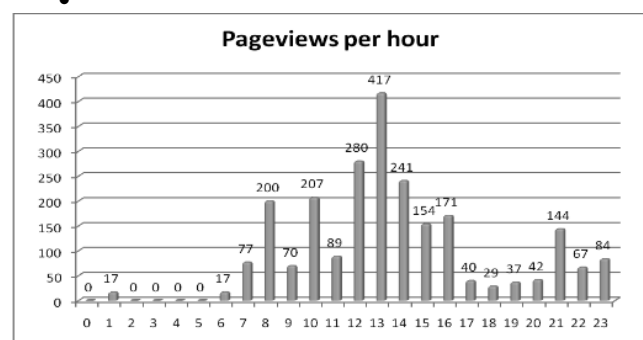
Statistical data about 1<sup>st</sup> phase process:



- Amount of the new visitors from 6<sup>th</sup> May 2007 till 20<sup>th</sup> May 2007



- Access distribution per time



## Results:

- The NCTT tool was accepted by the NetAcad community with great appreciation and they showed great interest in its use during the education process.
- Especially simplicity of the NCTT tool was appreciated – it could work practically without any restrictions and without any violation of existing curricula.
- Developed solutions appeared to be stable and steady enough – no operational problems arose during the monthly pilot operation phase.
- According to the users' suggestions, it is necessary to put in practice the new authorization of edited text.
- It is necessary to develop a model for authorization of text revisions.
- It was recommended to continue in the project by 2<sup>nd</sup> stage (see below) with maximal tool extension for all NetAcad students and instructors in Slovakia and for selected countries.

During the 2<sup>nd</sup> phase (May - August 2007), after reviewing users' feedback, additional development created new features like the moderation, some changes have been done to the GUI and the support of the NCTT was extended also to cover other courses and curricula. During this period other countries are also involved in trials.

## 5. REFERENCES

- [1] <http://en.Wikipedia.org/Wiki/Wiki>
- [2] [http://en.Wikipedia.org/Wiki/Metcalfe%27s\\_law](http://en.Wikipedia.org/Wiki/Metcalfe%27s_law) via [http://en.Wikipedia.org/Wiki/Collaborative\\_software](http://en.Wikipedia.org/Wiki/Collaborative_software)
- [3] <http://www.google.com/google-d-s/intl/en/tour2.html> via <http://docs.google.com/>
- [4] <http://www.usemod.com/cgi-bin/mb.pl?SoftSecurity>

## THE AUTHORS



**František Jakab** was born in 1959. He received the MSc. degree in Systemotechnic engineering at the St. Petersburg Electrotechnical Institute (Russia) in 1984 and the PhD. degree in 2005. He is employed as an assistant professor at the Department. of Computers and Informatics of the Technical University of Košice, Slovakia. He is a head of the Computer Engineering Group and Computer Networks Laboratory ([www.cnl.tuke.sk](http://www.cnl.tuke.sk)). His research interests include projecting of computer network, modeling, simulation and network management, new form of multimedia-based communication, QoS, telelearning systems, intelligent tutoring systems. He has been a coordinator of several large

international e-learning oriented projects supported by EC. He is a coordinator of the Cisco Networking Academy Program for the Slovak Republic and head of the Application Section of the Communication Technology Forum Association in the Slovak Republic. You can contact him at [frantisek.jakab@tuke.sk](mailto:frantisek.jakab@tuke.sk).



**Jozef Janitor** is student at Technical University in Košice. As a member of the Computer Network Laboratory he is active in the field of VoIP implementation and integration in the heterogeneous environments. You can contact him at [Jozef.Janitor@cnl.tuke.sk](mailto:Jozef.Janitor@cnl.tuke.sk).

**Jan Genčí** is a researcher and a university teacher at Technical University of Kosice. His research areas are database algorithms optimalization are automatized translation systems.

**Karol Kniewald** is the Cisco NetAcad Area Academy Manager for Czech Republic.

**Vladimir Sidimak** is student at Technical University in Košice. As a member of the Computer Network Laboratory he is active in the field of video streaming technologies and web design.





5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications  
The High Tatras,  
Slovakia  
September 6-8, 2007

## IMPLEMENTATION CISCO NETWORKING ACADEMY PROGRAM INTO STUDY PROGRAM FOR GRAMMAR SCHOOLS.

Ivica Kovacova

Grammar school M. Galandu, Turcianske Teplice, ivica\_kovacova@gymtut.edu.sk

**Abstract.** The contribution relates to implementation Cisco Networking Academy Program as an optional subject the Network Technology into study program for grammar schools. The first part considers the proposal of three basic models of introduction the subject. The second one considers results of research of students' attitude to possibility of subject choice for the orientation.

**Keywords.** Proposal of the curricula. 1<sup>st</sup> model. 2<sup>nd</sup> model. 3<sup>rd</sup> model. Research of students' point of view.

### 1. INTRODUCTION

The Cisco Networking Academy Program is a comprehensive e-learning program that provides students with the Internet technology skills essential in a global economy. The Networking Academy delivers web-based content, online assessment, student performance tracking, hands-on labs, instructor training and support, and preparation for industry standard certifications.

Implementation of this program into study program for grammar school has not been authorised yet. Every school has its own way of introducing of the program although curricula and exams are standardised and equal for students all over the world. It is the reason why I tried to create the proposal of CCNA into study program for grammar school. I have chosen the secondary school because I am experienced with this type of schools. The program should be implemented to optional subject with the name the Network Technology. The content of the subject is the same as Cisco Networking Academy Program.

### 2. PROPOSAL OF THE CURRICULA OF SUBJECT NETWORK TECHNOLOGY

The base of the proposal is the content of the modules of Cisco Networking Academy Program version 3.1. According to my experiences I suggest the introduction of three basic models of the subject the Network technology into study program:

- Every semester of NetAcad expanded in separated school year with interval two lessons weekly
- Two semesters for the duration of one school year with interval two lessons weekly
- Two semesters for the duration of one school year with interval four lessons weekly

According to the 1st model 66 lessons in school year are planned for the first three semesters, it means 2 lessons weekly for the duration three school years. In the 4<sup>th</sup> semester 48 lessons is planned because of the shortened

content. It is advantageous for the students finishing the grammar school. One lesson for each partial exam is planned and two lessons are planned for the final exam. In my opinion, after each partial exam it is essential that the instructor points out all the mistakes to students.

As to the 2<sup>nd</sup> model, the students would have to study the theoretical part by themselves and lab activities would practise at school. There are several combinations possible.

The suggested aims that should be fulfilled have been defined according to NetAcad modules. The proposal of the Network technology subject curricula is based on curricula of the 1<sup>st</sup> – 4<sup>th</sup> semester Cisco Networking Academy Program. The program enables students to train theoretical knowledge in laboratories. It is possible to use simulating programmes in computers. The benefit of the subject is also to integrate several school subjects: informatics, physics, mathematics and English.

I suggest three basic models:

1<sup>st</sup> model: Every semester of NetAcad expanded in separated school year with interval two lessons weekly

1<sup>st</sup> year - 1<sup>st</sup> semester:

- Theory – 22 lessons
- Labs – 22 lessons
- Exams – 15 lessons
- Projects – 7 lessons

2<sup>nd</sup> year - 2<sup>nd</sup> semester:

- Theory - 21 lessons.
- Labs - 29 lessons
- Exams - 13 lessons
- Projects - 3 lessons

3<sup>rd</sup> year - 3<sup>rd</sup> semester:

- Theory – 20 lessons
- Labs – 28 lessons
- Exams – 12 lessons

- Projects – 6 lessons

#### 4<sup>th</sup> year - 4<sup>th</sup> semester:

- Theory – 18 lessons
- Labs – 16 lessons
- Exams – 8 lessons
- Projects - 6 lessons

2<sup>nd</sup> model: Two semesters for the duration of one school year with interval two lessons weekly

#### 3<sup>rd</sup> year - 1<sup>st</sup> semester:

- Theory – self-study
- Labs – 22 lessons
- Exams – 2 lessons (final exam)
- Projects – 7 lessons

#### 3<sup>rd</sup> year - 2<sup>nd</sup> semester:

- Theory– self-study
- Labs – 29 lessons
- Exams – 2 lessons. (final exam)
- Projects – 4 lessons

#### 4<sup>th</sup> year - 3<sup>rd</sup> semester:

- Theory– self-study
- Labs – 28 lessons.
- Exams – 2 lessons. (final exam)
- Projects – 4 lessons.

#### 4<sup>th</sup> year - 4<sup>th</sup> semester:

- Theory – self-study
- Labs – 16 lessons.
- Exams – 2 lessons. (final exam)
- Projects - 4 lessons.

3<sup>rd</sup> model: Two semesters for the duration of one school year with interval four lessons weekly – it takes the same time as the 1<sup>st</sup> model.

According to the first model - every semester of NetAcad expanded in separated school year with interval two lessons weekly:

#### **1<sup>st</sup> school year: Networking Basics (66 lessons)**

Content:

hardware and software PC  
network terminology and protocols  
local area networks (LAN)  
wide area networks (WAN)  
Ethernet  
Open system interconnections (OSI)  
Transport Control Protocol/Internet Protocol (TCP/IP)  
IP addressing  
cabling, cabling tools

- networks standards

Aims:

Define the structure and technologies of modern computer networks

Describe the major properties and standards associated with copper and optical media used in networks

Describe the similarities and differences between LAN and WAN

Identify and describe the similarities and differences between OSI model and TCP/IP model

Demonstrate familiarity with all aspects of IP addressing and subnetting

Install a simple LAN

Describe the different topologies and physical issues associated with cabling common LANs

List the major TCP/IP application protocols and briefly define their features and operation

#### **2<sup>nd</sup> school year: Routers and routing basics (66 lessons)**

Content:

User interface, components and initial router configuration

Cisco IOS software management, managing configuration files and IOS images, the IOS naming convention

TCP/IP, IP addressing and subnetting,

Routing protocols - RIP, IGRP

Access control lists (ACL)

Aims:

Identify the key characteristics of common WAN configurations and technologies

Describe the role of a router in a WAN

Explain the fundamental operation of the routing operating system (IOS)

Manage system image and device configuration files

Identify, configure, and verify the use of static and default routes

Configure, verify, analyze, and troubleshoot simple distance vector routing protocols

Troubleshoot by sequential testing of OSI layers

Analyze, configure, implement, and verify access control lists within a router configuration

#### **3<sup>rd</sup> school year: Switching basics and intermediate routing (66 lessons)**

Content:

IP addressing techniques, Variable Length Subnet Masking (VLMS)

Intermediate routing protocols RIP v2, single-area OSPF, EIGRP

Command-line interface configuration of switches

Ethernet switching and Virtual LANs (VLSM)

Spanning Tree Protocol (STP)

VLAN Trunking Protocol (VTP)

Network documentation, security and troubleshooting

Aims:

Compute and use VLMS techniques to design and implement effective IP addressing

Configure and use routing protocols RIP v2, OSPF and EIGRP

Describe and compare the concepts and techniques used by Ethernet LAN switches

Configure and administer a Cisco Catalyst LAN switch



Describe the operation of the spanning tree algorithm and describe the methods by which is implemented and used in a switched network

Configure VTP on switches.

Configure and administer inter-switch VLANs and routing between VLANs on Cisco switches

Solve a simple VLAN problem

#### **4<sup>th</sup> school year: WAN technologies (48 lessons)**

Content:

IP addressing techniques (Network Address Translation [NAT], Port Address Translation [PAT])

Dynamic Host Configuration Protocol (DHCP)

WAN technology and terminology (PPP, ISDN, Frame Relay)

Point-to-Point (PPP) and High-level Data Link Control (HDLC) encapsulation

Configuration WAN technologies

Network management

Aims:

Describe the concepts and characteristics of NAT and DHCP

Describe, compare and contrast the essential features of WAN technology

Configure and administer PPP on serial link

Describe the concepts, characteristics, and functionality of ISDN and Frame Relay

Configure and administer a router ISDN interface

Configure and administer Frame Relay using PVCs

Describe the concepts of network management, and explain using network management tools on a modern network

### **3. RESEARCH OF STUDENTS' POINT OF VIEW TO INTRODUCTION OF THE SUBJECT THE NETWORK TECHNOLOGY**

#### **AIMS OF THE RESEARCH**

When I formed the proposal of the curricula I was interested in point of view of the students who studied NetAcad. My proposal of curriculum was suggested with respect to their responses.

