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ABSTRACT

This document presents the proceedings from the 5th International European University Information Systems (EUNIS) Conference on Information Technology that took place in Helsinki, Finland on June 7-9, 1999. Topics of the conference proceedings were divided into five tracks (A through E): Use of Information Technology in Learning and Teaching; Information Technology in University Management; The New Library Role with Evolving Technologies; Security Issues; and Co-Operation within and between Universities. Track A full papers include: "Use of ITC Technology in Teaching at the Level of A B.Sc.: A Practical Experience"; "Implementing Multimedia Methods in Engineering Education"; "Using the Web To Deliver and Enhance Classes: Two Case Studies"; "Network Education"; "Tailored Teaching for Students with Diverse Scientific and Linguistic Backgrounds: Potential of the WWW in Plant Pathology"; "The Academic Development Fund at the University of Derby 1994-1998: Origins, Implementation and Lessons"; "A University Model for Integrating Technology into the Curriculum: The Academic Architecture Initiative"; "Virtual Classroom for Business Planning Formulation"; "Dynamic WWW Style Processing with SeSAMe"; "User Interface Implementation Issues for a Web-based System for Ordered Asynchronous Multimedia Annotations"; and "The Adaptation of the CAL System Ceilidh for Teaching the Oberon Language." Track B full papers are: "Student Self-Service: A Challenge for Customer-Oriented Universities"; "Web-Based Information Services for Studies Planning, Management and Administration"; "Traveling the Innovative Path: How To Survive the Implementation of a New Information System"; "Getting Management Support from a University Information System"; "Balanced Scorecard for Universities"; "Reflections on the Fate of IT Strategies"; "The Growth of the Information Strategy Approach"; "Characteristics of IT Strategy in the Medical University of Varna"; and "Systems, Processes and Transformation: The Liverpool John Moores University Approach to C&IT-Enabled Change." Track C papers include: "Converged Librarian/Academic Roles in the 'Wired' University"; "DEDICATE: A Networked Professional Development Project in Information Literacy and User Education"; "Library Cooperation at the NOVA University: The Nordic University in Agriculture Forestry and Veterinary Medicine"; "Electronic Libraries and Collaboration in the UK: The eLib Clump Projects"; "Viikki Virtual Infocenter: An Integrated Information Workstation"; and "The ELISE II Project, A Digital Image Library for Europe."

Track D papers are: "Authentication on WWW Using Smartcards"; "Coordinating the Swedish Admission Systems Using the Ping-System"; "Remote Management of Computing Resources in Academic Institutions with Secure Shell"; "Security Concerns in Medium-Sized Academic Institutions. An Implementation at the University of Las Palmas de G.C."; and "Security: Policy and Education of Users at the Level of an Institute." Track E papers include: "Metropolitan Area Networks: The Opportunities for Collaboration Amongst Universities"; "Quality Process as an IT Strategy"; "Introducing Information and Communication Technology for Teaching in French Universities"; and "Collaboration as a Challenge: New Learning Environments Embedded in Old Traditions." Poster abstracts are provided at the end of the document. (AEF)

EUNIS '99: Information Technology Shaping European Universities. Proceedings of the International European University Information Systems

(5th, Espoo, Finland, June 7-9, 1999)

EUNIS '99

Information Technology Shaping European Universities
7. - 9. June 1999, Espoo, Finland

The 5th International EUNIS Conference on Information Technology took place in Espoo in the metropolitan area of Helsinki, Finland, on 7 - 9 June 1999.

These pages are still developed. The proceedings are being completed and pictures from the event added.

Pictures from the conference

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Conference Proceedings

The topics were divided in five tracks:

A Use of Information Technology in Learning and Teaching
B Information Technology in University Management
C The New Library Role with Evolving Technologies
D Security Issues
E Co-operation Within and Between Universities

Poster Abstracts

ORGANIZERS

EUNIS 99 was organized by Helsinki University of Technology. It brought together managers, staff and users of information technology services in higher education and scientific research institutes from 29 countries.

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EUNIS '99
HELSINKI UNIVERSITY OF TECHNOLOGY

TRACK A: (Paper Abstracts)
Use of Information Technology in Learning and Teaching

Use of ITC Technology in Teaching at the level of a B.Sc.: A Practical Experience

Implementing Multimedia Methods in Engineering Education

Using the Web to Deliver and Enhance Classes: Two Case Studies

Network Education

Tailored Teaching for Students with Diverse Scientific and Linguistic Backgrounds: Potential of the WWW in Plant Pathology

The Acamemic Development Fund at the University of Derby 1994-1998: Origins, Implementation and Lessons

A University Model for Integrating Technology into the Curriculum

Virtual Classroom for Business Planning Formulation

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User Interface Implementation Issues for a Web-based system for Ordered Asynchronous Multimedia Annotations

The adaptation of the CAL system Ceilidh for teaching the Oberon language

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TRACK A Abstracts:
Use of Information Technology in Learning and Teaching

USE OF ITC TECHNOLOGY IN TEACHING AT THE LEVEL OF A B.Sc.: A PRACTICAL EXPERIENCE

Y. Epelboin
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Since 3 years the Web is intensively used for a course on Numerical Methods in Physics. All materials are available to students in advance and no paper is delivered. We report our experience, which is not as successful as it could be expected. Moving from old to new technologies does not seem so appealing to students and the transition may take some time.

IMPLEMENTING MULTIMEDIA METHODS IN ENGINEERING EDUCATION

Antti Keurulainen and Sven-Gustav Häggman
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In this paper, we investigate the process of generating modern multimedia-based learning material. The current status of the computer equipment utilised by the students was analysed and multimedia material suitable for the students' equipment was produced. The material is built on a CBE (Computer Based Education) concept that was developed in an earlier pilot project. The produced material covers the main areas of the course "Signals and Systems", taught in the Department of Electrical and Communications Engineering at the Helsinki University of Technology (HUT). The effort needed for constructing such material was analysed. The quality of the material was evaluated by distributing the implemented software to the students and assessing the benefits of using the material.

Network Education

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University of Tampere
Finland

The Institute for Extension Studies at the University of Tampere is coordinating a project called Network Education for Scientific Libraries, Archives and Museums. This three-year project is a part of the national programme Finnish Information Society. The Ministry of Education is funding the professional further education of scientific libraries and archives through the project. The aim of the project is to develop training based on information networks and to promote the production of related distance learning material. The project also aims at improving knowledge of teleinformatics and information networks in libraries, archives and museums. So far 14 courses of varying length have been organised with approximately 300 students from all over Finland participating. The project started in May 1996 and continues until the end of 1999 when the final report will be available.

Tailored Teaching for Students with Diverse Scientific and Linguistic Backgrounds: Potential of the WWW in Plant Pathology

Jyri Kankila
University of Helsinki, Finland

Pedagogic problems in teaching Plant Pathology at the University of Helsinki are analyzed, and some solutions
based on web-supported courses are suggested. In a wider perspective, web technology offers a tool for co-operation to the relatively small Plant Pathology departments in Northern European countries.

Web-supported
courses within the Nordic Forestry, Veterinary and Agricultural University (NOVA) or larger consortia, present an
opportunity to use the limited resources efficiently. At its best, web-based instruction can help combining
internationally-oriented education with maintaining scientific culture within small language groups.

Using the Web to Deliver and Enhance Classes: Two Case Studies

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Richard M. Lei, Associate Professor, School of Communication
Northern Arizona University, USA

This paper discusses two case studies conducted at Northern Arizona University. The studies are from classes that are using the World Wide Web to enhance teaching and learning. One class is the Art of Cinema, a film studies class that has been taught via Instructional Television (ITV) for five years. Various techniques have been used over the years to increase class interaction. This paper will address a step by step procedure for effectively using the Web to enhance the learning environment in large enrollment courses like this one by increasing interaction between student and teacher and among students. The second class, Creative Advertising Strategies was developed as a fully web-based course in the summer and fall of 1997 and taught on the web, concurrently with a traditional classroom section, in Spring 1998. A pilot study was conducted to determine student satisfaction of web-based versus a traditional classroom environment and comparisons are made to each other. Results of the study, along with implications for future web-based courses, are provided in this paper.

The Academic Development Fund at the University of Derby 1994-1998: Origins, Implementation and Lessons

Chris O'Hagan and Jennifer Fry,
University of Derby, UK

Today the University of Derby is an acknowledged leader in the UK in the integration of technology into teaching and learning and in the development of open and distance learning materials at all levels of post-school education - from outcentres linked to a main campus by videoconferencing, to Masters programmes delivered on CD-ROM supported by computer-mediated communication. Development is ubiquitous, and a key component in creating this ubiquity has been the Academic Development Fund (ADF) which began in 1994 and continues today (and at least to 2001) as the Operational Plan for the Teaching and Learning Strategy. The paper describes the origins and processes of the ADF and how it led to a combination of bottom-up and top-down approaches. We also suggest that some of the most significant outcomes of such a major investment in a 'shift from teaching to learning' are the hardest to quantify. Although our strategies were almost unique in 1994, more and more institutions are taking similar measures, and this account of the Derby experience may prove helpful.

A University Model for Integrating Technology into the Curriculum The Academic Architecture Initiative

John A. Bielec and Kenneth Blackney
Drexel University
Philadelphia, Pennsylvania,USA

A common academic architecture which facilitates the integration of technology into the educational process is critical for institutional success. The architecture must encourage faculty use and enhance learner productivity (i.e. make integration of technology into the curriculum as easy and painless as possible) by demonstrating "added value" to traditional teaching methodologies and course management. Technology must provide clear incentives for use. The Academic Architecture Initiative includes a Course Management Service (CMS) linked to common Instructional Application Tools (IAT).

Virtual Classroom for Business Planning Formulation

Osorio, J.; Rubio-Royo, E.; Ocón, A.
University of Las Palmas de Gran Canaria, Spain

One of the most promising possibilities of the WWW resides in its potential to support the long distance formation. The Web Based Training (WBT) acquires thus a high importance as a learning tool. In 1996, the University of Las Palmas de Gran Canaria developed the "INNOVA Project" in order to promote Web based training and learning. As a result, the Virtual Classroom Interface (IVA) was created, and WebCT (Word Wide Web Course Tools) was chosen as the main development tool. One application developed on this platform contemplates the academic instruction in business from an innovative perspective. The application, named SISTRAT, reinforces the teaching-learning process, guiding the student on a continuous basis through the different stages that conform to a strategic plan.

Dynamic WWW Style Processing with SeSAMe

Thomas Fischer
Universität Gesamthochschule Kassel, Germany

In the process of developing a new design concept for our university's WWW service we catalogued a list of specific formal and aesthetical requirements and finally worked out a problem oriented software concept. This might be useful for the university online worker as well as of hypertext-theoretical interest.

User Interface Implementation Issues for a Web-based system for Ordered Asynchronous Multimedia Annotations

Cleo Sgouropoulou, Anastasios Koutoumanos and Emmanuel Skordalakis
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Peter Goodyear
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WebOrama is a Web-based system that provides a platform for creating, managing and presenting ordered asynchronous multimedia annotations. This system will be used within the project 'SHARP' for the support of coordinated, asynchronous discussions, which will emanate from a video representation of industry's best practice. These discussions will serve as a medium for the exchange of tacit, experience-based knowledge, among a community of practitioners, and will also facilitate learners in the acquisition of complex skills applicable in real-world working context. WebOrama utilises an innovative algorithm for dynamic filtering of annotations, in order to provide an adaptive and customisable representation of content, personalised for a particular user-group perspective. This paper presents the issues encountered in the design and implementation of the user interface of WebOrama.

The adaptation of the CAL system Ceilidh for teaching the Oberon language

Igor Rozanc, Viljan Mahniè
University of Ljubljana, Faculty of Computer and Information Science, Slovenia

The Ceilidh CAL system [1,2] was developed at the University of Nottingham in order to support the teaching of programming courses with a special emphasis on the preparation and assessment of practical exercises. We describe the adaptation of Ceilidh for teaching the Oberon language at the University of Ljubljana. In order to minimize the extent of modifications, a careful choice of an appropriate Oberon compiler was necessary, and a compilation procedure that allows the compilation of several modules had to be defined. Major changes were necessary in order to adapt the six tests that compose the Ceilidh marking system, especially the built-in typographic and complexity analyses.

USE OF ITC TECHNOLOGY IN TEACHING AT THE LEVEL OF A B.Sc.: A PRACTICAL EXPERIENCE

Y. Epelboin
Université P.M. Curie, Paris, France

Abstract

Since 3 years the Web is intensively used for a course on Numerical Methods in Physics. All materials are available to students in advance and no paper is delivered. We report our experience, which is not as successful as it could be expected. Moving from old to new technologies does not seem so appealing to students and the transition may take some time.

The context in French universities

The use of Web technology in teaching is advocated everywhere and a number of people have already expressed their view [1]. Use of Information Technology and Communication (ITC) for teaching has been thought as the solution to different problems:

- presence of students in the theaters: more and more students work, at least part time, and cannot attend all the classes
- Active participation of students who, quite often, passively listen to the teacher. Since the notes are available in advance they may arrive, having read the course and asking more questions.
- Need to follow the real life where computers are used everywhere. Young people will have to use the Web and related technologies all along their life and should be accustomed to them very early.
- With the rapid increase in the number of students ITC may solve the permanent problem of the lack of teachers in front of students.

All these are good reasons to be interested in using ITC. Only the last one was not true, in our case, where 200 students follow a course in Numerical Methods in Physics and are taught a minimum in Fortran language for this use at the B.Sc. level (3rd year of Higher Education).

An additional reason is linked to the French Higher Education System. Fees are very low in France and the teaching services do not have the credit to print all papers for the students. By law we are not authorized to sell documents to the students: when they are considered as mandatory they must be delivered for free, otherwise we are not allowed to sell them. Thus each professor is limited in the number of pages, he/she may deliver to the students. Presenting documents on the Web for free is a good means to go around this limitation.

I may also add a more personal note: writing a book is a wonderful means to disseminate a course but the author looses his freedom as soon as the drafts are delivered to the editor. Publishing them on the Web allows to permanently update the contents and the visibility may be better than a specialized book which will never be sold to a large audience, especially when not written in English!

The course

The course is made of:

- General lectures that the students may attend in a theater. The presence is not mandatory. The professor speaks from the bottom of the theater and the interaction is very weak. The course presents mainly the theoretical side of the teaching without computer.
- Applied lectures for small groups of 25 students about, where they must be more active. They must solve a problem to be later written as Fortran program. The class may be very interactive depending upon the audience and the ability of the teacher. The rooms are not equipped with computers, not only because their access is limited due to the large number of students in the university, but also because we do not want them to start the programming. They must work primarily on the

theoretical and algorithmic aspects.
- Practical classes where each student seats alone in front of an X-Window terminal. He/she writes his/her code and solves the problem, which has been studied in the applied lecture. The attendance is never larger than 10 students, so that the teacher interacts very closely with the student, following the writing of the code and answering personally to each question.

The two first practical classes are devoted to a presentation of the computers and to the use of the Internet, both for Web and e-mail. Students are encouraged to use this means to communicate with their professors.

The use of Web [2] documents has been introduced in 1996. Since 1997 no paper is delivered. The students find the full course, the text of the problems for the small and practical classes as well as a number of other documents, practical information and links to other servers of interest. They decide by themselves when and how to use the documents. We ask them to print the text of the exercises and to prepare them in advance. It means they must establish a strategy in learning.

The content of the course is a classical one. The presentation has been thought for the Web. It means that the document has been divided in numerous pages, each of them presenting a topic and short enough to be loaded in a reasonable time. Frames allow to rapidly move among the chapters and hyperlinks are used to navigate in the course. Very few parts may be used interactively. This is a choice since we wanted to use the course also as a reference document. Our experience of interactive course [3] is that they are very useful for self-teaching but do not replace a reference book. It is also very difficult to integrate them in the classical organization of teaching: main courses and application classes with a limited number of controls.

An interactive course also means that the students have a free access to the terminals. Although true in theory, this is not the case in our university where the ratio of students per computer is still very high. This will change in the near future since we are installing a new computer room for the physicists only. The ratio will be 10 students per computer, which is much better than in many others fields. It must be remembered that Higher Education fees are very low in France (of the order of 200 Euros) and entrance into university granted to any student who has successfully achieved High School. Thus the money is scarce. Although growing rapidly, very few students have an access to Internet from home (10% only the past year, 20% in 1999, 30% expected next year). The price of computers decreases dramatically but access to the Internet is still considered as too expensive. It is a cultural problem: remote services using a Minitel exist since a long time and people do not yet understand the advantage to pay more for services which already exist and they do not yet realize what are the new ones.

Each year, the students are asked to fill a questionnaire. Filling the questionnaire is not mandatory, however the return level is of the order of 60%.

Practical experience

Most students (95%) are very happy to be taught about the use of the Internet and the Web. However when asked about its use for others courses, a minority only (15%) has been using the Web. In most cases the Web has been used for fun and looking for information not related to their study. They seldom use documents not written in French; it must be emphasized that the language is a strong barrier to access foreign documents.

E-mail is seldom used to exchange with the teachers (5%). They use it among them, mostly for fun and very few have correspondents outside the campus. It seems that the interest is growing rapidly the following year when they are starting to look for a position in a laboratory for practical experience.

The criticism about the use of ITC for education is more severe and clearly shows the limitation in their use nowadays.

It must be remembered that the grant per student is rather small, compared to the number of students, and the ownership of a microcomputer cannot be made mandatory. The students complain about the

difficulty to access a terminal or a PC on the campus and about the limitation for printing. However this is often more a pretext than a real reason: during the practical courses where they sit alone in front of a terminal they very seldom start a browser to find an explanation in the course on line. This explains why complementary documents are seldom opened: they are thought to be read mostly when programming and students seldom open a browser at that time.

All students have read and printed the texts of the problems because they must have them at hand for practical classes. But 60% only have looked at all the chapters of the course! Many other are often ignored: most students never look at the texts of the examinations from the preceding years or additional information such as time schedule, history of computing...

The students primarily want to print all the information and do not yet have the habit to browse from a screen and to select the most useful documents. They are still paper addicts. When asked, at the beginning of the present year what would be their choice, 80% answered that they prefer a course delivered on paper. This figure does not change significantly at the end of the year.

Near future

Our primary idea was to develop a series of control exercises and to give access to a chapter of the course only if the understanding of a preceding one had been tested successfully. A number of packages, such as Lotus notes, allow to include such a control and to dynamically follow the progress of a student.

Although the number of terminals available next year would be sufficient to allow such a strategy we will not start this move. A new technology does not mean that the students are ready to change the way they learn. They are accustomed, in the French education system, to listen to teachers, from time to time to solve exercises when requested and to read back their notes rapidly at home, going into details often only a few week before the examination. Using the Web means to be more reactive, to lurk into the course each time a question is not answered.

For the teacher, the Web would be a real support if the students read the contents of the lecture in advance, so that he/she only has to comment the topics of the day and to answer to questions. It means a complete change in the way young people are taught and this is clearly another challenge!

Conclusion

Our conclusion is not pessimistic. The revolution in the use of new technologies is not only the problem of access: it is more a cultural problem moving from a client attitude where the student receives the information to an active one where the student is really engaged in his/her study. In a few years the majority of students will have access to the web from home. However this will not make them enthusiastic supporters of ITC. They will continue to favor the classical approach as long as the methods of teaching remain the same.

The future is more in permanent education. Professionals seek desperately all kind of information, which may be of help at any time anywhere. We have received a number of messages from people inside or outside the University, already engaged in their professional life, who use this course in other contexts. For people who cannot attend a course there is a great future in these new methods. It is believed [4] that as soon as 2002, more than 60% of students in American Universities will belong to this category. We should keep in mind, that, for many years, the main use of ITC would be for permanent education, at least in countries with classical education, such as France.

Using ITC is more a long-term investment preparing new methods of teaching for tomorrow than a method to solve rapidly today problems.

Bibliography

[1] For instance the papers presented at EUNIS 97: http://www.eunis.org/congres.html

[2] See URL: http://www.lmcp.jussieu.fr/enseignement/ye/licence/

[3] See for instance the interactive course on "Symmetry in Crystallography" URL: http://www.lmcp.jussieu.fr/enseignement/ye/cristallographie/cristal.html

[4] J. Bielec, Drexel University, USA, conference at the General Assembly of Universities Presidents in France, Paris, February 1999

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IMPLEMENTING MULTIMEDIA METHODS IN ENGINEERING EDUCATION

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In this paper, we investigate the process of generating modern multimedia-based learning material. The current status of the computer equipment utilised by the students was analysed and multimedia material suitable for the students' equipment was produced. The material is built on a CBE (Computer Based Education) concept that was developed in an earlier pilot project. The produced material covers the main areas of the course "Signals and Systems", taught in the Department of Electrical and Communications Engineering at the Helsinki University of Technology (HUT). The effort needed for constructing such material was analysed. The quality of the material was evaluated by distributing the implemented software to the students and assessing the benefits of using the material.

KEYWORDS: MULTIMEDIA TEACHING, CBE, CD-ROM

1. INTRODUCTION

From the beginning of the history of the computer, there have been various attempts to use computer and software programs for teaching purposes. The potential benefits that Computer Based Education (CBE) offers are considered tempting and promising among teaching material producers. In many areas, there is a need for more efficient teaching methods and also a lack of teaching recourses due to increasing student volumes. Production of CBE material has, however, faced difficulties, since the production process has been very demanding and expensive. This has changed dramatically during the last five years; the development tools for multimedia authoring, graphics production and voice production have experienced a rapid development. The production of high-quality multimedia material is now easier and faster than ever before. In addition, the latest versions of the multimedia authoring tools usually support network-based distribution by utilising efficient compression on streaming technologies, bringing new possibilities to the distribution of the study material. On the hardware side, the equipment that can execute rich multimedia presentations has been expensive and thus has not been affordable by students in general. The rapid evolution of the PC-computer has made it powerful enough to execute processing-intensive multimedia presentations. At the same time, the cost of the PC-computer has gone down resulting in an increased penetration of computers.

The work related to this paper is based on a previously documented pilot project [1], in which the multimedia CBE concept was developed and 30 % of the material of a specific course, "Signals and Systems", was organised into a developed platform. The main objectives of the present project, in addition to the produced material itself, were to follow the evolution of the students' hardware, to analyse the effort needed to produce multimedia material on a larger scale, and to evaluate the quality of the produced material.

The results of this survey of the students' hardware are presented in the second section. In the third section we briefly describe the pedagogical multimedia concept and the platform that was designed during a previous pilot project. The effort needed for producing multimedia material is presented in the fourth section. In the fifth section, we evaluate the quality and the usability of the CBE concept

and the learning material. Finally, in the last section we draw the conclusions.

2. SURVEY OF THE STUDENTS' EQUIPMENT

Two different inquiries have been organised to investigate the development trends of the computer hardware utilised by the students. The first survey was conducted in autumn 1997, and the second in spring 1999. The survey was organised in connection with a course that is obligatory for all students studying in the Department of Electrical and Communications Engineering at the Helsinki University of Technology. In the first survey, 237 students attended the course of which 218 took part in the survey, resulting in a turnout of 92%. In spring 1999, correspondingly, 350 students attended the course of which 244 took part in the survey, resulting in a turnout of 73%.

We have collected information on the computer penetration among the students participating in different courses in the Communications laboratory. Based on these inquiries, we estimate that the overall computer penetration among the students in the department is 85 %. The high penetration indicates that students lacking the necessary equipment efficiently utilise the computer hardware in the classrooms provided by the university. Thus, the CBE material is accessible by practically all students.

Fig. 1 summarises the types of computer owned by the students, and illustrates the development trend between the two surveys. The quality of the equipment has been improving rapidly, since within 18 months the number of 486-type processors has dropped considerably and the Pentium-level processors have reached a 94 % share of the total computer population. There are now less severe restrictions on the multimedia material itself, since the minimum hardware requirement can be shifted to a Pentium-level processor. This is an important improvement, since many concepts - like audio decompression - require a Pentium-level processor.

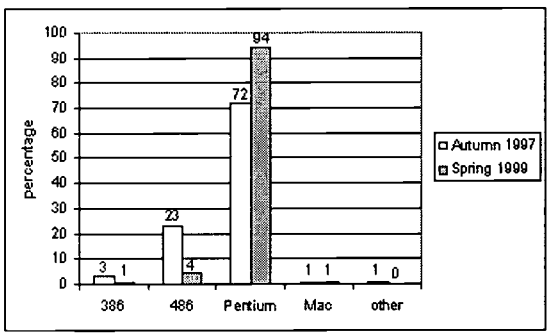

Figure 1. Type of computer owned by the students in the survey.

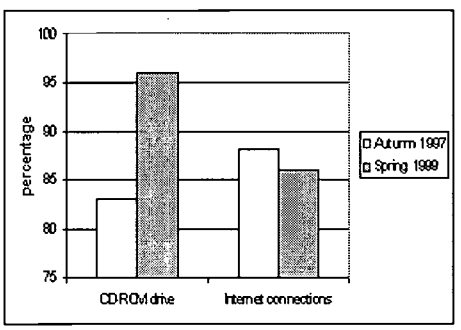

Figure 2. Availability of CD-ROM drives and Internet *connections*

Fig. 2 presents information for selecting a suitable distribution channel where, in practice, the choice is between internet/intranet and CD-ROM. It seems that the students are reached more efficiently through CD-ROM; however, network-based distribution might offer some other benefits. The greatest advantages provided by network-based distribution are more flexible updating and publication of the material and better control over unauthorised usage.

3. THE IMPLEMENTED CBE CONCEPT

The implemented CBE concept was developed during a previous pilot project and is described here only briefly. A more detailed description can be found in [1]. When designing a modern multimedia

application, both pedagogical and technical aspects should be taken into account. On the technical side, one of the most important aspects is the flexibility and easiness of the management of the material. In practice this implies a highly modular system, where the replacement and addition of different software modules is made as easy as possible. When designing the CBE concept, one should also always keep in mind the possible future needs and trends. The distribution channel might be different in the future, there might be a need for other language versions, etc.

On the pedagogical side, modern multimedia methods can offer potential benefits not achievable with traditional learning methods. A learning environment can be made adaptive to the learners' skills and learning styles. There might be built-in tools for assisting the user to gain conceptual understanding of the material and to improve his/her metacognitive skills. The implemented system includes two major sections, namely conceptual learning and in-depth learning. The main purpose of the conceptual learning section is to provide knowledge of the conceptual relation between different modules of the system. The user is visually shown all the material modules that he/she should learn to understand a certain topic as a whole. Employing this tool, the user is able to select a set of modules in a suitable order depending on his/her background, learning goals and learning styles. The conceptual section also includes support for problem-based learning where the user is guided to find answers to particular questions instead of learning the material as such [2].

The in-depth learning section comprises the actual study material. This section is divided into theory, examples and demonstrations parts, each presenting a different view on the study material. This section strongly relies on multimedia techniques including animations, visualisations and voice. Utilising these components, the user can take advantage of the powerful human visual system to gain conceptual understanding [3]. The construction of the material differs greatly from the hyperlink-type approach, which is not seen to offer a reliable alternative to improve the conceptual understanding of the material [4]. The user will, instead, always go through the conceptual learning section to review the structure and interrelation of the material modules.

The implemented concept also includes a self-assessment function, where the user is asked to estimate how well he/she understood the studied block. The result is recorded into a specific learning log designed to support the development of the students' comprehension monitoring and other metacognitive skills [5].

4. SOFTWARE IMPLEMENTATION AND DEVELOPMENT EFFORT

A well-known problem in the field of CBE is the production cost of high-quality multimedia material. We decided to use a modern multimedia production environment that supports a wide range of multimedia components with support for animations, visualisations, voice integration and media synchronisation. In our case, the production process can be divided into two distinct phases. The first phase comprises the design of the pedagogical concept and the implementation of the platform for the material modules. The second phase involves the production of the material modules. The first phase constitutes a big initial effort, where probably many months have to be spent before the production team can start producing the actual learning material. To reduce the production costs, it is possible to generate distinct material modules without employing a common platform or pedagogical concept, but in this case the many benefits and possibilities of CBE are lost.

When the platform and CBE concept is ready, the material itself can be produced and added into the system. In our implementation, multimedia material corresponding to approximately one credit unit (the equivalent of 13 lectures of 45 min. duration) is divided into 25 - 35 modules. The effort

devoted to the construction is proportional to the quality and usability of the material. Reducing the amount of animation and visualisation, the material can be produced faster and cheaper, but then the benefits of using multimedia applications in the educational material become less obvious. Regarding the extent of multimedia applications, we aimed at the level where there is a clear benefit for the students to be gained by efficiently utilising the possibilities of the CBE.

Table 1 shows the effort needed to build a typical block for a team that already knows the area of the material and is familiar with the production tools and methods.

Effort needed for one typical material module	
manuscript	8 h
graphics	4 h
formulas	1 h
animations	5 h
authoring	5 h
audio	1 h
Total effort for one module	24 h
Total effort for material corresponding to one credit unit	600 - 840 h

Table 1. Effort needed to build CBE material.

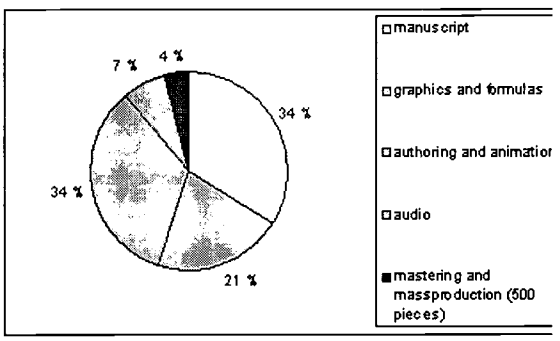

Figure 3. Cost distribution for different phases of the production.

Fig. 3 presents the cost distribution for the different phases of the production, in the case where the distribution channel consists of a CD-ROM. It should be observed that the delivery and mastering costs do not play a significant role in the overall cost distribution.

The software was implemented by using Macromedia Director authoring tool and standard graphic production tools, voice production tools and equation editors. The results from the students' hardware survey were used for setting the minimum computer configuration for the CBE program, namely a Pentium-level processor, 16-bit colour mode, monitor with resolution 800 x 600, Soundblaster compatible soundcard, CD-ROM drive and mouse.

Fig. 4 presents a screen view of the conceptual learning section and the in-depth learning section. The user first selects a suitable module in the conceptual learning section and then moves to the in-depth learning section simply by double-clicking the desired module.

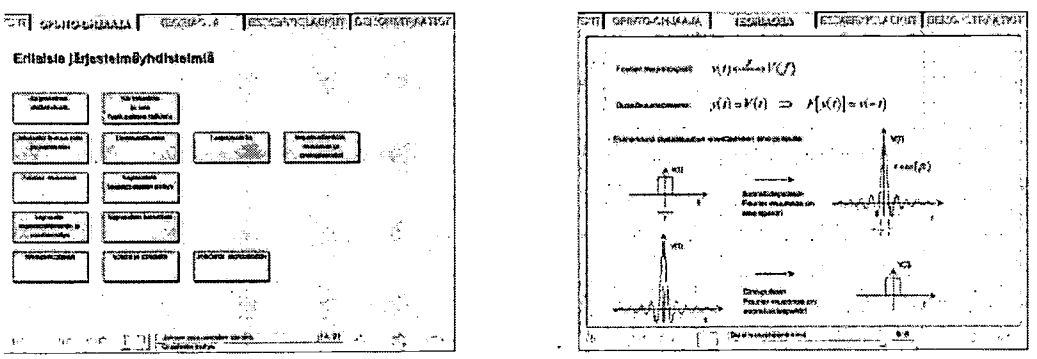

Figure 4. Screen views of the conceptual learning and in-depth learning sections.

5. EVALUATION OF THE CBE SOFTWARE

When producing multimedia material, there is a trade-off between the quality of the material and development cost. The target in our case was to produce material which benefits from the use of multimedia methods like animation and visualisation. To find out if this target had been achieved, we distributed the software on a CD-ROM to all students that took part in the "Signals and Systems" course. The multimedia material was selected to cover all main areas of the course material, and the students used the CD-ROM in conjunction with the traditional learning methods. After the examination, we conducted a survey in which the students were asked to estimate the usefulness of the CBE software. The results of this survey are presented in Fig. 6. The majority of the students who took part in the survey felt that there was a clear benefit of using the program. 13 % of the students were of the opinion that the multimedia material was crucial to them for understanding the course content.

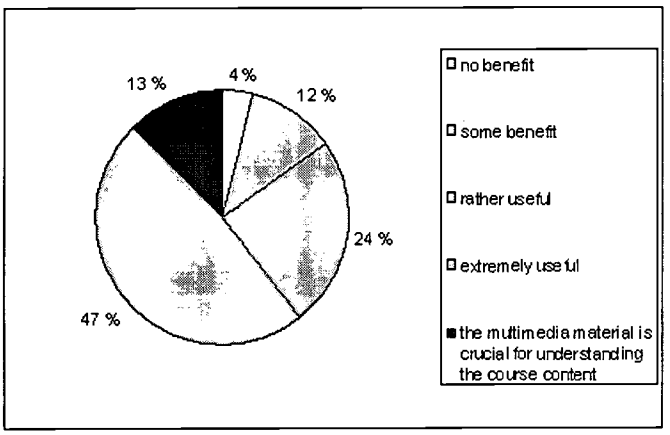

Figure 6. Feedback from the students about the benefits of the CBE software.

The students were also asked to name the most advantageous part of the CD-ROM. The most popular choice was "convolution", which is one of the basic principles described in the course. The examination usually includes one task from this area, and thus the examination results can be compared to previous results. In Fig. 7, three examination results are shown. The latest result is from an examination that was held in spring 1999, when the students could use the CD-ROM in preparing for the exam. In spring 1998, the students could use the pilot version of the software, containing 30 % of the course material. In four exams during the years 1996-1997, the students did not have any multimedia material available. It can be observed that there is a clear improvement in the examination results. The comparison of the different examination results is not, however, straightforward. Small variations in the degree of difficulty of the exam tasks - and the change of examiner from one task to another - make a straight comparison difficult.

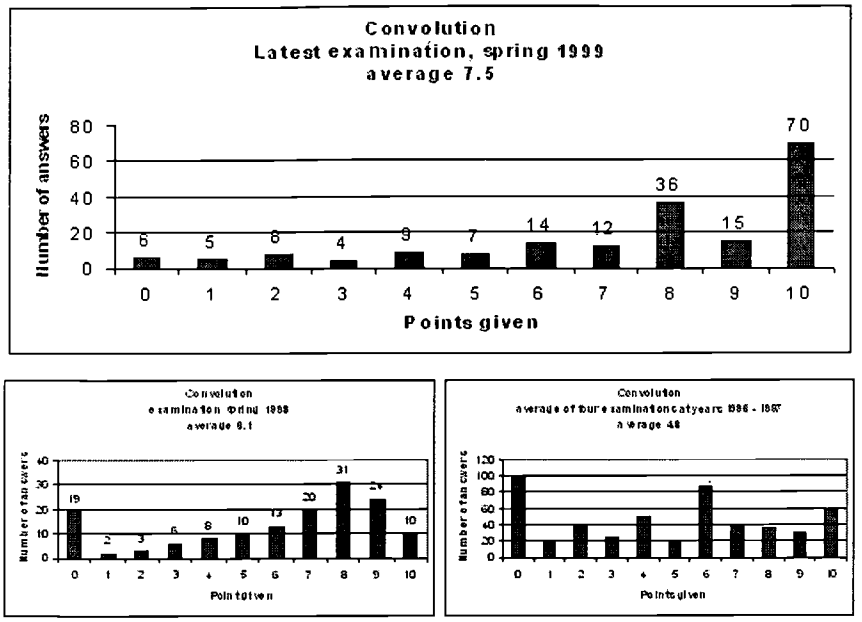

Figure 7. Comparison between different examinations.

6. CONCLUSIONS

In this paper, we addressed the production and evaluation of CBE material. First, we investigated how the students were following the trends in hardware development. A high computer penetration among the students was observed, and the quality of the equipment also turned out to be high. Secondly, we shortly described a CBE concept that was developed during an earlier pilot project. Thirdly, we analysed the effort needed for producing the material, employing the existing CBE concept. With modern production tools and methods, 600 - 840 hours of work was required for producing the material corresponding to 1 credit unit. Finally, we evaluated the implemented software and CBE concept by collecting feedback from the students and comparing the latest examination results to previous examinations. The feedback from the students was very positive, and a large majority believed that there was a clear benefit from using the CBE software while studying the course content.

ACKNOWLEDGEMENTS

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Using the Web to Deliver and Enhance Classes: Two Case Studies

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Abstract

This paper discusses two case studies conducted at Northern Arizona University. The studies are from classes that are using the World Wide Web to enhance teaching and learning. One class is the Art of Cinema, a film studies class that has been taught via Instructional Television (ITV) for five years. Various techniques have been used over the years to increase class interaction. This paper will address a step by step procedure for effectively using the Web to enhance the learning environment in large enrollment courses like this one by increasing interaction between student and teacher and among students. The second class, Creative Advertising Strategies was developed as a fully web-based course in the summer and fall of 1997 and taught on the web, concurrently with a traditional classroom section, in Spring 1998. A pilot study was conducted to determine student satisfaction of web-based versus a traditional classroom environment and comparisons are made to each other. Results of the study, along with implications for future web-based courses, are provided in this paper.

Background

Northern Arizona University (NAU) is located in the mountain community of Flagstaff, Arizona (population 50,000) at an altitude of 7,000 feet (2,100 meters) and is about a ninety minute drive to one of the Seven Wonder of the World, the Grand Canyon.

NAU is the smallest of three universities in the state of Arizona with an on-campus enrollment of approximately 14,000. The University of Arizona in Tucson and Arizona State University in Phoenix are large research institutions located in major metropolitan areas. Each of these two universities has an enrollment in excess of 40,000. The Arizona state legislature and the three-university governing board have mandated that NAU deliver higher education programs and courses throughout this large, sparsely populated state, from the Mexican border in the south to the northern most point on the Navajo Native American Indian reservation.

For decades NAU's continuing education program either hired teachers at locations throughout the state or had teachers travel sometimes hundreds of kilometers from the Flagstaff campus to statewide sites. This proved to be both time consuming and limiting.

In the spring of 1990, the university offered its first live interactive television courses to 59 students in Yuma, Arizona, some 250 miles away near the Arizona/Mexican border. Instructional Television (ITV) grew fitfully at first, facing deep internal divisions. Through a series of programs, workshops, seminars, research projects, grants and evaluation tools, all of which were developed with input from the teaching faculty, ITV has become a university success story. Today NAUNet, a distance-learning telecommunications network connects more than twenty statewide classrooms for live, full audio and video ITV classes, as well as classes that are shown on cable TV. This year about 9,000 students have enrolled in over 160 ITV classes.

The Distance Learning Technology Mission

The NAU mission states that the university will "offer instruction... that employs a variety of strategies to support distance learning and provide opportunities for faculty (teacher)... development." And a stated NAU goal is "to be recognized as a national and international leader in the application of distance learning technologies."

NAU's accrediting agency, the North Central Association on Institutions of Higher Education (NCA) has published its Guidelines for Distance Education. The first of those guidelines is that distance education "programs provide for timely and appropriate interaction between students and faculty and

among students."

Additionally NAU subscribes to the American Association of Higher Education's endorsed Seven Principles for Good Practice in Undergraduate Education. The first two principles are:

- Good practice encourages contact between students and faculty.
- Good practice develops reciprocity and cooperation among students.

In its centralized development of web-based courses, NAU has incorporated interactivity into the course design. ITV course development, on the other hand, is not centralized, so some ITV classes, like some traditional classes, are more interactive than others are. The highest enrollment classes at NAU are offered live on cable TV. Students who watch the classes live at home are generally reticent about calling in. Many students tape the classes and view at their convenience. In these classes there is little contact between students and faculty, and reciprocity and cooperation among students has been almost been non-existent.

This paper discusses two case studies conducted at Northern Arizona University. The studies are from classes that are using the World Wide Web to enhance teaching and learning. One class is the Art of Cinema, a film studies class that has been taught via Instructional Television (ITV) for five years. Various techniques have been used over the years to increase class interaction. This paper will address a step by step procedure for effectively using the Web to enhance the learning environment in large enrollment courses by increasing interaction between student and teacher and among students.

The second class, Creative Advertising Strategies was developed as a fully web-based course in the summer and fall of 1997 and taught on the web, concurrently with a traditional classroom section, in Spring 1998. The results of a study conducted three times during the semester, which asked students to rate their overall satisfaction/dissatisfaction with the course mode of delivery along with implications of this study, conclude this paper.

Class: The Art of Cinema

Approximately 25% of a student's academic career at NAU consists of general studies courses in the areas of arts, humanities, natural sciences, social sciences, language, analysis skills and world and cultural diversity. In the arts block a student can choose courses from the disciplines of music theory, theater and drama, literature and film studies. The Art of Cinema is an overview of the art, history, technique and business of film. Most students who take the course are juniors and seniors who have never studied film before.

The Art of Cinema has been a popular course for many years, offered in several large lecture sections, of about 150 each, every semester. Class size has influenced pedagogy which has been primarily lecture with many film clip examples. The class seemed a natural for ITV and since 1993 one section each semester has been offered on cable television with enrollments often reaching 300. Students are divided into two sections: a live studio section consisting of up to eighty students and a television section with hundreds enrolled. What little interactivity there had been in the lecture hall continues in the live smaller studio section but has been almost non existent among the home students.

Interaction

There were various attempts at interaction. In the lecture section there had been two exams and two papers each semester. A weekly writing component was added to the class, thus affording students an opportunity to interact with the material, if not each other. During one semester video coupon gift certificates were handed out to anyone who called in from home with a relevant question or comment. That worked for a few weeks, but the same people kept calling in.

One activity that did work and has been repeated each semester has been to give students specific questions to think about one week and then offer credit toward a grade for contributing during the live class period. Specifically, the students read the novel and watch the film version of "One Flew Over the

Cuckoo's Nest." The week before the class discussion, the students are given ten questions to consider. The resulting class discussion lasts nearly two hours with students calling in from home interacting with those in the studio classroom, and the instructor. Still this is only one class period, and the course does not lend itself to a weekly discussion.

Adding Technology

In spring of 1997 students in The Art of Cinema were required for the first time to submit all assignments electronically via E-mail. About half of them had used E-mail up to that time. They were given three weeks to establish an E-mail account. The instructor was much more lax about assignments being received on time, allowing both for technological problems and more importantly for students' fear and discomfort with technology. Faculty-student interaction increased so much that the instructor needed assistance and a separate account to handle the volume of E-mail. Enrollments fell in the class that semester for the first time.

In fall 1997 an asynchronous, text-based Virtual Conference Center (VCC) was added to the class. Now rather than individual E-mails to the instructor, the students were put into groups to write about the weekly lesson and movie with classmates. The first assignment was to introduce themselves to their group members. Another assignment was for each to find a cinema web site, share it with their group, evaluate the web sites and discuss criteria for evaluation. The most successful assignment was to set up virtual study groups for a midterm examination. The first week each group was given a study question to discuss. The second week, all the groups got together in the Virtual Conference Center to discuss their answers.

About ten percent of the total course points were for the weekly assignments. Almost all of the students did almost all of the assignments. The instructor needed even more assistance. Enrollment dropped again.

The enrollment in Fall 1998 was the lowest yet. The drop out rate was over 20%, ending with160 students. The students were again put into groups in the Virtual Conference Center, this time for a semester project, made up of seven assignments, accounting for over thirty percent of their grade.

The assignment was to do an in-depth study of one classic film by studying and writing about the movie individually and creating a group web site for the film. Assignments were due on a stated date but could be submitted in the VCC as late as 23:59 on the due date. Like most electronic communication, the Virtual Conference Center notes the time of submission.

There are a few keys to ensure student involvement in a virtual setting. First, credit toward their final grade must be given. Extra credit can be used, but that does not work as well. Flexibility on the instructor's part is necessary at this stage in students' technological savvy. Many students are still afraid of the technology, and the instructor may need to do some virtual hand holding to guide the students along. The student needs regular input from the instructor or from a qualified teaching assistant. For group work, a group leader must be identified.

The fall, 1998 Art of Cinema assignment schedule is included below and is easily adaptable to other academic disciplines. Note that the first assignment was E-mailed to the instructor, so that groups could be built using students' names.

Assignment number	**Assignment Schedule** Description
# 1	E-mail your top 3 movie choices and identify your skills and strengths from this list to help determine the contribution you can make to your group: knowledge of html coding, knowledge of movies, web user, research on the web, research in print, artistic, computer skills, computer software (identify PowerPoint, Director, Page Maker, etc.), writing ability, public speaking and presentation skills, other (be specific) You may also include names of people you wish to work with.
# 2	Find your name in the Virtual Conference Center. Each group is identified by a movie title. Your name should be within one of the movies from your list. Introduce yourself to your group. There will be specific items for you to discuss.
# 3	You should have watched your movie by now and begun research. Publish a home page for your web site. Note the film title and names of your group members. In the VCC, give your web page URL and request a presentation date.
#5	In VCC identify at least 8 links for your movie. Rank the links from best to worst and discuss your criteria for the ranking. Add at least four links to your web page. Add other information to your web page. Discuss themes and ideas that your will be exploring in your web site
#6	Complete your writing assignment and link it to your movie home page.
#7	Complete your web site and grade each person in your group.
#8	**In-class Web Presentations** are to be no more than 10 minutes long.

Be certain to allow enough time between each assignment both for the instructor and the student.

Class: Introduction to Advertising Course - ITV Example

Beginning in 1994, Introduction to Advertising has been taught via ITV on cable television every fall semester. This course is designed as an introductory level advertising class teaching vocabulary, concepts, and basic elements of advertising. Most students enrolled in the class are either freshmen or sophomores. Utilization of television allows large enrollments of approximately 170 per semester.

Students are divided into two sections: a studio section consisting of 18 individuals, and a television section where the remaining +/- 150 students watch the class via television on and off campus, live or on video tape. The studio students provide a "live audience" component in that they ask questions, are encouraged to participate, and provide an important feedback loop for the instructor. Students who view the course via television are encouraged to call in with questions. Those students who do call become

part of the audio component of the class, and their questions are answered while the class is being broadcast live.

Student exam scores for both sections are essentially equal and student evaluations of the class are uniformly positive. The television model has been successful in exposing students to non-traditional teaching environments without sacrificing quality or student learning outcomes.

Class: Creative Advertising Strategies - Web Based Delivery & Pilot Study

In the spring of 1998, another advertising course was developed for a different non-traditional teaching environment. Creative Advertising Strategies is a junior level course taken by advertising and marketing promotion majors. The course focuses on the marketing concepts utilized in advertising campaigns, and requires the students to work in teams to develop a prototype campaign as well as complete two examinations and read a textbook. This same course was also taught as a traditional class, and the lectures were video streamed allowing web-based students the opportunity to see lectures.

In order to assess strengths and weaknesses and assess learning outcomes, a pilot research study was conducted. The two sections of the course (one web-based, the other traditional classroom) were administered questionnaires at roughly four week intervals throughout the semester. A total of 17 questions were developed, which roughly translated to the

evaluation of overall student satisfaction with the course and its delivery mode.

Five broad conclusions were suggested by this research:

- Students in both the web and lecture sections reported greater overall satisfaction as the course progressed throughout the semester.
- Throughout the semester, the lecture section reported greater overall satisfaction with the class than the web section at all reporting intervals.
- The greatest strength reported by students in the lecture section was "faculty and student interaction" while web students reported "convenience."
- The greatest weakness reported by students in the lecture section was "inconvenient time/location." Web-based students reported "lack of faculty and student interaction" as the greatest weakness. This was the opposite of the strengths noted by each section.
- Consistent with lower overall satisfaction in the web class, students performed 4% -10% below the lecture in their mid-term and final exam scores.

Working on team projects proved to be the greatest challenge for this web-delivered class. Despite use of a variety of electronic means, students believed that their lack of face-to-face contact was difficult to overcome. Most often, they developed their own means to facilitate communication, and appeared to default to whichever communication means were easiest, E-mail, virtual conferencing, telephoning, or face-to-face contact.

Implications for Web Course Development

This pilot study suggested five key implications for those developing web-based courses in the future:

- In that convenience is perceived as a major advantage of a web class, faculty should provide means (e.g. E-mail, virtual conferencing, etc.) to ensure adequate faculty-student interaction. Students can become overwhelmed and feel isolated because they do not have regular person-to-person contact with each other.
- Students will likely perform below those who enroll in a traditional course. Additional review materials or segmenting material into relatively short "learning modules" help break up content into smaller, testable units.
- Group/team projects pose scheduling and implementation challenges. In classes where group activities are utilized, virtual conferencing should be implemented.
- Students should be required to demonstrate that they have adequate computer skills and access to

appropriate equipment before registering for a web-based class.
- Blending of technologies is suggested, For example, supplement web materials with an audio track of the instructor giving a truncated lecture could better simulate a classroom environment.

Web-based delivery offers institutions a means to extend their geographic service area, and to serve a student population who would otherwise not have the opportunity to take university classes. As improvements in pedagogy are implemented, student satisfaction and performance will be maximized.

Network Education

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Abstract

The Institute for Extension Studies at the University of Tampere is coordinating a project called Network Education for Scientific Libraries, Archives and Museums. This three-year project is a part of the national programme Finnish Information Society. The Ministry of Education is funding the professional further education of scientific libraries and archives through the project. The aim of the project is to develop training based on information networks and to promote the production of related distance learning material. The project also aims at improving knowledge of teleinformatics and information networks in libraries, archives and museums. So far 14 courses of varying length have been organised with approximately 300 students from all over Finland participating. The project started in May 1996 and continues until the end of 1999 when the final report will be available.

Aims and Organisation

Network Education for Scientific Libraries, Archives and Museums is a project launched in the spring of 1996 by the Institute for Extension Studies at the University of Tampere. The aim of the project is to enable the personnel in libraries, archives and museums to take advantage of teleinformatics and information networks more effectively in their everyday work. Information networks are also used in the actual training of the personnel. The Ministry of Education is funding the project as part of the national programme Finnish Information Society.

The project focuses on developing distance learning based on information networks, related learning material and necessary tools. Distance learning through information networks is integrated as part of the training so that using the technology would become a natural part of work for the personnel. Information networks are topical and play an important role in the organisations which participate in the project, and therefore, the entire personnel should have a basic knowledge of this field.