The research was realised by the form of anonymous electronic questionnaire with participation of five grammar schools. 67 fulfilled questionnaires were returned.

The students were asked to complete the questionnaire with 15 points. The questionnaire was divided into two parts. The first part considered basic information about students: current semester, satisfaction with subject choice, difficulties to pass lessons, study resources and study language. The second part was orientated on students' point of view to introduction of the subject the Network Technology: number of NetAcad semesters in a school year, number of lessons per week, expectations after the end.

#### **RESULTS OF THE RESEARCH**

**Tab. 1**

|                            |          |      |
|----------------------------|----------|------|
| Gender                     | Male     | 93 % |
|                            | Female   | 7 %  |
| My current semester        | First    | 48 % |
|                            | Second   | 27 % |
|                            | Third    | 7 %  |
|                            | Fourth   | 18 % |
| I want to graduate NetAcad | Yes      | 78 % |
|                            | Not sure | 21 % |
|                            | No       | 1 %  |

**Tab. 2**

|                                 |                                  |      |
|---------------------------------|----------------------------------|------|
| Difficulties to pass lessons    | No problems                      | 37 % |
|                                 | Normal problems                  | 63 % |
|                                 | Big problems                     | 0 %  |
| Difficulties are caused by      | Language skills                  | 55 % |
|                                 | Subject of the lessons           | 21 % |
|                                 | Both possibilities               | 14 % |
|                                 | Other problems                   | 10 % |
| Time to prepare for the lessons | I have enough time               | 61 % |
|                                 | I have not enough time sometimes | 25 % |

**Tab. 3**

|                        |   |      |
|------------------------|---|------|
| Materials for studying | I translate to Slovak language              | 21 % |
|                        | Somebody else translates it for me          | 7 %  |
|                        | I study in English                          | 72 % |
|                        | I study in other language                   | 0 %  |
| Study resources        | I use basic materials                       | 64 % |
|                        | I use also links recommended in the lessons | 10 % |
|                        | I use another information                   | 25 % |

**Tab. 4**

|  |   |      |
|--|---|------|
| Organization of the subject                                | Each semester in separate school year         | 70 % |
|  | Two semesters in one school year              | 30 % |
|  | Another suggestion                            | 0 %  |
| How many semesters do you want to finish in grammar school | 4 semesters                                   | 69 % |
|  | 3 semesters                                   | 10 % |
|  | 2 semesters                                   | 21 % |
| Time schedule  | 2 lessons per week                            | 46 % |
|  | 4 lessons per week                            | 34 % |
|  | Selfstudying and laboratory lessons in school | 16 % |
|  | Another suggestion                            | 3 %  |

**Tab. 5**

|  |                |      |
|--|----------------|------|
| My satisfaction with course choice                 | Very satisfied | 33 % |
|  | Satisfied      | 57 % |
|  | Less satisfied | 10 % |
|  | Not satisfied  | 0 %  |
| Applicability of acquired skills in my future life | Yes            | 67 % |
|  | Maybe          | 28 % |
|  | Probably no    | 3 %  |
|  | No             | 1%   |

**Tab. 6**

|  |                                       |      |
|--|---------------------------------------|------|
| Recommendation of CCNA for other students    | Yes                                   | 37 % |
|  | Probably yes                          | 60 % |
|  | Probably no                           | 3 %  |
|  | No                                    | 0 %  |
| What do you expect from studying of NetAcad? | New skills a knowledge                | 33 % |
|  | It can be helpful for my next studies | 15 % |
|  | It can be helpful for my job          | 30 % |
|  | Nothing                               | 4 %  |
|  | Studying in Slovak language           | 3 %  |
|  | I don't know                          | 6 %  |
|  | No answer                             | 9 %  |

## 4. CONCLUSION

In my contribution I tried to suggest several possibilities to implement Cisco Networking Academy Program as an optional subject the Network Technology into study program for grammar schools. My research confirmed that the introduction of the subject could be effective. The subject gives new opportunities to obtain skills and knowledge for students. The students themselves expect to be more successful at the future studies and at the future jobs. They improve their English and they are very satisfied with e-learning program which offers students an opportunity to pursue IT curricula through online instructor-led training and hands-on lab exercises.

## 6. REFERENCES

- [1] [http://cisco.netacad.net/cnams/course/ViewCurriculumI E.jsp;jsessionid=1712769AAE2DCC6EA81385CE63298528.tc\\_2\\_2?USA](http://cisco.netacad.net/cnams/course/ViewCurriculumI E.jsp;jsessionid=1712769AAE2DCC6EA81385CE63298528.tc_2_2?USA)
- [2] <http://www.cisco.com/web/learning/netacad/academy/About.html>
- [3] <http://www.cisco.com/global/sk/NetAcad/popis.shtml>

## THE AUTHOR



**Ivica Kovacova**, teach informatics, is an instructor NetAcad program in LCNA in a Grammar school M. Galandu, Turcianske Teplice.



5<sup>th</sup> Int. Conference on  
Emerging e-learning  
Technologies  
and Applications

The High Tatras,  
Slovakia  
September 6-8, 2007

## NETACAD PROGRAM: HOW WE IMPLEMENT IT AT THE FACULTY OF MANAGEMENT SCIENCE AND INFORMATICS, UNIVERSITY OF ŽILINA

Pavel Segeč, Tatiana Kováčiková, Milan Kubina

University of Žilina, Faculty of management science and informatics, Department of InfoComm networks, Univerzitná 8215/1, 010 26 Žilina, Slovak republic

Tel.: ++ 421 41 5134 323, Fax.: ++ 421 41 5134 312

e-mail: {Tatiana.Kovacikova, Pavel.Segec, Milan.Kubina}@kis.fri.uniza.sk

web.: <http://www.kis.fri.uniza.sk>

**Abstract.** Paper gives an analysis of possibilities how to establish a university studies in a networking based on standardized educational programs. The paper describes implementation of NetAcad program for creating such networking study at Bachelor programs Informatics and Computer engineering and Master program Information systems at University of Žilina, Faculty of management science and informatics. The NetAcad program is worldwide used and very popular elearning education system. The program includes web-based courses with engaging activities such as animated simulations, videos, and interactive quizzes, along with valuable “hands-on” lab exercises for real networking experience. The study programs based on the NetAcad program allow students, which are interesting on networking, expand their current IT (Information Technology) knowledge and reach deep theoretical and practical knowledge and skills. The graduate students are prepared to start their career in a current IT industry.

**Keywords:** Networking, NetAcad, study, academy, elearning, self education, networks

### 1. INTRODUCTION

There are many analyzes worldwide, which points out the problem of missing networking professionals, needed by IT market. There are requirements for thousands of IT experts, which modern economics needs for usage of modern technologies and improved its competition and this job market needs are still growing. Such situation creates pressure for new, standardized forms of education in the field of IT. Some analysis was created in [4]. The networking education we understand as a self-contained field of study with its own particularities. Respect mentioned, at the Faculty of Management Science and Informatics a bachelor and a master study in networking was created, so student has the possibilities to study networking within his bachelor study programs and master study program. After first of three year's bachelor study, the student can select specialization Networking. The networking studies contain courses based on the NetAcad program of associate and professional levels, a worldwide used and popular elearning education system, which allows students reach a deep theoretical knowledge and practical skills in networking.

### 2. ABOUT FACULTY OF MANAGEMENT SCIENCE AND INFORMATICS, UNIVERSITY OF ŽILINA

Faculty of Management Science and Informatics (FRI) at University of Žilina was established on 1990 by integration of several departments from two faculties of University of

Transport and Communications. Department of technical cybernetics and its students from the former Faculty of mechanical and electrotechnical engineering, Institute of transport development, Department of languages, Department of mathematical methods and Department of transport economy of Faculty of operation and economics of transport and communications.

Academic senate ratifies its establishment on 11 July 1990 under name of Faculty of management; on 1996 it was renamed to Faculty of management science and informatics. Study programs at FRI outline and follow up more than twenty year old teaching tradition and experience in the area of technical cybernetics and ten years old experience on study program Information and control systems and Applied mathematic. Main activities of FRI are determined by new trends on information and communications technologies development, where priority task is place on continuous integration of research, education and success of graduate students.

There are two basic levels to the study programs of the FRI, a three-year Bachelor program and a two-year follow-up Master program. Faculty is accredited on study programs Informatics, Management, Computer engineering at bachelor level and on study programs Information systems, Information management, Economic informatics, Computer engineering at master level. Nowadays on FRI is studying more than thousand students of all programs and levels.

FRI has more than fifteen years experience in networking teaching. The main responsibility for teaching networking was given to the Department of InfoCom Networks (DoIN), which was established in December 1990.

The department staff was created from people with telecommunication background (from Department of telecommunication technology) and people with computer networks background (from Department of applied cybernetics).

The department activities are oriented to theoretical and practical aspects of information and communication technologies. They are focused mainly on studies of service properties that are supported by next generation networks from of performance, signalling and QoS point of view as well as development of such as services.

Applied research is oriented to e-learning services, standardisation of NGN networks, evaluation and measurement of speech quality, text-to-speech systems, and NGN network planning. The department participates on international projects as well as on national grant projects

### 3. ABOUT THE NETACAD PROGRAM

The Cisco Networking Academy Program (NetAcad program) launched in October 1997 with 64 educational institutions in seven states, the Networking Academy has spread to more than 150 countries. Since its inception, over 1.6 Million students have enrolled at more than 10,000 Academies located in high schools, technical schools, colleges, universities, and community-based organizations.

The NetAcad program is a comprehensive e-learning program that provides students with the Internet technology skills essential needed in a global economy. The Networking Academy delivers web-based content, online assessment, student performance tracking, hands-on labs, instructor training and support, and preparation for industry standard certifications.

To educational institutions interested in program are given the designation of Networking Academy at the level of training that they will be providing in the program. There are three possible tiers of training. At the Cisco Academy Training Centers (CATCs), industry experts at Cisco Systems train the Instructor Trainers, the CATC Instructors train Regional Academy (RCNA) Instructors and the Regional Academy Instructors train the Local Academy (LCNA) Instructors who then educate students.

The Internet enables anytime, anywhere learning for all students, regardless of location, socio-economic status, gender, or race. The Networking Academy program continually raises the bar on e-learning and educational processes. Through community feedback and electronic assessment, the Academy program adapts curriculum to improve outcomes and student achievement. The Academy infrastructure is designed to deliver a rich, interactive, and personalized curriculum to students around the world.

### 4. PROCEDURE OF IMPLEMENTING NETACAD PROGRAM AT DOIN

Needs for educated network professionals are still growing and it creates pressure for new, standardized forms of education, which will prepare well educated and prepared students following job market requirements. Respecting

mentioned, DoIN as department of FRI responsible for teaching networking, made decision to participate in the NetAcad program, which is de facto standard in the networking education, and to introduce NetAcad courses to our students. During June 2000 DoIN signed agreement and it has become Local Cisco Networking Academy (LCNA) of NetAcad program. The participation in the NetAcad program immediately led to introduction of new networking study courses during the next school year 2001/2002 into the bachelor study programs and master study program at our faculty. New courses are completely based on the NetAcad courses, associate or professional levels.

Following NetAcad program requirements, the specialized networking laboratories with bundles of network equipments, network infrastructure and measurement equipments was built. For courses based on the associate level (CCNA1 to CCNA4) during the year 2001 and for courses based on the professional level (CCNP1 to CCNP4) during the 2006.

In May 2002 was signed a new agreement and DoIN has become the fourth Regional Cisco Networking Academy (RCNA) of the NetAcad program in Slovakia.

Nowadays there are teaching seven RCNA academy instructors, three of them are Cisco certified associate instructors (CCAI). Every year there are around four hundred students, graduated their networking courses.

### 5. INTEGRATION OF NETACAD COURSES INTO STUDY PROGRAMS

In present days networking courses based on NetAcad are integrated into study program at our faculty by two separate ways depends on the study programs.

| Semester | Course title        | Course type |
|----------|---------------------|-------------|
| 3th      | Computer networks 1 | Optional    |
| 4th      | Computer networks 2 | Optional    |
| 5th      | Computer networks 3 | Optional    |
| 6th      | Computer networks 4 | Optional    |

Table 1. First implementation model.