The project is coordinated and training designed by the Institute for Extension Studies at the University of Tampere. The Continuing Education Centre at the University of Oulu is responsible for the distance learning course environment and it is also involved in the designing of the learning material. Partner libraries include the libraries of the University of Jyväskylä, the University of Tampere and the University of Techology, who give regular feedback on the training and learning material. In addition to these partners, representatives of the National Archives and the Finnish Museum Association participate in the project.

Stages of the Project

The project lasts three years. The first stage consisted of designing training for libraries, and the first courses began in the autumn of 1996. At the same time the project team began planning the distance learning and related study material. The second phase of the project focused on the education itself and how it could be further improved. The education was expanded at this stage to also include archives and museums. The third and last phase is presently in progress: in addition to existing courses, in-house instructors for the organisations are being trained. The last courses in the project are organised in the autumn of this year. Part of the courses will undoubtedly continue in one form or another even after the project has ended.

Based on feedback received during the training, the distance learning and related study material have been further developed. The participants give feedback both during the training as well as at the end of it. The aim is to react to this feedback as quickly as possible. If necessary changes cannot be made in the ongoing training, they will be made when the next training is designed. Part of the feedback also comes from the project team. This group of experts, who meet 3-4 times a year, functions as a support group in

- the project. The group monitors the progress of the project and guides it in the right direction. The project lasts until the end of this year after which the final report will be made.

Training

The project consists of extensive information network courses and short updating seminars. The courses take place primarily in Tampere, and participants come from different parts of Finland. The courses aimed at libraries comprise contact teaching days and distance learning periods between and after the contact days. Participants meet three times for the contact teaching, which lasts 2-3 days. In all, the training takes from three to four months. The corresponding, but shorter training aimed at archives and museums has been adapted from the training for libraries. The need for basic training in archives and museums seems to be smaller and the starting level of students on average lower than in libraries. Both programmes require a basic knowledge of Windows.

In addition to long courses, two-day open updating seminars are held approximately twice a year. The majority of participants have earlier completed the network education or some other training provided by the Institute for Extension Studies. The aim of the seminars, as the name implies, is to update on the participants' knowledge of information networks. Topics vary, but the aim is to choose current themes which are relevant to the target group. In the seminars experts give information about the latest developments in the field, for example, in content, software and hardware. These seminars will be held even after the project has ended, because the field develops so rapidly, and the seminars have proven to be a good forum for meeting people in one's own field, for getting new ideas and exchanging experiences.

Participants in the instructor training are required to have a basic knowledge and skills of information networks. The majority of participants have had extensive training in information networks or they have completed other corresponding training. The instructor training is primarily pedagogical with an emphasis on distance learning. The participants are trained to master tools necessary for distance learning. The students also hold a practice course in their own organisation during the training period. They design, execute and tutor this course themselves supported by their own tutors.

Courses in the project are independent entities, but at the same time they complement each other. For example, a student who has had extensive training in information networks can regularly attend the updating seminars in order to get the latest information. In addition, he can take part in the instructor training. By combining different courses, an organisation will get truly valuable information network experts, who can train the rest of the personnel in the future.

So far 14 courses have been organised, and there have been altogether approximately 300 participants. The students come from scientific libraries, public libraries, company information services as well as archives and museums. The programme for the autumn will include one more instructor training, one updating seminar, and one extensive information network course for libraries. The information network education in the Institute for Extension Studies began as early as 1994, and it will undoubtedly continue after the project. In the future experiences gained from the project will be an important asset, and they will be used to further develop the network education.

Studying

The contact teaching has been constructed in a way to support distance learning as well as possible. Participants will learn basic skills, which they can broaden during the distance learning periods according to their own interests. Most of the teaching takes places in a computer classroom where all the students have their own computer. They will learn the use of information networks by doing and get the necessary skills needed in independent study. During the distance learning periods the participants complete independent assignments, which are closely linked to the contact teaching. They are supervised by the instructor. The assignments tie together the individual contact hours, they teach the participants how to use the team software and guide them to work in groups. The assignments are also used to monitor that all the students can keep up with the training.

- In the beginning of the project web pages with an access code combined to a mailing list and an automatically updated noticeboard were used as the basic learning environment. During the second year a team software developed by the Continuing Education Centre at the University of Oulu was adopted. It has built-in communication tools and editors which have made studying easier and more wide-ranging. The students only need a computer connected to a network. Currently the third version of the course environment is being used.

The material for the courses can be accessed with a password and the students can also save their work in the same environment. Communicating with teachers, tutors and other students also takes place in the same environment. The team software enables collaborative learning across organisational boundaries and helps students share ideas and experiences with other participants throughout the training.

The instructor of a course creates the learning environment and distributes access codes to teachers and students. He also updates the pages and acts as tutor throughout the training. Students become familiar with the team software during the first contact teaching period when they are introduced to all the relevant functions with the help of exercises. The supervised exercises in the computer classroom guarantee that all the participants get a good start for the distance learning. Another medium of learning is the open discussion forum where students can discuss problems and ask questions. Tutors and teachers can also be contacted personally.

The course environment contains material related to the teacher's own teaching and assignments, and it can contain a list of links to web pages which deal with relevant themes. Thus, the student has at his disposal all the material used during the contact teaching to support the distance learning. In addition, separate study packages have been designed, which also contain lecture material, links to web material, and exercises. The study packages are completed between the contact teaching periods under the supervision of the tutor, who also checks the exercises and gives feedback. Each student chooses sections of the package that he needs and completes the related exercises. In other words, the distance learning is based on voluntarism, but students who complete all the sections in the package are given a separate certificate.

Results of the Project

The project has been extremely valuable for the development of information network education. Preliminary information of the students' skills, earlier experience and their expectations have proven useful. A detailed description of them, however, is almost impossible to get prior to the training even from the students themselves, because they all have a different understanding of their own skills and needs. During long training periods the programme can be changed according to the wishes of the participants. However, courses that students may have initially regarded as unnecessary have often proven to be the most rewarding ones. This is because the students have not had an exact idea of the topic.

In the beginning of the project it was difficult to estimate the correct ratio between contact teaching and distance learning. After experimenting different alternatives, the contact teaching has been decreased by way of increasing the amount of distance learning material and by having the teaching primarily in computer classrooms. Some contact teaching, however, seems to be necessary for effective training and results. Interaction between the participants increases when they meet each other, and study motivation remains high when students can solve problems in groups, exchange experiences and get individual guidance while sitting at the computer. Also, the success of one individual inspires others.

It is difficult for the participants to find time for studying while working, and the contact teaching seems to be one solution to this problem. During the contact hours the students can forget problems at work and concentrate fully on studying. At the moment the students feel that the ratio between contact teaching and distance learning functions well. The organisations that send their employees to this type of training ought to remember that students should be guaranteed time to study at the workplace during the distance learning periods. The organisation must be committed to the entire training, not just to a few contact teaching days.

- The team software has proven to be a good means of combining distance learning and contact teaching. The course environment supports independent study, because it is flexible and does not tie the student to a certain time or place. While we offer students the means for independent information search and for adapting it, we also have to guarantee the availability of information and sufficient guidance. The distance learning assignments must be clear and unambiguous. The tool is new for many students and care should be taken in guiding them to use it, so that the software does not become an impediment instead of a tool of learning. Tutoring must continue throughout the training, because different people adopt the use of the tool at a different pace. Also, before the training begins the participants must be explained the technical requirements of the software.

The team software is ideal as a means of communication, because compared to email, many people can join in the discussion regardless of time and place. This is vital in long training periods with few contact hours. The team software functions as a support and contact channel, with the help of which the tutor can make sure that all participants get the support and guidance they need. However, it is important to remember to define the roles and tasks of all participants in the beginning of the course and explain them to the students, so that they know who to turn to in different situations.

Feedback from the participants is used to improve the training and learning material. The activeness of the participants can be followed with the help of statistics available from the course environment. This also puts the feedback into perspective and helps design courses accordingly. If a student has not sought to the training himself, his attitude toward it can be negative in the beginning. Motivating these persons has been one of the most challenging tasks in the project: we have been successful, as only one student has left the training.

The participants have been pleased to find a common language with computer experts. Misunderstandings have been avoided, and the students feel they have been able to cooperate with other professional groups better than before. Work that they used to think as a necessary evil, because it was unfamiliar, now seems challenging and rewarding. Many students have even found new interests and areas in their own work environment that they want to improve. An important motivating factor is that benefits received from the training are real and exceed the effort that was put into it.

Conclusion

The most important aim of the education has been to give an overall picture of information networks to the students. Hopefully they have also learned to see the range of opportunities available for taking advantage of information networks in their own organisation. It is also important to realise that one does not have to master everything: the student can improve skills in those areas that he is interested in and that he needs in his work. However, it is useful to be aware of different possibilities and how they can be adapted in one's own work, so that it is easier to ask for help in the right situation and from the right place. Learning by doing has also borne fruit: inspired by the basic skills learned during the training, many students have continued to study independently.

The project has so far been carried out according to the original plan, schedule and budget. We have also succeeded in our original objectives. It remains to be seen how well we can take advantage of the experiences gained during the project in the future. Including distance learning based on information networks in the training has proven to be an excellent addition to the entire education. The use of information networks alone while studying decreases prejudice and lowers the threshold for using information networks in one's own work.

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Tailored Teaching for Students with Diverse Scientific and Linguistic Backgrounds: Potential of the WWW in Plant Pathology

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Abstract

Pedagogic problems in teaching Plant Pathology at the University of Helsinki are analyzed, and some solutions based on web-supported courses are suggested. In a wider perspective, web technology offers a tool for co-operation to the relatively small Plant Pathology departments in Northern European countries. Web-supported courses within the Nordic Forestry, Veterinary and Agricultural University (NOVA) or larger consortia, present an opportunity to use the limited resources efficiently. At its best, web-based instruction can help combining internationally-oriented education with maintaining scientific culture within small language groups.

Characteristics of Plant Pathology in the University of Helsinki

Plant Pathology deals with plant diseases caused by biotic and abiotic agents. The emphasis is strongly on microbial diseases of cultivated plants. At the University of Helsinki, Faculty of Agriculture and Forestry, approximately 3-6 students annually choose Plant Pathology as their main subject. Basic courses in Plant Pathology are attended by 15-30 students each year. Instruction is primarily given by one full professor and two research associates. A closely related subject, Forest Pathology, has a slightly lower number of students. Some common courses in Plant and Forest Pathology are organized. These two fields of science are characterized by a relatively high number of postgraduate students as compared to the number of students graduating with a Master´s degree.

Some of the students in Plant Pathology aim at an expertise in practical aspects of plant protection, while others direct their studies towards research in epidemiology or biotechnology. Thus, their previous knowledge of biological , chemical and agricultural sciences as well as their expectations of Plant Pathology courses are widely variable.

The University of Helsinki is a bilingual university, with Finnish and Swedish as its official languages. However, instruction is mainly given in Finnish, while the Swedish-speaking minority of the students have the right to take examinations in their mother tongue. In recent years, numerous courses in the Faculty of Agriculture and Forestry have also been given in English. This has been motivated by a willingness to serve the growing number of foreign students, but another aim is to give the students a working knowledge of the principal language of life science.

Case: Course on diagnostic techniques

The author´s interest in using web technology as an educational tool was awakened by some practical problems in teaching a course called Diagnostic Techniques in Plant Pathology. This is a course on identifying plant pathogens by modern laboratory methods, such as immunological, chromatographic and nucleic acid -based techniques. The estimated work load for the student is 90 hours of lab work (including short lectures) and 30 hours of reading and other independent study.

The heterogeneity of students attending this course is based on several reasons. Mother tongue is one of these factors. Foreign students either enrolled in the University or coming for an academic year through ERASMUS exchange often choose this course. Therefore, an increasing proportion of the instruction and written course material has been given in English. Consequently, the course has also been made available to students of other universities participating in NOVA (Nordic Forestry, Veterinary and Agricultural University) (1). Most of the Finnish students are prepared to take courses in English, but some of them find the foreign language a hindrance to their learning. While our university has realized the importance of providing the students with abilities for international work, our responsibility to create, maintain and teach scientific Finnish language cannot be overlooked either.

Another factor of heterogeneity is the scientific background of the students. Previous studies in Microbiology, Biochemistry or Genetics are an advantage in this course. The biotechnologically-oriented students have a much stronger background in these subjects than the agronomically-oriented ones. Furthermore, the participants include both undergraduate and postgraduate students.

In addition to designing an optimal syllabus for the diverse students, the teacher faces the problem of scheduling the course satisfactorily. The NOVA students typically come to Finland to attend one course only, and for financial and academic reasons they want to minimize the length of their stay. In contrast, our own students are taking other courses simultaneously, and a very dense schedule would be problematic to them.

Electronic solutions

One obvious solution to the problems in this particular course is to restrict the common sessions to hands-on laboratory work and to minimize lecturing during these sessions. Instead, the students have to be acquainted with the relatively wide theoretical basis before starting the lab work. Printed preliminary reading would be the classical solution, but an electronic hypertext has the advantage of allowing each student to construct a personal combination of texts. Presenting the explanations of terms as hyperlinks helps the students with weaker theoretical background, while these elements will be omitted with no difficulty by students with better previous knowledge. Another category of links (categories should be visually differentiated) are the optional links leading to deeper knowledge on subjects of the student's own interest. Since this course deals with a wide range of laboratory instruments, links to commercial sites of their manufacturers form a third category of links.

In order to solve the language problem, the hypertexts, naturally, have to be both in English and in Finnish. The option of using links to existing web documents will ease the work load of the author.

The course material could well be distributed on disks or CD-ROM, but the location of potential students in several different countries favours publishing the material on the WWW. Also, answers to many frequently asked questions, such as accommodation for NOVA students, will be most efficiently given through the web. Most importantly, interaction with the teacher through e-mail will motivate and guide the student through the theoretical part of the course.

Another means of offering "tailored teaching" is to attach a questionnaire to the course registration form in the web. The students will be asked about their level of previous experience on each of the methods to be covered. Thereby they can, to some extent, influence the emphasis of different subjects on the course, and the teacher will also be able to place the student in an appropriate subgroup during the lab sessions.

So far, web technology has been used in this course to the extent that the students have been taught how to search for relevant information in the web, and they have also written literature summaries as HTML documents, which have been made accessible to all students through the course site. A renewed course site (2), realizing the ideas presented above, is under construction and will serve the students by September 1999, which will be the period of registration for the course. The month of October will be used for the web session, and practical lab work will take place in November and early December.

The idea, at the moment, is to use basic web authoring tools for constructing the course site. The goal of providing each student with instruction that meets his or her personal needs, will be attained by utilizing the basic qualities of the WWW: hypertext structure and independence of time and location. The utilization of special courseware, which would allow the use of self-correcting quizzes and other automatic interactive elements (3), may be considered for future courses. However, e-mail between students and the teacher is probably a sufficient tool to maintain interactivity in courses like this, which have only about ten students each year. In fact, although web-based teaching will diminish face-to-face contact between student and teacher, the total amount of interaction is likely to increase. The sad truth remains that it is very difficult to activate all students into classroom discussions, while web assignments

cannot be escaped by any (honest) student.

Prospects and restrictions of web-based teaching

The course described above, with its special characteristics, is an ideal pilot project for utilizing web technology in teaching Plant Pathology. It also seems beneficial to move parts of other courses out of the lecture room or laboratory and onto the web. Remote, asynchronous instruction would be one solution to the constant problems that our students are facing with overlapping course schedules. It is also noteworthy, that lots of pictures of pathogens and diseased plants are needed in studying Plant Pathology. Publishing the graphics in the web would not only help the students, but would also serve farmers, agricultural extension service, and students elsewhere. Examples of web-assisted courses in Plant Pathology can be found through Plant Pathology Internet Guidebook (4).

Furthermore, the University could benefit more from the docents (senior scientists listed as teachers of the University, often employed in another university or research institution) by encouraging and supporting web-assisted instruction by them. In recent years, diminishing funding has forced us to cut down on docent lectures. In the long run, remote instruction would be both cheaper for the University and more convenient for the docent.

On the other hand, it is important to keep appropriate limits to electronic instruction. In basic courses it is important to establish personal contact with new students. Also, laboratory courses aiming at skills based on a single method, such as microscopy, would not benefit from the web as much as courses with a wide theoretical basis.

The technology needed for wider web-based instruction is largely available in our University, but nonetheless, even brief information on course contents is lacking from the web in many cases (or is outdated). There is obviously a need for short courses on developing web-based teaching and authoring other web documents. Another factor keeping the web under-utilized is the quite rational allocation of working time by adademic staff in the present situation, where scientific achievements yield much more professional merit than educational development work.

Opportunities in NOVA and beyond

The Plant Pathology departments in other universities participating in NOVA operate in a similar situation, with a relatively low number of students and staff. Co-operation over the WWW would allow the departments to offer their students a wider range of courses. Furthermore, the University of Helsinki would thus be able to serve the Swedish-speaking students better, by providing easier access to courses in Swedish and other Scandinavian languages. NOVA is a relatively new organization and has not gained full speed yet; e.g. some synchronization of the academic year in different countries is needed in order to make student exchange more feasible. A wider co-operation programme, NOVABA, includes also the agricultural universities in the Baltic countries (Estonia, Latvia, Lithuania).

An organization for remote education within agricultural sciences, EVA (The European Virtual Agricultural and Veterinary Faculty) is about to start its operation (5). It will hopefully further improve the opportunities of students in small countries to study special subjects within agricultural sciences.

Besides co-organized courses, the WWW could and should be used more for the pedagogic development of university teachers, most of whom have no pedagogic education. For example, the exchange of ideas on planning lab courses could be organized as mailing lists or on-line conferencing. Already, technology for this is also offered by NOVA (6).

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The Academic Development Fund at the University of Derby 1994-1998: Origins, Implementation and Lessons

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Abstract

Today the University of Derby is an acknowledged leader in the UK in the integration of technology into teaching and learning and in the development of open and distance learning materials at all levels of post-school education - from outcentres linked to a main campus by videoconferencing, to Masters programmes delivered on CD-ROM supported by computer-mediated communication. Development is ubiquitous, and a key component in creating this ubiquity has been the Academic Development Fund (ADF) which began in 1994 and continues today (and at least to 2001) as the Operational Plan for the Teaching and Learning Strategy. The paper describes the origins and processes of the ADF and how it led to a combination of bottom-up and top-down approaches. We also suggest that some of the most significant outcomes of such a major investment in a 'shift from teaching to learning' are the hardest to quantify. Although our strategies were almost unique in 1994, more and more institutions are taking similar measures, and this account of the Derby experience may prove helpful.

Introduction

In 1994 the University of Derby had just been granted university status following a period of rapid expansion from 3,000 to 8,000 full-time equivalent students in the space of just 4 years. (It now has nearly 25,000 students, about 13,000 full-time equivalent.) This growth had partly been achieved by increasing class sizes and reducing student-tutor contact time. It was recognised that such an expansion could not be sustained without further innovation in teaching and learning methods. Ongoing 'efficiency gains' of 3% per annum demanded by the government of the day meant that to achieve institutional goals further expansion was essential.

At the same time the University had developed a policy of a 'shift from teaching to learning' - a shift in emphasis from inputs (teaching effort) to outputs (student achievement). There was a need to stimulate change and innovation in teaching and learning methods which would better facilitate student learning than the more traditional lecture/seminar. Such methods would help develop students as self-directed learners, with the ultimate goal of enabling them to become autonomous learners, with the skills of learning for life. The institution's background was already one of a relatively student-centred nature, which made it more open to new ideas than more traditional universities.

Thus there were both financial and pedagogical pressures towards innovation in teaching and learning which would enable yet higher staff-student ratios at the same time as enhancing the learning, and therefore the achievement, of our students. To some extent this was a scenario facing all higher education institutions in the UK, though many were slower to respond, either because they were able to call on cash reserves and alternative income streams, or because they were research dominated universities. Five years on, few can now avoid these pressures as can be seen in the Higher Education Funding Council for England's recent measures to require institutions to draw up proper learning and teaching strategies and adopt new learning technologies.

Back in 1994 our Directorate realised that substantial action would be needed to stimulate in-depth innovation among academic staff. A small Academic Development Fund (circa £20K pa) had been in existence for several years, but although it had been successful in stimulating some developments, these had remained as 'pockets' led by enthusiasts. The problem was how to bring on board the less-committed staff to new learning methods. The authors argued that the current fund was too small, was distributed ad hoc, and did not release staff from other duties. The response was a sum of £200K rolled over two financial years, with instructions to change the culture quickly.

The Academic Development Fund

The authors favoured a project bidding process similar to that established by the Teaching and Learning Technology Programme in the UK (in which the University had had some success as a bidder), but with greater democracy and transparency. There were some who believed that such an open process would lead to too much disappointment from a potentially large number of failed bids, but we thought that the creative thinking stimulated by competitive bidding would outweigh any such disappointment. Our counsel prevailed, and the new Academic Development Fund (ADF) was launched, inviting bids to cover the costs of development equipment, staff time and technical support.

The ADF had a specific theme: the shift from teaching to learning. The aim was to empower both teaching and support staff to acquire new skills and to develop new resources and approaches for student learning. An ADF committee was formed with Chris O'Hagan as chairman and Jennifer Fry as Directorate representative. The nine university schools were each invited to nominate a committed teaching practitioner rather than a manager. Learning support services also had a representative. The committee drew up criteria and detailed bidding procedures. There was no constraint on bid length as there was no constraint on complexity or overall cost, but a two page proforma summary was required with each bid.

Around 50 bids were received totalling over £500K. No rules on adjudication had been established prior to the selection meeting, though members had been asked to rate each bid against the prescribed criteria. At the meeting each member in turn was asked to briefly outline their reasons for favouring or rejecting particular bids. It was then agreed each member should have 8 votes (one per bid) in a secret ballot supervised by the chairman who had no votes. This resulted in a hierarchy of bids which were discussed in turn and finally approved, sometimes with reservations which had to be addressed in the project team's business plan, to be submitted and accepted before any money would be released by the committee. When about £150K had been allocated entirely on the basis of votes cast, the committee decided to look at the balance of projects approved and see if there were any bids which had not scored highly enough but which could be 'promoted' for a particular reason, for example because they helped improve overall participation in the ADF. Sometimes the committee merged bids, requiring two project groups to produce a joint business plan.

We have described all this at length because we believe that process is critical in gaining support for innovation. Inevitably there were suggestions of bias, but they had little fertile ground to root in. Logistical problems, such as delays in getting projects moving because of difficulty in replacing staff or appointing technicians, were more evident. We were better able to predict some of these in the second phase of the ADF which began in 1996.

The ADF in Practice

The first phase funded 15 projects in all, some quite large. But the main successes were in the stimulus the bidding process gave to thinking in new ways about teaching and learning across the institution, to staff development through real projects in the curriculum, and to creating a team of experienced technical support staff. Over half the projects generated significant resource outcomes as well - a bonus, really, at this early stage in shifting the culture.

Before the first phase was complete, the Directorate had agreed to a second phase, also £200K rolled over two financial years, this time with the theme "developing the use of the new Learning Centre and its networks, electronic and human." (A 1200 seat library/learning centre was about to open, with 250 PCs on an ATM network.) Another fourteen projects were supported in this second phase, following a similar process to the first.

Although 'technology' was not a necessary criterion for bidding, most of the bids in both phases involved use of technology. Support services for teaching and learning had recently been brought together under a single Pro Vice Chancellor - Jennifer Fry - who enabled proper discussion and coordination between the Centre for Educational Development and Media, Computing Services and Library Services. It was crucial to the success of many of the projects that these staff and student support services provided coordinated on-demand assistance.

Of course one or two project teams in both phases experienced difficulties in 'getting going'. The committee was usually able to address the reasons for this and enable progress, but in one notable case in phase one most of the project monies were recalled rather than allow them to be spent towards an uncertain outcome. It had been made clear that funding to schools in phase two would take account of successful management in phase one. In fact, the way ADF funding was monitored and supervised in schools revealed quite a lot about differences in culture between them.

The committee was able to vire unused resources, such as the 'refund' described, into providing continuation funding to the more successful projects for further development and diffusion. There is always the question as to what happens when funding stops. The ADF committee had made it quite clear that at some point the individual schools would have to pick up the costs of further development as well as the running costs. If the project was clearly successful, then there should be no difficulty. In practice it was not so clear cut, for reasons of culture, finance, management etc, and the committee had to find alternative ways of preventing a successful innovation from being lost. Sometimes the solution was relatively simple - like bridging the gap in retaining a key technician until the School could pick up the cost in the coming financial year, or finding a place for a key worker either on a new project or in central services. The committee was disappointed when one project, on peer proctoring, was not taken up by schools, but disaster was averted by eventually locating peer proctoring centrally, in the new Learning Centre as one of its many student support services.

Although the committee was essentially composed of academic practitioners, its flexibility of manoeuvre was greatly helped by having a representative of the Directorate and budget managers from central services among its members.

Lessons

We here itemise some of the key principles which emerged during implementation of the ADF.

- A competitive bidding process stimulates creative thinking.
- A substantial level of funding enables many projects, large and small, giving real credibility and motivation.
- Buying out staff time encourages initiative and provides 'bottom-up' empowerment.
- A democratic selection and monitoring process defuses notions of patronage and bias - but, on the other hand, the monitoring committee needs both influence and some financial flexibility.
- After selection, a second stage of articulating full business plans, with Gantt charts, milestones and clear descriptions of outcomes focuses project team planning.
- Regular progress reports to the committee keep teams on target but a delicate balance needs to be struck between audit/control and smothering enthusiasm and initiative with bureaucracy.
- There must be on-demand central support for the usual media (photo, video, graphics, multimedia, WWW, print, networks, email, electronic databases, electronic library services etc). Centralising technical support is both cost effective and an important method of retaining the technical skills the university is investing in. It also provides better career paths than devolved systems.
- Staff development (both academic and technical) which is work-based within real curriculum development projects is far more effective than discrete event-based activity. (See O'Hagan 1998)

Outcomes

Those who hold the purse strings in institutions sometimes find it hard to see the full range of benefits that flow from such a large investment. They tend to focus on the specified project outcomes, such as courseware, and it can be difficult for them to believe that good value-for-money has been achieved when measured in hours of learning materials per thousand pounds, for example. The two phases of the ADF did produce some really significant project outcomes - such as the CEBAG assessment engine (now, as TRIADS, probably the best in the world), the University VideoNet service, the Electronic Library, the ATLAS virtual laboratory, and the Fast Track Course in Open and Distance Learning which spawned nine further developments. In fact, most of the projects had useful products even if the full

specification was not ultimately achieved, but perhaps the most profound outcomes were less quantifiable and less immediately apparent.

Firstly, as intended, the learning and teaching culture was transformed in the direction of a willingness to adopt new methods and new technologies in particular. Secondly, support services were strengthened, and the Centre for Educational Development and Media grew to be a leading educational technology department in the UK, chosen by the funding councils as one of only nine such university departments to support the other 177 higher-education institutions in integrating technology into teaching and learning. Thirdly, the new Learning Centre was born in a developmental environment which quickly made it a model for the integration of traditional and technology-assisted learning. The £7m cost had been questioned by some academics, but from the start it was rather punished by its success. The 250 computers were in such heavy use that another 100 were soon added, and initial problems with network and server reliability were quickly exposed. These have been resolved, but such difficulties with support infrastructures are occurring in more and more institutions with rapidly increasing use of information and communications technologies. (See Gilbert 1998). As has been noted in a number of research projects (eg. McMahon & Gardner 1995), where there is a staff culture of a readiness to use technology students more readily adapt to it themselves. Our students took to it like ducks to water! Of course, the ADF was not alone responsible for these successes, but it helped create a university-wide synergy, drawing many pockets of expertise into the mainstream.

Nevertheless by the end of the second phase the authors and others were aware of a major difficulty blocking further progress. Although the teaching staff had been significantly up-skilled or had had their awareness of the uses of technology generally raised, many middle and senior managers were either unaware of their staff's new skills or were themselves insufficiently educational technology-literate to build further on that expertise. In a sense we had been too successful in empowering staff, and a kind of glass ceiling had been revealed. Teachers could see that all the strategic signals from the top were for more development, but many were not finding sufficient support from hard-pressed managers within their department or school. Discussions with others from the UK staff development community revealed this as a common and intractable problem in many higher education institutions.

The Vice Chancellor was made aware of the issue, essentially one of ownership and leadership, and discussions in the Directorate resulted in a decision to make phase three a 'top-down' process, persuading managers to engage with staff skills and to build on resources developed in previous phases. This phase became known as the Operational Plan (OP) for implementing the Teaching and Learning Strategy, with £400K funding for the single year 98/99. A further two years are foreseen. The OP is project-based, but this time not competitive. Projects have been selected by a Steering Committee involving Deans and Senior Managers, according to how effectively they address the Strategy in terms of current institutional priorities. Process was again critical in bringing all the School Deans on board with the Plan. The knowledge of the different cultures in schools, learned from their different approaches to the ADF, was very useful to us when developing the Plan in consultation with school managers.

Conclusion

The University of Derby is one of the most innovative in the UK in developing open and distance learning resources and student support. This has been achieved in a short period of time. A key component in this achievement has been the Academic Development Fund 1994-98, though it was not the only component.

We have had a continuous stream of visitors from home and abroad to our new Learning Centre and the Centre for Educational Development and Media. After one such visit by a group from a leading UK university, a spokesman wrote, "I think we learned a great deal from our visit. In terms of services for teaching and learning and, indeed, in terms of staff development in teaching and learning, you are light years ahead of us. I just hope we may be able to persuade the powers that be here to make some moves in the direction of catching up."

Although a mixture of top-down and bottom-up processes is fairly widely acknowledged in industry and commerce as essential to promoting real institutional change, there is always the question of the

appropriate processes for achieving this combination. We hope our paper will aid others seeking to develop such processes. We do not believe that we have the only solution, and indeed we are still experiencing problems in reaching full 'take-off'. Nor can we claim omniscient planning in arriving at where we are, but we believe we have overcome most of the major barriers, and are very close to establishing a new model for the distributed university of the next millennium.

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A University Model for Integrating Technology into the Curriculum
The Academic Architecture Initiative

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A common academic architecture which facilitates the integration of technology into the educational process is critical for institutional success. The architecture must encourage faculty use and enhance learner productivity (i.e. make integration of technology into the curriculum as easy and painless as possible) by demonstrating "added value" to traditional teaching methodologies and course management. Technology must provide clear incentives for use. The Academic Architecture Initiative includes a Course Management Service (CMS) linked to common Instructional Application Tools (IAT).

Course Management Service tools have been developed internally and include Template Based Structures for ease of constructing Syllabi and other support material, File Distribution, File In Basket, Threaded Discussion and Message Boards, Live Text Chat, and Search Engines. In addition, CMS offers a Photo Class List and Seating Chart, Email Announcements and Collaborative Lists, and Course Registration Data Download capabilities.

Instructional Application Tools include WBT TopClass, Chat Rooms and a Message Board, and Microsoft Internet Information Server version 4 (IIS4) resident on multiple institutional NT Servers. In addition, integration is provided for Oracle, Sybase and Microsoft Database products.

The full presentation will be available under "Academic Architecture" at time of presentation at www.drexel.edu/irt/irtorg/vcati/

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vCATI: Virtual Center for Applied Technology Integration

Virtual Center for Applied Technology Integration (vCATI)

The Virtual Center for Applied Technology Integration (vCATI) is a "collaboratory" facilitated by the Office of Information Resources and Technology and involves experts from various technologies interested in providing an integrated academic technological architecture for the creation of the next generation of teaching and learning methodologies. Technology experts, both internal and external, work with multi-disciplinary and multi-institutional subject matter experts to provide an integrated technical foundation to test and validate academic programs (human cognition learning and performance) at the undergraduate and graduate levels.

Team Leader: John A. Bielec
More on vCATI

Academic Architecture Initiative

A common academic architecture which facilitates the integration of technology into the educational process is critical for institutional success. The architecture must encourage faculty use and enhance learner productivity (i.e. make integration of technology into the curriculum as easy and painless as possible) by demonstrating "added value" to traditional teaching methodologies and course management. Technology must provide clear incentives for use. The Academic Architecture Initiative includes a Course Management Service (CMS) linked to common Instructional Application Tools (IAT).

Course Management Service tools have been developed internally and include Template Based Structures for ease of constructing Syllabi and other support material, File Distribution, File In Basket, Threaded Discussion and Message Boards, Live Text Chat, and Search Engines. In addition, CMS offers a Photo Class List and Seating Chart, Email Announcements and Collaborative Lists, and Course Registration Data Download capabilities.

Instructional Application Tools include WBT TopClass, Chat Rooms and a Message Board , and Microsoft Internet Information Server version 4(IIS4) resident on multiple institutional NT Servers. In addition, integration is provided for Oracle, Sybase and Microsoft Database products.

Team Leader: Ken Blackney

Participants: Jim Mitchell (CA&E), Tom Hewett (Psych), Doug Chute (Psych), Shortie McKinney (BioSci/Tech) and John Morris (CA&E)
More on the Academic Architecture Initiative

WEB/Television Integration Initiative

One example of rapid technology integration is the use of television and the web. vCATI is currently piloting the integration of live (or taped) televised educational material via cable TV (DUTV) integrated with web content (WEB-TV). Picture in Picture (PIP) capability along with multiple web windowing provides a rich architecture for not only the teaching process but also the learning environment. For example, during a live lecture, students in their individual homes or places of employment, will each be able to conduct their own unique experimental simulations via the web; receive live responses to chat or threaded discussions, and view video material unrestricted by bandwidth or modem speeds. This pilot differentiates itself from others in the market place (e.g. web over TV or TV over the web) in that success is dependent on the integration of the strengths of two similar but different technologies.

Team Leaders: John Morris and Ken Blackney

Participants: Current participants include Drexel's Engineering Core Curriculum Multimedia Laboratory (John Morris), DUTV (George McCollough), Campus Computing Infrastructure (Ken Blackney), Instructional Technology Support (Jan Biros) and New Technologies and Innovation (Ken Blackney). External participants to date include visiting experts (Jean-Francois Desnos, Joseph Fourier University, Grenoble), WHYY, and the Sarnoff Corporation.
More on Web/Television Initiative

EUNIS

EUNIS (European University Information Systems Organization) has initiated a Trans Atlantic collaboration effort with the appointment of Dr. John A. Bielec as the organizations United States liaison. EUNIS is similar to the combined Educom/CAUSE organization (EDUCAUSE) in the United States. Dr. Bielec is the Vice President for Information Resources and Technology/CIO at Drexel University in Philadelphia and has had a long involvement in international university administrative and technological issues. Drexel is known for the creation of the first teaching and learning "ubiquitous" computing environment, a trend which has recently caught on in the U. S., when it required in 1984 that all students own a computer. The objective of EUNIS is to contribute to the development of high quality information systems in higher education in Europe via the exchange of information among members. Each European Country is allowed a maximum of two members to the organizations Executive Committee (normally appointed from the country's national Information Technology association). EUNIS's goals are to increase collaboration among both European and United States higher education institutions as well as information technology suppliers.

Team Leaders: John A. Bielec and Professor Yves Epelboin, University P. M. Curie

Participants: Members currently include University Information Technology leaders in the Czech Republic, Estonia, Finland, France, Germany, Georgia, Ireland, Lithuania, Moldova, Netherlands, Poland, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.
More on EUNIS

Center for Educational Research and Development in Biomedical Engineering

The Center is a technology-enabled and richly interconnected "community of researchers, practitioners and learners" in biomedical research and development. Whenever appropriate and feasible, existing and emerging collaborative computing, communication, networking and information technologies are exploited to provide learners remote access to human and physical resources of leading research and development laboratories. A strong commitment to research on human cognition, learning and performance while simultaneously launching and establishing technology-enhanced and richly interconnected research, development and learning environments are crucial to ensure successful piloting, implementation, and eventual deployment and institutionalization of appropriate methodologies and technologies.

Project Team Leaders: Director: Banu Onaral (Drexel) - Co-Director: Rocky Tuan (Thomas Jefferson). Other members of the management team include Eli Fromm (Drexel), Arye Rosen (Sarnoff), Vic Korsun (Sarnoff), Jeanne Beck (Coriell), John Bielec (Drexel), Nihat Bilgutay (Drexel) and Jill Felix (University City Science Center)

Participants: Drexel University, Thomas Jefferson University, Coriell Institute for Medical Research, Sarnoff Corporation, National Information Display Laboratory and University City Science Center
More on Center for Educational Research and Development

Virtual Classroom for Business Planning Formulation

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Abstract

One of the most promising possibilities of the WWW resides in its potential to support the long distance formation. The Web Based Training (WBT) acquires thus a high importance as a learning tool. In 1996, the University of Las Palmas de Gran Canaria developed the "INNOVA Project" in order to promote Web based training and learning. As a result, the Virtual Classroom Interface (IVA) was created, and WebCT (Word Wide Web Course Tools) was chosen as the main development tool. One application developed on this platform contemplates the academic instruction in business from an innovative perspective. The application, named SISTRAT, reinforces the teaching-learning process, guiding the student on a continuous basis through the different stages that conform to a strategic plan.

"[...] it can be predicted that in the next fifty years, colleges and universities will change more and more in a dramatically way [...]. These changes will be partly imposed by new technologies [...], partly because of the demands of a knowledge based society in which the organized learning process should become [...] a process that will last a lifetime"

Peter Drucker (1996:78)

Information technology as a support tool for learning

Since the invention of writing there has been a continued passing parade of new technologies, each of which is claimed to have the potential to "revolutionise learning". These technologies are released in a flurry of excitement but often end in disappointment when evaluation studies fail to reveal the much anticipated improvement in learning. One of these technologies was the introduction of computers to learning.

Early evaluations studies of Computer Based Training (CBT) began to appear by the late 1960s and early 1970s, which in general supported the effectiveness of computer-based teaching as a supplement to conventional instruction. CBT was reported to reduce the time required to learn and to be effective in teaching mathematics and a number of other disciplines (Kulik *et al.* 1980).

Clark (1983), in a review of a number of similar studies questioned the methods of instruction used in the "experiments" and suggested that CBT authors had simply computerised methods of programmed instruction rather than capitalise on the possible "added value" of using computers. It seems them surprisingly obvious that there is no reason to expect the quality of learning to be improved if we simply transfer a learning experience from one medium to another.

Clark and Craig (1991) responded to these claims with a survey of multimedia and interactive videodisc research, drawing a number of conclusions including "multiple media, including videodisc technology, are not the factors that influence learning; the measured learning gains in studies of the instructional uses of multiple media are most likely due to instructional methods...".

And now the latest in this long line of learning technologies is the World Wide Web (WWW). The greatest potential of the Web, however, lies in the fact that we have a chance to learn from the lessons of the previous faded technologies, and at the same time an opportunity to develop new learning experiences for students which had not been possible before. Firstly, let us consider those which can be critical factors in the learning process.

Biggs and Telfer (1987) suggest that the following kinds of teaching foster deep approaches: an appropriate motivational context, a high degree of learning activity; interaction with others, both peers

and teachers, and a well-structured knowledge base.

Laurillard (1993) discusses a number of key aspects of learning that can be used in any discussion about teaching strategies. These aspects are:

1.-*Apprehending structure*. Students construct meaning as they read, listen, act and reflect on the subject content. However, as Laurillard points out "Meaning is given through structure" and it is therefore essential that students are able to interpret the structure of any discourse before they can construct the meaning that we have previously seen to be so crucial to understanding.

2.- *Integrating parts*. Students need to be able to integrate the signs of knowledge such as the language, symbols and diagrams with what is signified by them.

3.-U*sing feedback*. Actions such as those mentioned above are futile for student's learning, unless feedback on individual actions is given.

Consequently, the challenge for educational developers is to use this knowledge of learning, together with an understanding of the features of the WWW in order to design learning experiences which promote a deep approach to learning so that "what" students learn is a deep understanding of the subject content, the ability to analyse and synthesise data and information, and the development of creative thinking and good communication skills. There are a number of features of the World Wide Web that determine the way in which it might be used for teaching and learning.

Web Based Training

After shellacking the World Wide Web with advertising and marketing content for the past years, businesses are starting to recognize the potential of the Internet as a training and educational tool. In a sort of returning-to-its-roots fashion, the Internet, which was originally formed to bring together scientists and research institutes, is now being tested as a medium for conducting computer-based training, more commonly known as CBT.

CBT and long distance learning, which typically requires a videoconferencing link between trainer and students, can be used in a variety of ways. For example, many companies rely on CBT materials to train employees to operate equipment or to familiarize new employees with company policies. Although the first CBT classes were conducted on mainframe computers, the CBT market took off only recently with the advent of multimedia technology such as graphics accelerators and CD-ROMs. Compact discs, which can hold more than 650 megabytes of information, have enabled trainers to enhance the learning experience with rich graphics and video and audio clips.

The big expense associated with CBT is the distribution of diskettes or CD-ROMs to learners or even to corporate networks, where a single CD can be shared among several users. Although an effective tool for delivering multimedia-based instructions, read-only CDs cannot be updated and require to press new discs in order to add or update course materials.

The Internet, on the other hand, enables to store instructional materials in one location (an internal or external Web server) and make frequent and timely updates to time-sensitive material as needed. A major feature of the WWW is the potential for developers to create links between text and other media, not only within an individual document but also between documents residing in any computers in the world which have access to the Web.

One approach to using these features for teaching/learning is to create documents which contain hypertext/ hypermedia links which the learner follows in a sequence which is often unique to the individual learner. A second approach to the use of hypertext programs is to take advantage of the interactivity, a capability which has been claimed to provide a useful strategy for active learning.

A third approach to the use of hypertext/hypermedia links on the Web is to encourage learners to become collaborative authors. Opportunities are provided for learners to contribute to the creation of

documents on the Web by attaching their own data in form of written or oral commentaries, either still or moving images, or alternative links which are then also available for other learners to read/follow. Thus by apprehending structure, integrating parts and using reflection, learners develop an individual interpretation of reality.

A fourth approach is to use a range of Internet services so that an integrated learning experience is provided. Students can use the Internet to communicate with one another and with the experts as they discusse a variety of issues. The learning strategies adopted here fit very well with Biggs and Telfer's comments about the importance of appropriate motivational contexts, a high degree of learning activity; interaction with others, both peers and teachers, and a well-structured knowledge base.

Finally, there is a great deal of research available to WWW developers, not only about the way people learn and the strategies that promote the kind of learning we value, but also the lessons learned by earlier technology developers. If we use this knowledge to inform our practice, the students of today can look forward to new learning experiences which will not only provide them with an education, but also with a capacity for life-long learning as well (Alexander, 1995).

Innova project: the virtual classroom

In 1996, the University of Las Palmas de Gran Canaria proposed an *"Education Quality Improvement Plan"*. The Computing and Communication Centre (CICEI) developed the "INNOVA Project" in order to promote Web based training and learning and to capitalize the University investments on its corporative ATM network. This project affects, in its initial phase, to more than 4,000 students and in it participate about 37 people among faculty and support staff.

As a result of the INNOVA Project, the University of Las Palmas Virtual Classroom Interface (IVA) was created. Several software tools to develop Web based training were analysed, and finally, WebCT (Word Wide Web Course Tools -University of British Columbia-) was chosen as the main development tool. IVA is a WebCT based common interface that works as a rapid online course development tool. It provides an organised set of educational and administration tools to make it easier for the faculty to implement online courses.

WebCT was first presented at the Fifth International World Wide Web Conference in Paris, France, in May, 1996 (Goldberg and Salari, 1997). WebCT is a teaching module that works within a Web browser. It provides the instructor and the students with many capabilities, not only the ability to post documents in HTML format, but also the ability to create a document file that students can easily download, a grade tracking module, and a calendar. Most useful, however, are the parts of the program that facilitate interchange between the students and the professor: e-mail and bulletin boards. On the one hand the e-mail function is simple and would be familiar to anyone who uses any e-mail package, but its power lies in allowing the student to easily correspond with either an individual, a group of students, or the entire class without having to collect and compile each students's e-mail address. On the other hand the bulletin board enables the professor and the students to post thoughts, comments, exercises, papers, and so on in a public forum.

The IVA interface benefits from most of the WebCT features and, furthermore, offers the advantage of being a Spanish-language adapted interface. IVA was developed under permission and cooperation of the authors, and as result of this cooperation, the CICEI's server currently holds the european mirror for the WebCT. Interactivity, structure and educational tools are provided by IVA, though these are all configurable by the course designer. In all there are three main aspects of IVA:

1.-A presentation tool that allows the course designer to determine the layout, colors, text, counters, *etc* for the course pages.

2.-A set of students tools that can be integrated into any course. These tools include communication tools, student evaluation and self-evaluation tools, student collaboration and presentation areas, course navigation, account administration tools and more.

3.-A set of administrative tools that aid in the delivery of the course. These tools include student progress tracking, course access tracking, on-line quiz creation tool, grade maintenance and reporting tool, and more.

As an example of innovative implementation, the next paragraphs describe briefly the application of this tool for the design of an undergraduate course about strategic planning in a business administration curriculum.

Strategic planning learning

In every business administration curriculum an ever present subject is strategic management, a subject focused on the formulation, implementation and control of the strategies that allow the future development of any organization. It can be said that of these three parts in which it is generally divided (most of the course programs and text manuals of strategic management are so structured), that concerning the formulation of strategies (strategic planning) usually requires the longest extent when compared with the other two. That is both because of the importance of the strategic planning into the strategic management field as well as the complexity of such a multi-stage process in companies (Hax and Majluf, 1984).

Centering on the particular objectives to be reached in the development of a strategic management course, García Falcón (1993) categorizes them in the three following groups: (1) knowledge transmission related objectives, (b) aptitude teaching related objectives, and (c) objectives related to attitudes to be developed into students. The list presented by the above mentioned professor, which includes both quantitative and qualitative variables, contributes to justify the inclusion of a strategic management subject in the academic program of any business administration degree. At this point, let us exclusively focus on those objectives the accomplishment of which can particularly be well supported by a tool with similar characteristics as the one presented in this paper. These objectives can be summarized as follows:

1.- *Objectives related to the knowledge to be transmitted:* to identify the different levels of strategic analysis and to assume the need of coherence among the decisions taken at corporate, business and at a functional level; to analyze how the internal reality and the external environment influence the company operation and, definitely its results and performance.

2.- *Objectives related to the aptitudes to be taught:* to be qualified enough in order to analyze the external and internal events of the organization, thus identifying external opportunities and threats, internal strengths and weaknesses, as well as competitive advantages and disadvantage

3.- *Objectives related to the attitudes to be developed:* to maintain a general and non-specialist knowledge of the company and its problems, learning how to integrate different concepts already studied in other administration disciplines. The purpose is just to teach the importance of making decisions from a general perspective, overcoming departmental frontiers.

SISTRAT methodology

In the next paragraphs will be described the main features of a research line conducted at our University. This is aimed to use the information technology in support of a business administration subject as it is the strategic planning. As a consequence of this research a methodology for strategic planning has been developed, and a supporting computer application -that we have named SISTRAT- has been designed.

The main challenge in this research line was how to provide students with a useful tool both to let them learn the basis of strategic planning and simulate the decision making process in low structured and highly unpredictable environments. Accordingly, SISTRAT methodology aims to formally support the strategic planning process, aiding students in simulating strategic analysis and the definition of activities at the different organizational levels.

Implantation of SISTRAT on IVA

The SISTRAT course developed using IVA is organized around one main homepage. This home page is the entry point of the course (the first page that students see after having logged on to the course) and contain, among other things, a banner image, a textual message, a message of the day, links to course content elements, links to course tools and links to supplementary homepages. IVA provides a set of educational student tools that have been incorporated into the course. The designer activates these tools by placing the icon representing the desired tool on the homepage.

The SISTRAT course incorporates not only the general IVA features but a set of specific items pertainning strategic planning. These include theroretical documentation about related topics (i.e. mission statement, competitive environment, internal analysis, *etc*), a glossary of terms, a case study and, finally, a supporting computer application for applying both concepts and the case study making use of most relevant tools usually adopted for the strategic planning. To sum up, the objective is to link theoretic concepts with a computer application for supporting the strategic process in a working environment where students can participate in an active manner posting thoughts, comments, chatting in real-time communication and making use of multi-fora asynchronous electronic conference.

Following, a brief description of several IVA educational tools included in SISTRAT course is provided: (a) *course bulletin-board*, which has been created for cooperating groups of students making use of a number of icons placed on separate pages the appearance of which reflects whether there are unread messages in the bulletin board; (b) *electronic mail*, allowing one-to-one message transfer among course participants; (c) *chat tool*, for real-time communication among students intended both for casual conversations among course participants as well as for tutorial sessions held on-line by instructors; (d) *student self evaluation*, supplementing content pages with multiple-choice questions, which are automatically marked as correct or incorrect by IVA; (e) *glossary*, showing a list of terms according to the letter they begin with; (f) *page references*, which consists of a database containing references to learning resources such as papers, textbooks and URLs, and finally (g) *progress tracking tool*, which maintains detailed information regarding accesses made by each student to the course.

Conclusions

Companies and educational centres that wish to distribute primarily text-based training materials which do not require data-intensive video or audio components can move their course materials to Internet today.Although bandwidth constraints are likely to be a concern for some more years, emerging technologies, that make efficient use of existing bandwidth, have helped the migration of multimedia-based CBT to the Web. Applications like WebCT have proved their suitability for the creation of sophisticated World Wide Web-based educational environments .We deeply believe tomorrows' education will need more flexibility and should give the students the opportunity to learn in an interactive way. We think the answer can be found in the information technology, being the WWW one of the maximum responses to this challenge that exists nowadays.

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Dynamic WWW Style Processing with SeSAMe

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Abstract

In the process of developing a new design concept for our university's WWW service we catalogued a list of specific formal and aesthetical requirements and finally worked out a problem oriented software concept. This might be useful for the university online worker as well as of hypertext-theoretical interest.

Introduction

In the moment of writing this paper, exactly one decade has passed since Tim Berners Lee with his article "Information Management: A Proposal" started the development of the World Wide Web. Half a decade later in late 1993 the University of Kassel launched its first official WWW server (www.uni-kassel.de). What we gained was more than a new medium – we also found an object for study as well as technical and scientific work. It was not hard to recognize that the new questions occurring in our new collaborative hypertext writing act could not be answered just with our knowledge of traditional media. So we developed and learned new ways of cooperation, authoring and thought.

The initial strategy of WWW document publishing was to mark up hypertext logically. Layout and design *were of minor importance* and it was the client side where the output format should be configured for a maximum of comprehensibility, independent of the actual output format. Nevertheless visual design manipulation was always *possible*, it was always practiced and in the end it is one of the reasons for the popularity that the World Wide Web has today. Accordingly universities, political parties, companies and clubs began to reproduce the corporate identities they used in traditional media on their websites.