Since 2001, when the courses were introduced, until summer 2007, when the existing five years engineering study program Information and control systems will end, NetAcad courses CCNA1 to CCNA4 were completely integrated into this bachelor and engineering study program as four optional courses in computer networking, named Computer networks 1 (based on CCNA1) to 4 (CCNA4). Time extent was dimensioned with zero hour's lectures, four hours practical lessons per week. Duration of semester is thirteen weeks, which provides time dimension of fifty-two hours per class and course. During the four hours lesson the first hour was reserved for testing, remaining three for practise. The main purpose of courses were allow students expand their knowledge and practice skills in the area of networking and expands the existing topics of the other mandatory courses focusing on computer networks.

Following years 2004/2005 a new university study model was introduced; with three-year bachelor study program and two-year master study program. This new study model led to completely redesign of provided networking education and a new study in networking was created. The faculty has accreditation for a new bachelor programs Informatics and Computer engineering, and a new master program Information Systems. Networking can be studied within these programs.

| Semester of study | Course title                        | Course type |
|-------------------|-------------------------------------|-------------|
| 1th               | Communication systems               | Mandatory   |
| 3th<br>4th        | Computer networks (CCNA 1, 2, 3, 4) | Optional    |
| 5th               | Broadband communication             | Optional    |

Table 2. Second implementation model.

At the bachelor level there are three courses specialised to networking, which main purpose is prepare well bachelor graduates for requirements of the practise.

Course Communication systems is first of them, which is mandatory in the first year of study for all students of Informatics and Computer engineering bachelor programs. The course is supported by e-learning. This is an introductory course to networking that gives basic ideas to all students and motivates some of them to join subsequent courses in networking.

Second course Computer networks follows within two semester's course during the second year of study. The course integrates the NetAcad program courses CCNA1 to CCNA4. CCNA1 and 2 are provided during first half of course (winter semester) and CCNA3 and 4 during second half (summer semester) of Computer networks course. Time extent is dimensioned with two hours lectures, four hours practical lessons per week with remote testing, which help us no consume time designated for laboratory practical work. Laboratory works completely contain practical lessons from CCNA laboratory manuals, the lectures extend content to teach students how to specified, implement, test, maintain and support communication network of small and medium enterprise and help them for lessons. Due to time requirements of course and lecturers busyness, we are limited to accept only eighty students per year. Therefore we accept only students with best study results.

The last course in this sequence is the course Broadband communication, that gives a deeper view to the high-speed networks and it is supported again by laboratory. The course is provided during third year of bachelor study.

After first of tree year's bachelor study, the student can selects specialization Networking within master study program Information systems, where the graduates gain deeper theoretical knowledge in their specialization. For the admission process, apart from others, we have requirement, students which would like to attend this specialization must pass all three mentioned courses from bachelor level of their study. For students of the networking specialization

we are preparing courses which are also based on NetAcad courses, but at professional level (CCNP1 to CCNP4) and some courses based on sponsored curriculums (Fundamentals of network security, IP telephony). For the creation of these new courses we assume mapping formula one professional course will be integrated to one study course. There are also some other courses (Network integration, Network architectures) which require passing courses based on NetAcad. We expect twenty masters program students per year.

We suppose also students of secondary schools from LCNAs, which have successfully finished NetAcad CCNA study, will be able study networking faster or more deeply by applying for additional networking courses. CCNA certified students are recognised as students with fulfilled duties in Computer network course labs.

## 6. TECHNICAL ASPECTS OF THE TUITION

The NetAcad courses place emphasises on practical laboratory classes where students can practise establishing, configuration and troubleshooting different network scenarios. For the purpose of teaching these specialized courses, using operating funds of DoIN, was constructed two specialized laboratories, RB301 and RB303. Laboratory RB301 is equipped with set of Cisco switches and routers required for providing CCNP courses or study courses based on CCNP. The laboratory contains ten workstations, necessary cabling and other tools. Laboratory RB303 is equipped with sets of Cisco switches and routers required for providing CCNA courses or study courses based on CCNA. The laboratory contains twenty-one workstations, necessary cabling, measuring devices, Fluke analyzers and other tools.

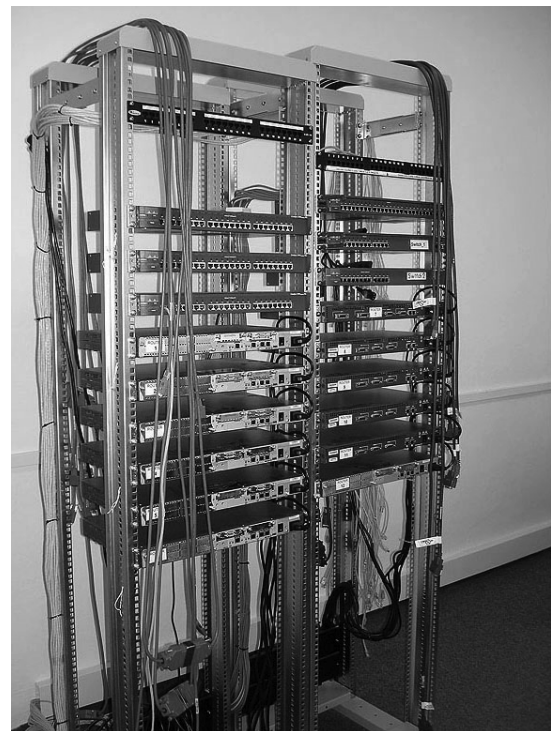


Figure 1. RB303 NetAcad laboratory.

First way of NetAcad program implementation is based on controlled self study of students through LMS portal of the NetAcad program, followed by practical laboratory work under individual class instructor leadership with no other lectures required. Course classes are organized into small groups of students (seven to twelve), with all activities planned and executed at the lab session with four hours per week periodicity. During the lab sessions instructors presents topics of the session and they lead practical labs. Classes are kept in a specialized networking laboratory, where students have enough time during the lab session to practice with the equipment and to troubleshoot topologies.

The second way of NetAcad program implementation follows practically the same way as a first one, but courses are extended for lectures with 2 hours per week periodicity. During lectures instructors presents the study material for a study week. The second purpose of the lectures is present students new, emerging networking technologies provided a rich overall theoretical networking knowledge.

The CCNA courses are free of charge and open to all students of the bachelor study program. The course can also be attended by students of other faculties of University of Žilina.

## 7. FINAL LINES

Continuous growing of student's interest for courses in computer networking leads us to continual improving of the teaching quality, quality of the labs and increasing of its capacity. Our RCNA academy was awarded as Best RCNA academy of the year 2006 in Slovakia and our students won national round of Cisco olymp for the year 2006. We would like to provide new, interesting courses also; therefore DoIN starts works how to provide new CCNP courses for our students and other courses of the NetAcad program (Security, IP telephony).

## 8. REFERENCES

- [1] <http://cisco.netacad.net>
- [2] <http://www.netacad.sk>
- [3] <http://netacad.uniza.sk>
- [4] Martin Klimo, Pavel Segeč: Networking education at FRI ŽU, ICETA 2004, Košice: Elfa, 2004. - ISBN 80-89066-85-2. - S. 535-539.
- [5] Ľudovít Mikuš, Peter Ivaniga: Neriadené on-line štúdium / Selfstudy on-line, In: UNINFOS 2006 - S. 278-282, 2006

[6] Jakab František: The Advanced Networking Technology Skills Needed to Drive European Business, Connection, The Official Magazine of the American Chamber of Commerce in Slovakia, Bratislava, American Chamber of Commerce in Slovakia, 2006, pp. 20-21, 2 pp., [www.amcham.sk](http://www.amcham.sk)

## THE AUTHOR(S)



**Ing. Pavel Segeč, PhD.:** He received his diploma in the Information and Management Systems from the University of Transport and Communications (UTC) Žilina in 1996 and PhD degree in transport and communication technology at University of Žilina in 2005. He is working as a teacher at the Department of InfoComm Networks of ZU. In 2002 he received the Jozef Murgas award for year 2001 as the appreciation of his research work and in 2003 he was the team member of the research group that got the Werner von Siemens Excellence Award 2003 for the research in the field of IP telephony.



**Doc. Ing. Tatiana Kováčiková, PhD.:** She received her diploma in telecommunication engineering from the University of Transport and Communications (UTC) Žilina in 1984. Since 1990, she has been working in the Department of InfoCom Networks, Faculty of Management Science and Informatics, since 2004 as a senior researcher. In 1996, she finished her PhD. studies aimed at broadband telecommunication networks and signalling. In October 2004, she was nominated Professor Associated at the University of Žilina in the field of the management and informatics systems. He has got the SIEMENS award 2003 for leading the research group in the field of IP telephony. Since 2002, she has been working in the European Telecommunications Standardization Institute (ETSI) as the expert in different Specialist Task Forces (STF) in the area of the NGN.



**Ing. Milan Kubina, PhD.:** He received his diploma in the Information and Management Systems from the University of Transport and Communications (UTC) Žilina in 1996 and PhD degree in transport and communication technology at University of Žilina in 2004. He is working as a teacher at the Department of InfoComm Networks of ZU and at the Department of Management of ZU. He worked as IT/ITC manager for the various companies from 1998 to 2006.



**5<sup>th</sup> International Conference on Emerging  
e-learning Technologies and Applications**

**Power Point Presentations**





## **Networked ICT Transforming Education**

František Baranec  
Cisco Systems Slovakia





## Networked ICT Transforming Education

### Cisco's Vision and Solutions for the College of the Future

Frantisek Baranec  
Obchodny riaditel pre verejny sektor  
Cisco Systems  
CEE, Middle East and Africa

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

1

## Pupils, Lecturers and Administrators

Cisco.com



amazon.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

2

## Day in the life

Cisco.com

- College
  - New build
- Lecturer
  - Mrs Stevens
  - Maths Lecturer
- Student
  - Peter
  - 17 year old
- Rather full day for the purpose of the presentation!

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

3

## A Day in the life

Cisco.com

Mrs Stevens



Mr Tennison



The Lecturers

Peter



The Student



College of the Future

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

4

## On the way to college – Mrs Stevens

Cisco.com

- Driving
- Phones into unified messaging
- Listen to voice mails
  - Gets the Cisco PA to call one of the pupil's mobiles as requested for a short discussion their current assignment
- Listen to emails
  - Text to speech
  - Replies to email from LSC advisor confirming she is will be recording her maths lesson today for sharing as best practice
- She saves 20 minutes doing this by using otherwise "dead" travel time

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

5

## On the way to college – Mrs Stevens

Cisco.com

- Phones into unified messaging
- Listen to voice mails
  - Gets the Cisco PA to call one of the students mobiles
- Listen to emails
  - Text to speech
  - Replies to email from LSC
- Saves 20 minutes using dead travel time

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

6

## On the way to college – Mrs Stevens

Cisco.com



- Unity
- Personal Assistant

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

## On the way to college - Peter

Cisco.com

- Takes buss go college
- Peter has mock biology examines this week
- Uses tablet PC to access the school network over 3G and Cisco VPN
- Accesses the Global Learning Network (GLN)
  - Goes through some exercises suggested by GLN based on personalised feedback linked to assessment system on biology
  - Takes online assessment to help he know how well he now understands the subject he was revising

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

8

## On the way to college - Peter

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

## Arrival – Mrs Stevens

Cisco.com

- Goes to classroom to prepare for first lesson
- Logs into IP Phone
- Heating and lighting adjust to Mrs Steven's preferences due to Intelligent building link between IPT system and building management system
- Important messages appear on the phone screen (fire drill at 10am, change in classroom for her afternoon lesson)
- Tablet PC connects to wireless network after Mrs Stevens provides her username/password (could be biometrics)
- Self defending network detects Mrs Stevens PC doesn't have an important software update
  - Mrs Steven's is redirected to the software update home page and instructed to click to install software
  - She can't access the rest of the network until this is done as an important security update is required
  - The software installs quickly as it is already stored on the school's local Cisco Content Engine, having been distributed automatically overnight
  - Once complete Mrs Stevens is connected to the teacher virtual network. This gives her access to sensitive systems that students don't have access to. Also means her network traffic is kept separate from students so whatever she does on the screen at the front of the classroom will be fast and reliable

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

10

## Arrival – Mrs Stevens

Cisco.com

- Logs into IP Phone
- Heating and lighting adjust to Mrs Steven's preferences
- Important messages appear on the phone screen
  - fire drill at 10am, change in classroom for her afternoon lesson
- Tablet PC connects to wireless network
- Self defending network detects Mrs Stevens PC doesn't have an important software update
- Self defending network puts Mrs Stevens PC in teacher virtual network

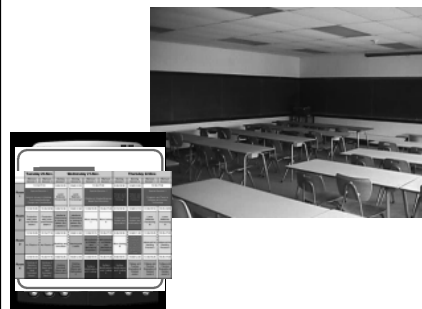
A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

11

## Arrival – Mrs Stevens

Cisco.com



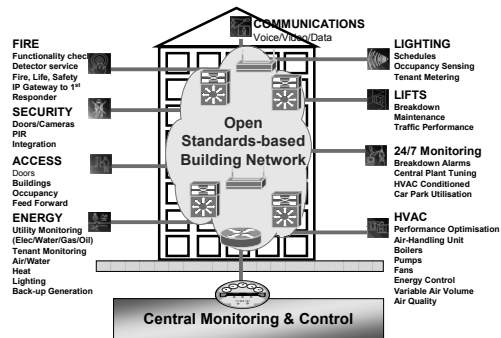
A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

12

## The Vision – a single IP network for Communication and Building Services

Cisco.com



A day in the life

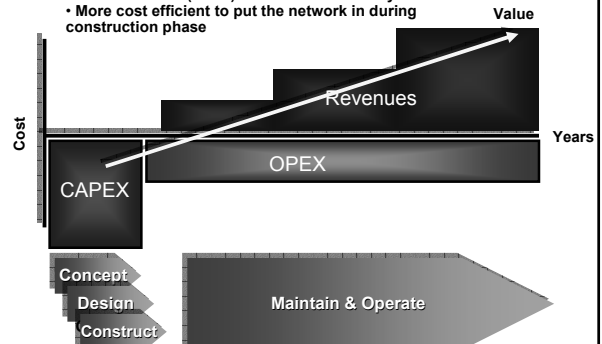
© 2005 Cisco Systems, Inc. All rights reserved.

13

## How building cost is distributed

Cisco.com

- Get the benefit (value) for more of the life cycle
- More cost efficient to put the network in during construction phase



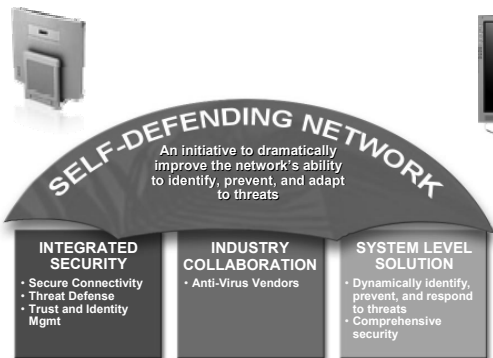
A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

14

## Arrival – Mrs Stevens

Cisco.com



15

## Start of Class – Mrs Stevens

Cisco.com

- Presses registration button on phone
- She gets the name of the first student in the class and clicks the appropriate button for attending, not attending (planned) or late

Phone include photo of the student which helped identify pupils names/faces at the beginning of term

For students that are not there but the college has already been informed the phone screen shows the details

David, one of the students has not turned up and college has not informed he will not attend

Mrs Steven's presses the "late button"

The system automatically sends an SMS message to David, about 5 minutes later he turns up, seems he got a big carried way talking to his friends in the cafeteria

Since the students are all tracking the college can accurately claim the correct funding for their causes

The college also uses the system to ensure they really pay the hours that part time staff teach

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

16

## Start of lecture – Mrs Stevens

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

17

## First lesson of the day – Mrs Stevens

Cisco.com

- Mrs Stevens has been identified as an exceptional maths teacher by the LSC. Initially by her much higher than average pupil results in GLN and later by meetings and video conferences with the LSE
- Mrs Stevens has agreed to video her class so that other maths teachers can view it on demand later to get some best practice ideas
- Mrs Stevens selects the recording menu on the IP phone and presses record. This automatically starts the video camera's at the back of the classroom recording directly to the schools media server
- At the end of the class she presses stop on the phone. Later in the morning she quickly reviews the video, is happy with the quality and selects upload. The video is automatically uploaded into the content delivery network and sent to all the schools where a maths teacher has subscribed to the best practice channel

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

18

## First lesson of the day – Mrs Stevens

Cisco.com

- Mrs Stevens exceptional maths teacher
- GLN results and later by meetings and video conferences
- Mrs Stevens has agreed to video her class
- Mrs Stevens selects the recording menu on the IP phone
- Later in the morning she quickly reviews the video
- Uploads to GLN which distributes in CDN

A day in the life

© 2009 Cisco Systems, Inc. All rights reserved.

19

## First lecture of the day – Mrs Stevens

Cisco.com



A day in the life

© 2009 Cisco Systems, Inc. All rights reserved.

20

## Blackpool LEA & CLC

Cisco.com

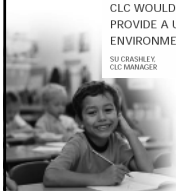
### BLACKPOOL CITY LEARNING CENTRE (CLC) IP TV AND VIDEO-CONFERENCING ENRICH INNER CITY TEACHING AND LEARNING AT UK'S TOP CLC

"THE PASSION AND COMMITMENT FOR WHAT CISCO DOES CAME ACROSS FROM ALL THE PEOPLE THAT WE MET. SINCE BEGINNING THE PROJECT I HAD BEEN LOOKING FOR EXAMPLES OF HOW THE CLC COULD 'THINK OUTSIDE THE BOX' AND AT THE LABS I FOUND THEM. I KNEW WITH CERTAINTY THAT THE BLACKPOOL CLC WOULD NOT ONLY BE THE BIGGEST, BUT WOULD PROVIDE A UNIQUE AND INNOVATIVE LEARNING ENVIRONMENT FOR ALL."

SU CRASHLEY,  
CLC MANAGER



Sound and vision mixer in CLC studio gallery



© 2009 Cisco Systems, Inc. All rights reserved.

21

## First lecture of the day - Peter

Cisco.com

- Peter's first lesson is biology
- They are learning details about plant "anatomy"
- The biology lecturer puts a flower on the digitizer at the front of the classroom.
- It is captured on the attached PC, projected on a 7 foot screen and the teacher uses his tablet PC to mark up key area of the flower. He walks over the Peter, hands him the tablet PC and asks him to mark up to other key areas and explain their significance. Peter is please he is able to answer this well, helped by him doing some last minute revision in the car that morning
- The 2<sup>nd</sup> half of the lesson is individual study time. Peter accesses to the GLN. Watches TV quality biology video's, asks his teacher some questions and uses the online assessment system to check his understanding of today's subject and revises a couple of learning objects that the GLN has highlighted based on the assessment

A day in the life

© 2009 Cisco Systems, Inc. All rights reserved.

22

## First lesson of the day - Peter

Cisco.com

- Learning details about plant "anatomy"
- Flower on the digitize
- It is captured on the attached PC
- Projected on a 7 foot screen
- Wireless presenter
- Hands to Peter
- Peter answers well due last minute revision in the car on GLN
- The 2<sup>nd</sup> half of the lesson is individual study time.
- GLN
- TV quality biology video's
- Asks his teacher questions
- Online assessment

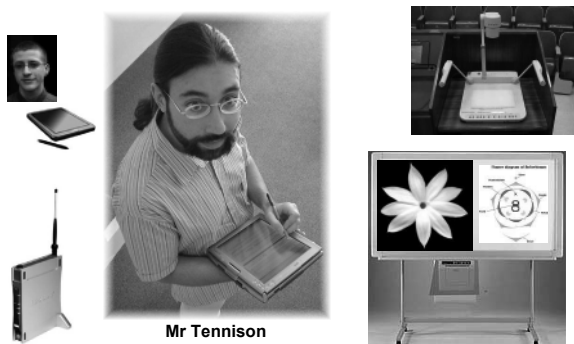
A day in the life

© 2009 Cisco Systems, Inc. All rights reserved.

23

## First lecture of the day - Peter

Cisco.com



Mr Tennison

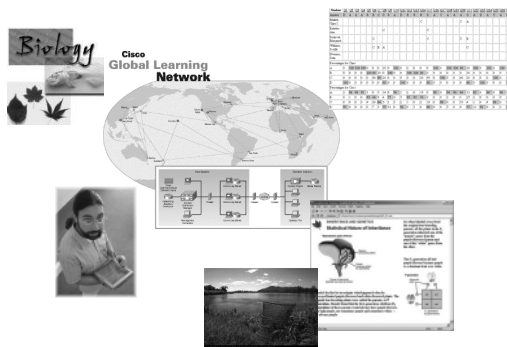
A day in the life

© 2009 Cisco Systems, Inc. All rights reserved.

24

## First lecture of the day - Peter

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

25

## 2<sup>nd</sup> Lesson – Mrs Stevens

Cisco.com

- Mrs Stevens is teaching A level maths
- To make the subject more interesting and real they are studying mathematics concepts as they relate to building design, specifically the 2<sup>nd</sup> Severn Bridge
- Her class and another A level maths class in a college in Bristol near the bridge have been working collaboratively this term
- They have a 15 minute video conference between the two classes
- The video is very easy

She selects the video conference system from the IP phone screen. This turns set the lighting correctly, switches on the right cameras and the projector

To make the call she simply calls the classrooms phone number, it is just the same as making a phone call

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

26

## 2<sup>nd</sup> Lesson – Mrs Stevens

Cisco.com

- A level maths
- Studying mathematics concepts as they relate to building design, specifically the 2<sup>nd</sup> Severn Bridge
- Collaboratively the Bristol college
- They have a 15 minute video conference between the two classes
- The video is very easy
- She selects the video conference system from the IP phone screen
- Set lighting, projector & cameras
- Dial the phone number of the classroom

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

27

## 2<sup>nd</sup> lecture – Mrs Stevens

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

28



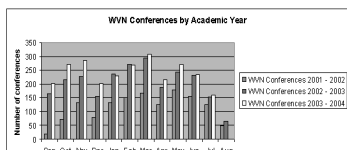
## WELSH VIDEO NETWORK

An UKERNA Project commissioned by the Welsh Funding Councils

Cisco.com



- Video Conference Masterclass sample lessons in philosophy and other subjects from Moorhouse Black
- The Classroom of the Future – an opportunity to visit and talk to pupils in Telford's KS2 and KS3 classrooms of the future.
- KS2 Literacy and Numeracy lessons from ATHENA
- An e-mission to the National Space Centre
- The Rock Idol Competition - a competition for secondary schools to showcase one song to a panel of celebrities
- Music Masterclass
- Performance Poetry
- A visit to Ann Frank's Museum
- Row to Victory - a VC rowing competition
- Birmingham University Masterclasses
- Visits to the Central TV Newsroom



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

## 2<sup>nd</sup> Lesson - Peter

Cisco.com

- Peter's favourite lesson!
- He enjoys the blended learning
- Mix of teacher delivered lesson, hands on lab work and self paced study using the CNAP web curriculum and assessment

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

30

## 2<sup>nd</sup> lecture - Peter

Cisco.com

Cisco Networking Academy

Blended Learning



Instructor-Led



Hands-On



Lab-Intensive

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

31

## Afternoon professional development period – Mrs Stevens

Cisco.com

- Mrs Stevens spends ½ hour reviewing some new maths curriculum materials she's been recommended by the LEA maths advisor. The animated lessons work instantly as they've already been distributed using the CDN that is controlled by GLN
- For the 2<sup>nd</sup> ½ hour Mrs Stevens is on a conference call with the LEA advisor and a small group of maths teachers participating in the best practice project

The LEA advisor had used the GLN virtual classroom to set-up the meeting

This has scheduled Cisco MeetingPlace to hold the audio conference and set-up a collaborative working space

They spend ½ discussing best practices and learning from one another

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

32

## Afternoon professional development period – Mrs Stevens

Cisco.com

- Review new maths curriculum materials
- The animated lessons work instantly due to CDN
- Conference call with the LEA advisor and a small group of maths teachers
- Best practice project
- GLN virtual classroom
- MeetingPlace audio conference
- Collaboration space
- Discuss and learn

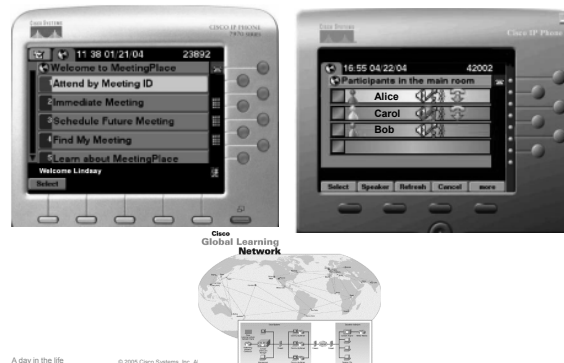
A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