Taking the point of view of these organizations several reasons can be found to set up a corporate identity: For example they ensure identification from within and recognition from outside the organisation. From the perspective of the user, i.e. the reader, recognition is a very valuable aspect of a unique online document appearance: Because potentially every inter-document distance appears as just one mouse click, a corporate design can answer the question whether two documents are located in the same directory on the same server or in different continents. Thus, a corporate identity can be regarded as a useful hypertext navigation aid for complex online hypertexts such as university WWW services.

Our redesign development

When we began to work on a redesign for the WWW presence of our University we first analyzed the advantages and the problems of our then current design and we found that most of the problems resulted from technical problems with our corporate identity. For organizational and of course for democratic reasons universities want their staff and students not only to receive online information but also to produce it. However, many of our WWW authors obviously had problems to reproduce the HTML code required for our official website appearance - we found that source code was often copied and pasted into new projects, thus becoming more and more defective and some common errors spreading just like viruses. Thus from the author's point of view a technical gap aggravates the production and the maintainance of stylish online material. We felt, that bridging that gap could solve problems like missing or outdated documents and dead links. We also felt that our hypertext structure should become more transparent through a greater emphasis on its logical structures. In the ideal case university WWW (sub-)hypertexts are not chaotic – they are structured. A simple model is a tree - starting with the universities' homepage branching to various subsites at various levels. These subsites may either consist of a tree structure or of a crystal-like matrix structure e.g. in time tables or staff overviews. In any case our documents can be found in contexts where a superior hypertext level is available which can provide an overview of the current content and links that refer to documents which can be classified as 'horizontally relative' or branching to subordinate documents. In this situation a 'navigation bar' with

links to related documents and a link up to the subordinate hypertext level is a useful tool. It can be found on many online documents in various appearances. We decided to integrate a legible navigation bar in every document as well as links to online help documents and a search engine.

When we presented our prototypes to the public our (future) authors recognized the more functional document source code as even more complex and harder to reproduce than the old design so they did not like it. Finally we found that the demands for a stylish and comfortable corporate design on the one hand and for a simple easy-to-reproduce HTML code on th other hand were contradicting each other and we started to think about proprietary strategies to fulfill all needs. What we have developed is a WWW server PlugIn and an authoring system. We call our concept SeSAMe (SErverbased Style and Authoring ManagemEnt).

The SeSAMe strategy

From other user software products such as text processors we know the concept of document templates. Integrating some content into a document template is a common technique so it would be a good idea to offer a content-free central style template. However, our authors had already used our homepage as a style template and as we have seen adapting it caused them problems concerning code correctness and maintainability. Nevertheless the merging of content and a style template is a trivial process so we decided to let the computer do this. Now the authors can concentrate on their content. As a side effect with a server technology based on a single design 'masterfile' maintained by the public relations office the central responsibility for our print media design is also given for our online documents. Furthermore, when we need to redesign our WWW service again in a few years, we will only have to edit a single template and every document will be served in the new style automatically.

Todays standard technique to describe HTML design elements centrally is the usage of so-called style-sheets. These are detailed specifications of sizes or colours of fonts, lists, screen coordinates and tables of layers stored in one file to which any number of documents may refer to. We found this solution not quite optimal for the following reasons: Style sheets can only be interpreted by the latest browser generation. But as a university we want our information to be read internationally. Therefore in a very early state of our redesign process we decided not to require modern high-standard client technology which is common to the well equipped readers in industrial nations. Older clients on slow machines should understand as much of our code as possible. Moreover a design generated with style sheets not only consists of the information in the style specification: It is also a result of the order of elements within the HTML documents. For example, when only using style sheets each file would require re-editing if we wanted our navigation bar to move from the document bottom to the document top in another redesign.

As mentioned above, the initial idea of HTML was to allow free output formats by marking up document elements logically. So why not invent a logical markup specification which allows a corporate design of any complexity being added automatically? Analyzing our WWW server's documents we found that all documents shared the same set of meta-information fields: For every document there was an author, his email address, his institution, the date of last modification, the title, the actual content and so on: We found a set of Meta Data (this is what the Dublin Core Set consists of). Every document also contains a standard set of visible elements in a defined appearance. We started to work on a technique that allows us to store documents without design information and that at each request interprets them on the server side where the design elements are being added.

SeSAMe technology

Our redesign definitively required each of our WWW documents to be revised and edited. So we decided to take the opportunity to port them into another format: We converted *.html files to our own format: *.ghk files. These are plain text documents containing pairs of variables and contents of the following format:

=TITLE <SQD>Homepage</SQD>;
=AUTHOR <SQD>Webmaster</SQD>;

=MAILTO <SQD>www@hrz.uni-kassel.de</SQD>;

The <SQD> sequences stand for 'SeSAMe quoted data'. These are used as string limiters and might be understood as a substitution for quotation marks. Variables like =CONTENT may contain contents of free length as well as HTML elements. The syntax as shown above is SeL (SeSAMe Language). This was developed for our needs by Andreas Matthias who is a member of our computer center. Our design masterfile is also written in SeL. It is the central design template for our corporate design. The SeL compiler is able to convert several input streams of characters dynamically to one output stream at a very high speed, while all features of high-level programming languages can be used, for example any type of variables, loops, subroutines, branching, mathematical functions, the definition of custom-functions, environment-calls etc. We use it to process *.ghk file contents and our masterfile to produce an HTML output every time a document is being requested.

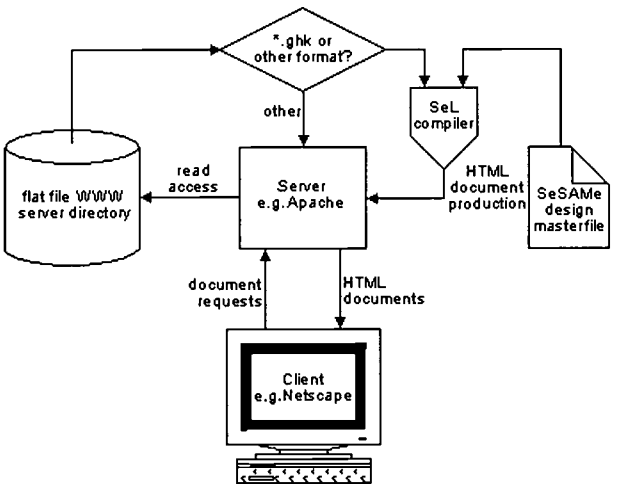

Fig. 1: SeSAMe WWW document service

The SeL compiler is an external program, called by our web server (Apache 1.3.2) when a request for a *.ghk file occurs. It can be understood as a PlugIn, extending the server's functionality: Besides SeL processing nothing was changed on the server so the service of traditional static HTML files continues unchanged and nobody is forced either to use our technology or to use the university's official design. On the contrary we have documented how every author is able to set up his own design masterfile to make use of our system's advantages without participating in the official design.

SeSAMe online document authoring

*.ghk files consist of a set of text elements which might be understood as 'fields' or 'objects'. We developed a method to allow our writers to create their documents using their WWW clients. As is well known the WWW protocol http allows collecting information from the client side by making use of forms. Form elements are fields for text input, checkboxes etc. We use this method to gather our *.ghk field's elements with a problem-oriented authoring system. The tool generates a user dialogue in dynamic HTML containing intelligent form elements by executing cgi scripts. It allows the creation, editing, renaming and deleting of WWW documents and directories. Though it is accompanied by online help material and an online handbook it acts as a wizard: It generates dialog-based input forms with context-relevant help texts and hints. We use JavaScript to evaluate user inputs immediately to avoid logical input errors. For example after the tool has asked for the language a document is written in the document may contain links to translations in any language except its own.

The authoring frontend finally collects the author's UNIX account password, encipheres it and transmitts it to a CGI based FTP client on the server who tries to use the identification data given by the author to connect to its FTP server and to communicate new and updated information. Developing this we found a way to make use of freeware viewer software as composers and finally to use the actually anonymous http protocol to permit access rights as configured on the UNIX file system.

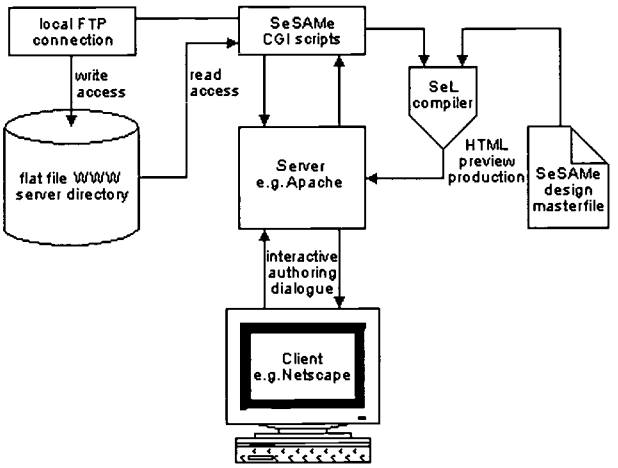

Fig. 2: SeSAMe authoring

The first conception of a hypertext system - Memex by Vannevar Bush from 1945 already showed the possibility and the importance not only of reading but also of writing hypertext by integrating a microfiche camera system enabling the user to add information to a knowledge base. Ever since then authoring systems attempted more or less successfully to provide authoring modules. Today for example Netscape comes along with a so-called composer for visual HTML editing and Microsoft sells Frontpage with an integrated site management system. These composers are designed for general purposes. Therefore their user interfaces suffer from a very high load of options and it appears arguable whether it is harder to learn how to write HTML by hand and being able to control the syntax or to learn to use a modern WYSIWYG editor. The SeSAMe authoring frontend is designed to handle a small amount of typical tasks excluding the solving of design problems. Therefore it can easily be understood and used as well as adapted to future requirements. It appaers in the user's WWW client and can be used to manage complex sites and group writing without requiring any knowledge on HTML programming or UNIX.

New possibilities

The strategy to mark up any information in WWW documents logically allows powerful services. For example, SeSAMe can play an active role in document maintainance. When we recorded the problems of our WWW service for our re-design, we found many online information obsolete and outdated because their authors had forgotten to maintain them. To solve this problem our authoring frontend can ask for a date and a short message and stores them in the *.ghk files. Every morning all documents are scanned for existing dates which are of the present day. Whenever that condition is given, the short message will be sent to the document's author reminding him to update it – this is possible because in another *.ghk file object the authors' email addresses are stored to generate the document bottom notes. Another useful utility we have implemented is the possibility of specifying a path to an author's public PGP key. This can be used to sign the documents electronically if an author wishes to do so and with a small icon at each document's bottom we can confirm whether a document is authentic or if its content was manipulated by an unauthorized person. Another service that our system provides is an automatic banner integration. Our new design reserves space for two small banners on each document. During the authoring dialogue the authors can choose whether a document shall have two, one or no banner and whether these banners are custom made ones maybe with author-defined linkage or if the banners should be integrated dynamically by the server. This can be used for commercial use of our WWW service and as the server is able to log how often which banner was shown on which authors's documents, every one of our authors has the chance to make commercial use of his online documents.

Although SeSAMe's *.ghk files are still stored in the file system, they already have much in common with database management systems. This leads us to the problems databases have to deal with. One of their problems is so-called file locking. It occurs when more than one author is entitled to edit a file. If more than one author has loaded a file into his editor to manipulate the content one writing process will delete the result of the other. A simple solution might be to mark a file to indicate that it is being edited.

Yet on our multitasking timesharing computer architectures small loopholes are hard to avoid and the data remains insecure. We solved this problem by using the UNIX revision control system RCS which includes a file locking system and as a side effect our authors can use a menue in our authoring frontend to restore any earlier state of their documents.

Ideas and future developments

The possibilities of our concept seem to be endless. At a certain point we had to stop to implement all our ideas that came up during our implementation process because of our limited ressources in order to finish version number one. I want to mention two of the ideas we could not yet implement on our own to show what has become possible and to inspire the reader of this article to improve and to contribute to SeSAMe.

We dream of online documents which contain a small icon for a print version. When this icon is clicked, the SeL compiler and another masterfile (executing some shell calls) could use the information contained in the *.ghk file to generate an output stream, which can be compiled by TeX, then converted to a *.pdf file on-the-fly and finally be displayed by the Acrobat Reader on the client side. Much information contained in the online appearance of a document is of no use when it is printed like the navigation bar or icons for online help and a search engine. The print version may even need additional information stored in additional objects but more importantly it should appear on paper as the designer of the document wishes. With the strategy proposed a professional and very stable postscript appearance can be transported. In addition with our PGP signature this is a method to publish documents of truly secure content and design.

SeSAMe already allows inclusion of local files into other local files like apache's server side includes do. But we see a much greater potential: Amongst others *.ghk files have objects containing the author's name, his email address, labels and URLs for a navigation aid and the actual content. Imagine if in the *.ghk files head we could determine which objects are allowed to be exported to which external servers. Now a WWW server might provide a link to a document located on a distant server displaying it in the local design. This techique could be used to export, to reuse and to share hypertext branches even inter-continentally and we finally gain a style-independent WWW correspondent of what Ted Nelson called 'transclusion' and originally wanted to implement with his Xanadu project.

Database compatibility

The internal data representation of SeSAMe in our *.ghk files is designed not only to be understood by our SeL compiler but also to be plausible to the human reader. The files can be written 'by hand' with a text editor on any text console. Nevertheless the field-orientation provides has database characteristics much more complex and more useful than usual flat-file WWW servers' directories. We perceive a strong impulse of large and professional WWW services to run websites from databases. These are powerful tools the possibilities of which allow very complex and dynamic outputs, that are not only of interest in the commercial sector but for all publishers of large online ressources. Regarding content and formal network structures the free growth of HTML material in universities can result in rather chaotic networks. This is not a good starting point to port WWW material to a database because it aggravates the porting while the aspect of formal relation is the key to powerful information handling through databases. In this situation SeSAMe might be the missing link between flat file systems and real databases because it can be used to re-organize structures and to mark-up contents logically in a transition period already providing features of huge database management systems. In a later database-based service SeSAMe features like dynamic on-the-fly style processing or the authoring frontend will still be of good use.

Conclusion

SeSAMe is more an idea than a particular piece of software. Nevertheless we have developed some programs which might be useful for others who feel that their traditional WWW service might run into style or maintainance problems in future. As our software is either based on cross-platform compatible internet standards like HTML and JavaScript on the client side and C and Perl on the server side the

system is also portable to other server systems. As pointed out above, there is a potential for further developments we could not finish by now. We hope that both the potential for the further development of our system and the common need for server software capable of university WWW difficulties might move the reader to visit the SeSAMe homepage, to read about the latest developments and maybe to download, use or even to contribute to the software. After software development has shifted more and more to the commercial market we want our project to be understood as an experiment which might turn out to be only of educational interest but which could also be useful to solve the above mentioned common problems and also to improve and support intra- and inter-university network authoring.

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The SeSAMe homepage: http://www.uni-kassel.de/~sesame

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User Interface Implementation Issues for a Web-based system for Ordered Asynchronous Multimedia Annotations

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Abstract

WebOrama is a Web-based system that provides a platform for creating, managing and presenting ordered asynchronous multimedia annotations. This system will be used within the project 'SHARP' for the support of coordinated, asynchronous discussions, which will emanate from a video representation of industry's best practice. These discussions will serve as a medium for the exchange of tacit, experience-based knowledge, among a community of practitioners, and will also facilitate learners in the acquisition of complex skills applicable in real-world working context. WebOrama utilises an innovative algorithm for dynamic filtering of annotations, in order to provide an adaptive and customisable representation of content, personalised for a particular user-group perspective. This paper presents the issues encountered in the design and implementation of the user interface of WebOrama.

Introduction

The widespread use of information and communications technologies (ICT), and particularly the use of the World Wide Web, has made feasible many new forms of collaborative distance learning activities, that take advantage of the capacity to integrate communications with information access and organisation, within a commonly accessible hyperlinked environment (Khan 1997). There is an increasing amount of research supporting the critical influence that the choice of communication technology and the design of any instrumentation, used commonly by the learners, can have on both the process and the product of collaborative distance learning (Collis and Smith 1997).

Asynchronous computer mediated communications (CMC), and especially asynchronous text-based communications, have long been established as having value in supporting the collaborative distance learning process, due to the fact that they offer flexibility in the use of time as well as space. However, this is the case only when what is being learned is 'textbook' knowledge. Text has its virtues, but it is not good for all purposes: almost ten years of experience with this approach reveal that it can be quite hard to begin and sustain a discussion about specific working practices if the medium of exchange has to be text. When it comes to the learning of skills, especially the complex skills that are embedded in real-world working practices, the support offered by this kind of technology proves to be insufficient, in the sense that it makes only some forms of exchange about working practices possible. Asynchronous multimedia conferencing (AMC) is a useful way of supporting the acquisition of such skills and real world knowledge.

SHARP (Shareable Representations of Practice: pedagogy for asynchronous multimedia conferencing) is a European partnership project in the Open and Distance Learning (ODL) sector of SOCRATES (European Commission 1995), that aims to identify and disseminate pedagogical and organisational guidelines for the use of asynchronous multimedia conferencing, both within a community of practitioners that exchange experience, knowledge and discuss on a common working practice, as well as with learners who are acquiring complex skills (SHARP team 1996).

There are various approaches that can be followed for the implementation of systems that support AMC. In fact a few such systems exist today, but they require proprietary hardware and software platforms and are generally not suitable for the specific needs of SHARP. On this basis, the Software Engineering Laboratory of the Computer Science Division, at the National Technical University of Athens (NTUA),

being responsible within SHARP for identifying the requirements for the user trials and providing a common infrastructure to the rest of the partners, decided to develop a system that would cover the specific needs of SHAPR. The approach that the development team chose, was the use and augmentation of existing components and standards, in order to create an integrated environment that provides the required functionality. The result of this undertaking is WebOrama: a Web-based system for ordered asynchronous multimedia annotations. The WebOrama system is presented in this paper, with emphasis on issues encountered in the requirements definition, the design and the implementation of the user interface.

The WebOrama System

WebOrama will serve as an integrated system that will facilitate the exchange of representations of working practices and the creation, management and presentation of asynchronous multimedia annotations on those working practices. In order to do so, it will facilitate the creation of an audio-visual representation of a working practice by an expert practitioner, which will serve as base material for an asynchronous, multimedia discussion. Furthermore, the system will provide a means for exchange and review of the base material and the capture and hyperlinking of multimedia annotations to this material.

One of the most innovative concepts incorporated within WebOrama is that of ordered annotations. Annotations created by different types of users (audio-visual representation creators, practitioners, and learners) are of different order. This ordering scheme serves as a means for filtering of what information (set of annotations) is presented to each user-group. In this way, even if the same base representation is used at the same time by both a group of practitioners and a class of learners, interference or degradation of service is impossible for either of these user-groups. However, while it is important to separate contributions to a discussion within each group, it might be some times equally necessary to attract attention to a contribution to one group to the members of another group. This is achieved through a transclusion mechanism, thoroughly described in (Bieber et al. 1997). Using this mechanism, the co-ordinator of the discussion of each user group can include an annotation in a different order-set to the one it originally appeared in. This mechanism can also be utilised to facilitate reusability of an existing set of annotations: a teacher, for example, can define a new order for her class and, transcluding all the relevant contributions from other order-sets, offer an exciting educational resource to her students.

User Interface Requirements Definition

The user interface is by all means the most important component of the WebOrama system, especially for the purposes of user trials that will be conducted within the SHARP project. An inappropriate user interface would invalidate the project and hinder its expected results: it is not the intention of the partners to test and evaluate an AMC system, but rather to use it in order to get feedback and data on the effectiveness of AMC within the educational process and for the exchange of working practices and ideas within a community of practitioners and learners. Therefore, it was clear to the development team of WebOrama that great effort had to be put on the design and implementation of the user interface. The design process of WebOrama's user interface was supported by the methodology proposed by Balasubramanian and Turoff (1995) and (1996), that provides a comprehensive approach to designing self-evident user interfaces for interactive systems.

The following *non-functional requirements* were defined for the user interface of WebOrama:

1. Portability and standardisation: As mentioned in the second section of this paper, it is very important for WebOrama to be an open and portable system, based on existing standards. This is especially true for the user interface, as this is the only component of WebOrama that will be used from all of the partners, throughout the user trials.
2. Consistency and integrability: One of our main considerations is the support of a consistent and uniform interaction model, so that all of the functionality of WebOrama is provided through an integrated environment, both for the practitioners and the learners.

The *functional requirements* that were set for the user interface of WebOrama, are summarised below:

1. Adaptive and customisable user's view: Users of WebOrama should be able to customise the user interface according to their preferences. The system should also provide an adaptive user's view, in the sense that it should present exactly those annotations a specific user would like to see: presenting too much information at a time could make the system unusable, whereas presenting too little would make it useless!

2. Personalised view and notification: Apart from providing a customisable interface, WebOrama should serve each different user in a personalised manner. The system should keep track of the annotations that each user has reviewed and, using an indicative marker, suggest annotations that have not yet been reviewed. Moreover, users should be able to choose whether or not to be notified by e-mail, when a new annotation appears.

3. User friendly information visualisation and navigation: The user interface should provide a clear view of the sequence of annotations and their follow-ups.

4. Multimedia material management: WebOrama should provide a friendly and functional interface for handling the multimedia elements, available for use at any time. In particular, it should accommodate controls for reviewing the audio-visual base representation (start, stop, fast-forward, etc.) and for creating, editing and deleting multimedia annotations. Finally, it should provide a straightforward interface for the use of the transclusion mechanism.

5. User type: The user interface should render a different representation of information and available functionality, according to the role within WebOrama. Four sets of users have been specified:

- Creators of base audio-visual representation, who play a limited but significant role in the annotation process. They are involved only in the creation and deletion of annotations referencing directly the base representation (1st order annotations). If creators wish to participate in the discussion to follow, their role will be that of ordinary practitioners.
- Practitioners, who have a dual role in the collaborative learning process, the first being that of an 'advanced' learner, in the sense that they benefit from the exchange of knowledge and the introduction of innovative working practices. Their other role is that of the provider of experience-based knowledge.
- Learners, who are only able to access the base representation of the working practice as well as review and add annotations.
- Teachers, whose main responsibility is to manage the flow of communication among the group of learners and contribute to the intra-group awareness. In order to do so, they are able to add annotations that can liven up the discussion, or, if they find it appropriate, use the transclusion mechanism to hyperlink annotations from practitioners to the discussion of their learners. In addition, they can choose to delete a learner's annotation, in case they believe it is inappropriate or irrelevant to the educational process.

User Interface Design Issues

The non-functional and functional requirements for WebOrama's user interface, led to a some strategic decisions, the most important of which are described below.

Portability and standardisation: The exclusive use of HTML pages, which can be presented in any Java-enabled Web browser (i.e., Netscape Navigator, Internet Explorer, etc.), was imperative in order to meet this requirement. This way, potential users of WebOrama are not constrained to using particular hardware or operating systems, which in fact was one of the greater considerations of the design, provided the great diversity of existing hardware and software infrastructure throughout the members of SHARP's team and their institutions.

Consistency and integrability: In order to meet this requirement, a well-defined set of available functions, for each different group of WebOrama's users, has been prescribed. This functionality was implemented with plain HTML, where possible, and with the use of Java, for the cases that HTML could

not cover the presentation or application level programming needs. For example, text annotations can be created using HTML forms, while audio annotations with the use of a suitable Java applet. A similar kind of functionality is not yet supported for the real-time creation of video annotations. However, hyperlinking of a video annotation (produced with the help of an external tool) is feasible. In order to achieve consistency and avoid confusion and degradation of service, the user interface controls and affordances were kept to a minimum.

Adaptive and customisable user's view: This requirement has been challenged mainly with the introduction of the transclusion mechanism, which provides a way for dynamic and collaborative filtering of information. While the system proposes the presentation of only those annotations that have been made by peers (i.e. users belonging to the same group), users do have a way to impose their personal criteria of significance and/or importance. As described in the previous section, with the use of the transclusion mechanism, annotations within a user group can be 'advertised' to members of other groups. In order to avoid confusion, the user interface uses indicative markers to clarify the original group that each annotation first appeared in (its order), as well as for implying the level of comments, questions, issues, etc. that have risen from a particular annotation. In addition, users have the choice of simultaneously viewing annotations from diverse groups, if they do not feel that the load of information presented is overwhelming.

User friendly information visualisation and navigation: WebOrama uses the familiar paradigm of threaded representation of subject lines, as this is used in many USENET news-readers applications and text-based annotation systems, in order to provide a clear view of the sequence of annotations and their follow-ups. Furthermore, in order to avoid undesirable navigation, a lightweight, popup viewer, activated with the right mouse button, hints on the content of each annotation and the corresponding follow-ups. This way, users can easily examine whether or not to follow a thread, which might lead to an irrelevant, and perhaps expensive in terms of network bandwidth, discussion.

Multimedia material management: Meeting this requirement was one of the most difficult issue, since embedding a video resource in an HTML page is only possible with the use of proprietary plugins that invalidate the portability of WebOrama. Existing media players for desktop computers are heavily dependent on native code for computationally intensive tasks like decompression and rendering. However, the newly released Java Media Framework (JMF) makes handling multimedia resources possible within any Java applet. The JMF specification defines application programming interfaces (APIs) that provide a platform-neutral framework for displaying time-based media. JMF provides an abstraction that hides implementation details from the developers. JMF is in fact a set of three APIs (being co-defined by Sun, Silicon Graphics, and Intel), the Media Player API, the Capture API and the Conferencing API. Only the first one is currently available for use, while the others' release date is still to be determined.

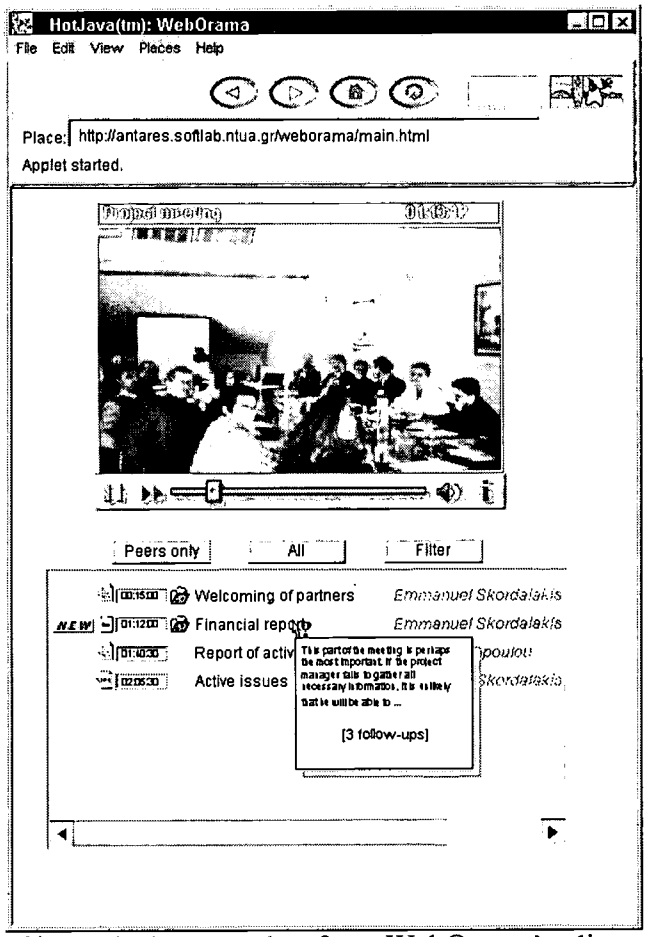

Figure 1: A screenshot from WebOrama's client

Implementation Issues

A prototype of WebOrama is currently underway at the Software Engineering Laboratory. The implementation of the user interface component of this prototype is based on the Java programming language, a choice made in order to satisfy the design principles for a portable, standard, consistent and integrated system. With regard to the user interface, a combination of HTML forms and Java applets was used to support the interaction model described in the previous section. The implementation was relatively straightforward, especially due to the use of JMF.

Using the Java Media Player API, we were able to build most of the desired functionality into the user interface, implementing support for almost any audio and video format. A screenshot of the user interface is shown in Figure 1. The user has control over the playback of the base audio-visual material, while at the same time, can review relevant annotations or add new ones.

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The adaptation of the CAL system Ceilidh for teaching the Oberon language

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Abstract

The Ceilidh CAL system [1,2] was developed at the University of Nottingham in order to support the teaching of programming courses with a special emphasis on the preparation and assessment of practical exercises. We describe the adaptation of Ceilidh for teaching the Oberon language at the University of Ljubljana. In order to minimize the extent of modifications, a careful choice of an appropriate Oberon compiler was necessary, and a compilation procedure that allows the compilation of several modules had to be defined. Major changes were necessary in order to adapt the six tests that compose the Ceilidh marking system, especially the built-in typographic and complexity analyses.

1.Introduction

The successful learning of programming courses requires a lot of practical computer work. This necessity causes a lot of additional work for the teaching staff, who have to assess and mark student program solutions. Such courses are usually performed in the first year of undergraduate study when the number of students is the highest. The bottom line is that this affects the educational quality of courses. However, we believe the computer can be valuable in this situation.

Several Computer Aided Learning systems (CAL) are currently known. One is the Ceilidh system (University of Nottingham)[1,2], that was the base of our experiment. Apart from the presentation of the learning subject (the usual goal of CAL systems), Ceilidh also performs the automatic assessment and marking of student exercises, and the administration of the course. This makes Ceilidh a suitable computer aid for the difficulties described above.

Within our department the Oberon programming language [3] is taught as the first programming course [4]. Each year the course has more than 300 students, and it creates the problems of intensive marking and assessment. When we recognized the features of Ceilidh and tested some already implemented programming courses, we started an experiment to determine the possibility of performing an Oberon course for Ceilidh. It might seem that the creation of a new Oberon course offers a straightforward solution. However Oberon has some special features (modularity, OO characteristics) that require special attention. First of all, an initial adaptation of Ceilidh for the Oberon programming course is required, and it is this process which this article describes.

2.The Ceilidh system

Our presentation begins with a description of the Ceilidh system. Although Ceilidh is not a result of our work, a more detailed knowledge of it is needed in order to understand the points we make later.

Ceilidh is a CAL system, which has three main functions:

- the presentation of course materials to students;
- automatic marking and assessment of student work (exercises);
- administration of academic courses.

The development of Ceilidh began at the University of Nottingham in 1988. Initially it was a Unix program with a few main functions, ASCII interface and the support of one programming course. In the years 1992-95 the Ceilidh project obtained funding from the UK government TLT Programme and a consortium of UK universities became involved in its development. They added functionality to the system, developed an X Windows interface, and added more (not just programming) courses. After 1995 development continued in cooperation with other universities including the integration of the WWW interface into the system and other modifications. By 1997 already 300 different institutions in 30 countries turned to Ceilidh to meet their needs.

2.1 Ceilidh structure and users

The structure of Ceilidh can be described as a tree of system components. Such a description corresponds to the directory layout of Ceilidh. It has four levels and each level's functionality reflects a structural view of the system. The **system level** is the top level and as such gives the widest overview of system functions. It enables access to system data (configuration, documentation, help), use/maintenance of common tools and user interfaces, and access to a number of built-in courses. The **course level** reflects functions needed for running a course. It includes basic course data (overview, student lists), special tools (for course implementation) and a number of chapters. The **chapter level** provides access to distinct parts of a course through chapter notes and a number of its exercises. The lowest level is the **exercise level**, which includes things connected with one exercise: problem description, sample, solution skeleton, student solutions and marks.

The Ceilidh structure can be recognized also from the features of the main system components. The three main components are: four **user interfaces** (command line, menu, X Windows and WWW), several **tools** (internal and external) and a **database** (help system, documentation, and courses).

Ceilidh defines 5 groups of users: **students**, **assistants**, **teachers**, **course developers** and **system administrators**. The group rights reflect the different roles of the Ceilidh users, where students have the least, and administrators all, rights. The groups are implemented by the Unix user system.

2.2 Automatic marking and assessment

The most valuable (and complicated) part of Ceilidh is automatic assessment and marking. From a student's point of view each exercise consists of the problem description, sample results and solution skeleton. By using these the students write their solutions, compile them with the built-in compiler and execute them. They can repeat those steps several times. Whereupon they can submit the solution. This is automatically assessed (with a number of tests) by using additional exercise data, which were defined during the exercise creation by the teacher. Obviously, such data are inaccessible to students. Finally the evaluation marks and comments are returned to the student. If they are not satisfied with the marks received, they can rebuild their solution and hand it in again, but this would also mean a lower mark. The teacher defines the deadlines for the assignment, and the number of attempts allowed. Ceilidh also has provision for a plagiarism check, which can be used after all the solutions are received.

Marking is based on six types of tests that can be performed **dynamically** (by executing a student solution) or **statically** (by parsing the solution code):

- The **dynamic correctness test** assesses the correctness of the student's solution by its execution on several predefined sets of input data. For each such set the results must be predefined, so the correctness is evaluated by comparison between the actual and expected results. The test mark depends on the number and difficulty of successful comparisons.
- The **dynamic efficiency test** compares the student's execution speed and the "optimal" solution, which is previously defined by the teacher. A speed test allows the evaluation of efficiency. The mark is defined by the evaluation of a relative speed factor. For the moment only the assessment of solutions written in C or C++ is possible.
- The **typographic analysis test** assesses the shape and syntactical correctness of a student's solution. Depending on the programming language used, the course developer has to define a number of rules (like "average percentage of comment rows must be 15% to 30%") and assign point values to them. During the assessment these rules are applied to the solution program, and a test mark is generated. Comments for the students are also created.
- The **complexity analysis test** is based on the idea that the code for the predefined teacher solution is optimal from the complexity viewpoint. We can create complexity rules by using this solution as a basis (like "the number of loops needed is 4"). Once the rules are defined, the test uses the same method as the previous one.
- The **program features test** parses the student's solution and determines whether (and how many times) a certain predefined word appears in it. By doing this, the test can assess what features the

solution achieves (like "word (function) Out.String should (not) be used"). The mark is summarized from points given for each successful feature testing.
- The **program structure test** is based on some compiler features and is enabled only for certain programming languages. Compilers can usually write warnings on a predefined file during its compilation. Many of those are meaningless, but some show the structural weakness of the compiled program. This test parses the file of warnings using a similar method as the previous one, except that only negative marks are given for each structural weakness found.

We can perform all or just some of the aforementioned tests for each exercise. However all necessary data (testing sets, results, rules, optimal solution, marks for each evaluation, etc.) must be defined first. All types of tests were originally created for programming courses, but some of them are also suitable for other types of assignments (i.e. questionnaires). We must mention another special feature of Ceilidh called plagiarism check, which compares all pairs of student solutions and points out suspicious similarities.

2.3. Implementation

The core of Ceilidh is basically a collection of Unix shell scripts, AWK programs and compiled C (C++) programs glued together in a hierarchy of directories. Together with links to additional tools and by relying on Unix file and user management system they form the described structure. User interfaces are integrated into the system to ease user work, but at a low level they all execute the same programs and run the same tools.

The core of automatic assessment and marking is a C program called *Oracle*, which is the implementation of a parser. It can parse the file searching for words, which are defined as regular expressions and count them. After that it can mark the results of searching considering one of four possible rules.

3. The adaptation of Ceilidh system for Oberon

The adaptation of Ceilidh for teaching Oberon required the following modifications: a selection of an appropriate Oberon compiler, a modification of a common compiling procedure in Ceilidh, and some major changes in the implementation of the Ceilidh tests for Oberon.

3.1. Selection of an appropriate Oberon compiler

For each Ceilidh programming course a compiler is the most important additional tool and it also has an important influence on the efficiency of Ceilidh. So our first task was to select an appropriate Oberon compiler. We first defined requirements for selection. Obviously, the compiler must run under the Unix system in way similar to other Unix compilers. If we want to completely preserve the Ceilidh's functionality, the selection is in many ways determined by the basic Ceilidh orientation for C (certain tests are strictly connected to a *cc* or *gcc* compiler). So, the selected compiler must have a similar behavior and all the required results. The final request is the compiler's current availability for use and latter integration.

We can divide Unix compilers for Oberon in two groups: the **first group** compiles the Oberon source code directly to the executable program, while the **second** translates the Oberon code into C source code first and then uses a *cc* or *gcc* compiler to create the executable code. The second group is more appropriate for us as it guarantees the required operation and results. On Internet we found many Oberon compilers, which could be appropriate for integration. We tested four (five) of them:

- **Ofront** (Software Templ) had some very good qualities, but it had problems with availability, as only a small part was available for free. Further, we had difficulties with the file locations that caused additional unnecessary complications.
- **pOt** (University of Moscow) was fully available, but it did not offer enough support. We had problems even during its installation. Additionaly, we discovered it was made for a standard Oberon code while we preferred a superior Oberon-2 code.

- **O_TO_c** (University of Ljubljana) had some good qualities (it generates ANSI C standard code) and suitability for the Oberon-2 code. However at the time of experiment it was still under development and not entirely usable, so we could not use it.
- **oo2c** (University of Köln) offered the best selection. We first tested its precessor **o2c** but it also lacked Oberon-2 support. **oo2c** is built for compiling the Oberon-2 code. It is fully available, has all the required functionality and generates an optimized ANSI C code. So we chose the **oo2c** compiler.

Ceilidh starts to compile student (or teacher) solutions by executing a shell script program. The script takes care of the definition of compiler parameters and file locations. We changed it in such a way that it starts the *oo2c* compiler first and the *cc* compiler afterwards.

3.2 Compiling of Oberon modules

That approach worked well for single module Oberon programs. However, one of the main features of Oberon is its modularity. Oberon programs usually consist of a hierarchy of several modules and the order of compiling is determined by the module hierarchy. The common Ceilidh procedure to solve the compilation problem of several files is to use an additional file named *Makefile*. But in the case of Oberon this solution fails as in *Makefile* the order of files for compilation is static. Additionally, the problem of editing arises, because the possibility to edit a previously unknown number of files is required. We solved the problem with a definition of rules for writing Oberon programs under Ceilidh, and with a modification of the compilation script file.

Rules: We decided that all Oberon modules must be written in one file only, the low level modules being declared first (as they must be compiled first) and the high level last. The solution skeleton of the teacher can define all the necessary modules and their order. In this way it can strictly control order. If the solution skeleton is not defined, solvers have more freedom for module definition, but they must maintain the right order of modules in file.

Modified script file: This was neccesary because the compiler cannot compile more than one module in a file. So we first temporarily divide the original source file into several files (as many files as modules). After that we compile them separately in correct order and we create one executable file. At the end all temporary files are deleted.

3.3 Automatic assessment and marking of Oberon programs

At first sight the implementation of automatic assessment and marking by Oberon programs seems pretty complicated, but it proves that it is possible to retain the core of Ceilidh marking system (program *Oracle*) unchanged. The Oracle is in one way or another the basis for each test in Ceilidh. Relying on the implementation of tests for the C course we adopted all tests for Oberon in following manner:

- The **dynamic correctness test** simply runs the compiled solution (executable file) on several sets of input data and counts successful attempts. By solving the problem of Oberon compilation the execution is no longer a problem. The only remaining problem is the file name conventions as the test must operate on files with extension *Mod* and not *c*. This requires the modification of a system script file, therefore a similar script file must be created for the Oberon course only.
- The **dynamic efficiency test** uses Unix system utility *tcov*, therefore it works only for solutions written in C. In our case we base the assessment on two C source code files, which are built during the compilation of student and teachers' solutions. As those C solutions reside on the right directory after each compilation, only the naming conventions must be solved (as in previous test) using an additional script file for the Oberon course. This test strongly relies on the hypothesis, that the *oo2c* generated C code preserves the same speed characteristics as the original Oberon code.
- The **typographic analysis test** depends on the programming language used. In spite of the fact that Oberon and C are both Algol-like languages, we had to rewrite the implementation of this test entirely. The changes were necessary because of (1) syntactical differences, (2) semantic differences, and (3) different pretty programming standards. An additional effort was required to define the file of pretty programming standards. We had also to change the shell script file for

starting this test because of naming conventions.

- The **complexity analysis test** is similar to the previous test and had to be rewritten as well. The cause of changes was similar as in the previous case except that some additional measures had to be taken into consideration. This test required changes of script files because of naming conventions too.
- The **program features test** is in fact a direct use of the *Oracle* program on the Oberon solution code. In a testing sense it is independent of language and it parses solutions as a text file. The only adaptation needed was due to naming conventions.
- The **program structure test** is currently implemented in the same way as in the C course and uses a Unix *lint* utility. As in the previous case the program structure test uses C source file (generated by *oo2c*) for its base. The only reason for changes were naming conventions. However this is only a temporary solution and should be changed in the future.

We have tested the above described changes empirically and they enable us to perform assessment and marking satisfactorily. They are implemented as a separate part of the Ceilidh system (under Oberon course) and do not interfere with other courses.

4. The Oberon course at our faculty

As already stated Ceilidh was originally developed to help programming course teachers of large classes and the Oberon course at our faculty is one of them. This course has a simple organization of course lessons, and suitable course material for development of the Ceilidh course. More importantly, the course currently has a practical work policy similar to that implemented in Ceilidh. The students have to solve and hand in several programming exercises on a regular time basis, which are afterwards marked by assistants. There are also some additional benefits to the implementation of Ceilidh. It provides a computer-supported course materials presentation to the students. There exist several developed Ceilidh courses and students can use them for self-learning. The teachers can also point to additional information on the Internet by using Ceilidh features.

However, there are also some difficulties with Ceilidh implementation. A clear assessment and marking policy has to be defined for Ceilidh use at our institution, where the roles of Ceilidh users and principles of work might be different as in its current implementation. Language is also a problem, as Ceilidh currently uses English and our formal teaching language is Slovene. Additionally, as we mostly use PC computers the appropriate way of using Ceilidh would be through Internet. A dificculty arises because not all students have the Internet connection at home. Thus many of them would still have to work during exercise hours at the faculty thus diminishing the benefits of Ceilidh.

5. Conclusion

At the moment the decision for (or against) Ceilidh use has still to be taken at our faculty. However, we have taken the first step by experimenting with the adaptation of Ceilidh for the Oberon course. The second step would be to develop a part of Oberon course and use it on a pilot group of students. After an analysis of their remarks, the entire course could be developed and used in class.

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Track B: (Paper Abstracts)
Information Technology in University Management

Track B Abstracts: Information Technology in University Management

Student Self-Service - a Challenge for Customer-Oriented Universities -

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Self-service is not primarily a technical problem – it is a organizational decision of the university's management.

This contribution is divided into three main parts and identifies the social, organizational and economic background leading to the introduction and integration of self-service functionality into the administrative business processes within higher education institutions.

First, we describe several business processes, examine their suitability for self-service and evaluate that potentials in improvement they eventually pose to the involved personnel, student body and the institution as a whole. In the second part an optimal scenario describing technological cornerstones of and limitations to a new self-service approach is developed. What distinguishes successful from unsuccessful implementations and how should self-service components be integrated into larger frameworks? In the third part exemplary self-service functionalities are presented as parts of the integrated solution i3v®-Education for decentralized higher education administration.

Web-based Information Services for Studies Planning, Management and Administration

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Higher education institutions of Lithuania are seeking for reconstruction and improvement of academic studies and university management structures to be able to join new European Union programs in education and training like SOCRATES and LEONARDO. The process goes intensively on through redevelopment of university Information System using IT as strategic tool for improvements in information and management services. The paper will focus on approach taken by Kaunas University of Technology (KUT) to make an open and flexible study system by implementing principles of transparency, accessibility, study data sharing and distribution in a networked environment. The work is supported by the TEMPUS project "A Shared Architecture for Academics and Administrators (SAAA)" during the period of 1998-1999.

Travelling the innovation path: how to survive the implementation of a new Information System

Sam Casey & Andrew Higgins
University of Greenwich, London, England

This paper considers the development of information systems within UK Universities, and the demands that this places on business process managers and computing professionals for staff development and training. The focus will be on the implementation of SCT's integrated BANNER 2000 Student System at the University of Greenwich (UoG). The system is rules based and driven by end users. It empowers the process manager and removes overall control from the computing professionals. The project has highlighted the progression of technology, the need to reassess UoG's business processes, information needs, and most significantly, human resource requirements and the way people work together.

Getting Management Support from an University Information System

Gabriel David and Lígia M. Ribeiro
Faculdade de Engenharia da Universidade do Porto, Portugal

In this work we describe a new layer of services for the Intranet of the Engineering Faculty of Porto University, corresponding to the extraction of relevant derived information specifically designed to support the several levels of school management.

Balanced Scorecard for Universities

Niclas Lindgren and Anneli Lappalainen
Elementum Oy and Helsinki University of Technology, Finland

In the second half of the 1990's business management philosophy moved on to conquer new territories with the emergence of the Balanced Scorecard-theory. The Balanced Scorecard complements financial measures of past performance with measures of the drivers of future performance. The objectives and measures of the scorecard are derived from an organisation's vision and strategy. This new way of thinking provides a framework for converting strategic targets into operationalised action plans complete with activities and measures on every organisational level. At first the philosophy was implemented in the business environment. As the benefits of the new way of thinking and acting have been perceived, the same ideology has been applied also in public, non-profit organisations.

The adaptation of the system requires transformation and modification of the theory in order to make it converge with the implied host environment. As the implementation of a Balanced Scorecard demands versatile verbal and numerical documentation — both in the path of (hierarchy-wise) delegation and setting of targets as in the path of reporting and measuring the realisation of the implied strategy, it is more than natural to consider the impact of and on information technology in such a context.

The aim of this paper is to describe the transformation process of the general framework into a working and pro-active concept meeting the evolving needs for strategic management in the university environment. This paper will also go on to describe how this change process will be realised with the developed technology platform called University Elements.

Reflections on the Fate of IT Strategies

Alex Reid
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This paper reflects on the fate of IT strategies at universities in several countries, based on the author's personal experience. It examines the purpose, nature, form, process and context of the development of IT Strategies, at universities in Australia, Hong Kong and the UK. It considers the following aspects of the whole process:

- *the forces which led to the decision to create IT strategies at these very different universities;*
- *the processes and resources which were employed to create them;*
- *their content in the context of their purpose;*
- *the form which their content has taken;*
- *the manner in which they have subsequently been (or not been) used.*
- *Finally, it considers the value of these efforts in the light of their fate.*

In broad terms, it concludes that political factors almost always overshadow the technical or "logical" issues, and that these need to be taken fully into account when deciding the nature of the IT Strategy, the resources and methods to employ in their creation, and the size of intellectual capital to invest. It finds that they can be of immense value, but that IT staff should have no illusions about their potential fate, and should not be overly concerned if they appear to end up gathering dust on bookshelves.

The Growth of the Information Strategy Approach

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The paper describes the growth of the information strategy at University College Worcester (UCW) and shows how it has become part of the strategic portfolio of the institution. In addition the paper reports on the growth in the adoption of information strategies in institutions across the UK and describes the recent extension of the Information Strategies Initiative of the UK Joint Information Systems Committee (JISC). A particular aspect of the paper is the inclusion of learning and teaching issues in the information strategy approach. Traditional Information Systems Strategies tend to focus on management and administrative information but the JISC approach tries to broaden the scope.

Characteristics of IT Strategy in the Medical University of Varna

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The Medical University in Varna, including the University Hospital, has quite a complex structure coming from the 45 departments it comprises and the 6 buildings spread over a distance of more than 5 kilometers throughout the city. The structure of the University can be expressed in four levels: departments, clinics, sectors and units (wards). Each of the departments and their corresponding clinics and minor units have a considerable number of computer facilities. There are also several computer rooms, used for the education of students and staff. The curricula for Medical Informatics for the students of medicine and for the students of health care management are developed according to the best European standards. Some attempts of implementing telemedicine has also been made. And yet, it is still not quite possible to implement the IT strategy in the University. This paper describes the aims of the IT strategy in the Medical University in Varna. It also points to some of the difficulties of the implementation of the IT strategy in the University. These difficulties have both objective and subjective origin. The objective difficulties come mainly from the transition period the country is undergoing during the last years, including the changes in the health care system, financial shortcomings etc. The main difficulties are the subjective difficulties, which are in fact closely related to the medical staff of the University. This paper also gives some ideas for how to overcome all those difficulties, the main task being to make medical staff understand the usefulness of the IT implementation.

Systems, Processes and Transformation - The Liverpool John Moores University Approach to C&IT-Enabled Change

John Townsend
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In March 1997 Liverpool John Moores University (JMU) embarked on a University-wide transformation initiative to create 'an enabling strategy for the foreseeable development of JMU'. The agenda set by this initiative presented a challenge through the need to coordinate University-wide process reviews, existing systems developments, new technology pilots and 'business-as-usual'. The dynamic and flexible Systems, Processes and Transformation approach to the management of Information, Technology and Change has been developed to answer this need. This approach should create the dynamic necessary to take JMU forward through the alignment of business-as-usual, Transformation objectives, and Communications and Information Technologies (C&IT), and, through the development and refinement of the global process map and associated information flows, in effect produce the JMU Information Strategy.

Student Self-Service
- a Challenge for Customer-Oriented Universities -

Dipl.-inform. Ulrich Kammerer
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Abstract

Self-service is not primarily a technical problem – it is a organizational decision of the university's management.

This contribution is divided into three main parts and identifies the social, organizational and economic background leading to the introduction and integration of self-service functionality into the administrative business processes within higher education institutions.

First, we describe several business processes, examine their suitability for self-service and evaluate that potentials in improvement they eventually pose to the involved personnel, student body and the institution as a whole. In the second part an optimal scenario describing technological cornerstones of and limitations to a new self-service approach is developed. What distinguishes successful from unsuccessful implementations and how should self-service components be integrated into larger frameworks? In the third part exemplary self-service functionalities are presented as parts of the integrated solution i3v® -Education for decentralized higher education administration.

Self-Service – why should universities deal with this?

When discussing self-service with university staff members and even some university managers, one often gets confronted with arguments like these:

> „Where is the use of these techniques, we have no need for all these new technical games. Everything has been working well for so many years!"
>
> "When all the work is done in self-service, my personnel will become unemployed!"
>
> "Our processes are so highly optimized today, there is no potential left!"

At least two facts which cannot be ignored when discussing the topic of self-service within universities clearly contradict these standpoints.

1) A Student´s life changes

New approaches to forms of learning imply dramatic changes to the individual students.

Continuing political focus on increased student mobility, distance learning and teaching alliances between higher education institutions introduce new difficulties to administrative processes.

Before that, administrative systems were designed for rather immobile students, normally studying on a single campus. Nowadays, an increasing number of students conduct some parts of their studies outside their home university, within other countries or even on other continents. This implies that all these students cannot physically visit their student administration office every time they have to perform some administrative tasks.

New self-service mechanisms for taking care of these affairs in a student centric approach with minimal overhead are a necessity in this respect.

2) The work of the administrative personnel changes

In general, and especially in days of low state budgets, we face the fact that there is no funding for

employing additional personnel. To the contrary, the university budget stays the same or is even cut, although, on the other side, new demands are put up by politicians and competition from other universities steadily increases.

Due to those new tasks, the student office has to change its philosophy from just administering students to increasingly acting as a consultant for them by dealing with their non-standard problems.

To accomplish this demand, it has to reduce standard tasks and move the free capacities to new functions which improve services not only to the students but also to the staff.

Introducing self-service methods can significantly support this goal by optimizing the workflows, thereby shortening overall processing time, and reducing the number of people involved in traditional manual work, so that existing personnel can take over the new tasks mentioned above.

Processes suited for self-service

In this chapter, various major business processes are examined which are suitable for student self-service and bring improvement for the involved personnel, student body and the institution university as a whole.

The student's processes

Many of these standardized processes still require a lot of paperwork to be done manually. Therefore, feedback to the student is quite slow, not to mention the waiting queues still building up in front of the student office.

Business processes dealing with student administration involve, but are not restricted to:

Matriculation, enrolment and payment of matriculation/study fees

Matriculation is one of the most controversially discussed processes for self-service.

Many student-affair departments have invested much time, money and ideas over the past 10 to 15 years into optimizing this process and have reached remarkable results. Already in some universities, students have to visit the office only once or in some cases can even stay at home. Having reached improvements or at least being on the way, many departments state that there is no further possibility for optimization, and they are right – from their local view.

But when discussing matriculation, a parallel between mathematics and administration comes to mind – it is a difference between local and global optimum. Let's look at some examples for this:

The first example is a very simple one. In many cases the student's address is outdated or simply incorrect, with the result that many letters are undeliverable and are therefore returned to the department of student affairs. And such wrong addresses are not as rare as one would suppose; sometimes wrong addresses sum up to the quite high percentage of 30%.

The next one is the financial aspect; a student has to pay matriculation or study fees, he has to fill out the money transfer form which is submitted to him by the university and has to hand it to a bank. But experience shows, that in 10 to 15% of all matriculation cases, the fees are paid multiple times, partially, or with no chance to relate the payment to the student automatically. It is obvious that this does not increase the work for student affair department, but the financial department involved into the clearing process gets into considerable trouble.

The third example is that every student needs a different number of letters of enrolment confirmations. When sending them by regular postal mail, students often receive too many of them (and those documents are not necessarily cheap, because they are printed on pre-printed forms) and others have to get additional ones from the department of student affairs, where they once again have to wait in queues

and generate additional work for the staff.

With a self-service matriculation process incorporating immediate payment of study-fees, all these problems are solved once and for all. The address is not needed anymore for matriculation but, as will be shown below, can be corrected in self-service as well. The financial transactions are automatically related in the correct amount to the correct student and multiple or partial payment of the fee is effectively prevented. And last but not least, the student is able to print out his letters of confirmation at self-service stations all around the clock by positively identifying himself as approved information requestor.

Address changes

When discussing the level of the quality of student addresses being kept in the student administration system, one will determine that there is a quite large number of incorrect addresses. What causes this?

There is a very simple reason: Up to now, address changes are requested from students in situations in which they do not have any interest of their own in correcting their address data. Normally, this takes place after receiving the matriculation papers, in the best case at home when opening the envelope, in the worst after waiting several hours in a queue.

To change this, it is one goal to design the process in a more convenient way for the student, but mainly it is necessary to ask for the correctness of address data in situations where the student himself is interested in updating the data. Such situations appear in different places, for example during the registration to an examination, the matriculation or enrolment, but as well while lending a book from the library.

Registration for examinations and issuing of documents

Another important process which can be optimized dramatically through the self-service approach is the registration for examinations and the issuing of confirmation documents.

In many universities, students are still forced to complete a very complex procedure to register for an exam. This means that there are up to four institutions with different consultation hours where the student has to appear in person, starting out with the students department over faculty and professor up to, in some cases, a separate secretary of examinations.

Based on a modern examination system, all these standard cases which require the students to spend hours and hours in administrative examination formalism can be processed in a fully automated manner through a self-service application.

The precondition for giving the permission to take part in an examination can be checked by the system itself, taking into account all the regulations of the respective study courses.

Instead of wasting hours and hours wandering from one office to the next, a student can regulate the necessary affairs at a self-service station within minutes.

And, as a second advantage, the staff of the student affairs department gains much time for providing consultation services to students with non-standard questions, e.g. studying in foreign countries, requests for non-standard examinations, recognition of credits gained within other courses or universities etc.

Lookup of grades and progress within the studies

In close relationship to the last point, self service offers the possibility for students to request information about their study progress.

Up to now these documents have often been issued manually within the student affairs department, again wasting time and resources. Based on a modern examination administration system, these documents

can be produced within self-service stations immediately. This also allows the student to constantly monitor his progress through his studies, set milestones, and get direct feedback on his performance.

Self-service for students – the final cornerstone to administrative optimization?

As shown above, self-service for students is a quite important aspect for providing efficient and high-quality higher education administration, even though it definitely is not the one and only crucial point determining success or failure.

Quite as important is the decentralization of a large variety of processes which additionally have to be provided through the universities staff. The use of an integrated system, which decentralizes data-acquisition at the same time guarantees that responsibility for the data is located at the person who is responsible in reality.

The next chapter talks about some of these aspects which should be respected when dealing with the decision process for inventing and implementing self-service systems.

Technological cornerstones for successful self-services

This chapter focuses on an optimal self-service scenario, describing technological cornerstones and limitations to a successful self-service approach. Important aspects are provided to tell successful and unsuccessful approaches apart.

Last but not least it is shown that self-service components have to be integrated into larger frameworks if they are to become lastingly successful.

The technological basis for realization

The most important aspect of the technological basis for the realization of self-service applications for students is their integration into an integrated business process architecture for the higher education administration. Only this integration assures that all data is stored only once and is interconnected with all the processes within the university administration.

Such a system has to build upon a powerful database, a specialized application framework for higher education management. It has to be suitable to the different organizational units of the university and should provide a window that opens the university to the remaining world.

To create this window, it is clear that, especially for information-oriented applications providing services to many, Internet-based technology is the right choice. The application only needs a standard TCP/IP-connection which is available at almost any location throughout the world, assumed that the user has access to an appropriate computer.

But what should be done if additional requirements, e.g. printing in pre-printed forms or electronic payment, are to be fulfilled and these are not available at all locations?

At this point Internet-based kiosk systems for self-service applications are suitable solutions, because they can provide capabilities for integrated payment with lower fees than credit card companies offer, provide printing-capabilities on pre-printed forms and last but not least can offer video-conference based consultation services to the student.

The availability of such kiosk systems ensures that any student can carry out all the transactions that cannot be done in the Internet, such as immediate and secure payment or the issuing of documents like matriculation proofs etc. Especially in Europe an outstanding infrastructure for payment named electronic cash and electronic purses like the German "GeldKarte" or the Austrian "Bankomat Quick", offer certain advantages and should be used more frequently than they are today.

As an add-on to these functionalities, the university has the chance to make use of these kiosks,

presupposed that they are multifunctional and capable of hosting advertisements by many providers, as a means of earning non-trivial amounts of money from advertisers which sell their products on these kiosks during off-peak times. In this context financing models exist which allow universities to get hold of kiosk systems through kiosk-providers without actually having to pay for them.

To ensure the correctness and the authenticity of the students transaction, the self-service applications should make use of digital signatures. As appropriate media for this purpose, cryptoprocessor Smart-Cards are recommending themselves as they can additionally be used as student-ID-card, as library-ID-card, as ticket for the public traffic, and many more functions.

Apart from these more technical implementational details, user acceptance must not be forgotten. Key points are the easy-to-use ergonomic user interface, the transaction speed of the application and, of course, security considerations. These can inflate the introduction of self-service components to a major task when non-standard software is being used or, in the worst case, solutions are being reinvented from scratch.

Self-service within i3v® -Education

In this chapter, real life examples of Internet-technology-based self-service applications will be given, which follow the ideas that were described within the last chapters. They are part of i3v® -Education, a system which has been successfully introduced in several European universities.

These applications can be seen and discussed as well within the accompanying exhibition where i3v® -Education with all its back-office and self-service-components will be presented.

Matriculation, enrolment and payment of study/matriculation fees

This Internet-technology based application integrates the cryptoprocessor SmartCard and provides all the functions mentioned above.

After the student logs in with his personal ID (the ID is not transmitted over the net but verified locally by the SmartCard), the matriculation or study fee can be paid with ec-cash or electronic purse at a self-service kiosk.

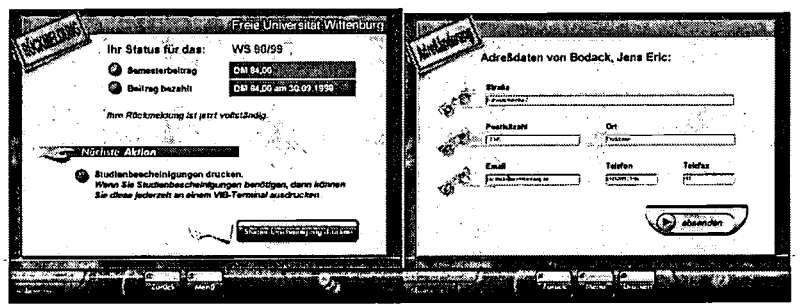


fig.1: The i3v® -matriculation application fig.2: The i3v® -address-change application

Upon successful payment (fig.1), one has the possibility to print out the letter of confirmation stating the matriculation status. Of course it is possible for the student to be issued more of these documents if needed until the matriculation period has ended.

Optionally it is possible to mark the student's SmartCard with different signs, e.g. applying a semester ticket for the public traffic system.

All these transactions are stored by i3v® -Education within the students vita, where entitled personnel can trace transactions performed by the student.

Address changes

The i3v® address change application shown in fig.2 can be integrated into different self-service-processes or be run standalone.

Therefore, it can be assured that the student is actively asked about the correctness of the address data at times when it is assumed that motivation for an eventual change is obvious on the students side.

Optionally, a digital signature can be asked for, so that it can be proven that the student indeed performed the questionable transaction.

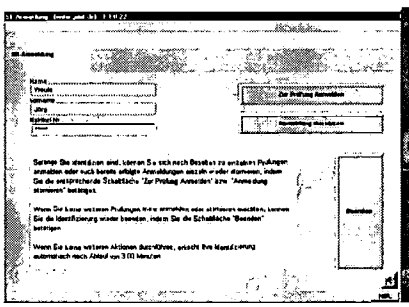
Beyond this, i3v® -Education offers different possibilities for authorized university personnel to change the students address as well. For example they can change the address immediately if they do have contact with the student during some consulting or service affairs and are told by the student that the address data has changed.

Registration for examinations

With the i3v® -Education application shown in fig.3, students can register for examinations in self-service.

The student has only to log into the system with his account, optionally using a SmartCard or a PIN/TAN-combination, and can then decide to which examinations he or she wants to register for or from which examination he or she wants to resign.

All checks for validity of the registration are done automatically based on the results achieved by the student during the studies.



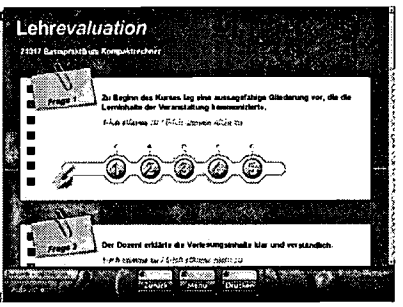


fig.3: The i3v® -registration application fig.4: The i3v® -course evaluation application

Of course, the staff of the student affairs department has the possibility to register students manually in special cases by using their i3v® -Education user-interface overriding standard preconditions according to entitlement.

Evaluation of lectures

As service-orientation gets more and more interspersed in universities, the need for evaluation of the lectures itself and their presentation by the staff become more and more important.

With the i3v® -Education application shown in fig.4, the students have the possibility to cast a vote about the lectures themselves and the lecturers who presented them.

It is possible to store individual questionnaires for every course administered by i3v® -Education. The catalogue of questions is published to the Internet via i3v® -Internet-Publisher as an add-on to the list of lectures available online.

The student identifies him- or herself, chooses the lecture to be rated and provides additional comments or appraisals into the web-form.

After that, all results are stored, optionally in an anonymous way, within the i3v® -Education database and different statistical analysis can be invoked by the staff and the university administration.

Summary

In summary: Self-service applications for students need to be based on Internet technology, incorporate proven payment methods, provide an ergonomic user interface and implement security aspects as well. For certain aspects, the use of self-service kiosk-systems is recommended.

However, it has to be stressed that the use of the self-service applications must be closely coupled to the back-office system of the university, because it is necessary to integrate the data originating at different sources.

That such an integration can indeed be managed successfully was exemplarily shown in the previous chapter presenting different parts of i3v® -Education, the specialized integrated information system for higher education administration.

Further information about the ideas behind this architecture for specialized integrated higher education administration can be found e.g. within the conference proceeding contributions to EUNIS conferences 1997 in Grenoble and 1998 in Prague.

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Web-based Information Services for Studies Planning, Management and Administration

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Abstract

Higher education institutions of Lithuania are seeking for reconstruction and improvement of academic studies and university management structures to be able to join new European Union programs in education and training like SOCRATES and LEONARDO. The process goes intensively on through redevelopment of university Information System using IT as strategic tool for improvements in information and management services. The paper will focus on approach taken by Kaunas University of Technology (KUT) to make an open and flexible study system by implementing principles of transparency, accessibility, study data sharing and distribution in a networked environment. The work is supported by the TEMPUS project "A Shared Architecture for Academics and Administrators (SAAA)" during the period of 1998-1999.

Introduction

Over past years there has been introduced a modular curriculum at KUT, and the well-timed TEMPUS JEPs also considerably supported this process. Having done this, the annual cycle of study process planning, management and administration is considered as a process consisting of several major stages:

General revision of curriculum, which is made up from a set of degree programs;

The first renewal of course modules, introduction of new ones and presentation of all of them to academics and administrators;

Revision and renewal of degree programs, which are to be made up from sets of modules;

The second revision and renewal of course modules;

Certification of course modules and degree programs;

Initial or continuous building up of individual study plans by all students;

Correction and adoption of students' individual study plans.

The entire process must take into consideration different and continual changing requirements of degree programs and students wishes, i.e. individual study plans must include various core modules and some choices from offered alternatives resulting in a certain amount of credits during each semester.

According to our approach all those stages of study management and administration can be realized through a unified Web-based interface with corresponding amount of applications.

In this presentation a web-based system to deal with course modules and degree programs will be presented in details, including an operational, organizational as well as design issues. There will be also discussed the requirements for a reasonably unified access to diverse information sources.

The database of course modules is already in use and is offered to academics to fill it up through web access from individual desktops. Our aim is to present the experience of using course module database along with networked applications built on this database to date of the conference.

Objectives

In the end of 1997, KUT took the decision to develop a new IS for the studies process management. Significant stimulation to modernize our old IS has been given from TEMPUS SAAA project with the overall objectives of (i) improving services offered for the academic community; (ii) modernizing the University organization; (iii) clarifying the degree programs offer; etc.

The foundation of the Studies Planning, Management, and Administration system is a new database of degree programs and course modules, i.e. database contains the details related to all awards together with their constituent parts.

The key elements of the project objectives are

to implement an active-Working/Informing environment both in the academics and student assistance provided/managed by an Office of academic affairs,

to deliver actual information to academic community and get the primary data feedback from them round the year,

via Web-based user interfaces.

What makes the difference between old-new IS?

'The course module program' specification was introduced instead of 'a course module description' in old IS what concluded in a primary data increase up to 10 times at least.

'The degree program' specification was introduced instead of 'a some set of course modules currently (previously) being (been) in use'.

Now the primary data collecting goes from a desktop directly to the central database with an information feedback. This reflects in a significant increase of on-line data suppliers in general.

System in outline

KUT is located over two sites throughout Kaunas city with one branch in Panevezys, north Lithuania, 150km from Kaunas.

Administrative function is distributed likewise; although distributed users use one central database in Kaunas for their direct access.

All new developed applications are accessed via Web. So, KUT extended the use of its studies IS throughout all sites and departments, and to all staff and students.

The system architecture is built in three layers. The first layer defines computation and communication

primitives, initially based on existing Web standards (HTML, CGI, and Java) to provide a publication model of computation. It is nothing more than an extension of a computing environment for heterogeneous and distributed computing by Web technology.

Services in module program preparation

The goals of these services have been to show all the university staff members the advantages of new IT and involve them into the process they are very familiar with over many past years.

All services are split and can be viewed in sense of different responsibility from users like author (data supplier), head of department (data supplier/manager), academic (evaluation/certification), administrator (maintenance of classificatory and user passwords, process scheduling and so on), others (browsing), etc.

We have achieved these goals by means of the highly interactive and well managed Web-based applications.

For instance, the lecturers do all of their work on-line in this environment and don't submit any work on paper for preview or later recording. For better understanding of what does it mean we could say that our module program is somewhat much more than regular syllabus, i.e. lecturer can specify several module delivery forms etc.

We provided two sessions of practical teaching in how to renew old course modules and develop new ones for all the representatives of university departments. About 250 attendees were taught by academics and application developers together at the same time.

After the whole process there was accepted to use the only paper form as a certificate to be signed by three representatives: author of a course module, head of his/her department (to prove the content and submission), chairman of relevant university academic committee (to prove an acceptance, duration for delivery or motivated rejection).

All certificates were collected to keep them in an office of academic affairs.

Services for degree programs

A degree program is treated as a combination of course modules that have been approved by the university. Most probably it is just a framework for students registration to follow study programs i.e. the students are required to enroll annually according to the procedures laid down by the university.

Annual enrolment for a program of study and its constituent modules include the registration for the relevant examination etc.

The majority of KUT undergraduate degree programs is a modular organized under what is known as the 'semester' system. Semesters making up a degree program are thought and examined during a single academic year.

On the other hand a study program and its associated modules and regulations must be approved by both the relevant university Committee and the Academic Board before the program can be offered.

Keeping in mind all the previous thoughts we are going to offer the Web-based services by addressing needs of both degree program developers and the wide distributed end users, administrators incl.

In these circumstances the specification of degree program and its database have been developed. It was first time the degree program specification as an object with relevant set of attributes was introduced to

university practice. We have an intention to provide you with an 'entity-relationship diagram' of degree program for discussion.

The applications we serve the degree programs with at this time are very simple, e.g. you can put the data describing degree program into database or browse the database throughout.

As we can imagine now, really suitable applications to deal with a degree program design/development should be somewhat like a Developers Kit & Navigator, when the usage is as much complicated as a complex underlying the database model.

Additional Services

The advanced networking infrastructure increases user requirements regarding other Web-Infoservices.

Special attention was given to allow users to have interactive access to different classificatory, regulations, schedulers, another descriptions etc. putting them on desktop in different windows upon user request.

Therefore, unified Web-based user interface for data entry is good enough to get user familiar with it quickly. The interface is also easy to implement (generate) but it is quite complicated in sense to observe of what user is doing or has done in general.

To meet such user requirements we introduced a Web publishing facilities i.e. a user maintaining data in database always can easy reproduce data in a form, which looks like a primary document or somewhat like a viewable report. So, user can always keep his/her activity in control and easy get a print copy as well.

Security, reliability, etc.

Intranet/Internet services management always might cause a particular risk in the university computer network security context. There may be natural issues and there may also be deliberate attacks against the information system.

The Authentication of access we initially introduced is based on a user ID/password scheme. Of course, as well there were used additional countermeasures by setting up an inactivity period (allowed duration between two database transactions for 20 minutes initially, for 30 minutes later; after that authentication fails).

Every university staff member already had his/her personal ID widely used for their accounting needs in old IS and now it is just a time to remember this. Initial passwords were generated (in pronounceable form), announced personally, encrypted and kept in database for further control and management. Even if such system worked quite well we tend to focus on being reasonably resistant to attacks and able to ensure totally non-interruptible working or to be totally impregnable against hacking.

Our main attempt to have SSL based sessions with Oracle Application server lead to success only with its new release 4.0.7. Now we are using our own Certificate Authority server, which well serves both Internet Explorer 4.x and Netscape Communicator 4.5 Web clients and WebServer as well.

Some figures

This part reports on an experiment investigating the functionality and usability of novel data input facility, different Web browsers, on a different computers, used by novice users for data entry tasks.

KUT is one of the largest universities in Lithuania with about 12 thousand students. About 60 organizational departments are permanently involved into the studies planning process by supporting degree programs and/or delivering of course modules. About 12 000 students and about 1000 of staffs are the main internal University potential to get a benefit from a new university IS in the nearest future.

Typical campus network (Ethernet 10 to 100 Mbs, ATM), Server Enterprise 450 (4x400MHz CPU's, 1GB RAM, 40GB Raid 5). Information technology background: Oracle8 Enterprise Edition 8.0.4, Oracle Application Server 4.0.7 Enterprise Edition, Oracle Designer 2.1, and Oracle Discoverer 3.0.

In the autumn semester, 1998, we tried to involve all the KUT pedagogical potential into the process of course modules preparation and its further certification using new technology. To accomplish this set of new applications there was developed 'on-the-fly' and integrated into the university web site services. What was quite important to start that every lecturer could find and see all the course modules being in his/her responsibility already moved from the old IS into the new environment i.e. a start took place from the modifying of old module description. In this new IS every KUT staff member enrolled in either the modules submitting or in its assessment or review has the ability to present information and receives all the messages on ongoing process regulations.

As a first step in the ongoing evaluation process of the effectiveness of new services offered to the community unfamiliar with a new technology, the Distribution of User-sessions has been taken into account.

The following deadlines have been announced in this process: (i) for submission of course module programs (CMPs) 09 Nov; (ii) for assessment and certification of core CMPs 16 Nov; (iii) for assessment and certification of all the remaining CMPs 30 Nov; (iv) for the final revision and review of CMPs database 14 Dec.

As you can see in the picture above, all the activity performed by university staff over a log time tells to us in terms of applications quality, reliability and satisfaction to group and intensive usage. As the outcome achieved almost in time from more than 1000 lecturers was result of 2722 certificated CMPs.

Summary and the Future Plans

This paper describes how we modified our old IS to provide a consistent, contiguous, and progressive applications development with a focus throughout the new technologies.

Another aspect, which should be considered in the nearest future, is to support an adequate management of access rights of the big variety of new users putting data to and accessing information from database round the year. At the same time the public access rights via Internet/Intranet should differ in depth and width.

The information held on curriculum should additionally facilitate the University marketing operations, provide information for the Prospectus, support the introduction of the European Credit Transfer System (ECTS) and cater for the information requirements of students on courses.

Three other Lithuania institutions for higher education (Klaipeda University, University of Agriculture and Lithuanian Academy of Music) already expressed their interest in such Web-based Information Services for Studies Planning, Management and Administration and we are ready to share our experience as well.

Conclusion

At this moment, the environmental conditions are becoming suitable to put on the foundations, with a certain warranty of success (e.g. course modules & degree programs), a new model of primary data collection and its further transference to centralized databases.

This trend produced a shift from the only paper-based once-per-year (during 2-3 months) performed revision/review of the degree programs and CMPs, devoted mainly to administrators, to personal productivity tools and applications; from reduced technological environments to a widespread community of users, etc.

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Targamadze A., Anusauskas L., Pocius K., Nauja studijø programø ir studijø moduliø programø

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Travelling the innovation path: how to survive the implementation of a new Information System.

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Abstract

This paper considers the development of information systems within UK Universities, and the demands that this places on business process managers and computing professionals for staff development and training. The focus will be on the implementation of SCT's integrated BANNER 2000 Student System at the University of Greenwich (UoG). The system is rules based and driven by end users. It empowers the process manager and removes overall control from the computing professionals. The project has highlighted the progression of technology, the need to reassess UoG's business processes, information needs, and most significantly, human resource requirements and the way people work together.

Implementation issues

Having identified a replacement student system through a systematic and structured approach (see Appendix 1) the University then had to address a number of implementation issues:

Technical: delivering BANNER onto the individual desktop with Network and infrastructural support to optimise and deliver robust performance and in a structured fashion.

Political: variability in institutional and managerial commitment and "ownership" of the Project: a simplistic perception that BANNER will deliver the existing services the same, but faster.

Functional: additional gaps in functionality not previously identified found during evaluation and testing. Solutions were often reliant upon satisfactory conclusion to problems in other categories.

Cultural: a perception that the system is "forcing" change, rather than recognition that the introduction of *any* system requires organisational and process review. Furthermore, and critically, a lack of recognition by senior managers that the information systems are business critical: intrinsic to the management function and not simply automation tools. There has been a tendency for senior managers to divorce themselves from the information systems that support and deliver the functions for which they are responsible. With a rules-based system, where validation tables and rules are controlled by the end-users, this is no longer a viable approach. Functional/service managers will require a new breed of staff who are functional and technical "experts". These users will be responsible for managing the data infrastructure, coding, menus and workflows, etc.

Resources: institutional cutbacks on project budget and resources dedicated to implementation, both in people and hardware/software terms.

Staff Development and Training: an acute "Development and Training Paradox" was identified: the mapping of business processes from legacy systems to BANNER identified a major shortfall in skills requiring development and changes to roles and responsibilities. At one level managers recognised and accepted the logical outcome of this: that significant staff development and re-training of staff was required. Operationally however, managers (and everyday users) were reluctant to accept that such change requires effort in terms of time, people and facilities. The University had a poor history in

delivering training and development in operational systems. BANNER highlighted the need for staff development which goes beyond simply "training".

A critical task for the Student Team was to apply their institutional knowledge to evaluate the product functionality within a University of Greenwich model and use its flexibility effectively. This 'evaluation phase' was an iterative process: proposals for management of a given business function using BANNER often had to be re-evaluated. The initial point of reference for the Team members was the University's existing legacy system and consequential processes. However, over time the point of reference for analysis and proposal became BANNER. This enabled the development of a collective and individual ability to review University business processes in a more reflective and objective manner: to develop innovative and practical solutions divorced from cultural and historical constraints. For BANNER to be implemented effectively, this paradigm shift has to be achieved in the general user and staff environment through a 'learning culture'. Training only was insufficient.

Organisational development: changing boundaries and roles: The move to a rules-based, user-led system turns the traditional relationship between the Computing Centre and the service departments on its head. Coding structures, validation tables and workflows are now the responsibility user departments, rather than the Computing Department. Furthermore, the business process rules are also user-defined. This requires different management skills and roles. The role of the Computing Department has shifted to one of technical enabler: ensuring effective network communications, technical infrastructure and database management are in place. Formal programming work has ceased to be the core function or raison d'être of the Computing Department. Computing Departments in such a relationship have to accept that they are a support department: in place to enable and support systems largely controlled in functionality by end-users. Desktop support and help-desk functions require a re-focusing on the softer "people" skills and a "customer" orientation.

Timescales: A relatively long development schedule reflected the order in which modules needed to be learnt, taking account of module relationships, practical numbers involved and the complexity of individual modules. For example, the creation of live data on the production database for courses and programmes structures, etc commenced in Feb1998, some 7 months in advance of registering the first students into BANNER. Most importantly, the timescale was designed to give sufficient time for users of the new system to make the mental shift required. This needed to be done for the University and users to allow proper process improvement and innovation, rather than simply automation of existing processes. This can be represented as an innovation curve.

Implementation methodology

The focus of discussion of the implementation methodology will be with the Student System, and in particular the staff development component for end users. This was identified as the most significant factor likely to influence success or failure. Appendix 2 gives an overview of the overall Project Management Structure and deliberative mechanisms.

Student Project Team structure and working methodology: The team comprises competent users of the legacy system who additionally have knowledge and experience of the University's business processes. Staff were initially seconded on a voluntary pro rata basis providing a total of 3.3 full time equivalent members for the team. The Deputy Academic Registrar was assigned as the Student Team Leader on a 0.6 fte basis. It was agreed that the Team should meet regularly two days per week in a designated project location. Over the course of the implementation, the demands of the project have made it a fulltime commitment for the Project Team members.

After pure functional training from the product supplier (SCT) the Team were allocated six months to an Evaluation Phase. The purpose of this phase was to allow:

Familiarisation – navigation skills and understanding of principles and processes within the system.

Mapping of University Procedures – modelling University processes within the system.

Consultation with key University Staff – identifying any functional gaps.

Generation and Testing of Possible Solutions – Considering all the possible solutions

Basic Documentation of Solutions – Documenting solutions for audit and distribution.

Staff Development and Training approach:The first decision was that the scope of development and training should initially cover core users only. This was primarily Registry staff. Consultation with managers identified the training requirements of the staff involved and the commitment in terms of staff time/attendance. The Project Team undertook the initial core training. This ensured consistency of delivery and the development of functional experts within the Team available to support end users, and in whom they had confidence. The first assessment identified 119 staff requiring retraining and development. Staff Development sessions were divided into 'chunks', relevant to working structures and functions, so that staff could develop skills at an even pace. It was decided that their needed to be two levels of training:

Intermediate – designed for users needing to understand the principles of how a particular part of the system works, interrogation of data and how it interacts with other modules.

Advanced – designed for users requiring all the intermediate skills, but in addition needing to enter and manage the data in a particular part of the system.

The system was broken into 13 sections, each to be delivered as individual training sessions of differing length (see Appendix 3). A training suite was developed by the Student Project Team, in addition to a facility available on another campus. The provision of a dedicated training environment was considered essential to provide trainees with the opportunity to develop skills away from the pressures of the office environment and to focus solely on the training in hand.

Development and production of Training Materials: One of the problems highlighted with the

University's legacy system was the lack of user documentation and training provided to functional users. It was agreed therefore to adopt a formal, structured approach to development and training, with supporting materials, presented in a professional manner. This would assist in establishing the credibility of the system with end users. It also aided the decision-making process, forcing decisions to be made on UoG specific issues, so that they could be committed to print. Development of the training material followed an agreed protocol that outlined the design, structure and content requirements.

Two members of the team were assigned to produce each document, based on experience of current procedures used by the University that will effect the use of the module to be documented, and experience of the specific BANNER module. The production of the documentation was split into three phases:

Production - six working days were allocated to each document.

Review - one day was allocated to this task

Editing - four working days were allocated to complete the document with all amendments agreed at the review day and produce all the additional training materials for the session to be delivered.

At a Registry Staff Development Launch day, each trainee was provided with a training folder prior to commencing training. Trainees were to use this to build up a comprehensive personal resource folder detailing the use of the new system and relevant to their working tasks.

Delivery, content and monitoring: Two trainers were allocated to each session. One trainer generally led the session with the other facilitating and assisting the trainees as they progressed through the session exercises. The number of trainees was limited to a maximum of eleven per session, reflecting the available training space and allowing trainers to provide a more personalised training session.

The contents of the sessions were designed so that they were developmental in nature. Many trainees were experienced members of the University's administration and it was important to allow these users to make comments on the methodologies demonstrated in the session. This was achieved by providing practical sessions with the opportunity to question the methods explained. Feedback was requested from each trainee at the end of the session in the form of an evaluation questionnaire. This was used to enhance further sessions and enable the team to constantly critically evaluate the training provided. The trainers were also required to analyse their own performance and highlight any important issues (technical, functional, procedural, policy) by completing a trainer's feedback form.

General awareness: In addition, to the structured development and training, it was essential to ensure that the new system did not become the property of the one department (Registry) that was developing it. A series of presentations to University Management Groups (Academic and Administrative) as well as all School Staff meetings was agreed and delivered.

The critical survival factors: what has the University learned?

Remember that people are your most valuable (and volatile) resource. Use your enthusiasts. Do not allocate team members on hierarchy, or existing organisational structures. Use the best people you have, from wherever they come within the organisation and at whatever grade.

Train the functional implementation team in the formal functionality of the system, then let them play with it in a structured way to test its potential in the context of your organisation, its structures and processes. Do this away from the normal working environment, together and in as free a fashion as possible.

Spread the awareness of the system as far and as wide as possible across the organisation via a "roadshow" approach: deliver presentations to deliberative committees, departmental and school management groups, etc. Target the staff who are influential and have a stake in making the system work. Consider if you were they, the question, "what is in it for me?" Place your presentations in this

context.

Develop a formal training plan and development strategy, based on at least 25% of your functional implementation effort. Ensure a structured approach and common protocol exists for the delivery of the development/training: make the trainees feel special, and that they are engaged in something "different". Formalise attendance at, and feedback from, the training/development sessions. Make sure line managers know that staff will be invited and expected to attend; invite attendees individually, well in advance. Use the training/development strategy as a means of identifying requirements and generating solutions. Treat user sessions as development sessions rather than 'training by rote' sessions. 'Enable' the users to understand what can be different and lose the blinkers associated with their current ways of doing.

Cultivate a learning culture: staff need to change their mindset and recognise that in a rules-based system they have the power to change things. The skills they require to operate the system will be related to problem-solving and an understanding of the organisation and its processes, not just technical aptitude.

Manage expectations: senior management are likely to have unrealistic expectations of what can and cannot be achieved. Use training/development sessions and the roadshow to highlight the critical scope of the implementation, **but** with a view to the future and the medium/long term benefits. Focus on the critical processes and solutions to be delivered: business survival comes first and foremost and the project implementation team must take a corporate stance.

Be proactive in mainstreaming system ownership: People need to know who is leading the Project implementation. However, it is important to target small groups or enthusiastic key individuals to take on the development of data entry standards and/or rules protocols. Make the users make a choice.

Achieve empathy between your technical community and your functional user community: invite technical project development staff to functional training sessions so that they can gain a user context and conversely, make functional users aware of the technical scope in terms they can understand. Have regular cross-team meetings: share the pressures that are restricting or influencing your respective teams.

Pay attention to your project team morale: what motivates the team members? Can you reward them directly (financially) or indirectly (study release, working environment, future prospects)? Plan a contingency for loss of project team members.

Start with a consensus strategy: ideally, you should work in agreement with managers of staff on whom you will have to call for training/expertise. However, managers often want to know what the project implementation plans are, but are unwilling to 'buy into' practical support when it impacts on their area of work. Use the relevant management fora and communications to at least make sure people are aware of what is planned – then press on ahead and 'do it'. Do not be deterred by either no feedback or negative feedback to these plans. Push it as far as you can until someone says 'no'. This forces the institution to address priorities and make decisions.

Allocate a reasonable amount of your project management time to the political and communication areas: Senior management will expect and require regular progress reports with empirical data. The process of generating these can be a necessary precursor to understanding that you cannot meet the necessary objectives within the desired timescales! However, Senior management will want this form of 'proof'.

Start people thinking as early as possible about radical change: introduce new technology and the possibility of changes to staff roles and responsibilities up front. Get the culture shock over with early and without engaging in wholesale process re-engineering, consider adapting your structures and/or processes.

Always have at the forefront of your mind the question "is this a system problem or a people/policy/ procedural issue"? Over 50% of the time, the problems raised by staff in relation to the new system will be tied in to organisational problems or lack of clarity/boundaries on particular functions/processes.

As part of the implementation process, develop a strategy for the future maintenance of the system: Make this transparent and move to get it in place before "going live" At Greenwich the future maintenance issues are represented in the diagram below.

Pick some winners: identify "high visibility" areas where benefits can be demonstrated even if this is only on a trial or pilot basis (at Greenwich, it is planned to pilot management of schedule and timetable information on one of the University's major campuses).

Functional Managers need to understand (and commit to) the concept that information systems are fundamental to their service delivery: i.e. they are not simply means to simply speed up processes, they are methodologies and tools to fundamentally change such processes. The successful managers and services will be those that embrace effectively the use of their organisational information systems.

Conclusion

During the course of our implementation at Greenwich, we have learned that you need to have a formalised staff development strategy for staff related to business systems (rather than just computing skills). As systems move to form the core tool for delivery of administrative services, particularly in institutions which operate a complex curriculum, you need to consider the skills and roles associated with staff. A focus on students as clients with a direct financial stake in services necessitates greater speed, accuracy and transparency of information. This affects your staff recruitment strategy. Staff need to be developed to manage new tasks based on a different set of competencies and skills. For example, which users control functional rules and/or data items that have an institution-wide impact? Managerial accountability will be key as service managers are increasingly reliant on the information systems for the basic core delivery of their services. Thus wider understanding of systems functionality and the rules-base will be a necessary skill for such managers to manage their staff and perform effectively. Such a staff development model must be ongoing, high profile and supported at a corporate level.

Purchase of an integrated system has forced Greenwich to recognise and deal with organisational (artificial) boundaries, since processes and workflows do not respect these. The management of a rules-based system requires us to re-evaluate the relationship between central infrastructure and support and user departments. Technical and functional divisions will blur as the user departments are required to develop a breed of "technical generalists": hybrid staff who have good technical and functional knowledge, but which can be applied in a business process context.

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Appendix 1

The need to change

The University's legacy student administrative system was a bespoke system built on a non-standard hardware and software. It had become increasingly difficult to maintain and/or develop this system to match the University's business requirements. Technical staff with the required skills were difficult to find and had no incentive to move on as their skills were not marketable. The system offered inadequate functionality, security and access, having been developed without a long term design strategy. There was very limited strategic potential: WEB or voice response access options did not exist without wholesale investment and advances in PC operating environments were a major challenge for technical support staff. The development of a University Information Strategy in 1995 further highlighted the system's inadequacies and the need for a replacement. Furthermore, the legacy system was non-2000 compliant.

The University of Greenwich adopted certain strategic principles to inform its tender exercise and purchase decision for replacement systems for Students and Finance administrative systems:

Supplier viability: the supplier would need to demonstrate investment in research and development, with a technical/management infrastructure able to support the product and University into the future.

"Out of the box" product functionality was not as important as the ability of the supplier and/or University to fill effectively, identified gaps in functionality.

Integration. An integrated solution was sought to remove the necessity for ad hoc databases and subsidiary systems within the University.

Leading edge technology: The successful supplier needed to demonstrate an awareness of new technologies, and evidence of accommodating IT/IS developments into product development.

ORACLE-based solution: the University had agreed that the successful product would be based on ORACLE as the worldwide industry standard platform.

Flexible functionality: the system should be rules-based with the emphasis on empowering end-users in the development and management of such rules.

Auditability: none-destructive update of data with transactions date/time stamped was a requirement.

Value for money. The initial and ongoing product cost was to be taken into account.

Proven track record. A history of successful product delivery and support to educational institutions.

Strategic vision. Where had the supplier forecast the product would be five years previously (and had the product met these forecasts) and what was the product forecast for five years in the future? The successful product would be one which would take the University through the next decade.

After a Tender exercise through the European Journal, the University agreed a list of nine potential suppliers. Using the above criteria, this list was reduced to four suppliers. After detailed product evaluation and demonstrations to end users by all four suppliers, the University arrived at a choice of two potential providers. Reference site visits and further detailed discussions resulted in a decision to purchase the BANNER Student System from Systems and Computer Technology (SCT).

Appendix 2

Overall Project Structure and Deliberative Mechanisms

Appendix 3: Staff development and training data

Session Name	Total Trainees	Number of Advanced Trainees	Number of Intermediate Trainees
Academic History		71	52
Admissions		47	45
Assessments		55	45
Class Schedule		95	24
Course Catalogue		63	54
Curriculum Advising and Planning		35	57
General Person		119	
HESA (Government Reporting)		12	
Navigation		119	
Recruiting		31	7
Registration		65	54
Reporting		68	51
Student Accounts Receivable		42	12
Total person Training Days	**1225**		

Session Name	Advanced Trainees	Intermediate Trainees	Advanced Sessions	Intermediate Sessions
Academic History	71	52	6	5
Admissions	47	45	4	4
Assessments	55	45	5	4
Class Schedule	95	24	9	2
Course Catalogue	63	54	6	5
Curriculum Advising and Planning	35	57	3	5
General Person	119		11	
HESA (Government Reporting)	12		1	
Navigation	119		11	
Recruiting	31	7	3	1
Registration	65	54	6	5
Reporting	68	51	6	5
Student Accounts Receivable	42	12	4	1
		Total Sessions:	**148**	

Session Name	Number of Trainers per session	Length of Advanced Session	Length of Intermediate Session	Number of Advanced Sessions	Number of Intermediate Sessions	Total Trainer Days
Academic History	2	1	0.5	6	5	17
Admissions	2	1.5	0.5	4	4	16
Assessments	2	1.5	0.5	5	4	19
Class Schedule	2	1.5	0.5	9	2	29
Course Catalogue	2	1	1.5	6	5	27
Curriculum Advising & Planning	2	3	1	3	5	28
General Person	2	0.5		11		11
HESA (Government Reporting)	2	1		1		2
Navigation	2	1		11		22
Recruiting	2	1.5	0.5	3	1	10
Registration	2	1.5	0.5	6	5	23
Reporting	2	0.5	0.5	6	5	11
Student Accounts Receivable	2	2	1	4	1	18
					Total	**233**

Getting Management Support from an University Information System

Gabriel David and Lígia M. Ribeiro

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Portugal

Abstract

In this work we describe a new layer of services for the Intranet of the Engineering Faculty of Porto University, corresponding to the extraction of relevant derived information specifically designed to support the several levels of school management.

Introduction

The assessment of higher education institutions is traditionally based on counting resources, collecting performance data, and concentrating the corresponding ratios in a bottom-up manner, until final reports are elaborated. More recent trends tend to focus both on resources and processes. For instance, Engineering Criteria 2000 [1], the new set of criteria starting to be used in the accreditation of US engineering programmes, insists on each programme having an assessment system that can actually influence how the programme works.

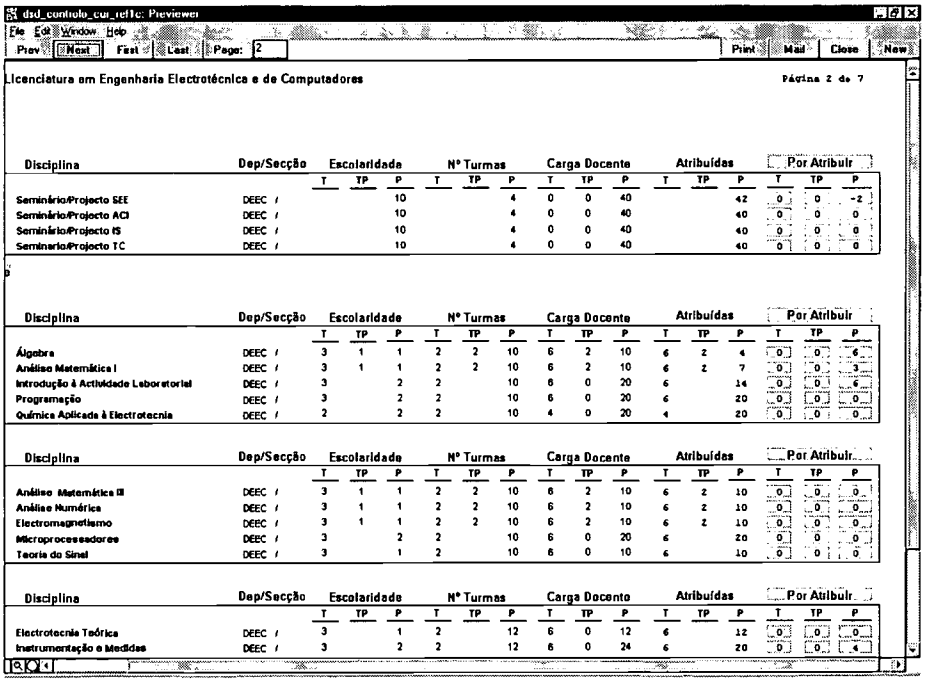
One way this feedback loop may become more effective is through campus-wide availability of some of those indicators and reports, as soon as they are produced. In fact, some corrective measures can be spontaneously triggered by the people involved and, more importantly, in the whole academic community awareness of the situation increases, preparing the ground for the required changes decided by the administration, while enabling more participation in the innovation process. The easier way to achieve that availability is by including the relevant elements in the institutional information system. There, they can be permanently consulted and related with other information concerning the programme.

In second phase of the development of the Intranet of FEUP (see [2]), we intend to refine the previous modules according to the experience already accumulated and to the suggestions received from the users. But we also want to add a new layer of services corresponding to the extraction of relevant derived information specifically designed to support the several levels of school management. In this work we will describe these services, of which some are already implemented.

Planning the teaching service

The task of planning and assigning the teaching service each year requires some preparation. For every course, the number of hours of each kind (lecture, tutorial, laboratory) offered to a class is fixed in the study plan. But the number of classes may vary each year due to fluctuations in the number of students. Though most programmes receive yearly a fixed number of freshmen, the level of fails a course has got in the preceding year determine the potential number of enrolments in the following edition. Moreover, there is a number of students, more significant in the first three years of undergraduate programmes, who, despite enrolling themselves in several courses, never show up or are submitted to evaluation. In order to avoid both empty and crowded classes, the number of classes planned for each course in a year is based on the number of evaluated students of the previous year. Once these numbers are established, the amount of teaching hours required by each programme is known. The workload is then distributed

among the teachers.



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Licenciatura em Engenharia Electrotécnica e de Computadores Página 2 de 7

Disciplina	Dep/Secção	Escolaridade			Nº Turmas			Carga Docente			Atribuídas			Por Atribuir		
		T	TP	P	T	TP	P	T	TP	P	T	TP	P	T	TP	P
Seminário/Projecto SEE	DEEC /			10			4	0	0	40			42	0	0	-2
Seminário/Projecto ACI	DEEC /			10			4	0	0	40			40	0	0	0
Seminário/Projecto IS	DEEC /			10			4	0	0	40			40	0	0	0
Seminário/Projecto TC	DEEC /			10			4	0	0	40			40	0	0	0

Disciplina	Dep/Secção	Escolaridade			Nº Turmas			Carga Docente			Atribuídas			Por Atribuir		
		T	TP	P	T	TP	P	T	TP	P	T	TP	P	T	TP	P
Álgebra	DEEC /	3	1	1	2	2	10	6	2	10	6	2	4	0	0	6
Análise Matemática I	DEEC /	3	1	1	2	2	10	6	2	10	6	2	7	0	0	3
Introdução à Actividade Laboratorial	DEEC /	3		2	2		10	6	0	20	6		14	0	0	6
Programação	DEEC /	3		2	2		10	6	0	20	6		20	0	0	0
Química Aplicada à Electrotecnia	DEEC /	2		2	2		10	4	0	20	4		20	0	0	0

Disciplina	Dep/Secção	Escolaridade			Nº Turmas			Carga Docente			Atribuídas			Por Atribuir		
		T	TP	P	T	TP	P	T	TP	P	T	TP	P	T	TP	P
Análise Matemática II	DEEC /	3	1	1	2	2	10	6	2	10	6	2	10	0	0	0
Análise Numérica	DEEC /	3	1	1	2	2	10	6	2	10	6	2	10	0	0	0
Electromagnetismo	DEEC /	3	1	1	2	2	10	6	2	10	6	2	10	0	0	0
Microprocessadores	DEEC /	3		2	2		10	6	0	20	6		20	0	0	0
Teoria do Sinal	DEEC /	3		1	2		10	6	0	10	6		10	0	0	0

Disciplina	Dep/Secção	Escolaridade			Nº Turmas			Carga Docente			Atribuídas			Por Atribuir		
		T	TP	P	T	TP	P	T	TP	P	T	TP	P	T	TP	P
Electrotecnia Teórica	DEEC /	3		1	2		12	6	0	12	6		12	0	0	0
Instrumentação e Medidas	DEEC /	3		2	2		12	6	0	24	6		20	0	0	4

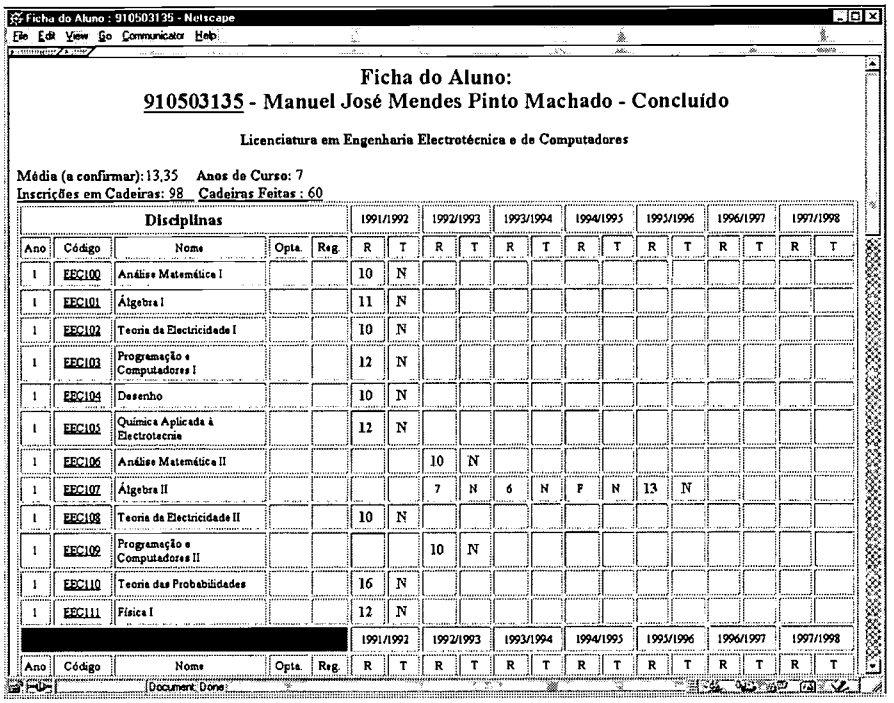
All this information is recorded in the SiFEUP (FEUP's information system). It is thus able to give back control maps pointing out any discrepancies between the assignment of classes to teachers and the previously defined workload attached to each course. Some of the maps are tailored for programme directors (see figure 1). They are organised by course and highlight under- or over-assignment situations. Other maps are meant for department directors and are organised by teacher, computing total and average workloads. Summary results enable comparison among groups and departments.

Figure 1. Control map for programme director.

These maps consolidate the information about the participation in several undergraduate and graduate programmes. The common availability of these maps through the net allows programme directors and department and school managers to earlier detect incompatibilities or abnormal situations.

Student and course performance

SiFEUP displays both individual data and summary values about the student's behaviour and course results. The student record (figure 2) shows, for every year the student has been registered, the courses taken and the corresponding results, as well as the on-going global classification.