33

## Afternoon professional development period – Mrs Stevens

Cisco.com



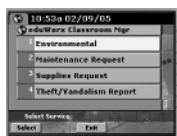
A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

34

## ICT Support – Mrs Stevens

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

35

## Afternoon Class - Peter

Cisco.com

- Peter has decided to study A level psychology. This is the first year the school has offered the course. They couldn't do it before because they only had 4 students wanting to do this which was too small to afford a psychology teacher
- The school is using a company that provides distance learning A level courses that include subject expert teachers
- The tutorial has been set-up by the tutor in the GLN virtual classroom. This creates a multipoint conference and calls out to all the systems. In this case the tutor is working with a total of 10 students, 4 in Peter's school and 5 in another school.
- Peter's group is using a Tandberg 1000, the tutor is using a Cisco Video Advantage Camera and s/w
- They are also using collaborative tools within virtual classroom
- At the end of the tutorial the tutor sets some tasks to complete and 1:1 reviews to go through the work. This is input into GLN to both create the tasks with drop box and schedule the individual calls (IPT)

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

36



## Afternoon Class - Peter

Cisco.com

- A level psychology
- Couldn't do before due to numbers
- Remote teaching
- Tutorial in GLN virtual classroom
- Sets up multipoint video conference and calls participants
- Peter's group is using a Tandberg 1000, the tutor is using a Cisco Video Advantage Camera and s/w
- Set assignments in GLN
- Set 1:1 phone tutoring on GLN

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

37

## Afternoon lecture - Peter

Cisco.com



**Courses**  
Psychology  
Level: A-Level  
Awarding Body: AQA  
Specification: A  
The A-level module includes:  
Module 1: Cognitive and Developmental Psychology  
Module 2: Experimental and Individual Differences  
Module 3: Social Psychology and Research Methods  
The A-level may be awarded as a discrete qualification or count as 50% of the A-level.  
The A-level module includes:  
Module 1: Social, Personality and Comparative Psychology  
Module 2: Individual Differences, Issues and Debates, and Approaches  
Module 3: Research Methods



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

## The Library - Peter

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

39

## Afternoon – Live broadcast for staff – Mrs Stevens

Cisco.com



Live interactivity with the presenters in the Studio is possible via a Q&A textbox

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

40

## Conference Centre Hot Spot

Cisco.com



HotSpot



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

41

## Evening Class – Mrs Stevens

Cisco.com

- The school's catchments area includes quite a large immigrant population
- The head has created an innovative program to get this population more involved in the school as she believes integrating these parents into the community and culture will have a positive impact on their children's school attainment
- Mr Johnson the English teacher and Mrs Stevens are jointly running this parent class. Mrs Stevens originally came from a similar family background she speaks the language know by many of the parents
- They hold the class as a mix of teaching, workshops and using content they and a couple of similar schools have created and are hosting in the GLN
- It's a winters day so at the end of the class its dark outside. Unfortunately the area the school is located in is quite high crime.
- Originally Mr Johnson and Mrs Stevens were nervous about taking this class as it meant going out to their cars in the dark after most of the staff and pupils had left
- However the school now had a IP CCTV system.
- They view the car park camera from the IP phone screen and confirm the area is quiet. As an added precaution they phone the central council monitoring station and as for a virtual escort
- The central station use the CCTV to monitor Mr Johnson and Mrs Stevens leaving the school and getting into the car. If they spotted anyone in the area who should be there they can frighten them off with a VoIP announcement over the CCTV speakers. If necessary they call the police who will come quickly to such monitored incidents
- Thankfully since the IP CCTV system has been deployed the school has seen a huge drop in both thefts and vandalism and the staff and pupils feel much more confident

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

42

## Evening Class – Mrs Stevens

Cisco.com

- The school's catchments area includes quite a large immigrant population
- The head has created an innovate program to get this population more involved
- Improve children's attainment
- Mr Johnson the English teacher
- Mrs Stevens background the speaks the language
- Teaching, workshops and GLN content

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

43

## Evening Class – Mrs Stevens

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

44

## Evening Class – Mrs Stevens

Cisco.com

- Winters day – Dark
- High crime area
- Would not doing this class without IP CCTV
- View the car park camera from the IP phone screen
- Phone the central council monitoring station for a virtual escort
- Voice from security
- CCTV system has reduced theft and vandalism

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

45

## Evening Class – Mrs Stevens

Cisco.com



A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

46

## Newport Local Education Authority

Cisco.com



Schools that had signed up for the monitoring and response service **saved 41 per cent** in the first year of the scheme and a further 28 percent in the second when nearly £46,000 less was spent on broken window replacement alone. At the same time, according to council estimates, money spent on cleaning graffiti and litter collection was reduced by £75,000. But the trend towards anti-social behaviour overall continues upward: those schools not participating suffered a 62 per cent increase in costs associated with vandalism in the year 2002 to 2003.

The atmosphere in the 27 schools now in the scheme is more relaxed and conducive to learning. Parents are impressed by the improvement in the control of anti-social behaviour. Not only is the physical environment better protected but so are the people within it: teachers feel less threatened by disruptive students or even aggressive parents. "The soft benefit" says Cox "is happier, less stressed, teaching staff".

"OUR SUCCESS GOES BACK TO THE CREATION OF THE UNDERPINNING, ENABLING [CISCO] INFRASTRUCTURE. WITHOUT THE RIGHT INFRASTRUCTURE THERE, YOU CANNOT MOVE FORWARD. AND ONLY WHEN YOU HAVE GOT A CONSISTENT, COORDINATED AND RESILIENT INFRASTRUCTURE CAN YOU TAKE ON CRITICAL REAL-TIME APPLICATIONS LIKE IP CCTV SURVEILLANCE."

PAUL COX  
PRINCIPAL CONSULTANT  
NEWPORT CITY COUNCIL

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

47

## At home – Mrs Stevens

Cisco.com

- Mrs Stevens is cooking her supper, her husband is away for the night on business
- Her IP softphone rings on her Tablet PC
- She looks at the name of the caller. Its Katie, one of her friends she made in teacher training, who is also a maths teacher in another school in the district
- She answers the phone using the bluetooth headset that works with both her mobile and the Tablet PC
- They have a chat while she cooks. They talk about personal stuff and also how Mrs Stevens is getting on with the maths best practice project. Katie is interested in some of what Mrs Stevens is learning and how she can use it in her classroom
- The call is free as its all part of the education authorities IP telephony system

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

48

## At home – Mrs Stevens

Cisco.com

- Cooking her supper, husband away
- IP softphone rings on her Tablet PC
- Its Katie
- Bluetooth headset
- They talk about personal stuff
- Talk about maths best practices
- Free call

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

49

## At home – Mrs Stevens

Cisco.com



Cisco Softphone

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

50

## At home - Peter

Cisco.com

- Peter watches TV when he gets home, there is a news item about a brand new virus that is spreading across the Internet like wild fire since the anti-virus companies have taken a few hours to develop a new anti-virus definition and longer still for distribution
- Peter connects to the school network from his home broadband connection  
Cisco VPN and Linksys Wireless ADSL router
- He accesses some of his work stored on the school file server as well as using the GLN to help him do some of his home work and submits the homework in GLN
- Peter's finished his work and listens to some of the music stored on his parent's home PC and listens to some live Internet radio  
Linksys media adapter
- Peter gets a couple of interesting emails from friends
- The first is from his friend John who's attached some "interest" sounding photo's. Peter eagerly opens the attachment. CSA detects that it is attempting abnormal behaviour and refuses to allow what is actually the new virus to execute on Peter's PC, despite his anti-virus definitions not being up to date
- The second is from another friend Paul. Paul tells Peter about Peer-to-peer music sharing software which would mean Peter didn't have to pay for his music anymore. Peter eagerly downloads the software. Unfortunately for him CSA has a profile that blocks installation of a range of software that is inappropriate for a PC that is being provided by the school. This includes illegal music download software!

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

51

## At home - Peter

Cisco.com

- Watch TV
- Watch videos
- Listen to Music
- Linksys media centre extender
- News story on new virus

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

52

## At home - Peter

Cisco.com

### News Flash: Major New Internet Virus

### Turn Any Room Into A Media Room!



Use your wireless network to enjoy Media Center PC entertainment on any TV in your house. Watch full movies, use your favorite digitally recorded TV shows without commercials or listen to digital music and Internet Radio.

Linksys Media Center Extender (WME54AG)

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

53

## At home - Peter

Cisco.com

- Connects to the school network from wireless home broadband connection
- Cisco VPN
- Linksys Wireless ADSL router
- Access work on school server
- Access GLN

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

54

## At home - Peter

Cisco.com

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

55

## At home - Peter

Cisco.com

- Virus / worm tries MS vulnerability (not patched) – CSA blocks
- Interesting emails from friends
- “Photo” – CSA blocks virus
- KaZar – CSA blocks illegal music downloading

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

56

## At home - Peter

Cisco.com

A day in the life

© 2005 Cisco Systems, Inc. All rights reserved.

57

## **Motivating Learners with Skills-based elearning**

Michael Furminger  
Cisco Networking Academy



## Motivating Learners with Skills-based elearning

**Michael Furminger**  
**Technical Manager Europe**  
**Cisco Networking Academy**



## Contents

- The premise
- Cisco Networking Academy
- E-Learning
- Motivation
- Evidence
- Conclusions



## Why be an Academy?



## Why should Institutions become an Academy?

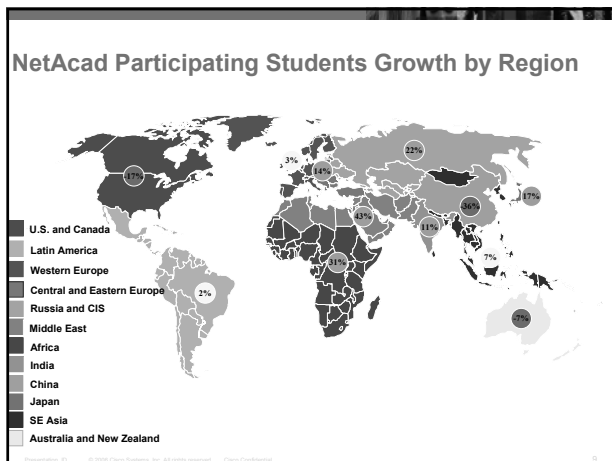
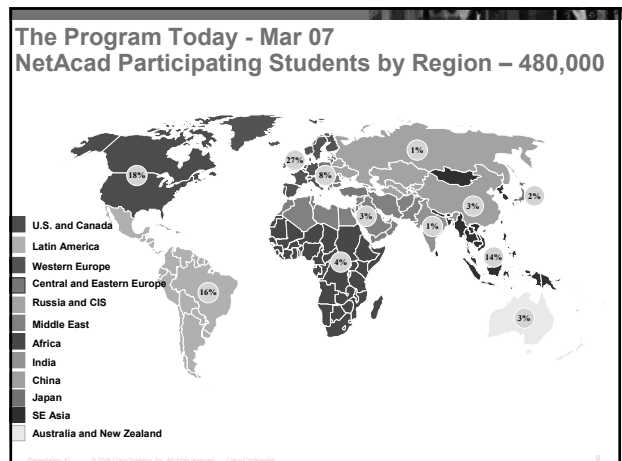
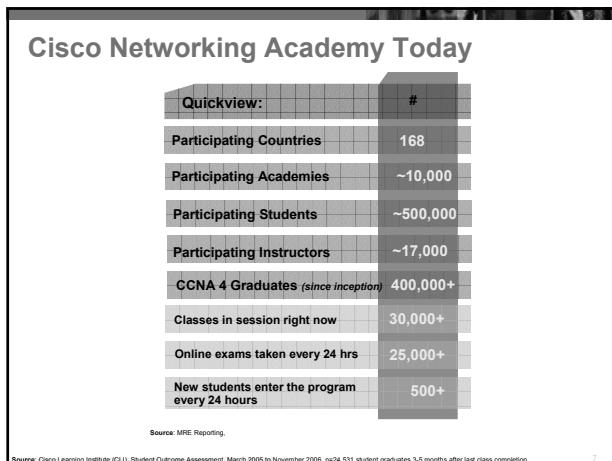
- The curriculum is what they want to teach
- The curriculum has high quality learning materials
- Assessment is integrated
- Attract more students
- Students are motivated
- Networking academies as an agent for change and country transformation.