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Licenciatura em Engenharia Electrotécnica e de Computadores

Média (a confirmar):13,35 Anos de Curso: 7
Inscrições em Cadeiras: 98 Cadeiras Feitas : 60

Disciplinas					1991/1992		1992/1993		1993/1994		1994/1995		1995/1996		1996/1997		1997/1998	
Ano	Código	Nome	Opta.	Reg.	R	T	R	T	R	T	R	T	R	T	R	T	R	T
1	EEC100	Análise Matemática I			10	N												
1	EEC101	Álgebra I			11	N												
1	EEC102	Teoria da Electricidade I			10	N												
1	EEC103	Programação e Computadores I			12	N												
1	EEC104	Desenho			10	N												
1	EEC105	Química Aplicada à Electrotecnia			12	N												
1	EEC106	Análise Matemática II					10	N										
1	EEC107	Álgebra II					7	N	6	N	F	N	13	N				
1	EEC108	Teoria da Electricidade II			10	N												
1	EEC109	Programação e Computadores II					10	N										
1	EEC110	Teoria das Probabilidades			16	N												
1	EEC111	Física I			12	N												
					1991/1992		1992/1993		1993/1994		1994/1995		1995/1996		1996/1997		1997/1998	
Ano	Código	Nome	Opta.	Reg.	R	T	R	T	R	T	R	T	R	T	R	T	R	T

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Figure 2. Individual student record.

This record is available only to the student concerned and all the lecturers. It plays a fundamental role in supporting personalised treatment, as it gives an instant view of individual performance.

From the course viewpoint, there is a set of figures summarising the results obtained, attached to the course description. To help to put these numbers in perspective, the evolution along several years is given, in a table of the form shown in figure 3:

Success rates

Programme:

Course: Year:

Year	Enrolled (R)	Evaluated (E)	Approved (A)	Evaluated rate (E/R)	Success rate (A/E)	Gross success rate (A/E)	Average mark	Approved average mark
1992/1993								
...								
1997/1998								

SiFEUP, 1999-03-18

Figure 3. Results computed for each course.

Detailed statistics, like the ones just shown, enable the characterisation of several student profiles and thus to develop an understanding of the average behaviour as a basis for better planning. Indicators of course performance help to realise where potential problems may arise and to monitor the teaching activity.

To support external quality assessment of a programme, more aggregated data is needed ([3]), like the dropout and graduate rates, that can give a global snapshot of the fate of each generation of freshmen (see in figure 4 an example table for a 5-year programme). However, this table is not suitable as management data in the feedback loop of quality improvement, because of its inherent excessively long delay.

Dropout and graduate rates

Programme:

Generation	Freshmen	% Dropout after X years					% Graduate after					On-going
		1	2	3	≥4	Total	5	6	7	≥8	Total	
1990/1991												
1991/1992										*		
1992/1993									*	*		
1993/1994								*	*	*		
1994/1995							*	*	*	*	*	
1995/1996					*		*	*	*	*	*	
1996/1997				*	*		*	*	*	*	*	
1997/1998			*	*	*		*	*	*	*	*	
1998/1999		*	*	*	*	*	*	*	*	*	*	

SiFEUP, 1999-03-18

Figure 4. Evolution of dropout and graduate rates.

A similar table, this time organised from the perspective of the graduates of each year, is presented in figure 5. The system presently lacks information about the first employment of the graduates, a shortcoming soon to be corrected.

Graduates

Programme:

Year	Graduates	Average duration	Average classification
1992/1993			
...			
1997/1998			

SiFEUP, 1999-03-18

Figure 5. Graduates indicators.

Course assessment by students

In the FEUP there is the practice of passing a questionnaire to the students whenever a course finishes. The answers are anonymous and optically read by machines. There are two groups of questions, one about the course and the other one applicable to each lecturer. The topics questioned include, for the course: syllabus adequacy; difficulty; required amount of work; students' interest on the subject; bibliography; co-ordination between lectures and tutorials/lab work; quality of the laboratories; assessment methods, global opinion. For the lecturers: presentation of course goals and methods; subject presentation; motivation ability; punctuality; availability to help the students; competence; lecture preparation; global opinion.

The answers, expressed in a 1-5 scale, are collected and grouped by lecturer in a course, and by course. Although all the data is stored in the SiFEUP, the access to individual lecturer and course results is restricted to the lecturers involved in the course and to the programme director. Students have access to more aggregated values, about the performance of all the courses in a year or in a scientific area.

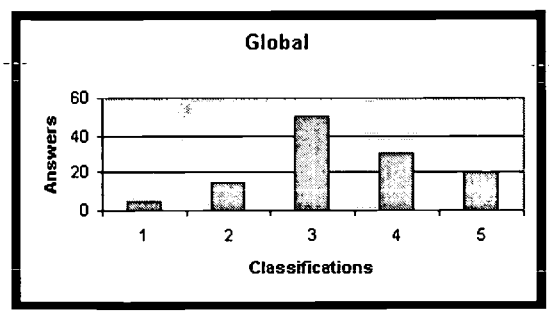
Pedagogic questionnaires

Programme: Academic year:

Course: Year: Semester:

Answers:

Nr	Topic	Average	Standard deviation
1	Syllabus adequacy		
2	Difficulty		
3	Amount of work		
4	Students' interest		
...			



10	Global	

Lecturer:

Answers:

Nr	Topic	Average	Standard deviation
1	Course goals presentation		
2	Subject presentation		
3	Motivation ability		
...			
8	Global		

SiFEUP, 1999-03-18

Figure 6. Results of the student questionnaires.

Scientific productivity

Finally, we will refer the indexes of scientific productivity, like the number of publications organised by kind, which enable to evaluate personal results in the context of its research area.

Publication rates

Department: Researchers:

Year	Books	Book chapters	Papers in international journals	Papers in national journals	Communications in international conferences	Communications in national conferences
1990						
...						
1998						

SiFEUP, 1999-03-18

Figure 7. Scientific productivity per capita.

Conclusion

The conclusion is that the school management has now more accurate sensors of the actual academic and research activities, which support decision making better suited to the school reality.

As a future development, a study using data mining techniques is being set up in order to find associations between the characteristics of incoming freshmen and their future performance.

[1] Aldridge, M. Dayne; Benefield, Larry D.. **Assessing a Specific Program.** In "How do you Measure Success?", American Society for Engineering Education Professional Books, 1998.

[2] Ribeiro, Lígia M.; David, Gabriel; Azevedo, Ana M.; Marques dos Santos, José C. **Developing an Information System at the Engineering Faculty of Porto University.** In Yves Epelboin, EUNIS 1997, Grenoble.

[3] Vroeijenstijn, A.I. **Improvement and Accountability: Navigating Between Scylla and Charybdis. Guide for External Quality Assessment in Higher Education.** Jessica Kingsley Publishers, 1995.

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Balanced Scorecard for Universities

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Elementum Oy and Helsinki University of Technology

In the second half of the 1990's business management philosophy moved on to conquer new territories with the emergence of the Balanced Scorecard-theory. The Balanced Scorecard complements financial measures of past performance with measures of the drivers of future performance. The objectives and measures of the scorecard are derived from an organisation's vision and strategy. This new way of thinking provides a framework for converting strategic targets into operationalised action plans complete with activities and measures on every organisational level. At first the philosophy was implemented in the business environment. As the benefits of the new way of thinking and acting have been perceived, the same ideology has been applied also in public, non-profit organisations.

The adaptation of the system requires transformation and modification of the theory in order to make it converge with the implied host environment. As the implementation of a Balanced Scorecard demands versatile verbal and numerical documentation — both in the path of (hierarchy-wise) delegation and setting of targets as in the path of reporting and measuring the realisation of the implied strategy, it is more than natural to consider the impact of and on information technology in such a context.

The aim of this paper is to describe the transformation process of the general framework into a working and pro-active concept meeting the evolving needs for strategic management in the university environment. This paper will also go on to describe how this change process will be realised with the developed technology platform called University Elements.

Managing universities in Finland

Up to the mid-1980s, the administration of the Finnish higher education system was centralised. The internal organisation and decision-making of universities was regulated by administrative orders and decrees. The university budget determined the allocation of funds in strict detail. Decrees on studies and degrees dictated curricula and the provision of instruction. Teachers' duties were laid down in detail in collective agreements.

In an effort to improve university performance, the Finnish higher education steering system began to be overhauled in the mid-eighties. More decision power was delegated to universities, mechanisms for management by objectives were introduced, and performance evaluation was expanded. In recent years, regulations have been lifted and authority transferred from the Ministry of Education to the universities; within the universities, the rector's position has been strengthened and his or her authority increased, while power has been delegated to the faculty and department levels. At the same time, budgetary and regulatory control has given way to steering of performance, backed up by a shift to budgeting by objectives and the development of evaluation systems.

University budgeting has been reformed to consist of block grants, according to which universities receive salary and other current expenditure coverage as a global amount and have considerable discretion over the use of these funds. Current expenditure consists of core funding, project funding (to ensure funds for projects of national relevance), and performance-based resources.

Currently strategic planning in the universities is still very much dominated by the joint dialogue with the Ministry of Education and still focuses on a three-year performance agreement between the Ministry and the university. In these negotiations the role of the university is defined in perspective of the national strategy and goals are set for universities concerning their performance, cost-effectiveness and overall

efficiency. Described by quantitative goals, the targets concern, for instance, Master's degrees, Doctor's degrees, adult education and international student changes for three-year periods for each university. Also the funding frame and the allocation for the next fiscal year are agreed upon in these negotiations. Based on the results of these negotiations and on past performance, universities are then granted a lump sum budget of which they can dispose to the best of their abilities.

The importance of developing strategic management in universities

It shouldn't come as a surprise to anyone that the environment tends to change. The current main driver of change is the availability of and the demand for information. As a result borders and boundaries, both physical and mental, are fading; what previously was national becomes *inter*national and the array and availability of services increases. With that comes a growing awareness of potential and possibilities. And with a wide palette of possibilities comes increased demands from service- and product-aware interest groups, who will, unless their demands are fully met, turn to other, readily available service providers. And this is a situation which *every* organisation active in any industry and sector faces and needs to act upon.

This is also true for the university sector. In its quest to provide services to the society, it tries to satisfy the needs of an increasingly aware interest group, consisting of *internal* (personnel, students...) and *external customers* (government, regions, companies, new students....). A few examples: companies are only willing to interact and co-operate with universities that provide *relevant, high-quality* and *state-of-the-art* services in teaching and research. This also applies to students who apply to and study at the university. Otherwise they choose not to, which, in turn, would affect operational preconditions of the organisation such as funding. The government wants a university sector which, in an international sense, is considered *high profile* and *competitive*; this is reflected in their budgetary strategies which, in turn, affects the funding of individual universities. The personnel might want a working environment which is high profile, *stimulating* and *supportive*; this affects the quality, inspiration and initiative of the personnel. This requires financial resources, thus affecting the status and qualities of the university. Which affects the attractiveness of the university in the eyes of its interest groups. Which in turn affects funding.

In the university environment such cyclical dependency threads come in a multitude, everyone equally important. Every possibility becomes tightly connected to one or many demands. And in this complex environment it is more and more bestowed upon the university itself to discern its future role and image in the eyes of its different interest groups. This implies potential weighed down by peril, and it means freedom weighed down by demanding responsibilities, responsibilities the management of the university has to identify and react to - before somebody else does.

In the environment set by these changes the university is first and foremost faced with a challenge of developing a method for strategic management and implementation, derived from extensive knowledge of environmental demands and complete with implementable long-range plans for the entire organisation. A process and tool for strategic feedback is needed. More effective models of institutional management and internal processes are to be identified and developed. Organisational units need to become more responsive to internal procedures and more sensitive to respond to other pressures and challenges triggered by the environment. The university is to be managed like and as a product brand. An administrative flexibility has to be achieved, revising the traditional system of setting up permanent posts by redefining work duties, driving on changes in personnel and competence management and force improvements in the legislation on universities and degrees.

The list goes on, but in short it tells the story of a reality in which resources are scarce and demands are many. Hence, in order to be able to focus the (at times) meagre assets on the correct activities the university needs a *realistic view of its current* status and processes, a *proper methodology* to review and plan its actions, *correct and real-time information* to support its internal demands and processes and *strong leadership* to implement the outlined detailed strategies and plans. The environment of and the demands on a university convergence on many levels towards those of a privately owned company. And, as any privately owned company, the university now faces a *competitive future*, a future in which a continuous and pitiless battle over resources and customers is fought according to rules set by the

environment and the competition.

University Elements – the tool for Strategic Management

University Elements - the project

With the above described vision in mind three universities, Ministry of Education and a commercial software company formed a project consortium with the purpose of developing an IT-system to support the future processes of strategic planning, management and reporting in the university environment. The project was named University Elements and the functionality and underlying theory is based on the Balanced Scorecard (BSC) management philosophy.

The universities participating in the project are Helsinki University of Technology, Turku School of Economics and Business Administration and Åbo Akademi University (Turku). Because of the wide scope and purpose of the project, universities are represented in the project both by higher management (the rector-level) as well as representatives for different functions, defining the real needs, contents and functionality of the system.

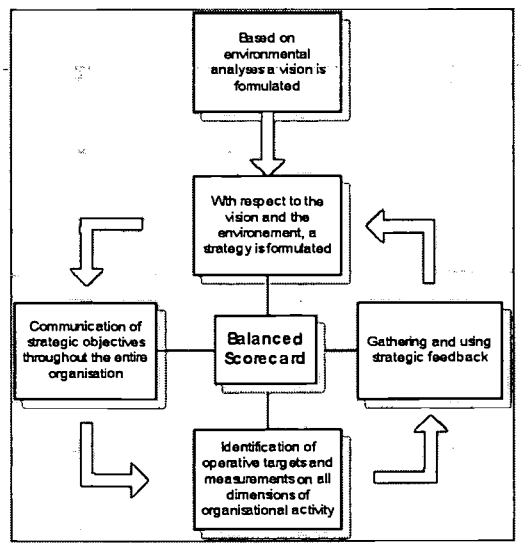
The software application is being developed by Elementum Ltd, a Turku-based software company with long-standing experience in strategic management systems in the corporate world. The functionality of the application rests on Elementum's modular and flexible Elements-technology.

University Elements - an introduction to the product

University Elements is a strategic planning tool planned, implemented and integrated with the aim of streamlining the strategic planning process throughout the entire organisation of the university. The theoretical management framework of the functionality and processes of the application are based on the concept of the Balanced Scorecard-philosophy, which assumes operationalised strategic goals communicated and tracked through all organisational levels. Based on the structured formulation of visions and strategies, University Elements is a versatile tool for goal-setting, communication and tracking on all functional levels of the university.

Support throughout the strategy process

University Elements supports the entire strategy process, from the formulation of a common vision to the follow-up of its strategic and tactical implementations in a Balanced Scorecard-context. By actually linking visions and strategies to operative targets on all levels of the organisation, the strategies are effectively communicated down into the organisational hierarchy and its many activities, streamlining the organisation and aligning its competencies.



Picture 1. Support for the strategy process in a BSC-context

Visions - a common goal

Visions are formed on a conception of the current and future state of reality. This conception is based on an analysis of the current and future development of the operating environment, which is then complemented with an analysis of the current organisation, its strengths and weaknesses and its past performance. The vision statement of the organisation becomes the joint target of several consecutive strategies. It is formulated through cause-effect chains, which, based on the view of the future, sets the pace, ways and targets for the organisational strategies to achieve. When a vision statement is well structured according to set standards it is easily divisible and translatable into relevant and attainable targets for time period-related strategies.

Strategies - the steps to reach the common goal

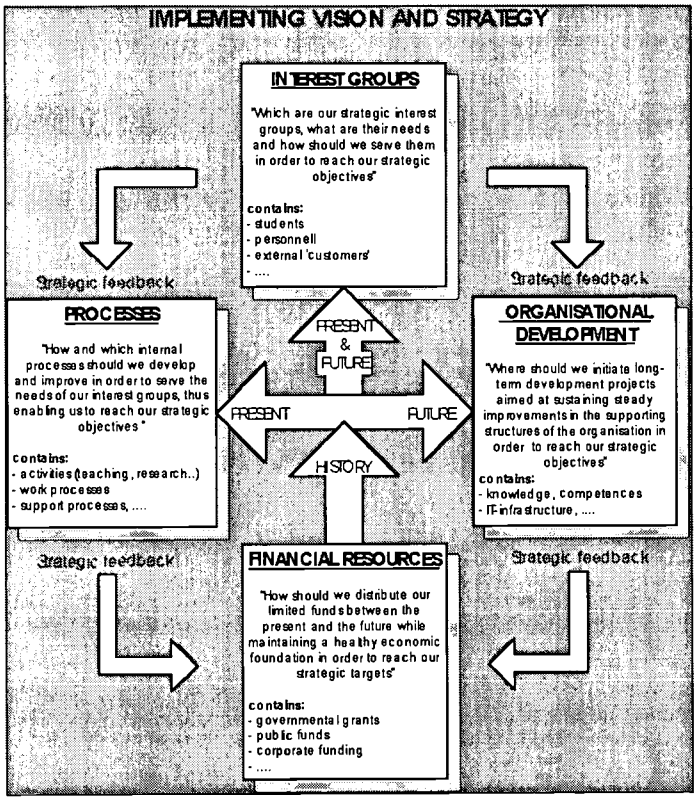
The vision is linked to operative activities through a structured set of operationalised strategies. Therefore, the vision is split into consecutive strategic periods, which together strive to form the high-level cause-effect path towards attaining the vision.

Resting on an overall environmental analysis, each strategy has to be conveyed down through all layers and functions of the organisation, always keeping in mind the overall strategy of the organisation. To ensure the implementation of the strategy, each functional unit in the organisation is assigned a role according to its position in the hierarchy and in the overall vision and evolution plan. To this role the strategic targets of each unit are defined as sub-tasks to the targets of the hierarchical level above. In this way a vertical chain of connected targets and sub-targets is created throughout the entire organisation, retaining the logical action link to the overall vision.

The Balanced Scorecard - a balanced set of measures

The concept of the Balanced Scorecard rests firmly on the philosophy of turning strategic objectives into tangible and measurable action. An operationalised view on visions and strategies requires that overall objectives are translated into operative targets and action plans on every organisational level. Targets on all levels are described through cause-and-effect relationships and their realisation is tracked through documented measures. Traditionally the performance of the organisation has been viewed against pure financial measures; the BSC-method strives to link the financial performance of past activities with measures of the drivers of future performance by incorporating *all* dimensions of organisational activity. Hence the *financial* aspect is complemented by a *process*-, the *learning and growth*- as well as the *customer* dimension. By identifying, integrating and communicating both financial and non-financial targets and measures, a more complete, *balanced*, view of the activities of the organisation is created.

In the University Elements-environment the Balanced Scorecard-method is implemented to fit the needs of the operating environment of universities. In this environment the whole process from vision and strategy formulation for the entire university to individual strategies and action plans for faculties or even subjects is viewed against one (1) set-up of dimensions. Through this philosophy of a homogenous palette of dimensions, the vertical chain of targets and sub-targets are easily operationalised and communicated, enabling a unified and structured way of planning, managing and tracking long-term operations on all levels of the organisation.



Picture 2. The BSC-dimensions

The dimensions are:

resources; the foundation for future development of the organisation is laid through current financial resources. Such are, for instance, public grant as well as both public and private funds. Lower in the organisation this implies budgetary funding and external sources.

organisational development; investments into IT, infrastructure, organisational structures and knowledge. Of special interest is expansion into new research topics and the balance between research and teaching.

processes; organisational development affects the processes by which the organisation conducts its operations. Such processes are research, teaching and several support processes such as the function of the library.

interest groups; improved processes improves the manner in which the organisation serves its external and internal customers and how these groups receive the services rendered by the organisation. The degree of satisfaction among customers affects the financial foundation for the next strategic period.

When a cause-effect-chain is created by combining all four business dimensions, targets for a specific organisational level are set. Using the above-defined dimensions, one follows (for each target) the thought of "how are we going to allocate our given financial *resources* between *maintaining and developing our organisation* and *improving our internal processes* through which we are in contact with our *interest groups*, who in the future will affect our financial resources which we allocate....". When this chain is defined and documented for each target, the organisation as a whole or any level of it has a set of measurable steps, which all have to be fulfilled both horizontally and vertically (organisation-wise) in order to achieve the target one initially set out to reach.

Reporting

The reporting and tracking structure of the University Elements is based on the organisational hierarchy it is representing. As an organisation is constantly in change, with regards to both structure and function, an IT-solution intending to support the management of such an organisation needs to be at least equally flexible. Therefore University Elements provides necessary options and tools for adjusting the structure and functionality according to physical and philosophical changes made in the organisation it is trying to depict.

Reporting and tracking of the implemented strategy on all levels of the organisation requires two types of reports: standardised routine reports and ad-hoc reports. *Ad-hoc reports* are reports, which are online composed from data in the operating environment of the university; these reports are equally useful in an official context as for internal management and reporting. Hence, the user will be able to easily create and save reports consisting of data from any existing data storage facility connected to University Elements.

The second type of report is a *standardised*, organisation-wide routine-report, used for, for instance, financial follow-ups or external reporting. These standardised reports form the spinal network of activity tracking running through the organisational layers.

This versatile reporting is based on the notion of *real-time data*. University Elements takes its data

through direct data channels from existing operative data sources such as the student and personnel data bases and financial management systems. Therefore the reports within the University Elements always and automatically contain guaranteed up-to-date data straight from its original source.

Summary

University Elements is an IT-solution that supports the planning, implementation as well as the tracking and reporting processes of strategic management in the current and future operating environment of universities. By implementing the philosophy of operationalised strategies, it provides the necessary tools for the formulation, communication and ad-hoc reporting of strategic and operational targets on all levels of the organisation.

With its dynamic structure, University Elements is a management tool that lives and breaths flexibility and adjusts to the changing needs of the organisation. A changing organisation or environment is not a threat, not even a challenge, it is an opportunity. An opportunity to let the user concentrate on managing the process of change and the impact of that on the organisation itself by not having to worry about providing the data for it. Just let the Elements take care of that.

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Reflections on the Fate of IT Strategies

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Abstract

This paper reflects on the fate of IT strategies at universities in several countries, based on the author's personal experience. It examines the purpose, nature, form, process and context of the development of IT Strategies, at universities in Australia, Hong Kong and the UK. It considers the following aspects of the whole process:

the forces which led to the decision to create IT strategies at these very different universities;

the processes and resources which were employed to create them;

their content in the context of their purpose;

the form which their content has taken;

the manner in which they have subsequently been (or not been) used.

Finally, it considers the value of these efforts in the light of their fate.

In broad terms, it concludes that political factors almost always overshadow the technical or "logical" issues, and that these need to be taken fully into account when deciding the nature of the IT Strategy, the resources and methods to employ in their creation, and the size of intellectual capital to invest. It finds that they can be of immense value, but that IT staff should have no illusions about their potential fate, and should not be overly concerned if they appear to end up gathering dust on bookshelves.

The Context

Decisions to develop IT Strategies are not made in a vacuum. They are taken for a variety of reasons, which can have a great bearing upon their form and their fate. It is worth exploring some of these reasons.

Universities in the UK and Australia (though less so in Hong Kong, and certainly less so in the USA) seem typically to have an equivocal attitude to strategic planning in general. They are accustomed to relying on their (not inconsiderable) wit to make sound long-term decisions. The notion of formal strategic planning smacks of managerialism. It is often seen as a fad, which will have its day but then disappear. There is some validity to much of this, since universities have survived enormous social, political and economic upheavals, for which some credit must be accorded to their traditional forms of governance and planning (largely based on the ability to analyse situations, reduce issues to first principles, and engage in in-depth and informed debate).

However, against this backdrop it is evident that universities world-wide are dependent on public funding to an unprecedented extent, and the pressures to be seen to be accountable cannot be withstood. The march of public accountability is inexorable. And we can perhaps all think of examples of waste of public monies within our universities, so this trend may not be without good cause.

IT Strategies, then, are sometimes conceived within the context of grudging lip-service to national requirements (the UK Joint Information Systems Committee requires that all universities possess an IT Strategy). On the other hand, some "enlightened" university managements recognise the value of a certain degree of planning, especially when large sums of money are involved, long-term investments are required, or decisions must be made in fields with which they feel ill-informed (or all three!).

As many IT Director can attest (and did in a recent I survey conducted in the UK), IT Strategies can be most valuable tools for gaining high-level understanding and support, as well as for raising the consciousness of broader strategic and academic issues among IT staff. Even if they don't enable the unknown to be controlled, at least they usually lead to its being much better recognised and understood.

At the end of the day, it is very hard to argue against a device which will enable you to utilise expensive or scarce resources more wisely, to demonstrate careful stewardship of substantial assets, to ensure that the profile of IT is raised among top management, to gain the understanding and support of the academic community, and to bring IT services more into alignment with the mission and academic priorities of the university.

Of course, more prosaic goals sometimes provide the context for the development of IT Strategies. I have been involved as external consultant in two cases where the (not altogether so) hidden agenda was to oust or sideline the incumbent IT Director. Equally, they can also be used as tools for justifying unpopular decisions, as a means of avoiding responsibility for certain outcomes, or for curbing the (perceived) excesses of the IT centre or of academics. They are even sometimes the battleground on which struggles between standardisation or centralisation and departmental autonomy are played out.

Another dimension to the context within which IT Strategies are developed is that of the timeframe to plan for. In business, most Strategic Plans cover the nest 5 or more years. In IT, it is virtually impossible to have any degree of certainty about technological developments over that length of time – for instance, only 5 years ago, the Web was hardly known. It has been well-said that most of the things we predict will happen in 2 years will take much longer, while those that we predict will happen in 5 years will happen much sooner.

The Content

Before getting deeper into strategic planning, a definition may be in order. The OED defines a strategy as: *"A plan for successful action based on the rationality and interdependence of the moves of the opposing parties"*. Translated into the context of the organisational/business world, this becomes (after Viljoen): *"A Strategy is a blueprint of all the important actions taken in response to both internal and external stimuli to enable an organisation to achieve its specific objectives."*

To be done properly, a strategic plan must take all the elements of this definition into account. First it must determine the objectives to be pursued (which in turn will be derived from the mission or distinctive purpose of the organisation); then identify internal and external stimuli to take into account (often via a SWOT analysis); then determine the actions to be taken and their relative importance; and finally establish these as a blueprint – an integrated set of ordered policies and actions.

It should be noted that a strategy is a means of moving from one scenario (the current) to a desired alternative (the future) scenario. This *ipso facto* requires identifying these two scenarios first – ie a serious and objective analysis of the current state of affairs, together with a perceptive understanding of what is possible (based on the capabilities of new or impending technologies, as well as the capability of the organisation to take full advantage of them). It requires an understanding not only of technology (current and likely future), but also of the political, social, economic and organisational characteristics of the institution which will enable it to move from the current to the desired future state of affairs.

IT Strategies will often contain some general statements of desired goals, rather like "motherhood" and "apple pie" (ie goals which are universally desired, and therefore perhaps may be seen as so obvious as to be facile and fatuous). There is nothing wrong in thus "stating the obvious", as long as that is not all it

states, since it sets the scene and context for more specific objectives. Furthermore, what may be obvious to some people may not be to others. It is essential, however, that the Strategy goes well beyond such statements. It might almost be said that if no objectives are stated which provoke disagreement or even controversy, then they have not gone far enough. Although one of the objectives of a Strategy is to achieve a common understanding and direction, this can never be achieved without assessing and rejecting alternatives, and people may well need to be persuaded to accept others' points of view. Indeed, it could be argued that this is one of the most important outcomes of the whole process.

It should also be noted that objectives cannot be set without there being a reasonable probability of being able to achieve them – starting from where you are now, and with the resources likely to be at your disposal. This question of the necessary resources is probably the most crucial of the whole process. There is no point in setting objectives which are clearly beyond your reach: there may be value in setting objectives which stretch your capabilities, but if set too far out this will only lead to disappointment and disillusionment.

Of course, one of the principal purposes of developing a Strategy is to achieve institutional commitment at the highest level to providing the necessary (usually additional) resources. So these must be clearly identified and the rationale for their provision well made.

Another important feature of the ideal IT Strategy is the clarification of and agreement to the setting of priorities to be observed in resource utilisation. This usually takes the form of the priorities with which human resources are to be expended. This is often the most contentious area, since one of the principal reasons for having IT Strategies developed is to address the disagreement, or even disbelief, within the institution regarding how the resources available to the computing centre should be deployed. There is frequently a significant underestimation of the effort required to maintain basic infrastructure items such as the network; a well-presented IT Strategy can both enlighten the academic community as to the true cost of running many basic IT services, and allay the fears of the computing centre that its human resources are about to be "stripped".

It is as important for the computing service as it is for the institution as a whole that it has its priorities set correctly. This can be one major reason why periodic revisions to the IT Strategy are necessary – not just because technology changes, but because there needs to be repeated public airing that the changing requirements are being tracked by changing priorities within the computing centre.

Just as the formal setting of priorities is a vital component of IT Strategies, is the clear identification of responsibilities. In a centralised university, this is not such a problem (most things fall to the computing centre); but in a devolved one (like the highly devolved universities of Oxford and Western Australia) this is a crucial element, since as much will depend on the actions at departmental level as on those of the computing centre. Of course, resources should follow responsibility – be that to the centre or to the departments.

The Strategy must also include a realistic timetable, with periodic milestones to mark progress. The longer the timeframe or horizon of the Strategy, the more must milestones be incorporated; these will enable a degree of "fine tuning" of the Strategy as it progresses. These milestones or interim objectives (as well as all the final objectives) must be capable of measurement, both to determine when/if they have been reached, but also to review progress towards them. It has been said that "if it's not measurable then its not manageable". The Strategy must contain sufficient handles (including clear objectives and milestones, as well as priorities, assignment of responsibilities and resources) to enable the process to be "managed".

It must also contain the degree of detail to enable this process to be carried out, but sufficiently broad brush to ensure that basic principles are not lost in the detail.

The Process

The exact process for developing an IT Strategy will depend to a very large extent on local politics, policies and practices, organisational structure and culture. However, there are certain essential elements

which must be taken into account.

The most important of these is to incorporate substantial consultation. In some universities, the process is left very largely to the IT Director – indeed, the recent UK survey referred to above revealed that in 93% of cases the Director was substantially or totally responsible. Yet most understood the need for consultation – 65% undertook substantial or total consultation with the university community. Often this takes the form of responses to a draft strategy document, which is a much more productive method than endeavouring to get a heterogeneous body of people (in committee or not) to fashion a reasonable document *ab initio* – after all, a camel is a horse designed by a committee!

It is important, of course, before the above two steps (drafting + consultation) are undertaken, to ensure that proper institutional endorsement has been given to the process – whether by the appropriate committee, or by the vice-chancellor or similar. This endorsement will also need to take into account (and approve) the scope for the study, the resources necessary to bring it to an effective conclusion, and the timetable to be observed.

The actual drafting (followed later, of course, by adaptation or redrafting) is often the simplest part of the whole process (akin to the coding part of a programming project). The need for formal commissioning and the key consultation activity are essential components of the vital political underpinning of the study. Other key aspects include having a champion (or godfather) to ensure the stability and credibility of the whole process, and achieving formal adoption (and promulgation) of the finished product. The champion may well be the chairman of the IT Committee, or even the vice-chancellor. On other occasions, the role might be a more shadowy one, undertaken by someone who prefers to pull the strings behind the scenes.

It is frequently wise to set up a Steering Committee to guide the whole process, especially if the vice-chancellor selects and appoints the chair (and is seen to be doing so!). This group might be a very useful means of working out how it is to be promulgated, and (if you come from that sort of university) policed. This is especially helpful if the prime "movers and shakers" from key departments are represented. On the other hand, membership must be chosen quite carefully. I have never personally been in favour of the practice adopted at one university of appointing a "devil's advocate" to these sorts of committee, with the ostensible aim of keeping everyone (ie the IT Director!) honest.

Promulgation is best served by employing some or all of the following practices:

- Publish the IT Strategy in printed form (a respectable-looking tome, designed to attract respect);

- ensure every head of department and IT staff member gets a copy;

- Ensure it has a readable and captivating Executive summary (2 pages at most – that being the limit of time that many senior academics feel able to give to this process);

- Ensure it has plenty of relevant graphics (to attract the casual browser);

- Publish it on the Web (on your intranet);

- Refer to it often in committees, expenditure proposals, etc;

- Publish an annual review of progress.

The resources consumed in the process of developing an IT Strategy can vary enormously. Inevitably, a considerable portion of the time of the IT Director in necessary throughout the process. Depending on the degree of formalism, a significant amount of the time of committee members, mostly academics, can also be consumed (often unfruitfully), especially if the drafting process is not delegated to 1 or 2 people. Another consumer of resources can be the task (usually assigned to members of the computing centre) of collecting data on current IT capabilities, performance and usage – but that does have a value beyond the IT Strategy itself which usually makes it worth while. Incidentally, I stress the high degree of

involvement of the IT Director, not because he has a monopoly on IT knowledge, nor because he needs to "defend his patch", but because he will be the most senior IT professional in the institution, and certainly the person that knows best whether raw ideas can be turned into practice or not. Academics (especially computer science ones) are good at coming up with radical ideas for the introduction or application of new technologies, but they sometimes need "bringing down to earth" in relation to what is actually practicable in the university setting.

The Outcome

Apart from the document itself (and a great sense of relief that it's over!), there are several possible outcomes that could be sought – depending, of course, on the rationale for the process in the first place.

Some of these outcomes may include the following:

- A reasonable degree of agreement, consensus, alignment (more than modest, one would hope)

- concerning future directions and priorities for the development and use of IT;

- a better understanding all round about what is important;

- An improved awareness of the role and potential of IT in various aspects of the academic mission;

- Ownership and commitment by top management to the role and value of IT and of the computing service;

-An ongoing commitment to the expenditure of resources in a planned and rationale fashion (eg in accordance with agreed expansion or replacement regimes);

- Justification for a wide range of policies, practices, expenditure, deployment of resources, etc, which enables effective forward planning;

- A better appreciation among the academic community of the work and value of the computing centre, leading to increased credibility for it;

- A better understanding of academic priorities, leading to a closer alignment with and support for them; this is heightened if the IT Strategy is fully integrated into other institutional high-level strategies, including in particular Information Strategies;

- Redirected computing centre and/or IT services generally (let us not think for a minute that it is just the academic community that warrants having its eyes opened!);

- A blueprint for future development, along with measurable goals, yardsticks and milestones;

- Satisfying the funding agencies (low down the list, perhaps, but fairly important!);

- Justification for other, perhaps unpopular or difficult, decisions – relating, for instance, to the management, direction or oversight of the computing centre.

There are several additional intangible outcomes (benefits) of this process. There can be a real sense of accomplishment at having established a framework within which planning can be undertaken with relative ease, at least for a while, with less political interference in IT initiatives. However, it must be recognised that there can also be a false sense of achievement – the IT Strategy should be a stretching exercise for the computing centre, not one which cossets (mind you, I have yet to encounter any which errs on the side of offering an easy life!).

Conclusions

The most tangible outcome (especially if, as I have suggested, you have put some effort into its appearance) is the IT Strategy document. Experience suggests, however, that this is the least of the accomplishments of the process. In many cases it is rarely (directly) referenced, and slavish adherence to it or invoking of it can even be taken as a sign of weakness. It is most certainly not a big stick with which to beat recalcitrant academics or forgetful vice-chancellors!

The most important outcome is the awareness-raising, not the document, and the political factors outweigh the technical. Essentially, it is the process which is the primary outcome, not the document. It is the process which raises awareness, enhances credibility, achieves alignment with institutional goals, and so on. Hence the importance of consultation throughout the process.

There is no doubt that the existence of an IT Strategy does make future decision-making easier – issues have already been aired, there is a real ownership of decisions, and much background has already been covered. On the other hand, it is very difficult to cost-justify the resources consumed in the process – not because there are not clearly identifiable benefits, but because it is not clear if they could have been achieved any other way.

Overall, however, the process **is** worthwhile. 98% of UK IT Directors responding to the survey said the process was worthwhile; some found it extremely so, as evidenced by the following direct quotes: "absolutely worthwhile", "extremely worthwhile", "very much so" – some saying so because of the benefit to the IT staff in focussing their attention on academic or strategic issues, and others because of the profile-raising it achieved among senior managers. 76% had a "current" IT strategy, which on average was 2.4 years old. It is also instructive to note that only 70% also had an information strategy, and of those that did, 60% said the IT Strategy was (or soon would be) an integral part of it.

Universities (in the UK) are moving inexorably towards doing more strategic planning – creating institutional goals and mission statements, information strategies, and so on. IT Strategies will not disappear or be seen as unimportant in this tide, but will take their place within a properly integrated context. It might also be found that, only then, will IT Strategies be given the proper attention and resourcing that they deserve.

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The Growth of the Information Strategy Approach

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Abstract

The paper describes the growth of the information strategy at University College Worcester (UCW) and shows how it has become part of the strategic portfolio of the institution. In addition the paper reports on the growth in the adoption of information strategies in institutions across the UK and describes the recent extension of the Information Strategies Initiative of the UK Joint Information Systems Committee (JISC). A particular aspect of the paper is the inclusion of learning and teaching issues in the information strategy approach. Traditional Information Systems Strategies tend to focus on management and administrative information but the JISC approach tries to broaden the scope.

Introduction

The particular concept of "Information Strategy" used in the UK was recommended to universities by the Joint Information Systems Committee (JISC) of the UK national funding agencies. The JISC's Information Strategy Initiative (JISC, 1998) became fully operational in 1996 and its beginnings are described in a paper presented at EUNIS97 (Rothery and Hughes, 1997). The idea of an information strategy is to set up an institution-wide approach to information of all kinds, linked to other key institutional strategies, which acts as a driving force for the development of more technical Information Technology or Systems strategies.

It is now two years since information strategy development began at UCW and it is interesting to see the extent to which this has been absorbed into the institution. UCW is one of a small group of UK institutions chosen by JISC and given "exemplar" status in respect of its information strategy in July 1998.

In the following sections, there will be an account of the development of the JISC information strategy approach in the UK. Then the developments at UCW will be explained, showing the impact on the institution in both specific and strategic terms.

Information Strategy development in the UK

The Joint Information Systems Committee (JISC) launched its Information Strategies Initiative in 1994. The first major promotion of the idea was the publication of the *Guidelines for Developing an Information Strategy* at the end of 1995. JISC set up six pilot sites, universities chosen to act as a test bed for the new initiative and to assist in the dissemination of the approach taken. The JISC also appointed a national Information Strategies Co-ordinator, Ann Hughes, to be responsible for co-ordinating the activity in the pilot sites, general dissemination and organising workshops. Full details of the initiative and relevant reports and documents are published on the JISC Web site (JISC, 1998).

Following this period of initial development, evaluation of the experience of the pilot sites and indeed that of many other universities who started to adopt an information strategy resulted in the publication of revised guidelines, *Guidelines for Developing an Information Strategy - the Sequel* early in 1998. These were published in recognition of the growing interest in information strategy development. The Information Strategy Co-ordinator has reported that she has made direct contact with around half the

universities in the UK and most have begun or are seriously interested in beginning to follow the JISC approach.

An extension of the pilot sites scheme was announced in the summer of 1998. The new scheme saw the designation of "exemplar sites"; eight institutions, including University College Worcester, were chosen to further broaden the initiative. These sites received additional support from the JISC, have each worked on some particular aspect of information strategy development and agreed to participate in further dissemination.

Information Strategy at University College Worcester

University College Worcester began to develop its information strategy during the 1996/97 academic year. An account of the intended approach is described in a paper presented at EUNIS97 (Rothery and Hughes, 1997). An Information Strategy Group chaired by the Vice Principal was set up and it carried out a programme of initial information analysis and a survey of staff views. The outcome of this was the publication of a Phase I Report (UCW, 1997) which set out "Information Objectives" together with a list of 21 recommendations for immediate action.

The Information Objectives are a brief statement of general standards providing a background to future progress. Many of the recommendations concerned the use of e-mail, the Web and other forms of electronic communication, but many related to the dissemination and location of key paper documents too. At the strategic level, the Phase I Report recommended the creation of a formally stated Learning and Teaching Strategy and a revision of the existing IT Strategy. It also set out the plan for implementation of Phase II of the Information Strategy.

Phase II commenced in October 1997. The notion of an Information Strategy Group chaired at pro-Vice Chancellor level continued, but efforts were made to involve wider groups of staff by setting up separate groups for information analysis of specific topics. One of the aims of Phase II was to embed the notion of information strategy into the work of the institution, but in recognising that it is not possible to deal with every aspect of UCW work simultaneously two themes were adopted: "Learning and Teaching" and "Administrative Systems". The College also created a part-time post of Information Strategy Co-ordinator to assist with the operation of Phase II.

During 1998, the role of the Information Strategy Group focussed on (a) checking the implementation of recommendations from Phase I, and (b) setting up groups to carry out further information analysis. For example, two groups set up considered the following topics.

The first carried out an analysis of the process of producing statistical returns to the funding councils, linking the work of the Registry, Personnel and Finance departments.

The second group carried out an analysis of the information and communication needs within learning and teaching, specifically the process of doing an assignment, linking student and staff roles and responsibilities. This analysis is described a little more in the next section.

In addition to activities specifically related to the published recommendations of the strategy, the Information Strategy Group also surveyed related activities within departments and found itself in a consultative, co-ordinating role.

The Phase IIb Report was published in June 1998 (UCW, 1999a) and at the same time, UCW became one of the JISC 'exemplar sites'.

In addition to pursuing its established themes, two new goals emerged as part of the 'exemplar site' project. One was to investigate ways of involving a wider cross-section of staff; the other was to pursue

the communication and information requirements of working with 'partner Colleges' in the local area.

In respect of local partner Further Education Colleges, the immediate action in the spring of 1999 has been to organise a one-day workshop to identify topics of concern for further analysis. The specific topics which were agreed at this workshop were: (a) sharing information across Libraries and Learning Resource Centres, (b) communications using C&IT in support of learning and teaching, and (c) sharing information on student profiles for strategic purposes. A more detailed workshop on each of these themes will be held during the early summer of 1999.

Learning and Teaching

An important message arising from the Information Strategy Initiative is that learning and teaching processes are just as much a part of information management as areas such as administrative and management information systems (MIS).

The information analysis carried out at UCW related to "doing an assignment". A group of teaching staff, support staff and students met to investigate the different processes in this task. These covered the information and communication requirements at the time of setting an assignment, the academic information needed during the "research phase", communications needs between tutors and students, and feedback from tutors about assignments.

In some instances it was felt that current arrangements were perfectly satisfactory; in others there were concerns, and proposals for change. A major area of concern turned out to be the return of work to students. Suggestions were made to improve the security and confidentiality of the processes used to return assignments and provide feedback. One seemingly minor suggestion was that communication would be improved if tutors' comments on assignments were "typewritten" rather than handwritten; and indeed would be further improved if sent by e-mail, thus guaranteeing legibility, confidentiality and providing an introduction to further communication between tutor and student. Though this seemed a minor suggestion at the time it has proved to be quite a major change to implement.

The results of the analysis therefore produced a whole list of recommendations and suggestions and these have been fed into the college system at various points. An interesting feature of the project, typical of information strategy analyses, is that the process focus cuts across several different departments and areas of institutional responsibility. Most quality control measures tend to focus on reviewing the work of one department; in contrast this process approach covers several.

Communication and information technology

One of the claims for adopting an information strategy is that changes in technical infrastructure should be led by users' needs rather than "technology for Technology's sake". Certainly at UCW there have been a number of substantial C and IT developments, all of which have related to recommendations coming from the Information Strategy Group.

For example the entire institutional Web system was overhauled during the last 12 months and a number of interactive information systems were developed for the Web. A pilot scheme was carried out to investigate a prototype of a data warehouse system; a new strategy for future MIS developments was adopted to permit better exchange of data between systems. The C and IT Strategy was updated and a new one published in January 1999 (UCW, 1999b). There has been a growth of interest in the use of electronic communications in learning and teaching both traditional use of e-mail and the Web and technologies such as a videoconferencing and computer conferencing . This has been pursued both in terms of the UCW campus and its partner colleges in the local region.

It would be naive to suggest none of these changes would have occurred without there being an

information strategy. Certainly many of these would have been considered in any case. However there has been much greater articulation of the relationship between the way people work, their information needs and the developments in the technical infrastructure which have been set up.

Issues related to communications, exchange of data and wider access to information have achieved a much higher profile within the institution and this in turn has led to a closer involvement of the IT Service with general developments. This is a much healthier relationship.

Strategic Context

An information strategy is meant to be an overarching strategy. In other words, other strategies are supposed to follow from the aspirations and attitudes promoted in the information strategy process. Clearly however, despite the all-pervading nature of information issues, information and communication are not the only issues; the institution's overall strategic plan is of course the primary overarching strategy. Resulting strategies in some areas may not likely be significantly bound up with information strategy.

Strategies which have the most connection with information strategy have proved to be the Communication and Information Technology Strategy, the Learning and Teaching Strategy, and the Research Strategy. Each of these has very clear links with information strategy concerns. Nevertheless, even these close partners have goals of their own, and therefore not merely a 'consequence' of the information strategy. The way they achieve their goals is however likely to be very closely connected with communication and information issues.

In effect an information strategy is not like an institutional strategic plan; it does not set out the specific goals which other strategies then have to take on board. However it does direct and work alongside other strategies; and many of the specific recommendations coming from information analysis groups and other investigations turn into specific projects, which then become part of the strategic development of a particular area.

Conclusion

At UCW we have found the information strategy approach very useful. It has been suggested that this may well be because ours is a relatively small institution (around 4000 students) based mainly on a single campus and therefore more able to co-ordinate a strategic initiative than institutions which incorporate substantial autonomous faculties, or consist of several distinct campuses.

However, UCW has begun to make progress in using the information strategy approach in examining processes which link our work with that of a partner FE colleges in the local region. So there is no reason why an information strategy should not be helpful in co-ordinating the work of separate components within an organisation.

Experience suggests that the best way to get the most advantage from an information strategy is to view it as an ongoing "quality management" process. It is not a strategy in the sense of a forward plan which everyone has to sign up to, but a series of activities which will lead to improvements. Though the specific projects carried out relate to a particular focus, there is a "spin off" in that the attitudes and values stimulated by specific projects can, once articulated, become more generally adopted in other areas of work.

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Characteristics of IT Strategy in the Medical University of Varna

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Abstract

The Medical University in Varna, including the University Hospital, has quite a complex structure coming from the 45 departments it comprises and the 6 buildings spread over a distance of more than 5 kilometers throughout the city. The structure of the University can be expressed in four levels: departments, clinics, sectors and units (wards). Each of the departments and their corresponding clinics and minor units have a considerable number of computer facilities. There are also several computer rooms, used for the education of students and staff. The curricula for Medical Informatics for the students of medicine and for the students of health care management are developed according to the best European standards. Some attempts of implementing telemedicine has also been made. And yet, it is still not quite possible to implement the IT strategy in the University. This paper describes the aims of the IT strategy in the Medical University in Varna. It also points to some of the difficulties of the implementation of the IT strategy in the University. These difficulties have both objective and subjective origin. The objective difficulties come mainly from the transition period the country is undergoing during the last years, including the changes in the health care system, financial shortcomings etc. The main difficulties are the subjective difficulties, which are in fact closely related to the medical staff of the University. This paper also gives some ideas for how to overcome all those difficulties, the main task being to make medical staff understand the usefulness of the IT implementation.

Introduction

The term *information technology* (IT) is usually associated with computer-based and telecommunication-based handling of information. Technologies have two aspects: physical resources (materials and tools) and knowledge about these resources and how to manipulate them to achieve specific results.

Organizations of all sizes have come to rely on IT. It allows information to be generated and evaluated faster, causing an increase in the speed with which events occur and the pace with which managers and organizations have to respond. Health care organizations are not an exception. Information technology has played an important part in many aspects of change in health care delivery. From small private practices to the largest hospital systems, IT have enabled information to be collected, stored and manipulated for payroll and billing, diagnostics (both managerial and clinical), records management, facilities control and decision making. Because information transfer is required among all the major functional areas of the health care organizations, an integrated information system, where various departments and functional units can communicate and share information is of great importance. Several additional factors affect the increasing use of IT in the health care environment:

Expansion of the traditional health care delivery area. Health care delivery area is constantly expanding through the implementation of IT by use of video diagnostics, telemedicine, virtual reality. The development of lightweight, powerful computers and network technologies, have enabled many health care professionals to work outside the traditional premises of the hospital or the physicians' offices. Hence health care delivery area is expanding rapidly because of the ability to access and deal with patient information no matter of its storage location.

Change at the point of delivery of health care. IT is everywhere. It is almighty. Most health care settings have workstations; bedside terminals are widely used; the use of electronic data interchange (EDI) is increasing and therefore many hospitals and other large health care settings are building powerful infrastructure for EDI. The technology expands to all health care settings including physicians' offices,

hospitals, long-term-care facilities, public health departments etc. Computers are interconnected via networks. In addition, all patient's medical data is already organized in such a way, that the electronic patient record is no more just a dream. The use of systems and patient data is no longer restricted to hospitals and diagnostic functional laboratories. Patient data can be present at the place where the patient meets the medical specialist. In addition, the care for patients can be shared among different care providers (i.e. patients with chronic diseases or cancer). So, the modern IT allows for the simultaneous treatment of the patient by different care providers (physicians, nurses, other medical specialists) sometimes located at considerable distance from each other. This is the idea of the so called "shared care".

Alteration of the history. It is expected that with the implementation of new powerful computers and the constant improvement of the communication technologies, the information from hospitals and other health care organizations will be electronically connected in the nearest future. When more and more health care settings can share information and resources through this information highway, those outside the system will be at distinct competitive disadvantages.

The most important justification for IT investments in health care is their contribution to the quality and cost effectiveness of direct patient care. Information systems in health care must support the basic process of providing high quality, cost-effective health services. It is all about meeting the needs of the patients.

The implementation of IT in health care requires a proper information strategy. An information strategy is a strategy for both information systems and information technology. It is a formal plan for introducing, maintaining and supporting information systems and information technology in an organization. An organization's information strategy is aimed at ensuring that its information systems and information technology are linked and support its objectives. Developing a useful and affordable information and technology strategy for any large and complex organization, particularly in health care, is exceptionally difficult.

An information strategy is above all a strategy and a plan for addressing gaps in currently available information through the implementation of new or modified information systems and information technology applications.