## Why should Institutions stay an Academy?

- Attract more students – Vendor Certification
- Match National curriculum standards
- Networking academies as an agent for change and country transformation. (particularly in the developing world)

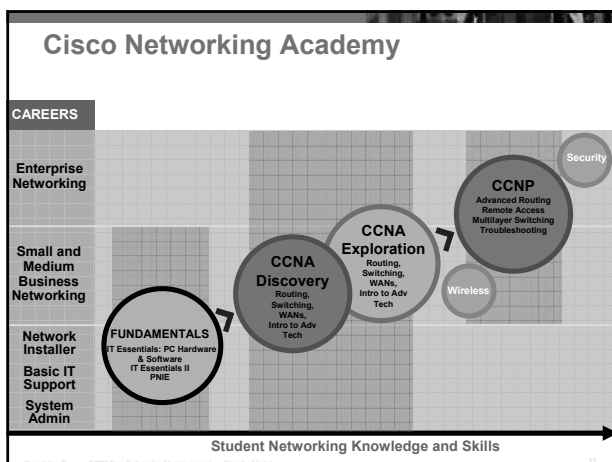
Cisco Networking  
Academy





### The Cisco Networking Academy Focus

- Shift focus from program growth to student outcomes
- Develop courseware tailored to student goals
- Align skills with specific jobs in networking

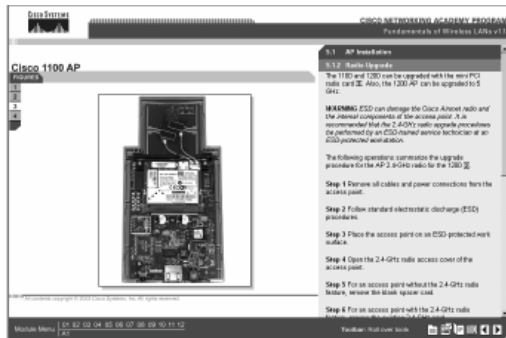


### Portal "Academy Connection"

The screenshot shows the 'Administrator Home' page of the Academy Connection portal. It includes a search bar, a 'Headlines' section with news items, a 'Manage My Academies' section, and a 'Course Catalog' section. The interface is designed for administrators to manage their academy's presence and offerings.



## E Learning – Old Interface



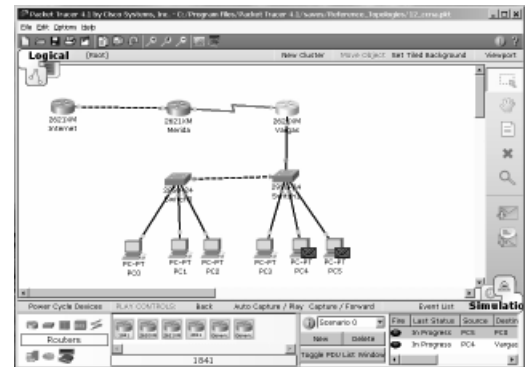
## New Interface



## New Tools – Virtual Laptop



## Skills Activities – Packet Tracer 4.1



## e-Learning



## Drivers for e-learning in education

- Preparation for lifelong learning
- Learners will return to learning at some stage
- Need to improve efficiency and control costs
- Desire for enhanced and innovative learning
- Increase resources
- Broader and more relevant curriculum
- Youth culture that embraces technology

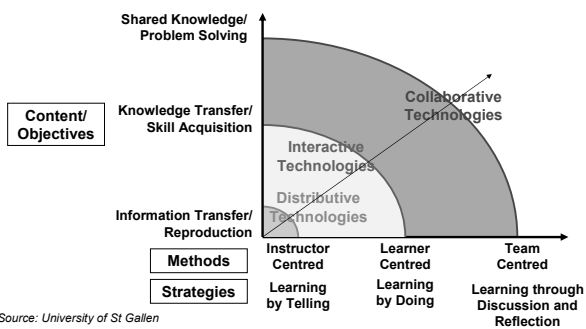
## Drivers for e-learning

- Government led initiatives in schools and colleges
- Teacher shortages
- Teacher professional development
- Preparation for higher education and work

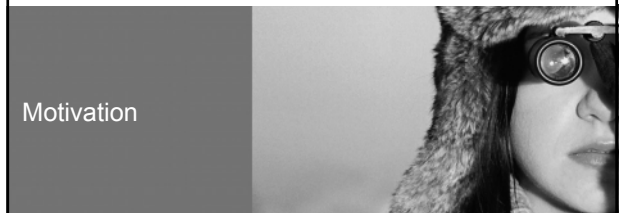
## Drivers for elearning in higher education

- Growth in student numbers and demand for life-long learning
- Widening participation and access to learning
- Need to improve efficiency and control costs
- Desire for enhanced and innovative learning
- Increased competition in global education
  - from overseas through access to online distance learning
  - from university consortia and for-profit universities

## Evolution of E-Learning

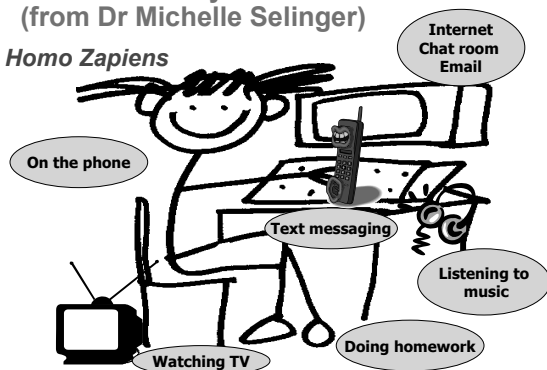


## Motivation



## Students Today (from Dr Michelle Selinger)

*Homo Zapiens*



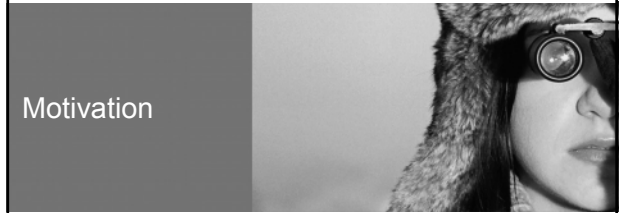
## Institutions want

- Motivate students
- Increase participation
- Improve status of institution / department
- Attract better / motivated staff
- Attract funding

## Preparing for life – things to think about

- Teachers and lecturers are educational companions - they help shape students' life and accompany them part of the way
- Students learn from experience not only from teachers
- Assessment ought to measure what's done with inputs not how well absorbed they are

## Motivation



## Obtaining a Job

- Over two-thirds indicated that the academy program helped them gain at least one job opportunity.  
Of the students who indicated their affiliation with the Academy led to a new job opportunity, more than half indicated that the academy program helped them "very much" or "completely" in obtaining the new opportunity.
- Approximately one-quarter indicated that their affiliation with the academy program has helped them obtain a new job, obtain a new job in IT, or obtain a new job in networking.
- Approximately 20% indicated that their affiliation with the academy program has helped them obtain a better or higher status job.

*Survey of Academies 2005*

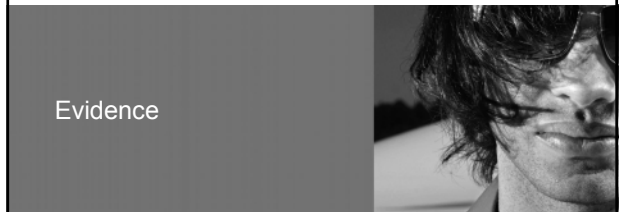
## Drivers for Vendor Certification

- Link to Job Market
- Perception of students being "Job ready"
- A value add for traditional academic qualifications
- Institution has a potential to earn extra income

## Drivers for Vendor Certification

- Full Time students
  - Generally students have little interest in certifications until year 3, as year and 1 and 2 is the time where most students 'enjoy' themselves. In year 3 they are too worried about passing and hence do not bother to take the Certifications(<10%).
- Part time Students:
  - These students' sole focus is to pass the Vendor course. Generally we have 30% of the class take the Cert. This group clearly are working and see the value and often look to extend their work potential.
- Industrial recognition
  - The driver for students to seek vendor qualification is based on the job market – this has shown an increase in jobs vacancies asking for vendor qualifications and certifications.

## Evidence



## Benefit to Institution

- Student numbers on networking and comms related Degrees have steadily increased in line with the introduction of Vendor material.
- We have increased the number of degrees related to Networking from 1 Master in Data Comms to 8 Bachelor and 3 Master, this represents approx 300 students on vendor based curriculum.
- Mak Sharma – Birmingham TIC

## Evidence - Cisco Networking Academy

- Student satisfaction
  - (5 point Likert scale – 5 is good)
  - 2005-6 3.78 (Std Dev 0.25)
  - 2006-7 3.91 (Std Dev 0.31)
- Program stability and growth – (Participating students)
  - 2005-6 460,000
  - 2006-7 487,000

• Data source MRE

## Why Cisco Networking Academy

- “Cisco Networking Academy is the most successful of the vendor programmes and is based on the ownership given to individual academies predicated by the fully supported model:**
- CATCs are supported by Cisco
  - RAs are supported by CATCs
  - LAs are supported by RAs
  - Students are supported by LAs”

• Mak Sharma – Birmingham TIC

## Why Cisco Networking Academy

**“We believe that this form of technology-enabled environment which combines a centrally developed curriculum and standards-based testing distributed over the internet with local delivery of instruction and strong instructor support enables students to perform at the level of their abilities, influenced only slightly by school setting. This program appears to close the traditional achievement gap between schools in different regions and enable students to reach their potential”**

• Source - Kelley Executive Partners – Indiana University  
“Student Success in the Cisco Networking Academy”  
August 2005

## Summary

- Students are motivated by skills based learning
- Vendor certificated are valued as a recruitment tool and by students when they enter the job market
- Instructors take ownership of the program
- Learning materials are valued for their technical relevance, labs, online learning and integrated assessment.
- Instructors can focus their efforts on teaching and extension materials
- Academies stay with the program if they understand the value add for them and their students.

## Q & A



Cisco | Networking Academy®  
Mind Wide Open™





## **Wind of Change**

Pavol Kukura  
Slovak Telekom





## Wind of Change

### Telco Operator in Multimedia Age



Pavol Kukura  
Slovak Telekom


.....T.....Com.....

## The things have changed

Wind of change is not only song by Scorpions.


Telecom yesterday

**Product/ service – voice**  
Metrics - minute  
Location matters  
Distance matters  
Duration matters



Telecom today

**Product/ service – broadband**  
Metrics - bandwidth  
Connectivity matters  
Mobility matters  
Interoperability matters

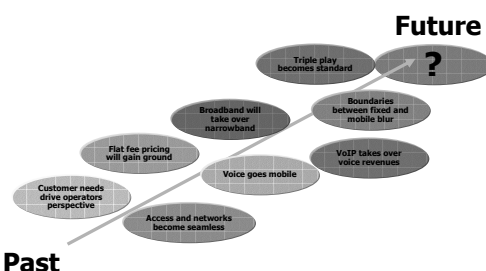


.....T.....Com.....

ICETA 2007 | 2

## Telco markets development

Telecom market facing a paradigm shift driven by technology, customer preference and changing growth dynamics.



.....T.....Com.....

ICETA 2007 | 3

## Telco markets development

Telecom market facing a paradigm shift driven by Technology, customer preference and changing growth dynamics.

### Migration from TDM world to NGN.

#### Design Principles for Next Generation Factory

- Introduce leading-edge NGN technologies on all network layers
- Pursue an intelligent integration of infrastructures and platforms
- Reduce number of technologies and technology complexity
- Reduce number of products and product complexity
- Reduce cost of field organization
- Introduce a service delivery architecture



.....T.....Com.....

ICETA 2007 | 4


## Telco markets development

Telecom market facing a paradigm shift driven by Technology, customer preference and changing growth dynamics.

### Technology Change enables Telecommunication Convergence

**Key technology drivers for coming telecommunication convergence**

- Instant broadband access anywhere
- Open network for IT platform
- Mobile solutions / applications
- Multi access innovative devices/solutions (VoD, VoIP, Visual Phone)



.....T.....Com.....


ICETA 2007 | 5

## Telco markets development

Telecom market facing a paradigm shift driven by technology, Customer Preference and changing growth dynamics.

### Future emerging segments


**Personal**



Future targeted portfolio

|                |              |                           |
|----------------|--------------|---------------------------|
| On-line gaming | Home office  | LBS, ...                  |
| MoD, VoD       | Media center | Digital TV                |
| Family comm.   | Home network | Home control Surveillance |

**Enterprise**



Future targeted portfolio

|                       |                   |                        |
|-----------------------|-------------------|------------------------|
| e-commerce platforms  | Billing solutions | ...                    |
| Corporate access      | ASP               | Data security & backup |
| Telephony & data svcs | Secured WANS      | Managed Networks       |

.....T.....Com.....

ICETA 2007 | 6

## Slovak Telekom

Telco operator in multimedia age

..T..Com

Slovak Telekom Group  
(Current Content/Online/Entertainment coverage)

..T..Mobile



- Launched 2007
- Launched 2006
- Launched 2006
- The MoD, VoD, VAS for mobile phones
- Biggest portal in SR including comprehensive mobile portal

..T..Com

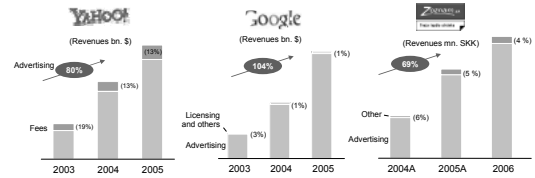
ICETA 2007 | 7

## Slovak Telekom

The advertisement based services become popular  
The new cool service has to be „for free“

The advertisement based business creates the opportunity for future advertisement based services

Typical revenue structures of portal business shows that advertisement is and will continue to be the main revenue source for all major portal players



..T..Com

ICETA 2007 | 8

## Slovak Telekom

Communities, communication and social life  
People are willing to spend their time online with friends

ST bought Zoznam because the portal services becomes part of people social life. They do not use it just for information but also for communication and meeting cool people there

Future web 2.0 services and business models based on user created content open space for new business opportunities.

..T..Com

ICETA 2007 | 9

## Slovak Telekom

Video on Demand



..T..Com

ICETA 2007 | 10

## Slovak Telekom

Gaming on Demand

2 week test for free

Games are also available on our gamestation for online playing

50+ games for 169Sk/month

100+ games for 349Sk/month

..T..Com

ICETA 2007 | 11

## Slovak Telekom

Music on Demand

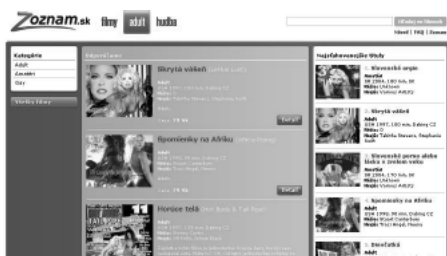
Many albums and compilations  
Slovak album for 199 Sk



..T..Com

ICETA 2007 | 12

## Slovak Telekom Adult Content



....T...Com

ICETA 2007 | 13

## Slovak Telekom

Triple Play – Integration of IPTV, VoIP and Broadband Internet



**Interactive Digital  
TV Entertainment**  
One click access

**Highspeed Internet**  
Speed and Comfort

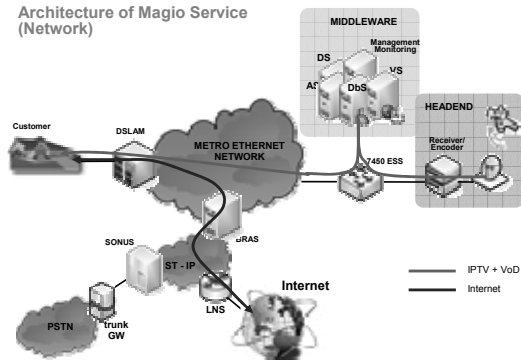


**IP Telephony**  
Simple and Modern Communication

....T...Com

ICETA 2007 | 14

## Slovak Telekom Architecture of Magio Service (Network)

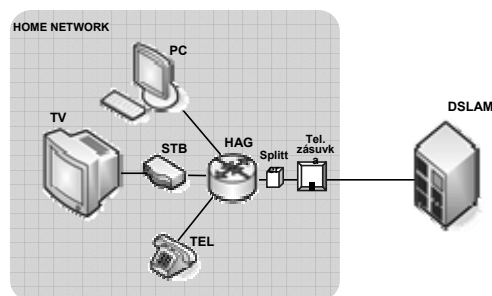


....T...Com

ICETA 2007 | 15

## Slovak Telekom

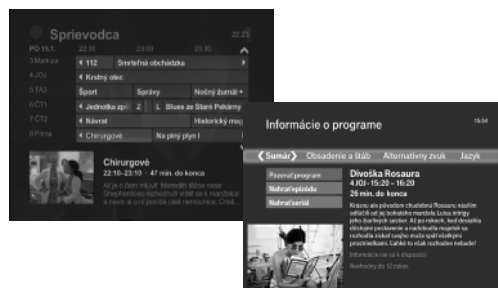
Architecture of Magio Service (Home)



....T...Com

ICETA 2007 | 16

## Slovak Telekom Magio – EPG Electronic Program Guide



....T...Com

ICETA 2007 | 17

## Slovak Telekom

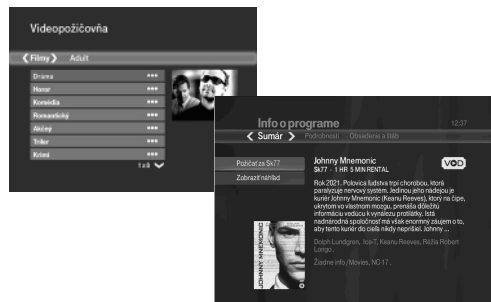
Magio – Recording



....T...Com

ICETA 2007 | 18

**Slovak Telekom**  
Magio – Videolibrary



• • • • T • • Com •

ICETA 2007 | 19



[pavol.kukura@st.sk](mailto:pavol.kukura@st.sk)  
[www.t-com.sk](http://www.t-com.sk)

• • • • T • • Com •

ICETA 2007 | 20

# **HP Managed Learning Environment**

Boris Tvaroška  
HP



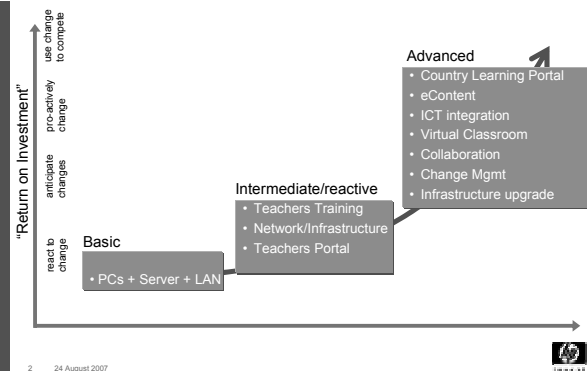
# HP Managed Learning Environment

Boris Tvaroška



© 2006 Hewlett-Packard Development Company, L.P.  
The information contained herein is subject to change without notice.

## ICT at schools



## Department of Education, Northern Ireland

HP plays a key role in world leading education initiative, C2K

"The C2K project is a unique requirement and there are elements of the solution for which there are no standards in today's world [...] we felt that HP, particularly with its global presence and its strategic partnerships, was best placed to help us succeed."

Roy Beattie, deputy head of IT, Department of Education, Northern Ireland



| Objective  | Approach  | Results   |
|--|---|---|
| <ul style="list-style-type: none"> <li>The Classroom 2000 (C2k) initiative was put in place to bring Northern Ireland's 1,245 primary and post-primary schools into the information age</li> </ul> | <ul style="list-style-type: none"> <li>Equip all pupils and teachers with e-mail addresses, Internet facilities and access to virtual learning platforms</li> <li>Connect all the schools to a Wide Area Network (WAN) that allows them to communicate with each other and access online resources stored at a central data centre</li> <li>Choose an IT partner that could share the vision, but also provide the leading-edge technology</li> </ul> | <p>IT improvements</p> <ul style="list-style-type: none"> <li>Enterprise Active Directory can handle 400,000 users</li> <li>Microsoft Exchange 2000 email and messaging service can serve 375,000 users</li> </ul> <p>Business outcomes</p> <ul style="list-style-type: none"> <li>Pupils can access digital learning resources 24x7</li> <li>Staff can share best practices and monitor pupils' progress effectively</li> <li>Parents can monitor homework tasks and available resources, plus check online child assessments</li> </ul> |

3 24 August 2007

## Ministère de l'Éducation Nationale

HP delivers new generation mySchool!

"Throughout the portal's evolution, HP Services has been on hand to adapt the software to the specific needs of learning and teaching. It has also done an outstanding job of implementing user management functionality through the use of Web services."



Daniel Weiler, project manager, mySchool Ministère de l'Éducation Nationale, Luxembourg

| Objective   | Approach   | Results  |
|---|--|--|
| <ul style="list-style-type: none"> <li>Pursue the goals of the European Schoolnet initiative to make all pupils digitally literate</li> <li>Implement a secure Web portal for use by all members of the Luxembourg educational community</li> <li>Over time, provide a more personalised experience and support the needs of individual schools to maintain their own content and applications</li> </ul> | <ul style="list-style-type: none"> <li>Engaged HP Services as an end-to-end partner, with responsibility for vision, concept, architecture design, implementation and ongoing support</li> <li>Based the portal infrastructure on the Plumtree Portal, customised for educational use by HP</li> </ul> | <p>IT improvements</p> <ul style="list-style-type: none"> <li>The portal acts as a communications infrastructure, within which schools can securely develop their own intranet communities</li> </ul> <p>Business outcomes</p> <ul style="list-style-type: none"> <li>Schools and others can access reliable, relevant information, applications and other educational resources</li> <li>Pupils and others can publish and maintain Web content easily, even</li> </ul> |

4 24 August 2007

## Stakeholders and Their Needs

| Students                 | Educators                | Education Management                        | Parents / Employer     |
|--------------------------|--------------------------|---|------------------------|
| Learn                    | Foster Learning          | Assess Learning Outcomes                    | Review progress        |
| Have fun                 | Manage classes           | Planning and Budgeting                      | Involvement            |
| Demonstrate Competence   | Time management          | Manage Information                          | Review assignments     |
| Be Challenged            | Collaborate              | Ensure a Safe Learning and Work Environment | Interact with Teachers |
| Plan                     | Engaging Lesson Plans    | Improve Productivity                        | Communicate            |
| Collaborate              | Rich Curricular content  | Support Standards                           | Collaborate            |
| Personalised Experiences | Best practices           | Manage Student Information                  | Support Learning       |
| Access anywhere          | Access anywhere          | Scalability and Manageability               | Confidence in Security |
| Internet a Part of Life  | Professional Development | Total cost of ownership                     | Appropriate content    |

5 24 August 2007

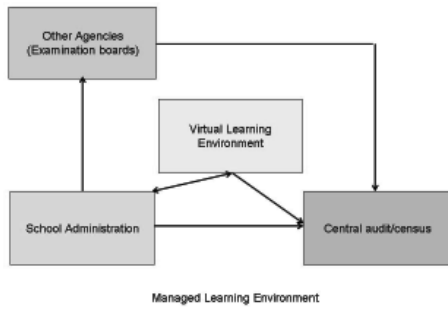
## Managed Learning Environment (MLE)

"An MLE encompasses the whole range of... information/content systems and process (including MIS and VLE...) that contribute directly or indirectly to learning and the management of learning"

BECTa – British Educational Communication and Technology Agency

6 24 August 2007

## Managed Learning Environment



7 24 August 2007



## Virtual Learning Environment (VLE)

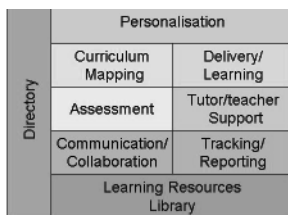
“VLE is a standardised, computer based environment that supports delivery of web-based learning and facilitates online interaction between students and teachers” – BECTa

“The Web offers the perfect technology and environment for personalised learning where learners can be uniquely identified, content can be specifically presented, and progress can be individually monitored, supported and assessed” – Martinez, Bunderson – Asynchronous Learning Networks Dec 2000

8 24 August 2007



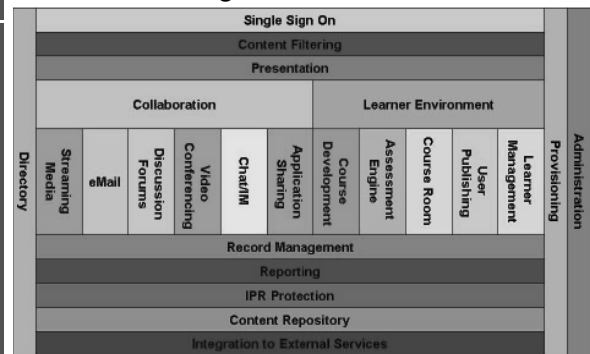
## Virtual Learning Environment Educationalist view