Consequently, the information technology strategy, derived from the health care organizations' information strategy, normally specifies:

- Analysis of the existing information systems and technology

- Application requirements

- Standards for health care data organization, coding and classification

- Technical support

- What hardware and software will be purchased, and how

- Communications strategy, including standards for medical data/message interchange

- Staffing or training of the personnel

- IT audit and review

- Ifidentiality and security requirements, especially essential for medical data

- Management the information systems

- Costs efits implementation timetable.

The IT strategy of the Medical University of Varna

The Medical University (MU) of Varna is one of the leading medical universities in Bulgaria. It has two specialties – medicine (a 6 years masters' program, covering both paraclinical and clinical education) and health care management (a 4 year bachelors' and a 2 year masters' program). The University comprises also the University Hospital. The structure of the MU, as a complex academic health care center, is very complicated, covering 45 departments, located in the main building of the University and 5 additional buildings spread over a distance of more than 5 kilometers through the city. The structure of the departments can be expressed in four levels: department – clinics – sectors – units (wards). On the other hand, all departments can be classified into several categories – paraclinical, clinical, managerial, administration.

Each of the departments in the Medical University of Varna and their corresponding clinics and minor units has a considerable amount of computer facilities. There are also several computer rooms, equipped with fairly modern computers and software (Pentium and above, networking, Internet) for the education of students and staff. The curricula for medical informatics are developed according to the best European standards in this field. There is a separate computer room, providing telemedicine facilities with the Medical University in Thessaloniki, Greece.

The IT strategy of the MU of Varna can be defined as: to use information technology to improve the quality of patient care as measured by outcomes (costs, benefits, patient satisfaction, care provider satisfaction, students education) and done in such a way that applications can be recognized and shared; supported by research and education.

Consequently, the main objectives of IT application, can be specified as follows:

To use computer technology to provide information in the most useful form when and where it is needed, including automated patient data acquisition, physician order entry, interactive patient management, integrated scheduling for patients, access to patient data in other health care settings outside the university hospital

To develop andmaintain an electronic patient record that integrates patients medical record and financial data

To improve quality and decrease the cost of patient care

To assist medical specialists with patient care decisions (intelligent decision support systems that will aid the medical specialists by alerting them of dangerous and/or potentially risky situations)

To assist performance and evaluation of patient care

To make the delivery of patient care more rewarding

To assist in delivering of the best care for patients

To provide effective computer tools to care providers

To create research data bases and opportunities for clinical and epidemiological studies

To assist in the development and the constant improvement of the measures concerning confidentiality, privacy and security of medical data

To contribute to longitudinal care

To contribute to implementation of structured data entry, use of recognized health care standards (EDIFACT), unified coding and classification systems (ICD-10), vocabularies

To provide constant education and training for the medical specialists

To provide education and training for the medical and health care management students (this means not only informatics and medical informatics); computer aided learning

To provide to the medical specialists and the students a current health care knowledge base consisting of the latest literature, available databases, expert opinions and cost and statistical data on line, including electronic libraries (MEDLINE etc.)

3. Difficulties of the implementation of IT strategy in the Medical University.

Although there is a large number of computers as well as other technical facilities in the MU, there are some difficulties in the implementation of the IT strategy. These difficulties are both objective and subjective.

3.1. Objective difficulties

The objective difficulties come mainly from the transition period the country is currently undergoing, including the changes in the health care system, financial shortcomings, inherited and legacy systems etc. However, no matter how serious these difficulties are, they can be relatively easily overcome. After all, this is mainly a question of money and organization skills and efforts. Here are some of these difficulties:

Financial shortcomings. This is a problem that is common for almost all academic health care settings not only in Bulgaria. However, in our case this is a major problem. Till now (and still) the University, including the University Hospital have been funded by the state and the funds were just covering the salaries and the health care expenses. The sad truth is that till now no one has ever tried to secure additional funds to purchase computer equipment so that to cover all computer needs of the University. As a result, some of the computers in the University (except the computers in the computer rooms) are rather old and evidently will not be changed in the near future. The current practice is that each department (or clinic) finds its own way of purchasing computer equipment. A large number of computers have been purchased with the funds, provided through different TEMPUS or other EC projects. The solution of this problem is in the proper utilization of the possibilities of the new health insurance policy, which is going to be implemented next year. Another alternative is a major computer provider that would be willing to help the health care.

Lack of network facilities. It is sad, but there isn't a computer network in the MU. Only the computers in the computer rooms are connected in LAN's and this is because of the Internet. This problem is one of the major problems we have. How to implement institutional information systems when there isn't a network. Again the reason is evident – financial shortcomings. However, no matter what the financial state of the University, it is already decided that a university network is going shortly to be installed.

The nature of the organization. Modern health care settings are extremely complex. The Medical University is not an exception. It is a complex academic health care center. As it is obvious that the structure of the University cannot be changed, we will have to fit the information systems to it. There are typically quite different needs and priorities between the university component and the component that delivers health care. This arrangement causes major problems. So far, information systems are implemented in the general university structural units, i.e. non-health care oriented entity and cover areas concerning tuition, personnel, finance and administration. There are several information systems introduced in some of the clinics. However, the actual health care activities are still indirectly linked to the financial and administration systems. What has to be done is to introduce a hospital information system, managing the information needs and flows of the hospital and link it to the general university system. Having in mind that a comprehensive medical information system deals with the complete information processing and information storage of the health care setting, the right solution of this problem is to implement a distributed and heterogenous hospital information system along with the necessary clinical and ancillary information systems.

Diversity of information processing and applications. In the Medical University, including the University Hospital, there are involved many different methods of information processing and many different types of applications. In practice, some of the clinics have information systems that are tailored to their requirements. However, these systems have been developed years ago and on different platforms. The right decisions in this case will be to try to harmonize the existing systems, both from hardware and software point of view. This includes the implementation of proper communication protocols, message exchange protocols and the development of strict requirements concerning future implementation of new hardware and software standards.

Diversity of coding and classification systems. This is really a major difficulty for the implementation of the IT strategy especially in the university hospital. There exist a large number of coding and classification systems, developed or adapted to the health care environment. Some of the most widely used are: the International Classification of the Diseases, which every 10 years comes out in a new revision, the latest one being ICD-10; the International Classification of Primary Care (ICPC), which is recommended for primary care settings; the Read Codes, which are mostly used in the United Kingdom; the Systematized Nomenclature of Human and Veterinary Medicine which with its 11 axes forms a complete hierarchical classification system etc. However, most of the older applications used in the MU do not use neither of the recognized codes and classification systems. Most of these applications use some parts of ICD-9 and codes and classifications tailored to the requirements of the clinic. The right decision in this case will be to develop strict requirements for the usage of the recognized codes and classification systems. In this case, some of the older applications would have to be fixed accordingly.

Redundancy of data. In the University Hospital the practice is that data for the same patient are stored in all clinics where that patient has been accepted. Currently these data are stored on paper. However, with the implementation of the IT strategy, all these data should be computerised (most probably scanned). This means that a large amount of redundant data will occur. The solution of this problem will be in the development of special software that will organise the data in such a way that will result in minimising the redundancy of the data.

Lack of communication between the departments. This is due to the fact that the different departments are spread all over the town and the lack of networks, directly connecting the departments. For example, the therapeutic departments and the surgery departments are located at a distance of several kilometres and very often the physicians in the surgical departments are not aware what is the actual result of the initial therapeutic care for their patient. The solution of this problem is in the installation of network facilities and reliable communication facilities between the departments, located at different sites.

3.2. Subjective difficulties

The subjective difficulties are the real obstacles for the implementation of the IT strategy in the Medical University of Varna. Although they are not so many as the objective difficulties, they are closely related to the medical staff of the University. Here are some of the subjective difficulties:

The managers. The top managers of the University are quite pessimistic to the implementation of IT. The constant financial shortcomings as well as the numerous problems, concerning patients, students, salaries, other hospital expenses etc. make them forget all about the advantages of IT. So, the very idea of spending so much money for something that seems somehow unclear and promises a great risk frightens them exceedingly. Another aspect is that the organization wide implementation of IT means a thorough change in the organization including not only equipment but also personal attitude and skills. Let me cite one of Machiavelli's most relevant statements for change managers: "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things". So, what must be done is to persuade the managers and make them believe that the future is in IT, no matter what they think or do. Once they realize this, they will find the way to achieve it.

The medical specialists. As a whole, physicians and other health care specialists have a very diverse attitude towards computers. The general opinion is that medical specialists are still confronted with

computers. Only a few medical specialists in the University (about 10%) state their positive attitude to computers, know how to use them and are really willing and eager to learn more and to participate in the actual implementation of IT. These are younger physicians (<40 years of age) and come mostly from the departments of surgery and radiology. Another part of the physicians (about 20%) consider the computer as an intelligent typewriter (as if living in the 60's). They can use computers mainly for word-processing when writing their own reports or articles and think that their computer literacy is more than enough. They refuse to improve their computer literacy. Others (about 20%) announce with dignity that they have studied hard for six years to become physicians and not to press the keyboard keys. They firmly refuse to deal with computers. Their opinion is that a physician is a physician, let the nurse or the clerk deals with the computer. It is absurd, but there still exist individuals among the medical specialists (about 10%) who state that they are really afraid of computers. Another group of the physicians (about 10%) don't know how to deal with computers and state that they never will. These are some of the oldest professors and associated professors who think that it is already too late for them to follow the pace of IT. The rest of the physicians (about 30%) don't know how to use computers. However, they are willing and even insist on taking courses of computer literacy and really feel the necessity of learning how to deal with computers. The final result is that about 70% of the physicians are computer illiterate. The main reason for this absurdity lies in the curriculum of the students of medicine. Till recently informatics has not been included in the regular discipline taught to the students. They had informatics as elective discipline aimed mainly to acquiring basic computer literacy. It is only during the last year that medical informatics has been included in the regular curriculum of the students of medicine and the students of health care management. The syllabus for medical informatics is developed in conformity to the syllabus in some of the best European Universities (the Cambridge University, UK and the Erasmus University, the Netherlands). So, the problem with the computer literacy and the medical informatics education of the future health care specialists might be considered as being solved. What has to be done currently is to persuade the medical specialists in the necessity of using computers, to acquaint them with the strong and week points of the new systems and equipment to be introduced, to persuade them take part in the development of the new medical information systems. There is no sense in imposing an information system and force the medical specialists use it. Such a system will be a real failure. Additionally we are preparing courses on computer literacy and medical informatics for the medical specialist who missed that during their initial education as well as courses for constant improvement of the skills for those who wish it.

Lack of medical informatics specialists. Bulgaria is well known for her computer specialists, especially programmers. However being a skilled programmer is not sufficient for developing a medical information system (hospital, clinical, laboratory etc.). It is universally acknowledged that the development of a good medical information system is not possible without the corresponding knowledge of medical informatics. Medical informatics specialists are needed also for the maintenance and support of the medical information systems. This is already a major problem, as medical informatics is not among the academic disciplines in Bulgaria. The best way of solving this problem is to introduce medical informatics as a new academic discipline. As this is extremely difficult, for the time being we will have to encourage those young physicians and computer specialists who are willing to deal with medical informatics.

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Systems, Processes and Transformation - The Liverpool John Moores University Approach to C&IT-Enabled Change

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Abstract

In March 1997 Liverpool John Moores University (JMU) embarked on a University-wide transformation initiative to create 'an enabling strategy for the foreseeable development of JMU'. The agenda set by this initiative presented a challenge through the need to coordinate University-wide process reviews, existing systems developments, new technology pilots and 'business-as-usual'. The dynamic and flexible Systems, Processes and Transformation approach to the management of Information, Technology and Change has been developed to answer this need. This approach should create the dynamic necessary to take JMU forward through the alignment of business-as-usual, Transformation objectives, and Communications and Information Technologies (C&IT), and, through the development and refinement of the global process map and associated information flows, in effect produce the JMU Information Strategy.

1. Organisational background – the Transformation Report

In March 1997 JMU embarked on a University-wide transformation initiative to create *'an enabling strategy for the foreseeable development of JMU'*. From June 1997 a representative Transformation Design Team consulted widely across the University and in December 1997 the Transformation Report was published.

This report detailed a number of recommendations across all areas of the business, with the overarching view being the need for the development of *'efficient and effective communication and organisational systems, in order to become a world-class institution...these must be shared by all staff and students'*. Within the body of the report a significant number of recommendations were linked to either the use of C&IT or to the need to understand and reengineer business processes.

2. Systems, Processes and Transformation

Following publication the Executive convened a number of task teams to address the key areas, including one looking at the whole area of Systems and Processes and the application of C&IT. This team was recognised as having a remit that cut across all areas of the University and was given the task of pulling together the recommendations of all of the task teams into a series of Transformation Projects which could be endorsed by the Executive. The problem encountered was that of coordinating the various different strands of Transformation-related development, whilst also incorporating the renewal of major technical systems which preceded the Transformation Report, and linking these with pilots of new technical approaches, and other issues critical to change management. Whilst Transformation had identified the high-level change agenda, it was not clear how this agenda was going to be operationalised across the University. The whole area was described in a Transformation update as ***"Systems and Processes, Web, and Information and Communications Technology (ICT) (Effective and Efficient***

Communication and Organisational Systems) *Combining ICT opportunities, Web developments and systems and processes reviews to bring about better and more direct service to staff, students and others".* Figure 1 below is a diagrammatic representation of the area.

Fig.1 – Transformation Diagram

Key: PWA – Personnel System

DMS – Document Management System

SMIS – Student Management Information System

Coda – Coda Financials System

CWIS – Campus-Wide Information System

The Systems and Processes approach is critical in understanding how the various different Reviews and System developments are merged together to produce a coherent approach to Transformation, as in the diagram. From the top down are the Transformation-driven major process review initiatives which are being approached through the Process Review methodology described below; from the bottom up, the System Self-Service (S3) JTAP-funded project which is the testbed for the technologies which might be used to implement the outcomes of a process review, plus other technology pilots such as Document Management Systems; and in the centre, the implementation 'cloud' where technical solutions meet with redesigned processes, also incorporating the essential aspects of change management and staff development. The diagram also, as an aside, exemplifies the project management approach that has been adopted, which is a very loose interpretation of the PRINCE (PRojects IN Controlled Environments) methodology developed by the Civil Service in the UK for dealing with major system development projects, characterised by a structure involving formally convened Project Boards and Project Teams.

The three major contributory components of Transformation are therefore identified as: Process Reviews; Implementation and Change Management; Technical/Organisational Pilots. The remainder of this paper will cover each of these aspects before drawing the final conclusions.

3. Process Review

The Transformation Task Group recommended the formation of a central Process Management team – the Systems and Processes Panel – with the following remit:

maintenance of the global process map, and positioning of all initiatives within that context

maintenance of an overview of all process management initiatives

provision of assistance in process selection, appraisal and review

development of a process performance model to assist in selection, appraisal, review and evaluation

evaluation of all process management initiatives against transformation and other strategic objectives

consideration of the application of C&IT as an enabler in all process management initiatives

The first task of the group was to develop a more detailed framework for business process management across the organisation, incorporating the above. As part of the work, an approach towards Business Process review was developed.

The approach is loosely based on the Soft Systems Methodology developed by Checkland et al at Lancaster University, but utilising alternative techniques for encouraging the creative process, most notably structured brainstorming through the use of affinity diagramming. The conduct of a Process Review consist of four stages:

modelling of the desired future process

modelling of the current process

gap analysis

development of implementation plan

(It should be noted that the first stage should be conducted without reference to the way in which the process is carried out at present)

The approach is also based around certain key principles derived from the Transformation Report, including most significantly:

a 'black-box' approach concentrating on the objectives and required outputs of a process before looking at what happens 'inside the box'

customer focus, emphasising the delivery of value to the end customer as the overriding driver of any process, and the primacy of the customer over the producer

a shift to a disintermediated or self-service business model – where wherever possible, the customer interacts directly with the system, and a 'good' process is defined as one without unnecessary intermediate steps or authorisations

an emphasis on effectiveness and efficiency, where effectiveness is defined as 'doing the right things' and efficiency as 'doing them at the lowest cost'

In outline, a process review is delivered through a number of facilitated half-day workshops plus background investigative analysis. Progress on Process Reviews to date is reported under 4. below.

4. Review, Implementation and Change Management: Progress to Date

As at the time of writing, a full review of Student Acquisition, defined anecdotally as 'attracting students and keeping them for a bit', or more formally as the process from marketing of study programmes through to induction and retention, has completed the series of six workshops, the outcomes of which are now being developed into an implementation plan. An evaluation of the approach adopted signalled it largely successful; the cross-University team convened for the workshops, including current practitioners, but also student and Governor representatives, worked well, managing to focus on the future vision not just the current problems, and proving open to creative and challenging thinking, facilitated by the affinity diagramming technique. The implementation team is now recommending the reorganisation of activities around the key business processes, to be overlaid on the current fragmentation across departments, providing end-to-end coordinated processes focussed on the delivery

of value to the end customer; this recommendation will be adopted as a general approach to delivery of all major processes. In contrast to the current organisation into hierarchical, line-managed departments, business process managers will be deployed to coordinate the delivery of process outcomes across departments and management lines.

Following the Student Acquisition Review an overall review of Student Management Information Systems has commenced. While strictly this is a review of a system rather than a process, the same workshop approach and facilitative techniques have been adopted and have again proved successful. The review is now in a transitional stage between the first three 'future' and the second three gap analysis and planning workshops.

Finally in terms of process review activity, a review of the operation of Human Resource Management across the University, linked to the rollout of a new software system and the self-service approach (see below), is under way, the results of a review of Web-development and management are being implemented, and a review of Timetabling has just scheduled the first three workshops.

5. Technical/Organisational Pilots: Student/Staff/System Self-Service (S3)

A key element of the approach of JMU to C&IT-enabled change, as described above, is the desire to significantly enhance the efficiency of its processes by using web technologies to enable a transformation to a *disintermediated* or *self-service* business model. That is, one in which all internal business transactions will be undertaken by staff and students directly interacting with automated systems, rather than these transactions having to be undertaken on their behalf by intermediaries.

JMU has received government-funding under the JISC Technology Applications Programme (JTAP) for a 12 month pilot project. S3 is concentrating on student-related systems, and is based on the development of a web-based system enabling students to view and update their own Student Record, undertake on-line module registration, and access course and exam timetables, and enabling staff to access student information, monitor progress, and enter assessment data.

The project will produce a system providing an exemplar of web access to secure and sensitive database records, and in addition will demonstrate the benefits of disintermediation when applied to what was hitherto an administratively intensive process.

Deliverables of the project include:

Practical knowledge of how various web development tools and utilities can be used to provide access to corporate database systems

An understanding of performance related issues, and their resolution, in relation to transaction intensive web-based applications

Solutions to security and access issues of web-based applications

An understanding of interface design issues related to applications for which no prior user exposure or training is given

Issues relating to human acceptance factors – both by the student users and by administrative and academic staff

The significance of the project in the Systems and Processes approach to Transformation is in the proving of the self-service concept in the JMU environment, which, if succesful, will be applied not only to other Student-related systems but also to Financial and HR Management and other processes as appropriate.

The progress of the project and other related information can be accessed at the URL: http://s3.livjm.ac.uk.

6. Conclusions - Information Strategy Emergence

In the traditional approach to Information or any other strategy development, a top-down approach is adopted, with a high-level steering group identifying the broad strategy, which is then devolved as appropriate within the organisational context for implementation. In addition, strategy is normally seen as, at least in principle, preceding action.

JMU has adopted a significantly different approach. The Transformation Agenda, whilst approved by the Executive, was based on the report of the Transformation Design team, who were representative of the University both vertically and horizontally, and also consulted widely at all levels; this was by no means a traditional strategic planning activity. Whilst parts of the final report could be seen as falling into the 'motherhood and apple pie' trap, nevertheless it set the broad, high-level agenda for future activity.

As identified above, this Agenda then had to be overlaid on 'business-as-usual', which, as is always the case, was not standing still waiting for strategy to be delivered from on high like Moses delivering the Ten Commandments. Essentially, the Systems and Processes approach was adopted to answer three questions:

what are we already doing that fits into the Transformation agenda?

what do we have to do anyway despite the Transformation agenda?

what new things do we need to do to meet the Transformation agenda?

The Systems and Processes Review initiatives described above were examples of new things that needed to be done; the Self-Service pilot and the new Finance and HR systems examples that were happening despite the agenda, but could be brought within it.

Finally the link must be made between Systems, Processes and Transformation and Information Strategy development. One thing apparent early in the process modelling taking part in the various reviews was that most steps in most processes are to do with the creation, reception, manipulation, transmission or interpretation of Information. In fact, it can be asserted that Information Management and University Management are one and the same thing, and that the Process Map developed during review and Transformation and enhanced with information inputs and outputs could alternatively be described as an Information Management Model. The continuous updating, revision and operationalisation of this map or model therefore becomes the Information management-related means of delivering organisational change, through its dynamism assisting in the development of a Learning Organisation capable of continual Transformation. The Information Strategy, if there must be one as such, could be stated simply as "To define and develop the flexible information management systems and processes required to meet current operational imperatives and enable continuous organisational Transformation'.

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Track C: (Paper Abstracts)
The New Library Role with Evolving Technologies

Converged Librarian/Academic Roles in the 'Wired' University

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New technologies allow universities to extend pedagogic practices, enhance learning experiences and develop self-managed lifelong learners. To take full advantage of evolving technologies, multi-skilled teaching and development teams are required with a merging and converging of academic and librarian roles. Conclusions are reported from the outcomes of such a partnership that has designed and delivered an accounting module at the University of the West of England, Bristol.

DEDICATE: a networked professional development project in information literacy and user education

Nancy Fjallbrant, Philippa Levy and Irma Pasanen-Tuomainen
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This paper describes the design and implementation of a networked professional development initiative for information literacy, run by DEDICATE ("Distance EDucation Information Courses with Access Through nEtworks"), an EU-funded project under the Telematics for Libraries 4th Framework Programme. Library and academic staff from five Central and Eastern European universities participated in the course, which is based on principles of collaborative and experiential on-line learning and has as its goal the development by participants of information literacy courses tailored to the needs of user groups within each of the five partner universities.

Library cooperation at the NOVA University - the Nordic University in Agriculture, Forestry and Veterinary Medicine

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The Nordic University in Agriculture, Forestry and Veterinary Medicine –The NOVA University - was established in 1995 to increase the cooperation between the Nordic agricultural universities. The NOVA libraries of the seven institutions and faculties involved wanted to show that they are a very useful partner in launching new ideas. They have the ability to put new emerging IT technology to use. The NOVA libraries have several IT projects like NOVAGate, NOVA Web Course and NOVABA. The NOVA libraries have found the right components for success: IT specialists, librarians and researchers working together multiprofessionally and concept of sharing the workload.

Electronic Libraries and Collaboration in the UK: the eLib Clump Projects

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The eLib 'clump' projects are utilising the Z39.50 bibliographic retrieval protocol to build gateways to library OPACs in the UK, creating virtual union catalogues of university, national and public libraries. The technology underlies increased collaborative activities between institutions in the Clump consortia, and will open up the resources of the libraries to far greater numbers than at present. The different approaches to the issues of collaboration and co-operation taken by each clump are outlined.

Viikki Virtual Infocentre - an Integrated Information Workstation

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University of Helsinki, Viikki Science Library, Finland

The Viikki Infocentre will be located on the Viikki Campus in Helsinki. It will be a modern learning environment offering library and information services, study rooms and learning facilities, computer and network services and administrative campus services to students and researchers. A good guiding system and a clear user interface are essential for the effective use of all these services. Clients will need guidance in the navigation both in the physical building and in the huge information cyberspace. This paper describes the electronic guiding system and discusses the challenges and rewards in the development of the virtual learning environment.

The ELISE II Project, A Digital Image Library for Europe

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University of Limerick, Ireland

This paper describes the progress made under the ELISE II electronic image library project from a technical standpoint. The Elise II project is a European-wide initiative which aims to provide a comprehensive electronic image library service for Europe. It is funded under the European Commission, DG XIII-E, Telematics for Libraries' initiative.

Converged Librarian/Academic Roles in the 'Wired' University

Christine Dugdale

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Abstract

New technologies allow universities to extend pedagogic practices, enhance learning experiences and develop self-managed lifelong learners. To take full advantage of evolving technologies, multi-skilled teaching and development teams are required with a merging and converging of academic and librarian roles. Conclusions are reported from the outcomes of such a partnership that has designed and delivered an accounting module at the University of the West of England, Bristol.

Background

Many faculty are committed to providing students with the best possible learning environment through a comprehensive range of information provision and delivery. Many are willing and able to harness new technologies to support these aims. Some, however, lack knowledge or time to create new electronic courses and teaching/ learning materials or feel that their department's technical infrastructure, hardware or software provision would not support such developments. They may not understand the implications of using copyrighted information or may lack expertise in obtaining necessary clearance permission. Consequently, they are unlikely to create imaginative new computer-aided learning systems or explore new methods of pedagogic delivery.

Cultural Change

Institutions can only reverse this situation if they are willing to encourage an institution-wide cultural change. A blurring of rigid boundaries, still existing in many UK universities between professional groups, would facilitate development of new teaching and learning methods. More exciting courses could be created, utilising new technological developments, if faculty were willing to work more closely with librarians who may possess the skills to exploit these tools. Traditionally, however, libraries have been perceived as support services to serve staff and students' research, teaching and learning; not as equal partners in the creation, design and delivery of courses.

Rapidly expanding technological advances have highlighted the need for librarians to accept new roles; reflected in a raft of new titles replacing the traditional 'librarian' (Bosseau, 1996). There have been moves towards converged services with increasing convergence of networking, telecommunications and information (Mendelsohn, 1996). However effective, nevertheless, this only merges two 'support' services. It does not address the wider issue of whether there should be a greater cultural change encompassing the merging of support and teaching functions.

Close collaboration of IT support and library staff is needed when new electronic library services are implemented (Geleijnse, 1996), but it may be less clear that there is an equally important need for the close and continual collaboration of academic and library staff before, during and after implementation of electronic library services (Creth, 1996). It may be even less clear to faculty that many new electronic library services are also teaching tools; not 'merely' media of information provision. Implementation of these services demands a cross-professional team for effective development and exploitation. Electronic information provision brings new responsibilities to the traditional librarian role (Rice-Lively & Racine, 1997), and offers academic librarians opportunities, if not responsibilities, to take more pivotal roles in framing their institutions' teaching and learning strategies. As technology drives change, academic libraries often change faster than their institutions (Riggs, 1977). They may be more aware of new possibilities for underpinning teaching initiatives or more appreciative of the need to integrate information provision and tuition for new courses which, increasingly, include larger elements of

self-directed study. Faculty may be less ready to recognise this. Yet, if librarians are to be the main agents of electronic development of the scholarly information system, they must be perceived as peers by academic staff (Crowley, 1996). Changing academics' perception of librarians' roles in teaching, which has been their monopoly, however, demands an enormous cultural change.

ResIDe Electronic Reserve

Fostering cultural change was one of the UK's eLib programme's aims, although defining 'cultural change' was and remains difficult (Davies, 1997a). An early study of eLib's impact on cultural change reached no firm conclusions as to its progress (Davies, 1997b). The eLib programme was created by the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils as a response to the Follett Report's IT recommendations (HEFCE, 1993). One of its funded projects was the ResIDe Electronic Reserve (or short loan) at the University of the West of England, Bristol which sought to examine such issues surrounding the implementation of an electronic reserve as copyright and management control mechanisms. ResIDe is now an operational part of UWE's overall Library Services. (Information about ResIDe is available on ResIDe's web pages: http://www.uwe.ac.uk/library/itdev/reside).

Re-named the ResIDe Electronic Library, ResIDe now also holds a current awareness database, comprising the Tables of Contents of journals to which the Library subscribes, and a past examination paper database. The Electronic Reserve supports four original pilot Built Environment modules, one Faculty of Health and Social Care module and three Bristol Business School modules through provision of core and additional readings and non-copyrighted module information networked to all faculties on all campuses. It gives simultaneous multi-user, multi-location, twenty four access to a range of secure documents in a variety of electronic formats held on a library server (Dugdale, 1998).

Research Study

A research study based upon ResIDe's support for a second year business elective, Information for Management Decision Making, is pioneering a new approach to collaborative working; moving away from traditional academic/librarian client-provider roles. The module has been designed by faculty and librarians to develop students' IT, presentational, evaluation and research skills, improve and reinforce their understanding of, and critical approach to, management accounting whilst encouraging and developing an inquisitive mind and fostering life-long learning skills that students will need later (Dugdale, 1999b).

This partnership has produced a teaching/learning 'package' that integrates information tuition and information provision in a way that would have been very difficult without such close collaboration. Staff are now able to draw upon an imaginative and stimulating mix of traditional teaching methods and self directed learning supported by print and electronic resources. The two module leaders would have concentrated more upon a traditional 'talk and chalk' approach through lectures and workshops using print manuals and overheads. They would have expected librarians to provide print copies of recommended items and to offer database training sessions, but would have neither expected nor welcomed anything more. Had librarians attempted to support the course more pro-actively, they may have provided electronic sources to enhance the learning experience (Davies, 1997), but would have lacked the necessary specialist knowledge to create a relevant information and skills training package to meet module objectives.

In using each other's different, but complementary skills, knowledge and experience, academics and librarians have designed a module that provides students with a well-balanced mix of teaching and learning methodologies. Students enjoy face-to-face contact with colleagues and with lecturers who have specialist knowledge to provide stimulus and personal help in lectures, workshops or laboratories. Exclusive concentration upon learning through technology would not be successful (Porritt, 1997). Lecturers, however, also use innovative teaching methods supported by ResIDe and students have the benefits of more self-paced individual study through materials held on ResIDe.

An important element of the module, introduced as a direct consequence of this academic/librarian

partnership, has been the joint setting and assessing of an entirely new assignment that tests students' subject, presentational, search, bibliographical and evaluation skills. Students need to find and present information using a wide range of media and explain which resources were used, how and why they were used in preference to other media and other resources and then evaluate them. Students, in groups, examine a related series of documents on a chosen subject. Each summarises one article with critical comments. As a group, they justify their document selection and describe their literature search, identifying used sources and how they were found. Critical analysis of the relative usefulness and ease of use of different sources is rewarded. There is sufficient material in the library's print collection to successfully complete the assignment and students are not penalised for not using electronic sources if use and value of print resources is justified, but many documents are also found on ResIDe and some are only found in electronic resources. Students are encouraged to find both print and electronic copies of documents and to compare the advantages and disadvantages of each format. These business students had never been set this type of evaluative work before, although they will need to develop analytical skills and to differentiate between and evaluate a range of information in their future working lives.

Successful Outcomes

A number of immediate administrative advantages accrued to library staff from the pattern of co-operative working established through 'course' meetings (Dugdale, 1999a). Academics explained module objectives, submitted essential course documentation and reading lists early, provided lecture time for librarians to promote, explain and train users and regularly 'endorsed' ResIDe during lectures. Consequently, library staff have provided their students with a service far better tailored to their needs. Having a much clearer understanding of module objectives they have been able to make more informed purchasing decisions. Database training is more relevant and information more likely to be assimilated. Well attended sessions were scheduled during lecture time and heavily 'publicised' by the module leaders.

Librarians were able to demonstrate that some recommended articles were available on databases to which the library already subscribes. These have not been scanned into ResIDe. Nor have they been placed in the print Academic Reserve. Instead, hypertext links to the databases have been added to ResIDe's module information. Library staff have, thus, been freed from providing a wasteful duplication of information. This has given them more time for individual training and help for the students on the course. They were also able to help academic staff to find additional relevant and more up-to-date sources of information, including new media and visual aids, which have been incorporated into teaching programmes. Consequently, students have a quick and easy access to a wealth of additional information and academics have been able to set assignments based upon a wider variety of topics; no longer being restricted to the library's print holdings. Lecturers have re-discovered a valuable source of information for their teaching and research that they had not been using to full advantage and are now encouraging colleagues to use them more frequently.

Students access internal and external databases, such as the library's own resources web pages and full text journal article databases, from ResIDe. The module guide, available in print and on ResIDe, clearly states where each document can be found - whether in print or electronic format, whether in more than one format or held in more than one place. Students, therefore, know that certain items will be found on a particular database and are more likely to continue a search after encountering a problem. Having, successfully, accessed and retrieved information from other databases from however a 'safe' and user-friendly environment, students develop more confidence in their ability to use online resources. They might also develop the habit of searching for information in other sources for other courses and in their later working lives. This should improve student IT and search skills and help them to develop lifelong learning skills.

Problems

Some problems have, inevitably, been encountered during the study. Despite close collaboration between academic and library staff, a number of misunderstandings and communication breakdowns have occurred. These have been highlighted in the course of an internal Teaching and Learning project within the Business School. This is examining the ways in which IT can be harnessed for teaching

programmes and is comparing different systems available within the Business School (Collett et al, 1999).

Staff and students completing a questionnaire noted a number of practical problems in relation to ResIDe, chiefly around access issues, especially, password control for copyrighted material, lack of hardware, especially printers, and Netscape's 'crashing' or working slowly. These issues, however, can all be addressed. The main difficulties remain centred around communication problems between staff.

Although many courses are now team taught, academics have, traditionally, often worked alone and do not have the same ethos of sharing which seems almost endemic amongst librarians. It has proved difficult for both groups to appreciate these differences. One of the systems being compared in the internal project, is a initiative led by the module leaders in the partnership study. They set up a directory on a shared drive so that materials such a visual aids could be deposited and shared amongst staff. So far, this has proved a one-way process. Consequently, although librarians are anxious to place material on the Electronic Reserve that could be used by other academics and students, these lecturers are hesitant to do so. In addition, having given librarians large amounts of course material, the two lecturers did not see any need for further regular meetings or provision of more information and found librarians' requests for additional reading lists intrusive. Library staff were unaware that students were being given material not submitted to them for ResIDe.

Problems also arose because the two lecturers did not fully understand how to access all information on ResIDe. In particular, they access ResIDe through a very circuitous route rather than using the URL. Library staff are unable to understand why they do this or persuade them to use the URL. As they demonstrate this to colleagues and students, many find ResIDe too complex to access. This problem probably arises because ResIDe, however closely library staff work with academics, is a library system available university-wide. This is one of its greatest strengths in that students studying cross-disciplinary modules are able to use ResIDe for different functions and for modules in different faculties through one familiar interface. Individual academics, however, do not feel a same sense of ownership as with systems they have created and mounted on their own departmental intranets and, therefore, are less willing to exploit them fully. Where libraries are able to provide electronic learning material, academics are often reluctant to allow them to be networked (Revill, 1998). One objective of the Teaching and Learning project was to compare ResIDe's service with the lecturers' own (often duplicated) system supporting the module. At the outset, faculty were very sceptical about the advantages claimed for ResIDe and have only just begun to appreciate the obvious benefits of a university-wide system. Though they appreciated innovative library input into the assignment and access to ResIDe's copyrighted document holdings, they were convinced that they could devise a much more user-friendly and module-tailored system.

Early Results

The mix of teaching and learning methods and learning resources has proved more informative, helpful and stimulating than sole provision of either traditional 'chalk and talk' or new open-learning methodologies. It develops subject knowledge, lifelong learning skills and IT skills. Assessment of completed assignments has already indicated that students are using a much wider range of information sources than before. A questionnaire completed by this group of ninety five students at the beginning of the year suggested that very few had used many business databases. Yet, almost all referred, quite knowledgeably, to a set of approximately six databases. They may not continue using these, of course, but have now learnt that they are easy to use and give access to a wealth of information. The lecturers are very impressed with the quality of the work received and have already decided to use the same exercise again next year.

The Future

The two academics teaching this course are now convinced of the value of having an institution-wide system and enlisting help and advice from librarians to make it more central to their course. Their report will strongly recommend that the Business School makes more use of ResIDe and that other academic and library staff forge closer working partnerships. It may, however, be some time before this happens.

It will require a cultural 'shift' involving a recognised 'institutional change'; possibly imposed from the highest level. For the foreseeable future, there will be academics unwilling to recognise librarians in anything other than a support role and librarians unwilling to leave the confines of the library and accept new teaching challenges.

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DEDICATE: a networked professional development project in information literacy and user education

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Abstract

This paper describes the design and implementation of a networked professional development initiative for information literacy, run by DEDICATE ("Distance EDucation Information Courses with Access Through nEtworks"), an EU-funded project under the Telematics for Libraries 4th Framework Programme. Library and academic staff from five Central and Eastern European universities participated in the course, which is based on principles of collaborative and experiential on-line learning and has as its goal the development by participants of information literacy courses tailored to the needs of user groups within each of the five partner universities.

Introduction

The information environment is undergoing fundamental changes. Users today have rapid access to a wide range of information sources, which can be accessed in a variety of ways. Delivery of full-text materials and databases of various kinds is often direct to users' own computers. The availability of vast quantities of information coupled with different delivery forms, has increased the complexity of finding and selecting relevant, high quality information. In this context, users need networked information literacy support at the point of search; that is, via their own computer.

Meeting information literacy training needs in higher education is therefore an increasingly challenging task. As the networked information environment becomes richer and more complex, information services are faced with widespread awareness-raising and skills development needs within their learning, teaching, and research communities. At the same time, the rapid pace of change, alongside pressures on traditional face-to-face training formats and the emergence of new, networked methods for the delivery of support, means that academic liaison and learner support staff themselves need to be able to engage in continuous up-dating and professional development activities which can be tailored to their specific responsibilities and institutional circumstances.

DEDICATE ("Distance EDucation Information Courses with Access Through nEtworks") is an EU-funded project under the Telematics for Libraries 4th Framework Programme which has developed, and at the time of writing is testing, a flexible model of networked professional development in information literacy. The Project started in May 1998 and will be completed in September 1999. The model is being piloted in a Central and Eastern European setting, at four university library sites in Estonia, Hungary, Latvia and Lithuania, and at the International Centre for Information Management, Systems, Services in Torun, Poland. Development of the DEDICATE course has been co-ordinated by Chalmers University of Technology, Sweden, in partnership with the University of Sheffield, UK, the University of Linköping, Sweden, and the Helsinki University of Technology, Finland. In this paper, we describe the design and implementation of the course and our evaluation strategy.

Pedagogic approach

Our aim in designing the course has been to create an environment which encourages participants to engage in *deep learning* - which implies understanding and facilitates retention - as opposed to *surface learning* which is soon forgotten when the person moves on from the learning activity itself. Our

approach draws on principles of adult, distance, and experiential learning, underpinned by a broadly constructivist philosophy regarding the nature of the learning process. Constructivism offers a theoretical framework for the design and facilitation of learning environments which is becoming increasingly influential and is frequently invoked in descriptions of emerging approaches to Web-based learning and teaching. Much of the over-arching philosophy of constructivism is in tune with the tradition of adult and professional learning using experiential and collaborative methods, and to those drawing on work in computer-supported collaborative learning (CSCL) contexts in which a good deal of emphasis is placed on enabling learners to pursue self-managed, independent learning through asynchronous interaction [e.g. 1, 2, 3]. Key assumptions [4] of the constructivist view of learning, and some implications for the design and facilitation of learning environments, are as follows:

Knowledge is constructed through an evolving process of personal, active engagement with the external world, and is therefore not a product which can be passively received by one person from another and accumulated. Learning environments need, therefore, to encourage personal responsibility and initiative, for instance in organising learning around the identification and achievement of personal goals rather than around general topics, and in enabling learners to exercise higher-order questioning skills, and skills in critical reflection, self-management and self-monitoring. Course design and facilitation needs to engage with individuals' experiences, interests and needs and encourage ownership of, and a self-directed approach to, learning.

Knowledge is closely connected to context, in that meaning is derived from, and closely associated with, the experience through which it is acquired. Focusing on acquisition of abstract concepts is unlikely to facilitate transfer of meaning between situations and domains. Learners need, therefore, to be able to engage with the connections between concepts and context, through participation in 'authentic' learning activities which involve contextualised problem-solving.

Personal understandings are developed through social negotiation and exploration of multiple perspectives, through interaction with texts and people. Learning experiences should include opportunities for co-operative interaction with peers and tutors, for instance through collaborative problem-solving or project work.

Laurillard [5] has described the learning activities of students in higher education in terms of five interdependent aspects of the learning process:

apprehending the structure of the material, interpreting the structure and organising as a coherent whole

integrating the representation of the material with the meaning, for example using language, mathematics or classification systems

relating knowledge to experience, relating theory to practice

using feedback, both intrinsic and extrinsic - to adjust actions to fit the task goal, and descriptions to fit the topic goal

reflecting on the goal-action-feedback cycle.

We have also drawn on Marton and Booth's work [6] and previous phenomenographic work by Marton [7, 8] which emphasises the different ways in which individuals experience learning; we have aimed to take into account the impact of contextual factors such as prior educational backgrounds, personal expectations and motivations, and organisational settings on participants' understandings of learning for professional development [9]. We are aware of the need to provide "process" support - including affective support - for distance learners who might well be working in relative isolation and who may feel uncertain and confused in their learning roles.

Overall, therefore, we have tried in the design and facilitation of the DEDICATE course to emphasise the importance of offering learners the chance to engage in active, self-directed, and "authentic" or situated learning activities, and in interactive dialogue with tutors and each other. We designed the

course to include experiential learning, for example about the use of networked resources and searching for scientific or technological information.

The course

How did these underpinning philosophies translate into practice? This section of the paper highlights the main features of the DEDICATE course and its technological environment, for which we drew on work previously undertaken within undergraduate and professional development settings at the University of Sheffield [10, 11, 12] – in particular through the Electronic Libraries programme NetLinkS project [13] - and on experience gained from the Swedish distance learning INFOVISION project [14]. In terms of structure, the course was divided into five Units, each of several weeks in length:

The Internet as a learning environment

Information searching

The institutional context: reflection and planning for project work

Projects: design of an information literacy initiative

Learning and course reviews

We encouraged a mixed participation of people with library backgrounds and engineering or science backgrounds. Participants include librarians without scientific backgrounds, librarians with science and engineering degrees, and academics without library backgrounds. They were advised to spend between 6 and 8 hours per week on course activities, including regular access to the course Web site. It was essential to seek strong support from their managers, to ensure that they received work-release time and adequate technical support within their institutions; in continuing and professional education it is essential, in order to avoid unnecessary drop-outs, that participants have adequate time to cope with their learning challenge and at the same time to feel that their institution is providing care and support.

Key features of the course were:

Initial face-to-face start-up meetings. At each site, two-day workshops were arranged for course participants, local managers and tutors. At these meetings, goals for the course were discussed and participants were introduced to the learning environment, including the *Into Info* resources, the computer-conferencing system and the DEDICATE resource base (see below).

Small-scale introductory activities. During an induction period and two further modules, participants were introduced to the networked learning environment and approach, and introduced themselves to the wider group (designing HTML based personal profiles as well as posting personal introductions to the on-line forum).

They undertook a number of structured activities as individuals and in groups; activities focused on: information resource discovery in selected subject areas, and methods and models of information literacy support.

Projects. Collaborative project-work determined by local institutional needs and the professional interests of participants at each location focused on the planning and design of information literacy courses and/or materials for specific user groups within the universities.

Group-work. Groups at each of the five libraries worked both face-to-face and on-line on the small-scale projects and on projects. Each learning set was assigned a tutor, who facilitated the launch meeting and participated subsequently in discussions and co-ordination of activities, but sets were encouraged to take on much of the responsibility for managing their collaborative work. More broadly, peer support and

wider discussion were encouraged through on-line communication.

Information and learning resources. Key resources for the course were a number of Web-based user education and training resources developed by the EU Telematics for Libraries Third Framework project, EDUCATE (1994-7) [15]. The EDUCATE project led to the production of the *Into Info* programs. So far, these have been produced in eight subject areas: *Architecture, Chemistry, Electrical and Electronic Engineering, Energy, Environmental Information, History of Science and Technology, Medicine,* and *Physics* and there is on-going work on the production of modules in civil engineering, and mechanical engineering. The programs, which provide a means for learning about and accessing relevant information sources, have been designed to meet the needs of scientists, engineers, doctors, teachers and librarians. They can be used for self-instruction, as a resource for formal campus-based or distance learning courses, and as rapid access tools to information sources. Participants on the DEDICATE course were able to draw on them to enhance their own resource awareness and skills in information seeking in these subject areas, and to consider how they might be used within their own training initiatives and/or might provide design models for similar, home grown learning resources in other subject areas. In addition, a collection of information resources comprising annotated links to external Web documents, links to a small range of materials produced specifically for the course and to full-text versions of key readings, and bibliographic references to off-line documents, was available. Resources generated by participants were also placed on the course Web site and used as learning resources.

Tutoring and technical support. Tutoring and technical support was distributed geographically; members of the support team were located at Chalmers University in Gothenburg, Linkoping, Helsinki and Sheffield. Tutors aimed to act as resources for, and facilitators of, learning and collaborative activity. Whilst some on-line seminar discussions were led by team-members, participants were likewise able to initiate discussion threads in all the course forums.

Technical environment. A key concept underpinning the technical environment for the course was that it should support active, collaborative and independent learning, and be perceived as far as possible by the user as an integrated Web application, offering easy and rapid access to a distributed range of facilities and resources. Key features of the interface, facilities and resources for the DEDICATE course were:

A frames-based Web environment, offering easy orientation and navigation within the site. The frames interface is also adopted to provide a conceptual "anchor" for participants in relation to their course activities, and to help reduce the problems of "getting lost in hyperspace" which are often encountered on the Web.

Easy access to all individual participants, tutors, and groups, as well as to information about them, and to work generated by them during the course.

Access to asynchronous conferencing facilities for group discussion and tutorial/technical support. The main discussion facility for the course is *Focus*, a UK Web product which supports Web-based, asynchronous conferencing and e-mail messaging. In addition to the main discussion forum within the conferencing environment, there were forums for each group, for discussion of technical issues, and for social chat.

Access to the *Into Info* programs and to the structured resource base.

Access to technical support in the form of links to information about using the discussion tools and other technical aspects of participating in the course, as well as e-mail links to the technical support team.

Implementation and evaluation

The course began with start-up meetings in October 1998 and at the time of writing Units 1 to 3 have been completed. In terms of concrete outcomes, one of the key aims of DEDICATE is to stimulate information literacy activity within participating institutions. Participants are currently hard at work on the design of their proposed Information Literacy courses. Through the vehicle of this project work, a range of initiatives have been established; it is planned that each of these will be implemented during the

academic year 1999/2000. Examples are:

Tallinn University of Technology, Estonia. Information literacy course for postgraduates in Computer and Systems Engineering, and Electronics and Biomedical Engineering Control. The course will carry University credits and is planned for Spring 2000.

Vesprem University, Hungary. Information searching in environmental protection and, specifically, in the problems of hazardous waste and air- water- and soil-pollution. Aimed at third year undergraduates on a 5-year Environmental Engineering course. Planned in collaboration with academic staff and due to be launched in autumn 1999.

Riga Technical University, Latvia. Information literacy course for students in the Faculty of Radioengineering and Telecommunications, planned for autumn 1999. In addition, chemistry information course for third year undergraduates in Chemistry and Chemical Technology, also planned for autumn 1999.

The DEDICATE course evaluation will be undertaken by means of a Web-based feedback questionnaire. Participants will be asked to assess whether or not their initial goals have been realised, and to provide feedback on the learning approach, the features of the learning environment, and the quality of technical and tutoring support. The ultimate test of the success of the DEDICATE project will be the production of viable Information Literacy courses which will be added to participants' university curricula.

Concluding remarks

There is a very real need for the development of information literacy training in Europe, and this is particularly important in view of the escalating rate of change in technical information transfer. We hope that the professional development activity and creation of information literacy programmes at the five participant sites will have spin-offs for wider-scale development of learner support initiatives within their countries, and that the DEDICATE model for networked professional development on this topic will be transferable to university library and information services throughout Europe. A number of dissemination activities are already under way and can be followed in the DEDICATE newsletter. A DEDICATE seminar will be held at the ICIMSS in Torun, Poland, in September 1999.

For the newsletter and further information about DEDICATE, please see the project's home page at: http://educate.lib.chalmers.se/DEDICATE/dedindex.html

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Library cooperation at the NOVA University - the Nordic University in Agriculture, Forestry and Veterinary Medicine

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Abstract

The Nordic University in Agriculture, Forestry and Veterinary Medicine –The NOVA University - was established in 1995 to increase the cooperation between the Nordic agricultural universities. The NOVA libraries of the seven institutions and faculties involved wanted to show that they are a very useful partner in launching new ideas. They have the ability to put new emerging IT technology to use. The NOVA libraries have several IT projects like NOVAGate, NOVA Web Course and NOVABA. The NOVA libraries have found the right components for success: IT specialists, librarians and researchers working together multiprofessionally and concept of sharing the workload.

1. NOVA UNIVERSITY

The NOVA University (http://www.nova-university.org/) is an organization established in 1995 to increase the cooperation between the Nordic agricultural universities. Members of NOVA are The Royal Veterinary and Agricultural University, Denmark, Faculty of Agriculture and Forestry, University of Helsinki, Finland, Faculty of Veterinary Medicine, University of Helsinki, Finland, Agricultural University of Norway, Norwegian College of Veterinary Medicine, The Swedish University of Agricultural Sciences, Agricultural College of Hvanneyri, Iceland.

Organization

NOVA is governed by the NOVA rector and the board of the rectors – in Finland the deans of faculties – of the seven institutions and faculties involved. The general purpose of establishing NOVA is through various cooperation projects to increase the range and raise the quality of education and research.

NOVA has joint postgraduate courses and an open postgraduate school and coordinated research programmes building on the strenghts of the individual institutions.

Today NOVA has three steering committees for post graduate education, undergraduate education and cooperation with the Baltic states. The intention is gradually to establish more steering committees and working groups. A NOVA catalogue informs of NOVA committee and working group members and persons taking part in NOVA. From January 1996 NOVAs secretariat is situated in Alnarp, Sweden.

Saving Money

The ideology behind NOVA University is free mobility of students, teachers and researchers. This means that they can choose between Hvanneyri, Copenhagen, Ås, Oslo, Ultuna, Umeå, Skara, Alnarp and Helsinki. NOVA university also wants to have a joint profile and cooperation to advance international cooperation with Baltic countries, developing countries, EU members etc. This means that as a unified team the NOVA University has a stronger position than each of its parts alone. Thus, NOVA University wants to unite its resources in dividing responsibility on subjects which are not broad enough for each country to develop or to maintain its own expertise. This means the division of labor and saving money.

A decentralized organization of NOVA is a university without walls. The activities of NOVA take place

at the institutions taking part in NOVA. NOVA has a bottom up principle and wants to see as many activities as possible based upon an active commitment from students and staff. The Nordic universities finance the costs of cooperation themselves. The main costs are the secretariat and the postgraduate courses. Such costs are shared according to a percentage distribution decided and used by Nordic Council of Ministers.

There are primarily courses in different subject fields for post-graduate students, approximately 10-12 courses per year. 24 NOVABA courses have been arranged in the Baltic countries during 1996-1998.

NOVA undergraduate education is a new target activity. It fulfils the vision of free mobility of students and teachers. At present priority is given to investigate possibilities within short courses and summer courses covering one full semester courses at master level and longer programmes of varying length.

Structural barriers like incomparable study programmes have to be overcome.

A new solution to overcome the structural barriers is in the planning phase. It is synchronized multiform block education. The idea is to teach the main subjects in five-week periodic units or blocks over five years. It also means that a student can take a certain course only in one NOVA university at a certain period of the time. The student has to travel to the university which has that course in the program. There are also so called empty blocks in the system that allow students to choose freely their subject courses. The system is based on three terms, Autumn, Winter and Spring which all start at the same time in every university.

The educational pros and cons of the system will be analyzed this spring. The analysis will concern the costs for the students to travel to different countries, the freedom to choose your subjects and times for them, the gross-benefit of the system, and lastly, the level of ambition and advantages and disadvantages of the system.

2. Organizing Library Services at the NOVA University

The Nordic agricultural libraries have a long tradition of cooperation but the cooperation has got a new more concrete form after the NOVA University was born. The libraries formed their own working group called Information Management. The group consists of the directors of the libraries. The group also functions as a steering group of various joint projects in the NOVA libraries.

The idea of the group was to combine the skills of librarians, researchers and IT professionals of the NOVA University and to work together multiprofessionally. The librarians wanted to unite the skills of the personnels and other resources of the Nordic libraries. The tasks of the information management group are 1) to develop an easy access to Nordic information systems. This means e.g. the NOVAGate – a project which is a subject-based information gateway to Internet resources in the NOVA fields. 2) to coordinate the management of information on research projects, publications and experts at the national and international level. This means e.g. that the agricultural libraries are the focal points of AGRIS input in their countries. *3)* to teach information management skills to Nordic and Baltic students and researchers. This means e.g. a Nordic web-course for information retrieval.

The Three C:s

There are some important themes which are connected to the concept of information society. The most important of them are connectivity, content and competence. Connectivity relates to access to the information for the widest possible community. Content refers to resources of information society. Competence relates to providing skills for the information society. The students and teachers have to have skills to play their role in a learning information society. Libraries are a natural, even a traditional home base for these concepts.

The NOVA libraries have been pioneers in NOVA Universities to teach these new skills. The libraries

wanted to show the NOVA University that the libraries are a very useful partner in launching new ideas. The libraries have the ability to put the new emerging IT technology to use. The libraries have a tradition to build new tools to help information retrieval. Internet was a new tool to all but initially only a few could take benefit of it at the time when NOVA University was established, 1995. The NOVA libraries achieved results faster and more easily than the other institutions involved in setting up their NOVA projects. This was possible because the initiatives of the libraries were so concrete and it was easy for them to cooperate across the borders using new IT-technology.

2.1. NOVAGate – the First Example of the IT Activities of NOVA Libraries

The libraries started by developing a multi-lingual, multi-national subject based information gateway to Internet resources in forestry, veterinary medicine, agricultural, food and environmental sciences. This NOVAGate project (http://novagate.nova-university.org) was established in 1996. The service was launched in July 1998. It is based on a web-accessible database, which contains Internet resource descriptions for searching and browsing. Initially the project aims at comprehensive coverage of Nordic resources, but it will expand to include resources from other areas also. The service is selective, not only by subject, but also by quality, i.e. all resources are first checked against a set of quality criteria before inclusion.

Cooperation

The management of the project has rotated between the participating countries. Finland was the first to have the thrill of managing a multinational project. Last year it was Sweden and this year it will be Denmark. An e-mailing list (nig-l@utb32.bibul.slu.se), telephone and occasional meetings have been the main communication channels between the project members. Each country updates a central ROADS database at the library of the Swedish University of Agricultural Sciences. A webguide (http://honeybee.helsinki.fi/mmhf/gguide.htm) for cataloguing and a list for quality criteria have been set up and they can be searched for free in the Internet. The libraries have divided the tasks which include management of the database, development of the web site, production of a web-based resource description guide, evaluation and marketing of the service, between each others.

Today

The focus has been shifted from service to contents after opening the site. The focus of the development will be to add contents and its quality by evaluating the service and by developing the database housekeeping procedures and the user interface. Also new Nordic and international partners are sought for.

The first more or less intern evaluation of the NOVAGate service was carried out in late 1998 although the database had only 300 references. The questions concerned the user interface and functionality, contents, target groups, personal details or any additional comments. The answering rate was 42%. The response was positive. NOVAGate is a good Nordic initiative. The second evaluation will be carried out when the service is completed.

The concept of working together and sharing the workload is a part of sustainable development in our opinion. The libraries can add resources by working together because each takes the responsibility of the work in turns. To promote the sustainable use of natural resources by the means of teaching and research is also the mission of FAO (Food and Agriculture Organization of the United Nations) which will promote Capacity Development in partner countries - a theme which stresses the importance of education.

Communication in the Net

The shared and distant cooperation led the libraries to use net-based communication. It was not always so easy to tell your partner what you actually think of the project under construction because of the language barriers and different cultures. The Finns seem to be more impatient: we seem to know at once how the work should be done. E.g. our Swedish friends want to sit down and discuss it thoroughly and democratically. Working together has been very educating and nice. We had fun too, of course. We have learned by doing and when doing so, we have combined technology and learning.

2.2. NOVA WEB COURSE for Information Retrieval

The free mobility of NOVA students, teachers and researchers is a theme that has been the object of discussions in the libraries lately. What does free mobility mean to the students and teachers.? Do they get similar library services in every country? Do they have equal access to electronic material? Do they have high-quality user education at their disposal when they need it?

One solution to the above questions is the NOVA web-course. The NOVA libraries are developing a NOVA web-course for learning to use the library material. The model of this course comes from Finland. The Helsinki University Agricultural Library has a web-course (http://honeybee.helsinki.fi/mmha/kurssi/) which makes it possible to choose a place and a time for learning. The structure of the course consists of student register, credit register, program for registration for courses/exams and program for allotment of questions. There are seven series of questions on the topics of plant production and agricultural engineering; animal production; forestry; environmental sciences; applied economics; food, household and nutrition sciences and veterinary medicine. Students draw questions for themselves by using the program for the allotment. Answers are sent back to teachers via email. The home-page of the course is common for the different countries and it is linked to homepages of every library. There are own contact persons in each library to give feedback to students. The materials in NOVA web course will be in English.

This kind of a self-study tool makes free moving from country to country easier to NOVA students. They can have access to every country' s resources easily. It also standardizes the library services. The students learn to search information and to use national library systems, cd-rom databases as well as electronic journals in each country. The NOVA web course will be in full use during the year 1999.

2.3. NOVABA – the Cooperation between the Nordic and Baltic Libraries

An other example of the activities of NOVA libraries is the cooperation with the Baltic libraries a.c.a. NOVABA libraries. The Nordic libraries have organized the first training course in 1995 in Finland and afterwards two training courses in using NOVA material and international material in the Internet in the Baltic countries for the staff of libraries and researchers of the universities. For this purpose The NOVA libraries have produced together a leaflet and some training material. The NOVA web course in English will help to enchance the usability of the information at the NOVA universities. The goal is that also the Baltic NOVA libraries will add their own questions and sources to NOVA web course.

The Baltic libraries have benefitted the most of the Nordic model of working together. Accordingly they now have a network of their own. According to an evaluation of NOBABA program 1995-1998 which was carried out in the autumn of 1998 the Baltic libraries seem to be very glad about the NOVABA cooperation. It gave them the first chance (in 1995) to go abroad and learn about the library systems operating in Nordic countries. Training and visits have been useful. The Baltic libraries have Internet connections but further education in new management techniques is needed.

The Information management working group has informed the Baltic libraries that they are welcome as

partners to NOVAGate service and for discussions in the mailing-list. Three Baltic librarians are also invited to the Royal Agricultural and Veterinary Library to a two-week visit in 1999. The Baltic libraries can have their photocopies and interlibrary loans from NOVA libraries free of charge.

2.4 AGRIS

The Nordic agricultural libraries are the focal points in their countries for managing national agricultural bibliographical references to FAO's centrally managed database AGRIS (International Information System for Agricultural Sciences and Technology). The model of working as a concerted team applies also here. The NOVA libraries are preparing together their contribution to FAO concerning the new decentralized production model of AGRIS. The NOVA libraries will inform FAO about the possibilities of NOVAGate in disseminating information.

FAO emphasized the new role of AGRIS as an information exchange network to provide data and knowledge on sustainable agricultural development which could include the establishment of viable working partnerships to facilitate the exchange of global and local information and know-how in a transnational way. The actors of this new AGRIS network will be given new tools to manage, analyse, process and disseminate information. FAO wants the new AGRIS network to include bibliografic information and non-bibliographic information. The users want to have all kind of agricultural and related information like statistics, information on research projects, administrative data, data on extension and education.

3. The Concept of Success

NOVA library cooperation is real in working together in concrete projects. But the NOVA libraries have their local troubles and local customers, too. When the syncronized multiform block education is a reality and the amount of NOVA students increases the libraries have to find the answers to a common intranet, division of work, sharing of resources, and developing of new services to support the free mobility of NOVA students and teachers. The NOVA courses will comprise about 8-20 per cent of the total 160 study weeks.

I think that the future looks rosy because the NOVA libraries have the right ingredients. They are firstly IT specialists, librarians and researchers working together multiprofessionally and secondly the concept of sharing the workload.

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Electronic Libraries and Collaboration in the UK:

the eLib Clump Projects

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Abstract

The eLib 'clump' projects are utilising the Z39.50 bibliographic retrieval protocol to build gateways to library OPACs in the UK, creating virtual union catalogues of university, national and public libraries. The technology underlies increased collaborative activities between institutions in the Clump consortia, and will open up the resources of the libraries to far greater numbers than at present. The different approaches to the issues of collaboration and co-operation taken by each clump are outlined.

The eLib Programme

The eLib (Electronic Libraries) Programme[1] in UK Higher Education (HE) began in the spring of 1995, as a result of the Follett Report[2] (Joint Funding Councils' Libraries Review Group, 1993) which emphasised the need for HE libraries to be involved in the development of Information and Communication Technologies. The projects are funded by the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils and fall into a number of broad areas, such as access to networked resources, electronic journals, on-demand publishing and digitisation.

Phases 1 and 2 of eLib saw the funding of approximately 60 projects, and in 1997 eLib Phase 3 was announced to consolidate the learning of earlier projects by developing four main approaches: hybrid libraries, large scale resource discovery (clumps), digital preservation, and the development of earlier projects into services.

The hybrid library projects aim to integrate access to electronic data with access to existing data held in a traditional manner, e.g. the book stock, whereas the clumps projects are based on the need to aid discovery and increase access to the vast scholarly bibliographic resources available to the Higher Education. The hybrid library projects take a variety of approaches - subject, technical, and user-oriented; there are 5 hybrid library projects[3]:AGORA, BUILDER, MALIBU, HYLIFE and HEADLINE.

The 'Clumps'

A 'clump' is a term that was coined at the 3rd MODELS (Moving to Distributed Environments for Library Services) Workshop[4] to describe an aggregation of library catalogues. The clump may be 'physical' – in traditional terminology a union catalogue, such as COPAC[5] (the CURL OPAC) or the BLCMP union catalogue – or it may be 'virtual', being created at the time of searching. All the eLib clumps are virtual electronic clumps using Z39.50 technology.

There are four clump projects, all of which commenced at the beginning of 1998; three are regionally based and one is subject based, covering the whole of the UK:

CAIRNS: Co-operative Academic Information Retrieval Network for Scotland

M25 Link (covering the London area)

Music Libraries Online (UK-wide)

RIDING: Z39.50 Gateway to Yorkshire Libraries.

Technical Issues

All four clumps are utilising the Z39.50 information retrieval protocol[6] for their basic virtual catalogue service. In the case of Music Libraries Online and RIDING, software developed by Fretwell-Downing Informatics[7] is being used, while CAIRNS and M25 Link are developing their own solutions.

Z39.50 is a standard protocol for retrieval of data from networked computers; it has been available since 1988, and has been used almost exclusively for bibliographic data, usually MARC catalogue records. It works in the standard client-server manner although the terminology is slightly different (client = 'origin', 'server' = target) as the standard was developed before wide use of client-server technology. Software suppliers of online library catalogues (OPACs) are beginning to include Z39.50 targets as part of their library management systems, and current Z39.50 clients normally support simultaneous searching of multiple targets so that, in theory, it should be possible to conduct a search of several different OPACs at the same time, no matter what library system is used by the target. A user will no longer have to access each OPAC separately and learn a different user interface for each one.

Unfortunately, in practice, interoperability between different library systems is not so easy, despite the use of Z39.50. The standard is 'flexible' and has been interpreted in a number of different ways by software suppliers, so much of the technical efforts of the clump projects are being directed towards obtaining reasonable results for Z-searches of their target OPACs. Use of Z39.50 is fairly new to most of the libraries and their systems teams in the UK, and understanding of the standard varies widely. Full documentation is scarce and even where the Z-target settings are configurable by the library concerned, in general staff do not have appropriate experience or knowledge.

Differing cataloguing practices between libraries are also highlighted by the use of Z-searching, and not all information about an item is actually held in the same fields in MARC records or indeed in the catalogue at all - for instance, availability information (i.e. is an item out on loan) and holdings information (what issues of a journal are held) are not necessarily available to a Z-search - so attempts to use Z39.50 for detailed searches of all OPACs are just not possible at the moment. However, it is very useful to be able to search multiple library catalogues with just one command, so despite a number of drawbacks, Z-searching offers the user a rapid method of locating an item.

Service Issues

Although the technical issues of clumping revolve around use of the Z39.50 protocol and all its attendant problems, there is a great deal more to clumping than at first may meet the eye. All the clumps have aims beyond the immediate building of Z39.50 gateways to their library catalogues.

Service issues are of particular importance and the clumps are encouraging the extension of collaboration between libraries, both academic and public sector institutions. The use of virtual union catalogues of the type that the clump projects are creating, and the accompanying opening up of resources to greater numbers will inevitably lead to increased demand on the libraries themselves. Users will be able to discover material in a much quicker and easier way than in the past, and find out where this material is located. In many cases they may wish to travel to consult the material rather than order by inter-library loan. Clumping projects aim to improve co-operative working between libraries, resulting in new service agreements, and the development of costing models for collaborative options.

Each clump project has a slightly different approach to collaboration, and in all cases it is based on some type of existing arrangement, whether formal or informal. The projects are not only increasing collaboration between existing partners but also involving new partners from academic and public sectors.

CAIRNS

The CAIRNS Project[8] is able to build on a solid foundation of co-operation and collaboration of libraries within Scotland which have worked together for some years under the auspices of SCURL (the Scottish Confederation of University and Research Libraries); SCURL includes academic libraries and the largest public libraries in Scotland. The SCURL IT Advisory Group has been a focus for SCURL system librarians to discuss a clumps-type approach to SCURL catalogues, and the CAIRNS Project has provided the opportunity to kick-start the process of integrating SCURL catalogues and information services with each other, and with significant resources elsewhere, supporting the SCURL commitment to cost-effectiveness through co-operation and resource sharing.

Collaborative work by CAIRNS operates on several levels, in addition to maximising support for the project from the network of relationships already established within Scottish libraries. The CAIRNS Consortium consists of 16 libraries who provide input to the project via groups of specialist librarians. The project activities have included collaborative work on testing interoperability, the development of a formal evaluation process, and the hosting of Project Awareness sessions to establish a dialogue with a broad section of the library community within Scotland, including the public libraries. An organisation called 'Friends of CAIRNS' has been established to act as a conduit to disseminate project information to bodies external to CAIRNS, and to provide feedback into the project; its membership includes representatives from Colleges of Higher Education and Public Libraries.

M25 Link

The M25 Link Project[9] is an initiative of the M25 Consortium of Higher Education Libraries. The Consortium was established in 1993 to foster co-operation between member institutions in the London region, and it now has 39 members in the area roughly bounded by the M25 motorway. It has undertaken a number of initiatives, including:

M25 Web Guide: This is an award winning guide to information on the libraries of the M25 Consortium; it provides three categories of library information: geographical (location, contact details, travel directions); subject (in which the library has sizeable or important collections); and access (opening hours, term dates etc.). Users can search for libraries having their chosen subject in a particular area of London and then link directly to the OPACs to continue a detailed search.

M25 Access Scheme: In 1996 the M25 Consortium agreed an M25-wide scheme to give free reference access to permanent academic and research staff. This replaced a number of more local agreements and has recently been extended to include research students. The scheme operates with its own ID card, and full details are on the Web Guide.

Staff Development: The M25 Consortium set up a Staff Development Group in 1996, which organises a number of events throughout the year aimed at encouraging library staff to receive training and to discuss issues. Examples include disaster planning, CD-ROM networking, the London Metropolitan Area Network, and the Dearing Report. A number of ad hoc working parties have met to investigate and report on topics identified by the M25 Consortium as important and worth addressing on a co-operative basis. An example of this has been the negotiation of special deals with suppliers for serials and CD-ROMs.

The M25 Link Project is building on the success of the Web Guide and is creating a dynamic virtual union catalogue of five of the M25 libraries' OPACs, with the long-term aim of including all M25 institutions in the service.

Music Libraries Online

Music Libraries Online[10] involves nine music conservatoire libraries across the UK, plus representatives of the Performing Arts Data Service, EARL (the UK consortium for public library networking), and

university music department libraries. All nine conservatoires, and other members of the Project's Steering Group, are active members of the International Association of Music Libraries (IAML), and have been for many years. Collaboration on both formal and informal bases is an essential part of the work of the libraries, and they have always formed a close-knit professional team. Prior to the establishment of the MLO Project, they met formally once a year and informal smaller special interest groups met more frequently. Many of the Music Libraries Online Project members have a history of previous successful collaboration on projects, including the Music LIP (Library and Information Plan) and the SIRSI Music Users+ Group UK.

The MLO Project conservatoire libraries hold an incomparable set of resources for both performance and research, and there is currently no national database fulfilling the need for rapid tracing of music resources. Among the Project's early priorities are agreements over the use of MARC and AACR2 for cataloguing music resources, and the establishment of core information for display and searching of such information. Part of this activity has been the creation of a set of bibliographic attributes specifically for music that the Z39.50 Implementors Group[11] has formally accepted as an addition to the standard.

RIDING

The RIDING Project[12] consortium covers the Yorkshire and Humberside region in the north of England, with nine university libraries, one public library, and the British Library Document Supply Centre as consortium members. In 1993 the vice-chancellors of the Yorkshire and Humberside universities set up the Yorkshire and Humberside Universities' Association[13] (YHUA) to promote and extend the universities' contribution to regional development, and this organisation, through its Information Systems and Services Committee, supports the RIDING Project.

As well as regional co-operation between the Yorkshire and Humberside universities generally, university libraries have traditionally collaborated in a number of spheres. There are local, regional and 'area' reciprocal access and borrowing agreements between libraries, involving all types of libraries: academic, public, government, and commercial. For example, the Sheffield area has one of the oldest co-operative schemes in the country - SINTO[14] - which dates back to the 1932. The 'new' universities (former polytechnics) in Yorkshire and Humberside have their own co-operative borrowing and access scheme, and the majority of the 'old' universities in the region have a similar scheme, as well as local agreements with specific institutions.

However, the proliferation of such schemes and local agreements is complicated and confusing for library users, particularly as the operation of the schemes varies considerably. RIDING aims to work towards replacing and augmenting these schemes by a general reciprocal agreement that covers *all* the RIDING members, thus harmonising the situation. The RIDING Access Policy provides free access to staff and accredited researchers and provides entitlement to borrowing in all academic libraries of the consortium, with special arrangements for borrowing by public library members.

The RIDING Gateway software includes an inter-library loan system, so users are able to search for items using the Z-searching facility and order them (through mediation by library staff) via the same web interface. This promotes inter-lending between RIDING members for items not available from the British Library Document Supply Service. Some restricted access databases, e.g. Inside Information, will be made available at the Gateway for use by RIDING members only. Access to the RIDING Gateway and its search facilities is free but value-added services such as inter-library loan are available only to RIDING members, and authentication is required at this point.

Finally, the RIDING Project has developed a scheme for describing collections of materials in a standard manner, to aid searching of our target databases and to open up the region's library resources in general. RIDING libraries hold some collections of regional and national importance, such as the Porton Collection of items of Jewish history held by Leeds Library and Information Service, and the National Fairground Archive at the University of Sheffield. This scheme is based on the work of a national

working group on Collection Description[15], and is drawing on the expertise of RIDING members as well as other eLib projects.

Conclusion

As well as supporting and promoting collaboration between their member institutions, clumps undertake a great deal of collaborative activity between themselves, an example of which is this paper. Meetings and events with other clumps personnel, other eLib projects and similar international projects take place regularly, and the clumps will be testing Z395.50 interoperability between themselves when their services are fully operational.

So, in conclusion it can be seen that the clumps projects are driving forward existing co-operation between libraries in the academic and non-academic sectors in the UK, as well as developing new scenarios for collaboration. The technical basis of the clumps services is acting as a catalyst for wider collaboration which will lead to changes in organisational and working practices. This mirrors other developments in UK higher education, such as the increase of distance learning courses and the promotion of life-long learning, that are opening up access to more and different sections of the population. The inclusion of public sector libraries in these projects is an additional exciting opportunity to make our resources more widely available.

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Viikki Virtual Infocentre - an Integrated Information Workstation

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Abstract

The Viikki Infocentre will be located on the Viikki Campus in Helsinki. It will be a modern learning environment offering library and information services, study rooms and learning facilities, computer and network services and administrative campus services to students and researchers. A good guiding system and a clear user interface are essential for the effective use of all these services. Clients will need guidance in the navigation both in the physical building and in the huge information cyberspace. This paper describes the electronic guiding system and discusses the challenges and rewards in the development of the virtual learning environment.

Introduction

The amount of retrievable information has grown tremendously. It has become more difficult to locate relevant information quickly. Students and researches often lack the skills necessary to succeed in the rapidly changing information environment. Information seekers are faced with an information overload and they are easily overwhelmed. Therefore it is essential to provide clients with tools which help them to locate, read, process, and publish electronic information. Students and researches need support from information management professionals throughout the whole process of research, from the formulation of a research problem to the dissemination of the results. Libraries are faced with new challenges when they try to develop their services to meet the needs of their clients. One interesting example of the services is the Advanced Information Workstation developed at the Koninklijke Bibliotheek, the National Library of the Netherlands (1).

Users of the electronic services are not dependent on opening hours or location, therefore web services are especially suitable for remote users. Electronic services cannot completely replace face to face contacts with human beings. However, the more there are useful tools and guides available on the web, the more time information management professionals can devote to other services, e.g. personal counseling of the clients who have challenging questions.

Viikki Infocentre

Viikki is one of the four campuses of the University of Helsinki. The Faculty of Agriculture and Forestry and the Department of Biosciences and the Department of Pharmacy of the Faculty of Science are located on the Viikki Campus. In a few years the Home Economics Section and the Textiles, Clothing, and Craft Design section of the Faculty of Education will move to the Viikki Campus, too.

The Viikki Infocentre Building will be completed in the summer of 1999. It will be a many-sided and stimulating learning environment offering library and information services, study rooms and learning facilities, computer and network services and administrative campus services to students and researchers. The service providers at the Viikki Infocentre are

- Viikki Science Library, University of Helsinki

- Viikki Library, a branch of the Helsinki City Library

- The Student Affairs Office of the Faculty of Agriculture and Forestry

- The Administration of the Faculty of Agriculture and Forestry

- The Administration of the Viikki Campus

Viikki Science Library is the biggest service provider at the Viikki Infocentre. Subject areas of the Viikki Science Library are agriculture, food, forestry, home economics, consumer research, textiles, clothing and craft design, education, biosciences and biotechnology, ecology, systematics and environment, pharmacy, and general science. The collections and services of the Viikki Science Library are available to everyone.

Viikki Virtual Infocentre

The Viikki Virtual Infocentre consists of two interlinked parts: the guiding system of the building and the user interface to library's networked resources providing users with easy access to a range of systems and services. The virtual infocentre integrates electronic information services into a broader electronic learning environment and the infocentre functions as a facilitator in an information landscape. The Viikki Virtual Infocentre will be available in Finnish, English, and Swedish.

The guiding system of the building

1.1. The three dimensional model

The three dimensional model is based on VRML (Virtual Reality Modeling Language) and WWW technology. In the model the user can move virtually in the building using floor plans. There is access to the online catalogues of the academic library and the city library and other electronic information services via links in the VRML model or from a separate WWW page. In practice this is done by linking the objects of the model (e.g. computers) to appropriate WWW pages. The VRML model can be used both in the building and on the web.

The application runs in a WWW browser with an additional plug-in component (Cosmo Player) for VRML. There are certain minimum requirements for the PCs which can run the virtual model. Therefore it cannot be viewed by the users of older PCs.

1.2. The two dimensional map and the service directory

The two dimensional map provides another type of navigational tool for the visitors. Users can pinpoint on the map where areas or services are located. The two dimensional map can be viewed also by those whose PCs cannot run the three dimensional model.

The guiding system of the information resources: "From Information to Publication" Interface

The interface provides access to information resources, training material, and guides on the use of

information retrieval and editing systems, and software which is needed when pieces of information are worked up into a publication. This helps students in their studies and teachers and researhers when they prepare course material and publications.

"From Information to Publication" Interface consists of six elements. The elements are presented in the figure 1.

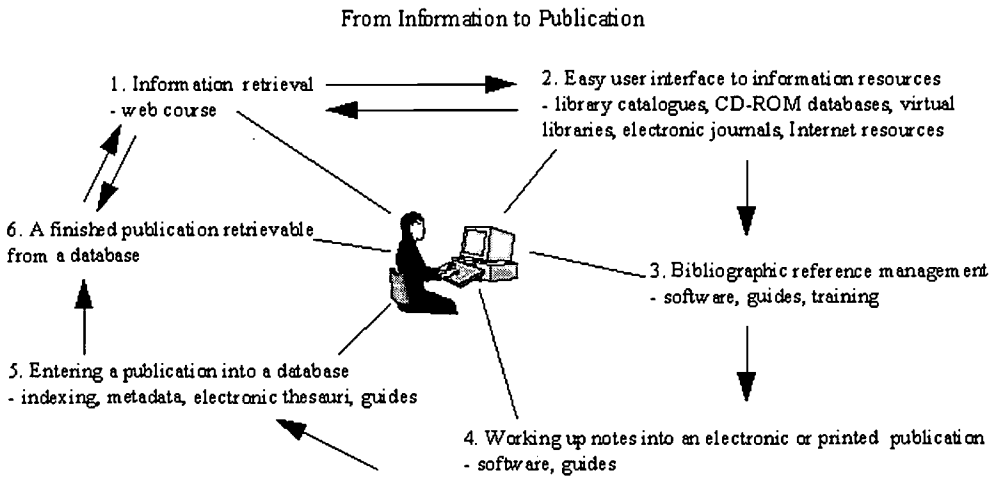

Figure 1. From Information to Publication Interface

1. Information Retrieval

The online course provides students and researchers with the skills they need to use information resources and searching tools efficiently and reliably. A web course on information retrieval and information resources has been used at the Faculty of Agriculture and Forestry since the autumn 1996. New disciplines will be included into the web course (biosciences and pharmacy). Also the geographical scope of the course will broaden because other libraries of the NOVA University (The Nordic Forestry, Veterinary and Agricultural University) will adopt the course and provide material on their national databases. The existing course material is translated into English.

The web course consists of the following parts:

1) course material

2) exercises

3) programme for allotment of questions

4) student and credit register

5) programme for registration for courses and exams

6) learner support, assessment, and feedback

Feedback from students has proven that the web course is very useful although it is quite challenging and requires much more work than on-class courses.

2. Information Resources

Information resources include library catalogues, reference databases, electronic journals, virtual libraries, and Internet resources.

There is a huge amount of information resources available and this can be confusing. It is not easy to group and present them clearly. Different users need different ways to access information resources, e.g. there are university students and staff who have access to all the licensed resources and there are remote users who only have access to the public domain resources which are freely available to everyone.

Also on-campus users need tailored services because there are several disciplines on the campus. Information resources are grouped by disciplines in order to make it easier to locate relevant resources. A searchable catalogue of databases which includes e.g. descriptions, keywords, dates of coverage, and update frequency of available electronic information resources will offer an alternative way to look for information resources.

3. Bibliographic Reference Management

A network license of a bibliographic reference management programme will be available on the Viikki Campus Local Area Network. The software helps users to search, sort, and print citations in a variety of ways. Guides on the use of the software will be provided.

4. Preparing an Electronic or Printed Publication

This module includes

Software: word processors like Word, and web and graphics editors, e.g. Netscape Gold, Corel, and PaintShopPro. These tools are provided via the Viikki Campus Local Area Network.

Guides on using word processing and web editing software.

Manuals for writers of term papers, theses, dissertations and other academic publications. Most departments and publication series have their own guidelines. Therefore, it is useful for the students and researches to have all the manuals collected into one place. Manuals can be either printed or electronic, and when possible, they are converted into PDF or HTML format.

The University of Helsinki has projects on electronic publishing (2, 3) which provide guides and consultation for researches, teachers, and students. These guides will be linked into our interface.

5. Entering a Publication into a Database

Authors and the library staff need tools for indexing and classification.

1) The electronic thesaurus, Agrisanasto, has already been publicly available on the web for a few years. It is a tool both for indexing and for information retrieval.

2) The indexing guide is a tool for writers and the library staff.

Authors can provide their publications with keywords derived from the electronic thesaurus. Bibliographic references are entered into the reference databases (HELKA, Linda, Agri, Forestree, Agris) by the library staff.

Authors will themselves produce metadata for their HTML documents by using Dublin Core Metadata Template (4). Guides on how to include metadata into electronic publications will be collected and produced. Some of the electronic publications will be stored by the projects on electronic publication at the University of Helsinki (2,3).

6. An End Product Retrievable from a Database

The cycle closes when a finished publication is searchable in a database or on the web. An information seeker finds the publication easily because it is provided with sufficient metadata and because she/he has

learned efficient information retrieval skills.

Conclusions

Because funding is always a problem students do not have enough PCs available. Many users still have PCs which are not powerful enough for the proper use the VRML model. Also a plug-in is needed in order to view the VRML model. Some clients might not be motivated enough to download the plug-in although it is available free of charge on the web.

It is very challenging to create a clear user interface when so many information resources are available and users are heterogenous. Information resources have to be presented differently for different users. We have e.g. students and researches of the University of Helsinki who have access to all our resources and we also have users who come outside the university and who have access to considerably fewer resources.

We still have not reached our goal where users could access electronic information and resources from a single interface. Although we do not have a truly user friendly interface to access all the information resources, at least we have collected them into one place, so that clients know which resources are available and they have one starting point in the information landscape. Many of the problems cannot be solved by the library alone. This work requires cooperation between various organizations and information providers.

Feedback from users indicates that there is clearly a need for a wider range of electronic services.

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The ELISE II Project, A Digital Image Library for Europe

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Abstract

This paper describes the progress made under the ELISE II electronic image library project from a technical standpoint. The Elise II project is a European-wide initiative which aims to provide a comprehensive electronic image library service for Europe. It is funded under the European Commission, DG XIII-E, Telematics for Libraries' initiative.

Introduction

The ELISE project has developed a comprehensive JAVA based demonstration system which provides controlled access to images and associated textual information. Eight of the partners are providing a variety of image data to the imagebank including still images, and streaming video. At the time of writing, there are over 30,000 images available on the set of demonstration databases.

The system is composed of four component parts :

- A JAVA client which runs on the users web-browser and allows access to the system.
- A Broker, based on JAVA servlet technology
- A set of distributed, non-compatible image databases located all over Europe.

The major design emphasis in the development of the ELISE system was on flexibility with the ability to easily add additional databases to the system being of paramount importance. It was decided to utilise a combination of tried and tested library technology to integrate the databases so that the design team could concentrate their efforts on designing the user interface and broker architecture which relies on less mature technology.

Overall System Architecture

The architecture of the ELISE II system is as shown in figure 1, the JAVA GUI client communicates with the broker via the web, the broker, which is a JAVA servlet, communicates with the image databases. Two separate protocols are used for this communication, the searching is done using the Z39.50 protocol which allows us to perform simultaneous searches on multiple databases. The images themselves are returned using the HTTPS protocol via a standard web server such as Apache™. This communication is at present, in clear, however experiments have been done to utilise SSL to encrypt the data.

The architecture of the system is such that the component parts of it may be widely distributed, this is in fact the case, in the current version of the system, the Broker servlet runs on a machine in the UK and the Database Image Server (DBIS) is located in Tilburg in the Netherlands. With the benefit of hindsight, the development of the system in this fashion, while it made perfect sense at the time, has resulted in performance difficulties. The network links between the institutions are insufficiently fast to provide the user with the performance one usually expects from a web based system.

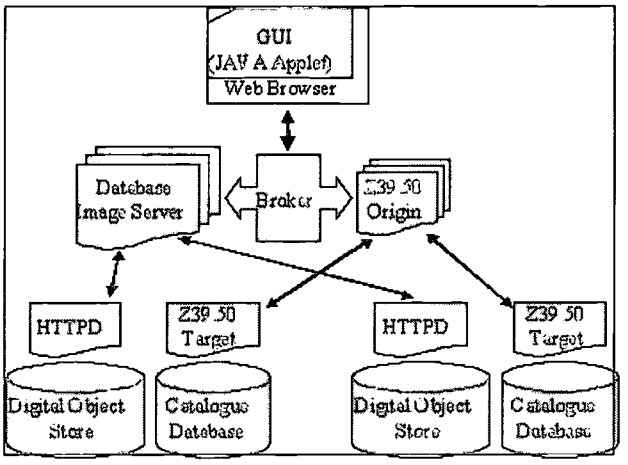

Figure 1 Overall ELISE System Architecture

The reason for this is that all the data delivered to the user must pass through the broker for security reasons. By doing this, it is possible to secure the online databases from external interference as they can only be accesses via the broker, despite the fact that they are available over the web.
If a user in Ireland, retrieves an image from Ireland, the image travels from Ireland to the UK to The Netherlands, back to the UK and then back to the user in Ireland. The simple solution to this is to implement local brokers at the main sites in each country, this has proved effective in the UK and will be implemented in Ireland in the near future.

Z39.50 and Dublin Core

The use of the Z39.50 protocol and Dublin core was a pragmatic decision based on the need for a straightforward means of adding multiple databases at some time in the future.

The Dublin Core metadata standard is a simple yet effective element set for describing a wide range of networked resources. The Dublin Core standard comprises fifteen elements, the semantics of which have been established by an international, group of professionals from librarianship, computer science and the museum community.

The Dublin core specifies (but does not dictate) a standard set of database fields onto which new databases may be mapped. For example, in the case of the RTE database the RTE field "Photographer" is mapped onto the Dublin core field "Creator". Using the Dublin core in this way, allows us to provide a potential database provider with a standard set of fields which he can map to his own database. Table 1 shows an example of how this was accomplished for the HUNT and RTE databases.

Dublin Core Field	HUNT Field	RTE Field
Title	Title	Title
Creator		Photographer
Subject	Associations	Keywords AND Personality
Description	Brief Description	Description
Publisher	"HUNT"	"RTE"
Date	Date	Date
Type	"IMAGE"	"IMAGE"
Format	"JPEG" OR "GIF"	"JPEG" OR "GIF"
Identifier	CD_Num/Image_Num	REF_Num/Image_Num
Source		Source
Coverage		Place
Rights		Copyright Owner

Table 1 Dublin Core to HUNT and RTE Database Mappings

In order to format search queries in a standard fashion, the Z39.50 library database search protocol was used, this is layered on top of a more generic search language which is similar to SQL. There are therefore various possibilities for searching a new database. If a standard Z39.50 target is available for the database, then it is automatically searchable. If not, then it is possible to write a thin layer which translates the generic search language into a form which is understood by the new database.

The advantage of Z39.50 over standard web search protocols is that it is stateful, that is to say that it is capable of maintaining a record of previous sessions, and therefore allows a user to take up where he left off. It is also unique in that it supports parallel searching of multiple databases, this is of particular interest in the case of ELISE as there are potentially large numbers of databases accessible to the system and the search protocol is capable of searching all of them, or a subset of them simultaneously.

The architectural model that Z39.50 uses is as follows; a server communicates with one or more databases containing records. Associated with each database are a set of indices that can be used for searching. Thus Z39.50 provides an abstract view of the databases and allows us to deal with logical entities based on the kind of information that is stored in them, while ignoring the minutiae of specific database implementations.

The Z39.50 origin standard allows the user to transmit a search to the server (SEARCH request) this produces a result set which is maintained on the server; the result of a search which is transmitted to the client is a report of the number of records comprising the result set, result sets can be manipulated by subsequent searches.

Records from the result set can be subsequently retrieved by the client using PRESENT requests. The PRESENT request offers elaborate options for controlling the contents and format of the records that are returned. The PRESENT request indicates specifically which records from the result set are to be retrieved.

The standard supports the transfer of large amounts of data, however it is not a particularly efficient way of doing this and therefore in the case of the ELISE system, the PRESENT request returns a reference to the broker which allows it to retrieve images via a standard web server.

Implementation of the GUI Client

When this project was initially conceived, JAVA technology was emerging as an obvious choice for client side applications designed to run in a web environment. JAVA is intended to provide the user with a programming language which is truly portable.

The JAVA language does this by defining a virtual machine which is, itself a computing engine. In order to run JAVA on a new machine, in theory all one has to do is to write a JAVA virtual machine for the new physical machine. The JAVA environment provides the user with a rich set of tools for developing web-based information services. The idea of JAVA is excellent and it should provide the user with a stable and portable computing platform. The reality is unfortunately somewhat different.
The failure of software manufacturers to provide a fully standardised run-time environment for JAVA makes the development of truly portable JAVA applets something of a challenge. The development team in the ELISE project has had an extremely difficult task writing the client for the system. The decision to use JAVA is regretted by all of the development team, the effort which was required was far in excess of what was budgeted for.

Most of the problems encountered by the developers have been related to instability and incompatibilities in the Netscape and Internet Explorer JAVA platforms, though a secondary consideration is that JAVA programming is a very marketable skill and the project had great difficulty in retaining programmers for any length of time.

The net result of this is that the JAVA code which was developed for the GUI has had to be written at a lower level than was initially expected and large amounts of run-time library code has to be downloaded along with the applet in order to allow it to function in both Netscape and Microsoft browser environments. A partial solution to this is the use of the Java Archive facility JAR which allows us to compress the applet into a smaller form for downloading.

A further solution may be the use of a browser plug-in which will be downloaded only once but will provide the platform dependant functionality to the user. This solution is not desirable as it defeats the purpose of using JAVA to some extent. Using a special plug-in means that the system is no longer truly platform independent and could have been developed more easily as a browser plug-in.

Implementation of the broker

The broker is implemented using JAVA™ servlet technology, this is effectively server-side JAVA™ which allows the user to develop portable applications which are ideal for implementing middleware between databases and GUI clients. It was found that the development of this broker was a much easier task than the development of the GUI.

The reasons for this stability seem to lie in the fact that the broker is not doing any graphics or mouse-event handling, it is simply brokering information from the various component parts of the system. In such an application, the use of servlet technology is an ideal solution and provides the developer with a very powerful, flexible and stable means of gluing a distributed system together.

Conclusions

In conclusion, we believe that the JAVA runtime environment is still not stable enough to easily develop complex applets. The competition between manufacturers has led to a situation where an appearance of cooperation between them is actually concealing efforts to kill off competing products. It is to be hoped that this situation will change as the technology is excellent in principle.

The excellence of the basic technology is demonstrated by the broker side of the system which uses a servlet for its implementation. In this case the lack of graphics and mouse event handling made the design and implementation of the system much more straightforward. In a situation where additional functionality has to be added to a web-server which supports servlets, it is a very credible alternative to using cgi scripts.

Under the current circumstances, educators should carefully consider the implications of using this technology to deliver content to desktops in their institutions.

Acknoledements

We would like to thank our partners in the ELISE II project for their assistance in producing this paper.

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Track D: (Paper Abstracts)
Security Issues

Authentication on WWW using smartcards

Coordinating the Swedish admission systems using the Ping-system.

Remote Management of Computing Resources in Academic Institutions with Secure Shell

Security concerns in medium-sized academic institution. An implementation at the University of Las Palmas de G.C.

Security: Policy and Education of Users at the Level of an Institute

Authentication on WWW using smartcards

Ineke Scholten, Jan Bakker
SURFdiensten, The Netherlands

Keywords: smartcard, security, educational licenses

SURFdiensten, a subsidiary of the SURF Foundation, is an intermediair between ICT-providers and Dutch (higher) education and research providing them with ICT-licenses covering a wide range of license levels like the single-copy license and the site-license. Authentication based on smartcard technology is used for access control and tailor made information. When a client requests the application server for information, the application server asks a third party, the authentication server, for authentication of the client. If the client has a valid smartcard for this authentication protocol, access is permitted to the application server which controls the application on data stored in the chip. SURFnet, also a subsidiary of the SURF Foundation, is now developing the authentication service.

Coordinating the Swedish admission systems using the Ping-system

Peter Lundberg.
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At EUNIS-97 we presented the Ping- system as a public interface to the Swedish University admission system using WWW-technology and smart cards" Through 1998 , we have developed and tested the system and it is currently under installation within the LADOK-consortium.

The original paper was presented with the name " Ping: an electronic interface for the Swedish universities" and is available At EUNIS-99 we present Ping as a multi-tier product which allows users an easy and secure access to a large administrative system and makes the coordination of student records from many universities possible.

Remote Management of Computing Resources in Academic Institutions with Secure Shell

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In academic institutions, part of the less critical computer administration is done by part time employees and students. While it is wise to restrict some administration to the physically protected space, some administration can be done remotely. In this paper, we outline some security problems in computer administration and show how the SSH program can be used in securing remote computer administration.

Security concerns in medium-sized academic institution. An implementation at the University of Las Palmas de Gran Canaria

Antonio Ocon-Carreras, Manuel Galan-Moreno, Mario Marrero-Ruiz and Enrique Rubio-Royo
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With the widespread use of Information Technologies in the universities, it has become of most importance to guarantee the integrity and fair use of Information Resources. The security concerns in an academic institution are not the same than those of an ISP or a commercial enterprise. The popularity of Internet, giving easy access to millions of people, has produced an exponential increase in the number of security incidents in our University. Those considerations led us to the initial deployment of a Security Plan, which is based upon the identification of security-sensitive points and the development of adequate standard responses to security breakage scenarios. Finally, the deployment of a full-fledged

firewall policy is under consideration, but faces the special characteristics of an academic institution, in which the use and availability of resources is based in the "mostly open" paradigm.

Security: Policy and Education of Users at the Level of an Institute

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In the present paper we will describe the policy security of the institute and how it has been implemented using a firewall built with cheap PC hardware and free software. We will also describe how the users were educated and their reaction to the establishment of such a policy.

Authentication on WWW using smartcards

Ineke Scholten, Jan Bakker
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The Netherlands

Abstract

Keywords: smartcard, security, educational licenses

SURFdiensten, a subsidiary of the SURF Foundation, is an intermediair between ICT-providers and Dutch (higher) education and research providing them with ICT-licenses covering a wide range of license levels like the single-copy license and the site-license. Authentication based on smartcard technology is used for access control and tailor made information. When a client requests the application server for information, the application server asks a third party, the authentication server, for authentication of the client. If the client has a valid smartcard for this authentication protocol, access is permitted to the application server which controls the application on data stored in the chip. SURFnet, also a subsidiary of the SURF Foundation, is now developing the authentication service.

Introduction

SURFdiensten is a subsidiary company of the SURF Foundation (1), and deals with concluding license agreements with suppliers of software, information services, courseware, hardware, lifeware and other ICT-services. As it presents for this purpose the entire sector (higher) education and research in the Netherlands, it can obtain exceptionally favorable terms. Organizations can then individually choose from the assortment that SURFdiensten has put together. In this way it is possible, for example, for all staff members and students of an educational establishment to obtain user rights for popular software at minimal prices. Partners involved in carrying out the license program are SLBdiensten covering the secondary educational segment and APS IT-diensten for the primary segment.

Slice (3), SURFdiensten Licences Information by Chipcard-available Extranet, is part of the Home Office (2) project and was funded by SURFnet in the SURF-ACE program. In march 1999, 400 cards were unrolled to participating universities and schools to open up tailor made information on their contracts. The cards are based on the regular Dutch student smartcard, the IBM Multi Function Card (4). A pilot was defined to develop an authentication service using this type of smartcard.

Smartcard

The Dutch student smartcard called 'Studentchipkaart' (SCK) conforms with the ISO 7816-1/4 and the ETSI TE9 standards specified by the telecommunications industry. The operating system on the chip is MFC 3.5 with an architecture similar to the architecture of an MS-DOS diskette. This multi-function card is equipped with over 20 security levels, which enables the use of different independent applications. The encryption used is full DES where the keys are shared by the external application and the card. A Card Holder Verification (CHV), a four digit number similar to a Personal Identification Number (PIN) opens up information for external applications. Current functions on the card besides the student card are library pass, (re-chargeable) telephone card, public transportation pass, payments for copying and canteen products and identification for communication with the central organization issuing students grants.

The way the card is used for authentication is done by Implicit Dynamically Secured Application Protocols (IDSAP) (5). If a value of a certain field of the card has to be read in an implicit save way, the field should only be read after CHV control. This can be done in a few steps:

The application, which calls for the data, sends a random number together with the read request. First the card then asks the user for the CHV to ensure the card and the user belongs together. Next a stamp, a Message Authentication Check (MAC) is calculated based on the random number and a key on the field which should be read. The application receives the MAC and the field value, recalculates the stamp and

compares with the received values. The data can be trusted if the two MAC's are identical. The keys are not sent across the net and all cryptographic actions are done inside the card and inside the web server!

ISI

The ISI protocol(6) based on the described IDSAP is developed for the Home Office project by IBM and SURFnet. This protocol consists of a Java applet on the client and a Java applet on the server combined with CGI scripts. Figure 1 shows the equipment necessary for the ISI-protocol.

	Processor	Platform	Additional hardware
Client	Intel	Win95, WIN98	Reader: Towitoko, Dr. Chip, IBM 5948
Server	Intel	NT	Crypto card

Fig.1

The client applet is available for Netscape 4.x and Microsoft Internet Explorer 4.x. The server applet runs on NT 4 servicepack 4 with the Microsoft Internet Server. But the Netscape Fasttrack server works fine too. The server is also provided with Secure Sockets Layer (SSL). The key is the restriction in using the ISI-protocol because only cards equipped with the same key can be used. In the Netherlands each institution has its own key, therefore the server can handle only 'own' smartcards.

Three Party Authentication (TPA)

In the case of an authentication server this server can be provided with a general key in stead of a particular, private key. If the application server can ask an authentication server if the client can be trusted as a secure client, the communication will be handled by three party's. The first one is the client asking for some restricted information. The second is the secured application server (SAS) providing the restricted information. The third party is the authentication server (AS) providing authentication information on the client to the SAS.

Client	PC equipped with browser and reader
SAS	Server with secured application and one authentication key to authenticate itself to the AS
AS	Server, guarding own authentication key, the key of the SAS and the keys of the smartcards

Fig. 2

In Figure 2 the key distribution is shown on the three parties.

The client needs to start a local installed TPA daemon before running a browser. Asking for restricted information starts with providing the CHV in a TPA session sending this information to the SAS. The SAS sends this information with its own key to the AS for authentication control based on additional information read from the smartcard. The AS first checks the key information of the smartcard followed by checking the card information on a 'black list', a list of invalid or unreliable cards. If all checks return ok, the AS sends this signal back to the SAS together with the additional card information. If or the MAC control or the black list control returns not ok the TPA session is aborted. If the SAS receives the authenticated data back another black list control is done there. Again the TPA session will be aborted when the card information is related with a card listed as invalid or unreliable. If both the AS and the SAS return ok, the application is started.

Environment:

	OS	TPA installation	Additional hardware
Client PC	PC WIN95, WIN98	Java Runtime Environment 1.1.6, TPA client software	Towitoko, Dr. Chip Specific reader software
SAS	Pentium II Win NT4, Service pack 4	Java Runtime Environment 1.1.6, TPA SAS software, HTTP daemon	Crypto adapter IBM 4758 PCI Cryptographic Coprocessor
AS	IBM RS/6000 43P-240 AIX 4.3.1	Java Runtime Environment 1.1.6, TPA AS software	Crypto adapter IBM 4758 PCI Cryptographic Coprocessor

Except of the CGI scripts on the SAS all TPA software is written in JAVA. Only the client reader drivers can be written in C and are platform specific. The TPA systems software on both the SAS and the AS is implemented as a daemon listening on a dedicated TCP/IP port.

Slice

The entry to the SURFdiensten database is restricted by the value of the field that holds the card number and the one that holds the BRIN-code, an official code for an educational institution in the Netherlands. The 400 so-called relation cards are checked by the ISI-protocol based on the specific, private SURFdiensten key. To handle requests from clients equipped with non-relation cards but regular student cards the TPA-protocol is necessary to authenticate the client. Extending these regular cards with a purse function each request for restricted information can be followed by a request for payment. If the payment is successful the requested information is sent to the client.

The information is stored in an Oracle database. Based on the card information the application is started. Contract information is shown to institutions on their own participations. Via CGI-BIN scripts the card parameters are passed to an Oracle agent running a specific procedure providing the requested information.

Available topics:

- available licenses by category (license conditions are not necessarily the same for different categories of institutions)
- their own participation's including the products
- new versions of software extended with the possibility to download upgrades
- ordering information and on-line ordering
- license rights for single-copy licenses followed by paying. In near future on-line payment will be introduced
- price lists and calculation models based on available information of numbers of students and staff
- near-future licenses (progress in negotiations will be showed and concepts can be discussed)
- financial information about present participation's
- special offers

Near Future

During 1999 the Slice server (SAS) will be connected to the Authentication Server. The information stored in the SURFdiensten database will become 'available' to cardholders using other student cards

provided with a foreign key. A pilot will be run with the payment function enabled on the card.