9 24 August 2007



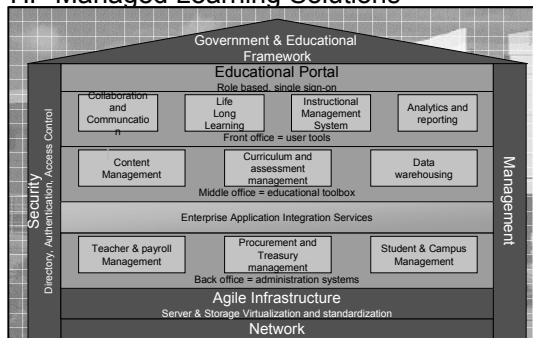
## Virtual Learning Environment



10 24 August 2007



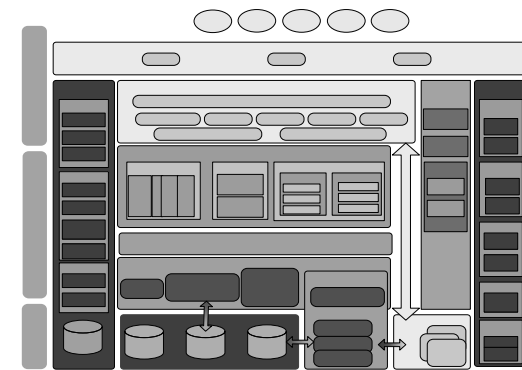
## HP Managed Learning Solutions



11 24 August 2007



## HP Managed Learning Environment Reference architecture

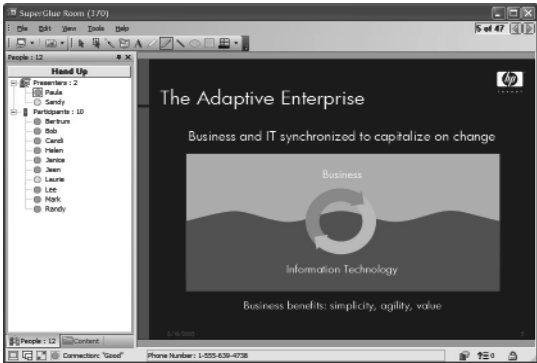


12 24 August 2007





Tools for delivery: HP Virtual Rooms



13 24 August 2007



invent



## REGISTER

|              |            |                            |            |            |   |
|--------------|------------|----------------------------|------------|------------|---|
| Adamek       | Rastislav  | 173                        | Genči      | Ján        | 317, 553  |
| Adamuščinová | Iveta      | 115                        | Glasnák    | Jozef      | 373   |
| Andoga       | Vladimír   | 401                        | Grabowska  | Anna       | 213   |
| Andrejko     | Anton      | 325                        | Grellneth  | Igor       | 131   |
| Anohina      | Alla       | 179                        | Grygárek   | Petr       | 377, 541  |
| Babič        | František  | 185                        | Halás      | Michal     | 137   |
| Backhaus     | Wolfgang   | 307                        | Hán        | Jan        | 509, 527  |
| Bača         | Ján        | 155, 165, 339              | Harčár     | Martin     | 173   |
| Bachratá     | Katarína   | 109                        | Hauliš     | Milan      | 339   |
| Balátová     | Grétká     | 373                        | Henning    | Klaus      | 307   |
| Baráth       | Július     | 533                        | Hlaváček   | Vladimír   | 245   |
| Baroňák      | Ivan       | 149                        | Hoang      | Linh Xuan  | 245   |
| Bauerová     | Danuše     | 11                         | Horváth    | Pavol      | 37  |
| Bažantová    | Libuše     | 499                        | Hrbáček    | Jiří       | 221   |
| Bezgachnyuk  | Yuriy      | 191                        | Hrubý      | Miroslav   | 383   |
| Bieke        | Schreurs   | 459                        | Huba       | Mikuláš    | 225, 389, 479   |
| Bieliková    | Mária      | 325                        | Hubáčková  | Šárka      | 395   |
| Bilousova    | Lyudmila   | 291                        | Hvorecký   | Jozef      | 513   |
| Biñas        | Miroslav   | 115, 143, 165,<br>197, 419 | Iriguchi   | Norio      | 95, 263   |
| Bober        | Marek      | 345                        | Ištván     | Milan      | 399   |
| Bondarenko   | Viktor     | 351                        | Jajcaj     | Michal     | 245   |
| Boroň        | Juraj      | 109                        | Jakab      | František  | 115, 127, 143, 155,<br>165, 197, 317, 401,<br>419, 547, 553 |
| Boycheva     | Svetla     | 357                        | Jakab      | Michal     | 143   |
| Brandejs     | Michal     | 503                        | Janitor    | Jozef      | 143, 553  |
| Brandejsová  | Jitka      | 503                        | Kapa       | Martin     | 401   |
| Brestenská   | Beáta      | 19                         | Kavacký    | Matej      | 149   |
| Brož         | Zdeněk     | 203                        | Kažik      | Peter      | 231   |
| Bučko        | Marián     | 547                        | Kess       | Pekka      | 41  |
| Burčík       | Vladimír   | 513                        | Kiprushkin | Sergey A.  | 237   |
| Burda        | Jaroslav   | 537                        | Kita       | Toshihiro  | 263   |
| Bureš        | Vladimír   | 297                        | Kitamura   | Shiro      | 263   |
| Connell      | John       | 23                         | Kleinová   | Katarína   | 127, 143, 155   |
| Csókás       | Erik       | 121                        | Kniewald   | Karol      | 553   |
| Čech         | Pavel      | 297                        | Kocur      | Dušan      | 47  |
| Černá        | Miloslava  | 523                        | Kolgatin   | Oleksandr  | 291   |
| Čičák        | Pavel      | 121                        | Kolgatina  | Larisa     | 291   |
| Čičáková     | Oľga       | 209                        | Kosc       | Peter      | 47  |
| Dado         | Milan      | 365                        | Kostelný   | Michal     | 241   |
| Danišovič    | Marián     | 435                        | Kovacova   | Ivica      | 561   |
| Dedera       | Ľubomír    | 533                        | Kováčik    | Milan      | 407   |
| DiCerbo      | Kristen E. | 27                         | Kováčiková | Tatiana    | 161, 565  |
| Dobiš        | Michal     | 245                        | Kovárová   | Alena      | 245, 331  |
| Dobrowolski  | Dariusz    | 213                        | Krajnyik   | Viktor     | 273   |
| Drozdová     | Matilda    | 365                        | Kubík      | Michal     | 209   |
| Dvorský      | Jiří       | 383                        | Kubina     | Milan      | 161, 565  |
| Fabián       | Peter      | 301, 307                   | Kukharekno | Vladimir   | 251   |
| Farkaš       | Pavel      | 173                        | Kurskov    | Sergey Yu. | 237   |
| Feciľak      | Peter      | 127, 155                   | Kvasnička  | Martin     | 131   |
| Fedák        | Viliam     | 241                        | Kyrbashov  | Bakyt      | 137   |
| Fedoruk      | Pavlo      | 313                        | Lafourcade | Pascal     | 213   |
| Figel'       | Ján        | 35                         | Lamoš      | Dušan      | 245   |
| Francisci    | Cyril      | 407                        | Lavrik     | Tetiana    | 281   |
| Frolova      | Alina      | 217                        | Lustigová  | Zdena      | 321   |
| Galajdová    | Alena      | 77, 197                    | Lyubchak   | Vladimir   | 281   |
| Galanská     | Erika      | 429                        | Madoš      | Branislav  | 285   |
| Gecovič      | Miroslav   | 469                        |            |            |   |

|             |                 |                    |              |           |          |
|-------------|-----------------|--------------------|--------------|-----------|----------|
| Mahmoud     | Safaa S.        | 449                | Šimšík       | Dušan     | 77       |
| Makarenko   | Alexander       | 413                | Šimůn        | Michal    | 325      |
| Martel      | Nicolas         | 255                | Šorm         | Milan     | 469      |
| Matsuba     | Ryuichi         | 263                | Šperka       | Martin    | 331      |
| Matviyenko  | Roman           | 191                | Šuba         | Stanislav | 339      |
| Mazálková   | Markéta         | 259                | Žapák        | Peter     | 479      |
| McQuade     | Eamonn          | 307                | Taylor       | James C.  | 87       |
| Meško       | Dušan           | 53                 | Tomčák       | Peter     | 89       |
| Migita      | Masahiro        | 263                | Tvaroška     | Boris     | 65       |
| Michalčín   | Viktor          | 173                | Usagawa      | Tsuyoshi  | 95, 263  |
| Michalko    | Miroslav        | 115, 165, 197, 419 | Vainio       | Aki       | 67       |
| Milata      | Martin          | 377                | Varga        | Milan     | 485      |
| Muhren      | Arnold          | 301                | Vasylyev     | Anatoliy  | 281      |
| Murín       | Pavel           | 173                | Vavříček     | Jan       | 377      |
| Musashi     | Yasuo           | 263                | Veen         | Wim       | 301      |
| Nagy        | Michal          | 401                | Vejvodová    | Jana      | 491      |
| Nakano      | Hiroshi         | 95, 263            | Velart       | Zdeněk    | 345      |
| Nascimento  | Jose Carlos     | 307                | Vokorokos    | Liberios  | 285      |
| Nemoto      | Junko           | 263                | Vozňák       | Miroslav  | 137      |
| Nisheva     | Maria           | 357                | Wagner       | Jozef     | 185      |
| Odrážka     | Luboš           | 267                | Zamikhovskyy | Leonid    | 191      |
| Olševičová  | Kamila          | 297                | Zary         | Ivan      | 513      |
| Ondrášová   | Iveta           | 209                | Zimola       | Bedřich   | 509, 527 |
| Otrusinová  | Milana          | 425                | Zvacek       | Susan M.  | 101, 491 |
| Parke       | Helen M.        | 27                 | Žáková       | Katarína  | 267      |
| Pařilová    | Hana            | 519                |              |           |          |
| Paseková    | Marie           | 425                |              |           |          |
| Paulíny     | Michal          | 173                |              |           |          |
| Paulsson    | Frederik        | 67                 |              |           |          |
| Petroszki   | Karel           | 519                |              |           |          |
| Pimenta     | Pedro           | 307                |              |           |          |
| Piovarčiová | Táňa            | 429                |              |           |          |
| Plášek      | Vladimír        | 435                |              |           |          |
| Poledna     | Juraj           | 439                |              |           |          |
| Ponce       | Daniela         | 297                |              |           |          |
| Poulová     | Petra           | 59, 509, 523, 527  |              |           |          |
| Remez       | Olga            | 445                |              |           |          |
| Révés       | Martin          | 143                |              |           |          |
| Rosival     | Boris           | 109                |              |           |          |
| Rovanová    | Lubica          | 225                |              |           |          |
| Salem       | Abdel-Badeeh M. | 3                  |              |           |          |
| Salmenjoki  | Kimmo           | 67                 |              |           |          |
| Sattari     | Sanaz           | 307                |              |           |          |
| Savyuk      | Larysa          | 191                |              |           |          |
| Segeč       | Pavel           | 161, 565           |              |           |          |
| Seidl       | David           | 541                |              |           |          |
| Schindler   | Frank           | 73                 |              |           |          |
| Sidimák     | Vladimír        | 553                |              |           |          |
| Sivý        | Igor            | 231, 273           |              |           |          |
| Sjoer       | Ellen           | 307                |              |           |          |
| Striuk      | Andrii          | 277                |              |           |          |
| Sugitani    | Kenichi         | 95, 263            |              |           |          |
| Sukharev    | Eugene S.       | 237                |              |           |          |
| Suzuki      | Katsuaki        | 263                |              |           |          |
| Svetský     | Štefan          | 473                |              |           |          |
| Syrotenko   | Nina            | 251                |              |           |          |
| Šaloun      | Petr            | 345                |              |           |          |
| Šály        | Vladimír        | 389                |              |           |          |
| Šedivý      | Miroslav        | 435                |              |           |          |
| Šimonová    | Ivana           | 465                |              |           |          |

© 2007 elfa, s.r.o

ISBN 978-80-8086-061-5