Ackowledgements

Connecting all these components caused a lot of struggle and needed a lot of invention. Thanks to Ali Odaci, Arnout Hannink, Marco Buys (all IBM), Rita Groothuizen and Frans Velthuis(RUG), Ester van Heuven and Audrey Visscher (SURFdiensten[7]), they all struggled and invented to get the solution.

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3. Jan Bakker, Ineke Scholten(1998) Slice, educational licenses via the web, EUNIS 98 (143 – 146).
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6. Arjan Koetsier, The ISI-protocol v3.0, 1997, http://www.iscit.surfnet.nl/team/Arjan/homepage/doc7.htm
7. http://www.surfdiensten.nl

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Coordinating the Swedish admission systems using the Ping-system.

Peter Lundberg.

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Abstract

*At EUNIS-97 we presented the Ping- system as a public interface to the Swedish University admission system using WWW-technology and smart cards" Through 1998 , we have developed and tested the system and it is currently under installation within the LADOK-consortium. (Information about LADOK see http://**Error! Bookmark not defined.**)*

*The original paper was presented with the name " Ping: an electronic interface for the Swedish universities" and is available at **Error! Bookmark not defined.**. At EUNIS-99 we present Ping as a multi-tier product which allows users an easy and secure access to a large administrative system and makes the coordination of student records from many universities possible.*

Background

During the 90's, we have seen an increasing need both to coordinate student records and to let students use the Internet to interact with the system. Ping has both the ambition of being one of many answers to the economic necessity of rationalization of the admission process, as well as trying to respond to students expectations of Internet-based services. In the change of paradigm from a *Paper-based* to an *Internet-based* admission system that's taking place we think that Ping can serve a useful purpose.

Short description of LADOK

LADOK is a computer based student admission and documentation system for a university or university college. It focuses on administration of undergraduate and graduate students. The system is locally deployed and managed by the institutions.

The LADOK system has a mutual core, identical for all LADOK system installations in Sweden. The core consists of a structure of database tables, computer programs and terminal screen routines. Every institution decides what parts of the core to be used at the institution and it is also possible to use locally developed addendum's. The LADOK-system can therefore be viewed upon as a large "smorgasbord" where the institution can choose which parts to use.

The LADOK-system consists of two major parts, the admission system and the documentation system. They are integrated and share data, e.g. name, address and other facts about applicants and students. A third part, handling documentation of graduate students, is newly added to the LADOK system core. Undergraduate studies are handled within two major concepts, courses and study programs. The first has its focus on students and single courses and the second of students following a specified study program, normally 3- 4 years study.

The system files contain information for student identification, general eligibility for university studies, admission to courses and study programs, registration on courses per semester, course data, credit points from courses, awarded degrees and international studies.

The LADOK system mainly focuses on student admission and documentation, planning and follow-up. The system is designed to be used by all Swedish state financed institutions of higher education and has its focus on the departmental level. Users of the LADOK system at an institution can be found at all levels:

university board and administration

faculty or school heads

departments

students

Data from LADOK are exported to the ministry of education and other agencies for follow-up purposes. An important objective of LADOK is to prepare the annual invoice to the government for studies on the undergraduate level at an institution.

The LADOK system is owned by a consortium of 49 institutions in higher education in Sweden. Software maintenance for the LADOK system core is conducted by a maintenance group at the University of Umeå. Local system usage is the responsibility of the institution, who pays for servers, networking, terminal equipment and local support.

The system is currently facing a major revision that aims for easier user interface and new functionality including a strong focus on security issues. Today, the system is used by approx. 2.000 simultaneously on-line users but it has to be prepared for a large growth in number of users inside institutions and, of course, there are more than 300.000 students waiting for better service with WWW, touch-tone telephone systems and explicit student applications.

Short description of the Ping-system

In this section we aim to describe the Ping-System as a highly modularized system where the functionality of a transaction is expressed at the "front" (in the client-application) and at the "back" (in the database interface).

The Ping-system is based on the following components.
1. A Java1.1.6 based client

2. An Authentication Server that can authenticate/log calling users, universities and transactions .

3. A Transaction Handler that distribute transactions to different universities and return results.

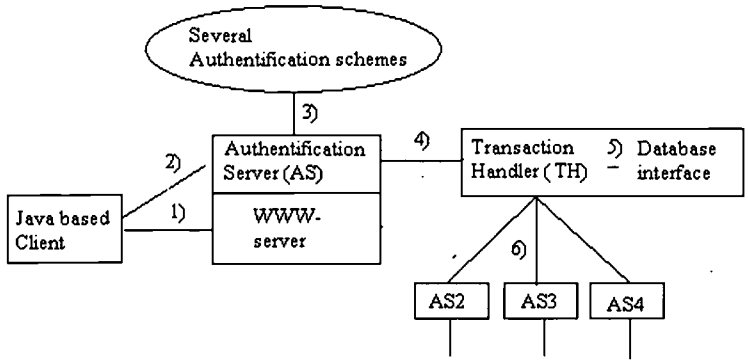
4. A Database interface where each transaction is expressed as a stand-alone component.

Changes from -97

In our paper to EUNIS-97 we had the ambition to focus more on security using smart-cards. Smart-cards has not gained ground in Sweden at the pace we anticipated. Today, we see no obvious economic alternative in the area of smart-cards. Also, we see no major changes in the infrastructure from –97 that would indicate that we are closer to a "grand scale" solution.

A View of the system

In the following sections we will present the different components more in detail. Graphically the system can be illustrated like this:



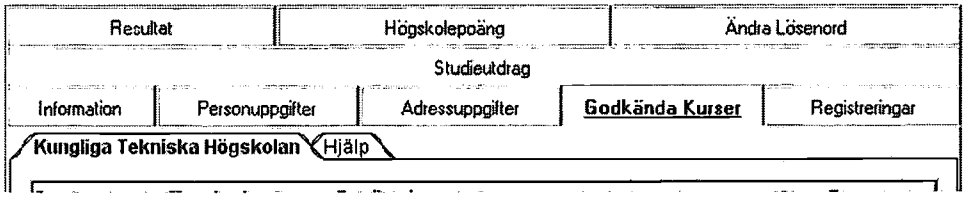
In the figure above we see 1) the client application that loads into a web-page using either normal or secure http-protocol. The next step is that the client contacts its Authentication-Server using TCP/IP protocol. 2) Ping uses DES and RSA-encryption to ensure a secure connection and a user can log on to the system using one of several authentication schemes. 3). When a logon has been performed certain services are loaded to the Java-applet depending on the users category. When a transaction has been sent from the client, it is authenticated by the Authentication Server and sent 4) to the Transaction Handler. Depending on the configuration in the Authentication Server the transaction is sent to the systems own database 5) or in parallel to the systems of other universities 6). To be noted is that **a:** all components communicate with each other using the same protocol and **b:** all components use threads which means that performance is more or less the same no matter how many universities that are connected to the system.

Modules

In the following sections we will describe the modules outlined above in a little more detail. We save some of the more technical issues to a special section.

The Client-program

The entire client is designed as a Java-Applet. When the user is logged on he/she is given a series of services presented as tabs. (shown below)



When the user clicks on a tab a transaction is sent to the Authentication Server and the result is presented as one or more sub-tabs. One sub-tab is shown for each university that is being called and one help-tab (Hjälp) that is always shown. Above we see "Course results" for a student at the Royal Institute of Technology" in Stockholm. Some transactions require input, in those cases the tab is shown to the user to enable input and the tab has an "OK" button. For non-complex transactions the only actual coding that has to be done is to design the tab and to separate the answers to designated data-fields.

The Authentification-server

The Authentication Server is the real heart in the system, it authenticates users as described above and transactions using a configuration file, so adding a new transaction doesn't mean that a lot of programming has to be done at this stage in the process either. In the configuration file we have extensive possibilities to filter out unwanted communication and unwanted transactions.

The system also uses a second file with public RSA-keys and a third containing secret keys and the password used to encrypt the communication between Authentication Server and Transaction Handler. The Authentication Server can use several authentication schemes, (see separate section) and has a built-in scheduler for reoccurring tasks. Examples of these are; checking clients for idle-timeouts, checking for the presence of other Authentication Servers and doing system checkup. The Authentication Server has two log-files, for ordinary traffic and errors but if it from any reason becomes worried it can always send a mail to its operator. The system has an administrative user who can (using the same user interface) start and stop the system and gather statistic data from the log files.

The Transaction-handler

The Transaction Handler has a much simpler task at hand then the Authentication Server. It accepts input from only one address, and uses the same technique as the Authentication Server to distribute the transaction to available universities. Unwanted attempts of access is logged and the system can always alert its operator if it finds itself under attack. Ping uses the transaction number to find out which software component to execute and has access to the same configuration files as the Authentication Server.

The Database-interface

When we designed Ping we wanted to build the system as modular as possible, one of the choices that we made was to use UNIFACE to build components to interface the to the database. This has enabled us to add or change transactions to the system without making changes in any other component of the system.

Authentification schemes

Today Ping has three different authentication schemes. When the Authentication Server is started the command-line parameter "aut_sys" is set to the values "standard", "CATS" or "extra". "Standard" is a local database with user-id and passwords in a traditional style. The only things that we have added is entry and expire-date plus user-category. "CATS" is an acronym for Central AuthenTication Server. This server is the result of a very recent cooperation between the Ladok-unit and the national Post office which want to develop a national authentication service for all Swedish students.

The purpose of the system is to facilitate the student's change of address using a internet based system. This work is very interesting but has not yet been incorporated in the other Ladok-products. "Extra" means that the local installation uses an authentication system of their own choice. This way we feel that we have "all bases covered".

Functionality

Today Ping has functionality to provide basic student access to a local LADOK installation and can present results to a student using a secure connection. We also have a possibility for the student to extract transcripts from the system. The transcripts have an electronic seal printed on them and can be verified by anyone using Internet. On a special web-page one would input the students personal-id plus the seal and then the original document can be retrieved from the database.

For an admission officer, Ping can provide data about a person in a coordinated way so that a complete picture of all results from all connected universities are shown, which we will show in the examples below. Ping can also be used to gather basic information about a student to present a more complete picture before the admission process starts.

The CATS-system is expected to start on May 1:st and it is supposed to contain at least 300 000 students at that point. At that time Ping with CATS will be a strong system for delivering data to students.

Some Technical issues

In this paper we have talked about an Authentication Server and a Transaction Handler. Actually these two components are the same program. They are just started with different parameters and perform different tasks. The system uses threads for maximum performance and the average time for a transaction is well below a second. Actually almost all of the time-consuming work is being performed in the Java-client.

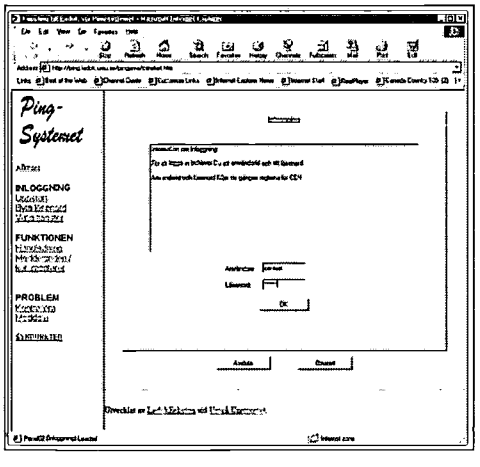
The system is developed in ANSI C on Windows NT but all components can run on the Unix- flavors of HP, SUN- and DEC-. This is with the exception of the authentication scheme "Standard" which is NT-specific. The java-applet is not compulsory, a html client with forms can be used, but then we will have to use a "helper-program" on the server instead. The database interface can be replaced by any kind of components.

Level of installation

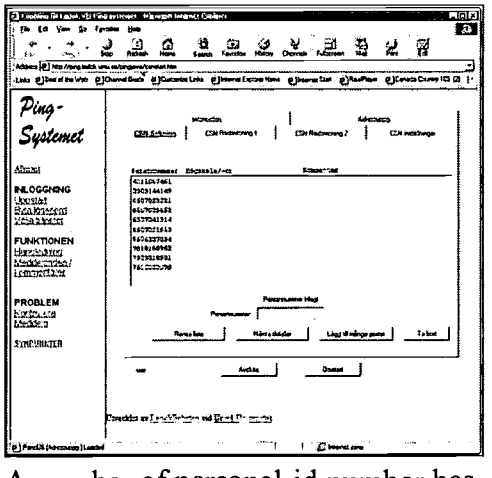
At EUNIS –98 in Prague Ulrich Kammerer held a much appreciated presentation concerning "Islands, Volcanoes and Dinosaurs". We have had to deal with much of similar problems during the year of –98. Unfortunately we have not been able to install the system in as many universities as we have wanted, but at the present day (99-03-14) the system is installed in eleven universities and by the time of the presentation we hope that the number is significantly higher. Also, there has been problems in the final testing of the system. Testing a distributed system such as Ping has led us to some interesting (and hopefully unique) situations.

Examples

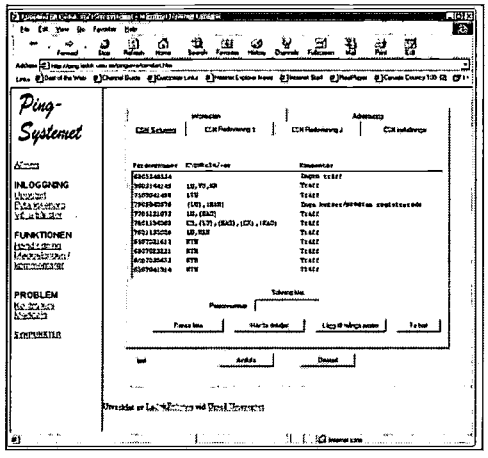
In this section we will show some examples of what the system looks like. Hopefully it will also illustrate some of the issues discussed in the section "The Client Program" We illustrate the system with a number of tabs developed for the National Bureau of Loans and Grants.



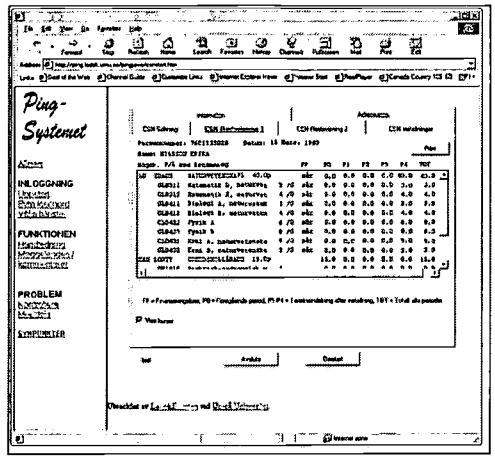
The java-Client has been loaded and the user can log on



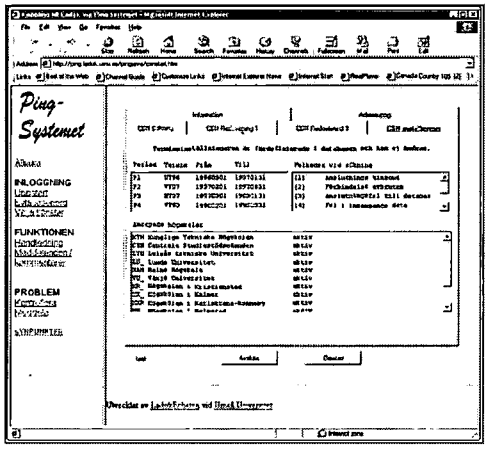
A number of personal-id number has been fed to the system which is ready to start a search



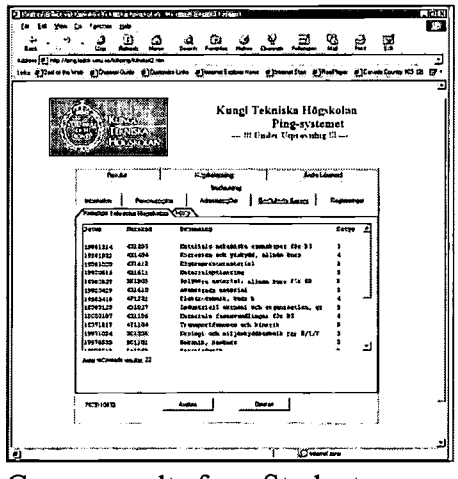
Ping shows which universities that have results for the different persons



We choose one person and examine her results. (from two universities)



Ping can report its system settings



Course results for a Student

Summary / Future plans

In this paper we have presented the Ping-System as a generic system to give a large number of users safe access to a large administrative system. To develop transactions all that has to be done is to develop the front and back-end. Ping will handle the rest.

During the spring of –99 we hope that we will have a national acceptance of Ping as an instrument for coordinating the different LADOK-databases. There are still battles to fight and victories to win. However we feel confident that time is in our favor.

The LADOK consortium has not yet discussed the possibility of licensing the software to other countries, but as I see it, there are some extremely interesting tasks that lie ahead, some of them can be approached with Ping.

Remote Management of Computing Resources in Academic Institutions with Secure Shell

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Abstract

In academic institutions, part of the less critical computer administration is done by part time employees and students. While it is wise to restrict some administration to the physically protected space, some administration can be done remotely. In this paper, we outline some security problems in computer administration and show how the SSH program can be used in securing remote computer administration.

Introduction

One of the main tasks of the computer administration is to ensure that the computing environment is secure. Computers need to be protected against intruders, that possibly hinder the normal operations of the computer. Also the information stored in the computer system has to be protected against attackers that possibly want to steal, destroy, or alter the information. It is obvious that with administrator privileges, intruders can make maximal damage and possibly also hide their tracks. In order to avoid this, it is customary to limit administrative access to the certain terminals that are in the physically protected space. However there are lots of less critical computer administration that is often taken care by part time employees and students. These administrators can't always enter the protected space to make the administration. In some cases it's also either impossible or too expensive to assign part time employee with an office and dedicated hardware for computer administration. In these cases remote administration may be an option.

Security Problems

There are obvious security problems in computer administration. Administrators create new user accounts, set privileges for other users and handle awkward situations, user account has expired or password has been lost. Potential intruder would be very interested in doing all this. In addition, he wants to cover his tracks as well as possible.

In fact most of the intrusions are done "from inside". What this means, is that the intruder doesn't usually really penetrate firewalls and crack into the system from outside, but instead he already has an user account somewhere within the network. In the attack, the intruder simply attempts to take over some other user's credentials. System administrator's credentials are very tempting target for this kind of an attack.

The attacker that already is the part of the organization itself can prepare his attacks in various ways. He can eavesdrop the network. He can "accidentally" try to log in as another user. And he can systematically gather data, that outsider would simply have to guess. All this is even many times easier, if the attacker has a physical access to the network - and usually he has.

If computers are administered via remote connection, some of the opportunities that only user's within the organization have are available also for people in the outside. Actually this doesn't necessarily require administrative access from the outside. In most of the cases any access is enough. We have to remember that computer cracking can be done and is usually done step by step. First, the intruder tries to get into the system as a normal user, only after then he tries to grab administrative privileges by one way or another.

Almost all computer systems in big organizations provide some kind of access from outside network. In business world this access may be strictly limited or even totally forbidden but in the academic institutions, there almost always is more slack in the rules.

Students that are using the computer systems don't usually have an office in the school premises, but instead they often use common terminals in classrooms or remote internet access from home to log into the system. Same systems are administered through network. It is questionable whether the administrative access to such systems can be absolutely limited to the terminals that are in the physically protected space. In fact this kind of protection, if poorly implemented, can only give false sense of security and make overall environment even more vulnerable.

With physical protection of the administrative systems, there are two main benefits to achieve. The first one is quite obvious. By isolating the administrative systems, only authorized personnel can even get to the terminal where administrative access is possible. The other, maybe even more important, aspect is trackability. When something inappropriate happens in the computer systems and the one responsible for this has erased his tracks from computer logs, some information can still be found from passage control systems and security personnel reports.

SSH - Secure Shell

Secure Shell (SSH) is primarily a secure remote login program. It encrypts all the traffic during the connection. Most importantly, it encrypts passwords and other authentication data sent through the network. If all network logins, both internet and intranet, are done with SSH, the amount of data that is useful for eavesdroppers is reduced dramatically.

SSH also provides authentication methods that make attacks by trojan horses more difficult. If authentication is done using public key cryptography instead of secret password, potential trojan horse can't gain access to the system by simply forging itself to be the target system and simply asking the password from the user. It is also possible to set access policy so, that several different authentication methods are required before the access to the system is granted.

Also numerous other benefits can be achieved by using the SSH in network logins. With SSH not only terminal connections but also other TCP connections can be tunnelled through secure channel. For example X-Windows programs that usually are impossible to use through the firewall, can be forwarded in a secure manner.

SSH Authentication Agent

SSH authentication agent is a program that serves user as a repository of secret authentication keys. When user logs into the system, an authentication agent starts and all other programs run as children of the agent process. Whenever some process (like SSH) needs to make public key authentication, it first checks the agent whether the agent is able to make the authentication. Only after this, program tries to authenticate the user autonomously.

The Authentication agent may also handle different external key methods.Keys and certificates used by the authentication agent may be stored on the disk file, smart card, or some other external encryption device. Client program using the agent don't see the difference and no changes are required on client programs when new external key methods are added to the agent.

Connections to the authentication agent can also be forwarded through SSH. When logged into the remote system, depending on the policy set by user, agent connection may be forwarded. This effectively forwards the authentication capability to the remote system without actually revealing the secret keys to the remote system.

Conclusions

With suitable cryptographic applications part of the computer administration can be done securely even over the network. There is however certain administrative tasks that should be left to be performed only via terminals in the physically protected space. Such critical administration is for example configuration of the firewalls, network audit system, and system logging. In this way potential intruders can't track

their tracks and even most of the internal misuse of the system can be tracked down.

In any case, it is vital for an organization with a computer network to have a security policy. Academic organizations may have even tens of tousands of active users. In such system some level of network intrusion is almost inevitable, but sensible security policy helps limit the damages.

Using of cryptographic tools can never make poor security policy better. The break-in is always done through the weakest spot. There is no point of spending billion dollars in cracking of the cryptosystem, if you can simply pick up a phone and ask for passwowd from some clerk, who haven't quite understood, why everyone has to have the account of their own.

Further Information

Further information about SSH is available in WWW:

- http://www.ssh.fi/sshprotocols2/ (free version)
- http://www.datafellows.com/ (commercial version)

Or via email:

- <info@ssh.fi> (free version)
- <f-secure-ssh-support@datafellows.com> (commercial version)

Address

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Email: tri@ssh.fi

"Security concerns in medium-sized academic institution. An implementation at the University of Las Palmas de G.C."

Antonio Ocon-Carreras
Manuel Galan-Moreno
Mario Marrero-Ruiz
and Enrique Rubio-Royo
CICEI - Univ. of Las Palmas de G.C. - SPAIN

Abstract

With the widespread use of Information Technologies in the universities, it has become of most importance to guarantee the integrity and fair use of Information Resources. The security concerns in an academic institution are not the same than those of an ISP or a commercial enterprise. The popularity of Internet, giving easy access to millions of people, has produced an exponential increase in the number of security incidents in our University. Those considerations led us to the initial deployment of a Security Plan, which is based upon the identification of security-sensitive points and the development of adequate standard responses to security breakage scenarios. Finally, the deployment of a full-fledged firewall policy is under consideration, but faces the special characteristics of an academic institution, in which the use and availability of resources is based in the "mostly open" paradigm.

1.- Introduction: Problem description and significative issues

The word "security" is somehow tainted of common-placeness. It has been so widely used and abused that we feel uncomfortable faced to the need to define it again. In our opinion, a security policy refers to "the rational organization of resources and its policies of use to set up an adequate balance between the easy access for the legitimate users and the protection of resources and data from malicious or unauthorized users". In common words, "*simplify the use and difficult the misuse and abuse*".

It seems clear that according to the finality and social dynamics, an academic institution as the University of Las Palmas de Gran Canaria is quite different from commercial enterprises or other institutions regarding the use, deployment and functionality's of its corporate network/Internet connectivity.

We firmly believe that the aim of the university should be "*to facilitate the creation, spread and sharing of knowledge*", and this foundational principle bring as a consequence that, regarding Information Technologies (IT), it should "*promote, develop and facilitate the use of IT resources not only within the institution but also within national, supranational and international academic and R&D communities*". From this point of view, the restrictions in the use of IT resources must be carefully analyzed and evaluated in order to minimize the impact of these measures in the normal use of such resources. On the other side, it seems evident that when some sophisticated resources and equipment are being handled by students, whose skills are not fully developed, some "casualties" are doomed to happen. A 1995-study [1] estimates that over 50% of all security incidents actually result from user accidents. However, these "casualties" must no be seen as an undesired situation, but as the normal evolution of the learning process.

Considering that the university is also a "focal point" of culture, science and knowledge within the community that supports it, it seems also clear that the "osmosis" between university and community must be as strong as possible. This way, the first one will be able to give back the investment made by the second one.

Among the several issues that conform the difference between academic institutions and other kind of organizations (both public and private), we can emphasize the following three that make specially difficult the design of security policies for the first ones:

Decentralization: Decision-making regarding ITs within public academic institutions (at least in our

country) is usually decentralized among several sometimes competing entities, i.e. management, department heads, high level technical staff, etc. Unless some kind of "Information Czar" (like the recently appearing "Chief Information Officer" -CIO-) position has been established, the setup of global IT security policies will have to face a global agreement in this respect.

Students and "Cracking for Dummies": The biggest part of the user base of IT resources within an university are the students. As previously said, students are prone to cause security incidents because of their lack of skills. They can be malicious though; not only for the reward they can get (marks, tests, etc.) but for the sake of the "excitement" about cracking university systems. This is aggravated by the fact that nowadays is very easy to find compilations of "cracking utilities" that allows even to the most illiterate user to compromise the security of servers through known security holes. (However, our experience up to date, indicates that the damage caused by this attitude is normally not as serious as it could seem).

Amateur system administrators: Another important issue raises from the special characteristics of many members of faculty, staff and even grant holders, which are plugged in the position of administering one or several servers with no further knowledge than being formerly an advanced user of the system.

Servers as "Jumping Platforms": The former issue, the openness and availability of university servers (which are up and running 24 hours a day, 7 days a week, with permanent connections to the Internet), produces that many times they become a "jumping platform" for crackers and other malicious users which do not have permanent Internet connections.

2.- Problem posing: ULPnet, deployment and facilities

The University of Las Palmas de Gran Canaria is a medium-sized public university (as for Spanish standards) that provides academic services to about 20,000 students with a faculty of about 1,400 members and a staff of 800 people. It is located about the city of Las Palmas de Gran Canaria (pop. 400,000) within the Island of Gran Canaria, one of the Canary Islands.

According to its Information Technologies Plan, our University deployed during last years an ATM (Asynchronous Transfer Mode) infrastructure for the corporate university network, ULPnet, allowing the interconnection of 23 buildings spread over 3 campuses. Each of these campuses is several kilometers away from the others, externally gathered via mono-mode fiber provided by Telefonica (Spanish PTT), and using multi-mode fiber inside. The ULPnet ATM backbone provides the global connections between several Ethernet Lanswitches (about 50), giving more than 3,000 dedicated Ethernet connections logically arranged into several "virtual LANs" (about 20) on behalf of LANE (LAN Emulation) services distributed into the 12 ATM backbone switches. Every ATM link is at 155 Mbps, with some trunks migrating to 640 Mbps in the near future. Several central servers are directly connected to the ATM switches (at 155 Mpbs) or via Fast Ethernet (100 Mbps). Internet connectivity is provided by Spanish Academic and R&D Network, RedIRIS with a bandwidth of 4 Mbps and another smaller link to the commercial Spanish Internet (via Telefonica) mainly used for SOHO –Small Office/Home Office- connectivity. [2].

Use of virtual LANs under ATM gives us the possibility to arrange the logical network structure according to functionality considerations, instead of being forced to an arrangement based upon geographical distribution. This technology provides a feature rich physical connectivity, that can be the basement for many Ethernet-emulated LANs, each one of them free of some of the conventional Ethernet constraints (i.e.: distance between nodes, number of nodes in a segment, etc.). In short: **"Any user on Any network, Anywhere"**.

Once that a flat LAN topology has been built over LAN Emulation and ATM, practical considerations have led us to the segmentation of these big LAN into smaller "C class" emulated IP-IPX networks, to avoid excessive broadcasts. That segmentation provides the above noted 20 VLANs, which can be arranged into four "functional classes" -as explained further on-.

The LAN Emulation mechanism has intrinsic security advantages, such as the "non-promiscuous" mode

of operation, which avoids the possibility of listening ("sniffing") at packets addressed to other destinations. Besides, the hardware deployed allows us to implement "blocking and assignment by MAC address" to avoid "equipment tampering and address counterfeiting". To take profit of all these capabilities, a special network Web-based Network Management Software has been developed by the local staff [3].

Nowadays, there seem to be a rising popularity in putting the task of security advisory over the shoulders of external consulting firms. However, following the recommendations given by [4], it appeared much more sensible to develop an "internal team" to take care of security concerns within the institution.

The University of Las Palmas de Gran Canaria (ULPGC) corporate network has evolved from two disjoint separate networks. The first one for academic and R&D uses, based upon IP, IPX and DECnet protocols, and the second one for administrative and management uses based upon SNA protocols suitable for the IBM mainframes. The result is the actual ULPnet described above, in which the IP protocol is taking a bigger role.

This unification in IT resources has brought with it the need to settle a global Security Policy, which definition is being developed by an "ad hoc" committee composed by people coming from both environments. The resulting "Security Plan for the ULPnet" is not a closed policy, but instead is a set of recommendations that try to adapt themselves to the changing environment and growing threats of security requirements. Also, there has been done an initial work to setup an electronic environment for secure data transmission and signature authentication for administrative and academic documentation and certification, as shown in [5]. In the following paragraphs the recommendations for security policy emanated from this committee will be explained in further detail.

3.- Security Recommendations

The following recommendations that were produced by the "Security Committee" of the ULPGC can be arranged in several categories, according to the concerns addressed that range from the good configuration and maintenance of the smallest PC to the actions that pertain to the global ULPnet definition, structure and interaction with the Internet.

A.- Computer Level

Despite the classical distinction between servers and workstations, actual trends emphasize the client/server paradigm, in which the roles can be dynamically interchanged or even shared. So we will center ourselves in different recommendations at this level according to the operating system that the computer runs. Taking apart operating systems that are in sheer decay in our University (VMS, IBM proprietary and Novell NOS) we will consider two big families: Microsoft Windows (in its several incarnations) and UNIX-like Operating Systems (lead by Linux).

A.1.- Viruses and alikes

Microsoft Operating Systems are prone to be attacked by almost every kind of computer viruses and alikes. This issue has been addressed by the acquisition of a corporate license of a Well-Known Spanish-produced antivirus software (Panda) which has shown to be the best and most effective alternative after the evaluation of several other products.

Regarding Unix-Like OS, they were traditionally immune to virus attacks. However, the growing popularity of Linux combined with the wide availability of its source code, makes that we are seeing now the birth of virus-like programs. On this issue we would like to mention the infamous "bliss" program that behaved like a standard virus and infected Linux machines. The best defense against this kind of attacks is a normal security policy for the "root" user that should by all means avoid to run dubious binaries. Further on, be will describe several other utilities to check the integrity of that kind of systems.

A.2.- Upgrading and Maintenance

Upgrading is a semi-automatic task in Microsoft Operating Systems. Our University has signed a corporate agreement with Microsoft Corp. which permits deployment, installation and easy access to upgrades of their products. This task accomplished by CD-ROM distribution and anonymous FTP services. The maintenance of PC Labs installations involves the replication of pre-configured standard disk images. This is done by means of specially designed utility applications.

The upgrading and maintenance of Linux operating systems has been dramatically simplified by the widespread use of Red Hat distributions (characterized by the concept of "software packages" and its installer, the Red Hat Package Manager –RPM-) combined with the commitment of redhat.com to provide easy installation updates that are produced to face any kind of security hazard and are available through their FTP servers. This can be combined with a small utility (autorpm) which in an automatic fashion upgrades the system according to the guidelines that are settled by the system manager in a configuration file. Another utility (check_packages) checks the integrity of the system and warns each time that a "sensitive file" is modified in any form.

B.- Network Application and Service Level

Here we will consider the recommendations which stands for interoperation, resource sharing and service providing of computers through network facilities, not including those related specific network relationships, which will be explained later.

B.1.- Authentication Services

Despite the non-promiscuous nature of the underlying ATM infrastructure, it seems sensible that the transmission of authentication's information (login names and passwords) be encrypted to minimize the risk of compromising these highly sensitive informations. This accomplished by enforcing the use of encrypting protocols for the authentication and authorization of users, especially for extranet accesses. We have adopted the standard and well known SSL (Secure Socket Layer) and SSH (Secure Shell) protocols, which can be combined with the flexibility provided by Linux PAM (Plugable Authentication Modules)

B.2.- Standard User Applications (e-mail, ftp, www, etc.)

These classes of applications are of uttermost importance. We can say that a sensible security policy for electronic mail retrieval and sending is one of the key points of any corporate security policy. Traditionally, network services like sendmail , telnet, ftp, POP, IMAP, etc. (specially from a extranet point of view) have been a security nightmare for the systems administrators. The trend right now is to hold as many as possible of these services via HTTP/SSL, minimizing this way the risks derived from the unencrypted transmission of authentication information and, at the same time, providing an "ubiquitous client" –web browsers- to the end user.

Monitoring of proper user of all these network services can be easily achieved by using the "logwatch" tool on Linux, that provides comprehensive mail reports of the singficant events of the daily server activity.

C.- Internal Network Level

Within the global security policy for the internal network, which includes the classification according to user criteria (Faculty, Staff and Students –undergraduates and postgraduates-) and functional criteria (Research, Academia, Global Information Services and Administration/Management). Due to the relative lack of security involving mere user authentication, it will be necessary to implement additional security checks based on workstation access for highly sensitive services. Besides, technical reasons rise two issues: a) functional criteria is associated to the server in which is located the application and b) servers (and clients too) have to be inserted in a particular VLAN. Hence, the mere user and password authentication will be enough to get granted access to the less sensitive services, while more sensitive services will need additional checks based on the physical location (which will be checked by the IP

address of the workstation, depending on the VLAN in which it has been previously inserted). This workstation to server (i.e.: VLAN to VLAN) controlled interaction mechanism will be implemented at central router level, by setting adequate access lists.

At this time, we have already implemented this scheme regarding administration and core networking services, and in the near future we hope to apply the model to other services, and the same time to implement a sensible encapsulation policy (IP secure tunneling) to override and complement the security model.

D.- External Network Level

According with all that has been previously stated, the security committee proposed the following measures regarding external accesses (besides the obvious monitoring and accounting on routers and servers):

D.1.- Client filtering by IP/Port and selective filtering of servers

According to [6], "The most important step is to disable any service that is not used or needed. Since any TCP/IP port can be a security concern, the removal of any unused service can reduce the amount of information that is leaked, and also eliminates the port daemon service the application protocol as a possible vector for an attack". In our University, we take into account this words by using the "selective filtering", which has two aspects: a) Clients can be the only ones to initiate the connection to the outside; and b) Servers can be connected from the outside only in specific ports, according to the service they are providing. These two aspects have been implemented by means of an "inventory of servers" and the enumeration of services that they are providing.

D.2.- Systemic Analysis and Scanning of Servers

Within the security policy, one important step is to check out the vulnerability of our servers to external attacks. According to [7] "The same tools that can be used to break into a system can be used to root out problems so that holes can be plugged and deficiencies mended. By showing what intruders can do to gain access to a remote site, a system administrator can make informed decisions on how to best secure their site".

D.2.- Dialup access control

This access is granted to the members of the University through and authentication server, which is based on Livingstone Radius. To all practical effects, the dynamic IP addresses assigned to the calling workstations belongs to a PC-Lab VLAN.

4.- Conclusions

From our experience in all these issues, there is something that we have learnt: security policies are based on people, and must cover the following aspects: a) continuous training and information for system administrators as well as for end users: b) global acceptance and commitment with the security policies which have to be perceived as sensible and feasible, and doesn't impose an excessive burden on the shoulders of the final user. The criteria of easiness of use should prevail over any other consideration, as long as the level of threaten does not increase in excess.

In the actual situation and considering the trade-offs between usability and security, the implementation of a full-fledged standard firewall does not seem a feasible alternative for the whole University network, while at the same time can be a very good solution to protect specially sensitive environments (i.e. inner administration).

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Security: Policy and Education of Users at the Level of an Institute

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Abstract

In the present paper we will describe the policy security of the institute and how it has been implemented using a firewall built with cheap PC hardware and free software. We will also describe how the users were educated and their reaction to the establishment of such a policy.

Context

Two universities share the Jussieu campus in Paris. It is the largest one in France with more than 60 000 students and about 7000 staff members. The "Laboratoire de Minéralogie-Cristallogaphie" is one of the research institutes. With about 120 members and 150 machines connected to a local area network it is a rather big institute. The Research Computing Center, which manages the campus network provides the connectivity to the outside world (Internet) and between the different institute sub-networks. Due to the size few controls can be performed at the campus level, so the security policy must be implemented at the institute level. The border between the institute Intranet and the outside world (Internet) is located at a unique point, the router connecting the institute to the campus network.

The members of the institute are ordinary users with no particular competence in data processing. The regulations, in France, practically prohibite the use of cryptography although they are changing. The users may have to connect from anywhere in the world. They do not use notebooks but use what computer or terminal is available on the site. We cannot rely on the fact that one particular software is implemented. We have already experimented intrusions from hackers.

We have a need to increase the security with minimum changes to the users habits.

Risk assessment

Before defining any security policy we have to assess the risks by examining the causes and the possible consequences of an incident.

When asked about security most people think to hackers coming from the Internet. The campus is connected to the Internet with a large bandwidth (155Mb/s) and academic organizations are known to be vulnerable, so the institute is a good target for hackers. This danger must no be minimized but hardware failures (disk crash), software failures, user mistakes (involuntary deletion of files) are more frequent. The malevolence can also come from the inside especially in a campus where buildings are largely open. The theft of computers is not rare. Catastrophic events as fire or flood must also be considered.

Very often a problem leads to data loss or data corruption. If the data can be restored from backups the damage is limited. In our context a few hours stop to restore data is not very serious. The most important issue is to have good backups and to detect the problem early enough before the tapes are recycled.

An intrusion or data theft can hurt very badly, so it is necessary to have good logs in order to detect them. A malicious person who gets access to the system can make many damages, especially if he/she connect from the outside. A particular concern is the hacker who connects from the outside using the stolen identity of a legitimate user and then use our network and this identity to perform illegal actions on the Internet. With one time passwords it is much harder to do this. Keeping good logs on the firewall of the traffic between the internal network and the Internet may help if a problem is discovered.

Generally members of academic organizations do not think that they have valuable information to protect.

Security policy

Whatever is the problem, good backups are essential to resume the service. All services that are legitimate (telnet, rlogin, FTP, HTTP, SMTP, POP, IMAP,) are allowed. On the other hand a strong authentication using one time password is performed for connections from the outside. New services are added as needed. A few useful services such as " talk ", well known for its problems are excluded. Everything not explicitly authorized is forbidden. When requested we add new services to the authorized ones. It is the safest method but it is very difficult to implement from a previous unrestricted situation. We routinely analyze the logs in order to detect possible problems. The major benefit from the firewall is certainly the logging of all the connections between outside and inside. We assume the inside as safe (although it is a too optimistic view) and the outside as unsafe. So we perform strong authentication only for the incoming connections and only log the outgoing connections. We use one time password in order to avoid the fact that a stolen connection can be replayed. Only machines and services that have to be known are reachable from the outside.

We routinely scan the logs in order to detect possible problems. We log a lot of events and keep them for a long period in order, when an incident arises, to reconstitute what happened. The log files are voluminous and we have to apply filters to analyze them. The rules must be adapted to the specific environment to extract only the pertinent information, focus on the possible problems and ignore normal traffic.

Implementation

The backups are performed each night and centralised through the network to a tape changer which has a capacity of 10 7Gbytes Exabyte tapes. We use the free software Amanda [1]. The load is automatically balanced between full and incremental backups in order to keep the size of data backed up each night roughly the same. All Unix machines are concerned. This also includes PC running both Windows and Linux. The PC with dual boot, by default boot under Linux. When running Windows a program called sleepy [2] automatically reboots the system at a predefined hour during the night so as to run Linux. When running Linux a command (lilo –R dos) put in the cron table allows to restart the PC under DOS so the user gets a Windows system when coming in the morning. The DOS partition is mounted under Linux and processed as a Linux one. The Macintosh are not backed up.

The firewall possesses three interfaces: one connected to the Internet, one to the internal network and one to a demilitarized zone (DMZ) for a Web and anonymous FTP servers. The machine is a PC running Linux. We use the Red Hat [3] distribution. The security is performed by a combination of IP filtering and proxies. IP filtering is performed using the Linux facilities (the ipfwadm command or the new ipchain one). Most proxies (telnet, rlogin, X11, FTP) come from the TIS toolkit [4]. We also use other free software: Bind [5] from the Red Hat distribution, Squid [6] for HTTP protocol (web), Postfix [7] for SMTP protocol (mail). More proxies can be found at [8]. TIS is a toolkit, not a black box, that the administrator must install and configure in order to implement the security policy. We consider that it is not a disadvantage because the most difficult part is to determine the security policy, test the rules and educate the users.

When connecting from outside, the user is first authenticated on the firewall using a one time password. The proxy ask for the user name, then send a challenge and the user must respond with a password that is a digest (MD5) of the challenge and a secret shared with the firewall. The firewall computes the password using the same algorithm and compares it to the received one. If there is no discrepancy the user is authenticated and relayed to the machine he wants to connect. Since the challenge is never the same, it cannot be replayed even if the communication was intercepted. To compute the one time password the user has three choices: 1) He may use a calculator running on the machine from which the connection is issued. By copying and pasting it is easy to transfer the challenge to the calculator and the password back to the application. 2) Some applications such as FTP or telnet include this feature. 3) Use of a paper list of passwords previously generated, and copy of the corresponding password. Any user wanting to connect from outside carries a password list or a diskette containing the calculator as well as versions of telnet or FTP applications that manage one time passwords. We distribute diskettes for Windows and Macintosh. This solution requests no specific hardware or software on the remote site.

The most vulnerable element and the target of all the attacks are the firewall. In order to control its integrity, the signatures of all the files are computed each night by the Tripwire program. Security fixes must be applied as soon as they are available.

Many attacks cannot reach the machines on the internal network because only some machines and, on these machines, selected protocols only are visible from the outside. This is especially useful for most of denial of service attacks.

Policy and users

The real challenge is not a technical one but a human one. Switching from a very open policy to a more restrictive is not so easy. Everything must work for the D-day. So exhaustive tests have to be performed. Education is the most important issue.

Establishing the best policy and using the best software is meaningless if it not accepted by the users. It took us six months to increase the level of security to its maximum. The firewall was first installed and tested on a small isolated network simulating the operations. Then it was operated using only logging functions. By modifying the MAC addresses and the ARP tables we are able to put or withdraw the firewall without disrupting the network traffic. Step by step we have added controls. This process took about six months.

Meanwhile we have written guides and made them available on the Web server. Regularly we have sent messages to the users to explain what was coming up. We have also organized several seminars. All this was not sufficient, so we had to give personal help to some users and to show them how to use the one time password. However, users who were abroad had no problem to connect with the only help of a paper copy of the guide sent by mail and a phone call to establish the initial password. All users are not equal in the use of the tools and we had to adapt to each one. Nowadays the safety procedures are accepted by all users, although they are not always very happy.

The security begins by following rules that may seem as trivial as having good passwords, changing them regularly, disconnecting the session when leaving the computer, always requiring an authentication to use a computer. It is not so easy to enforce these rules. We use automatic procedures because people accept more willingly to have is their account locked by the system rather than by a human intervention, which is often considered as a personal aggression. For a good acceptance the thing must be as simple as possible for the users. So whatever the machine he/she connects on the internal network the user gives always the same login name an password. The user as only once to authenticate on a machine. We avoid as much possible a second authentication to connect to another machine. The login names and passwords are shared among all the Unix systems using NIS. The Samba free software [9] allows a Unix server to act as a Windows NT domain server with the extra benefit to share the login name and password between Unix and Windows. For availability reasons we use two Samba servers. Using "poledit" the Windows policy editor and storing the configuration on the servers we require a user to first authenticate and we can control what he/she is allowed to do on his/her Windows computer. Login scripts are also stored on the server and are executed when the user logs in; they are used to perform several actions as to update the anti-virus with the last signatures.

Conclusion

The configuration of the firewall (Pentium pro 180Mhz, 64Mbytes RAM, 2Gbytes SCSI disk) and free software is rather cheap. But it requires a lot of work to implement it, although the most important part of the work is to define the security policy and to test it. We are connected at 10Mbits/s to the campus network and we experiment no performance problem. The main processor activity is logging the events.

Since the firewall is in use, it is astonishing to see the number of attempts to enter an academic network not only from hackers but also from institutional users. The firewall is running at maximum security level since one year about and we think that we have a good control of the use of our machines as well as the exchanged traffic. The LMCP is an institute of 120 persons about. We believe that it is the good level to establish all controls since the traffic remains rather limited and because it is possible to know

and to guide each user. This would not be feasible at the level of the campus where personal contacts are always limited.

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Track E: (Paper Abstracts)
Co-operation within and between Universities

Metropolitan Area Networks – The Opportunities for Collaboration Amongst Universities

Quality Process as an IT Strategy

Introducing Information and Communication Technology for Teaching in French Universities

Collaboration as a challenge:
New learning environments embedded in old traditions

Metropolitan Area Networks – The Opportunities for Collaboration Amongst Universities

Robin McDonough – Director of Information Systems
University of Manchester, UK

The development of Metropolitan Area Networks has provided universities with a unique opportunity to collaborate amongst themselves and with commercial and industrial partners. This talk will provide a description of developments in this area within the United Kingdom, describing the national strategy that has been adopted and how that has been applied to one particular region, the North West of England, in which there are sixteen universities. This talk will describe the trend towards Regional Area Networks and outline the many opportunities for collaboration which now exist following the installation of such a network.

Quality Process as an IT Strategy

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The "Centre Interuniversitaire de Calcul de Grenoble", CICG, is Center for Information Resources and Technology shared by the five universities of Grenoble (representing 63,000 students and a number of renowned research labs). CICG provides Management Information Systems (MIS) and backbone networks. MIS software is Unix, Oracle client/server based. Major issues are availability, performance and security of data, as well as software maintenance and improvement.

Quality requirements led to the development of middleware around BMC Software "Patrol" knowledge modules. In this context, documentation about systems administration is designed according to ISO 9002 standards. Issues discussed include: staff incentives, control of computing activities, risk assessment, quality and performance requirements, reactivity to technical troubles.

Introducing Information and Communication Technology for Teaching in French Universities
Organisational and Technical aspects

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This paper summarises the research carried out by three workgroups of French university faculty members (engineers and education specialists) between 1997 and 1999, organised by the scientific group GEMME.

It lists the objectives of introducing information and communication technology in universities and their consequences, organisational and technical. It concludes on necessary co-operation of services to resolve organisational problems. It proposes some technical solutions especially to provide students with necessary resources and tries to evaluate some costs, financial and human, of all this process.

Collaboration as a challenge:
New learning environments embedded in old traditions

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The European tradition in higher education is built on the authority of professors appointed to a chair undertaking research as well as teaching their students. This medieval structure of universities still operates, so that the university represents one of the few European institutions which can trace its roots back to the twelfth or thirteenth century. Lecturers and their students came together at real places at real times to undertake scholarship. These crucial conditions have determined universitas litterarum, the university. Over time this basic structure has developed a wide variety of institutional forms. The European sector of higher education consists of a complex of institutions operating within different academic traditions and different national policy guidelines for education. Organizational differences between institutions are considerable and reflect dissimilarities in staffing structures, student recruitment, course assessment, programme validation and even the very language of instruction. Add commercial and industrial organizations to the equation and the differences are compounded. In principle these fundamental conditions have to be considered when we are talking about collaboration in Europe. Collaborative projects and knowledge networks that fail to take into account the traditional self-image of universities as well as the fundamental differences in the institutional cultures of partner organizations are not very likely to get off the ground. When the potential of virtual learning environments is added, the traditional university system faces new challenges such as student-centred, personalized and flexible learning combined with inter-cultural approaches to provide adequate structures of transnational collaboration. All in all we are witnesses of developments towards a new quality of universitas litterarum, namely a step towards a new way of collaboration among European universities in which resources are shared, different ways of thinking about a topic are confronted, trans-national and comparative studies are supported and learners add a European dimension to their learning experiences. This paper examines the potential of the new learning environments - in particular in the area of the Humanities - in the light of a number of current projects [e.g. the Coimbra Humanities Model; the CEFES project etc.] utilizing European networks and considers the way that the application of new technology is beginning to blur the distinctions between traditional universities and distance education providers. It also offers an assessment of the pedagogical, professional and technical conditions required for the mainstreaming of collaboration in the university curriculum.

Metropolitan Area Networks – The Opportunities for Collaboration Amongst Universities

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Abstract

The development of Metropolitan Area Networks has provided universities with a unique opportunity to collaborate amongst themselves and with commercial and industrial partners. This talk will provide a description of developments in this area within the United Kingdom, describing the national strategy that has been adopted and how that has been applied to one particular region, the North West of England, in which there are sixteen universities. This talk will describe the trend towards Regional Area Networks and outline the many opportunities for collaboration which now exist following the installation of such a network.

The United Kingdom Academic Scene

In the UK there are 105 universities and about another 70 general colleges of higher education. The total number of students attending these higher education institutions is approximately 1.2 million full-time and 650 part-time students. The universities vary in size from the largest with about 19,000 students, but more typically an average university in the UK will have about 8-10,000 students. The nature of the universities vary very considerably. For example, universities such as Oxford, Cambridge and Manchester, and about another 12 universities have a very high research element within their activities whereas others such as the Universities of Brighton, Westminster and Greenwich are largely teaching universities with only small amounts of research carried out. Over the last ten years there has been a significant increase in the number of students attending British universities and the age participation rate of 18 year olds is about 35%. The Government froze this figure at this level about four years ago. However, in 1997 the new Government, under Prime Minister Tony Blair, was elected with a commitment to an agenda of 'education, education, education'. As part of this it is indicated that it sees a further increase in the number of students over the next five years.

The University of Manchester

Manchester University is one of the oldest universities in the UK and has 18,000 students on courses in all subjects. It has a strong international research reputation – for example, the splitting of the atom was achieved here by Ernest Rutherford as Professor of Physics in 1919, and in 1948 Tom Kilburn and Freddie Williams invented the first stored program computer. This reputation continues to this day since it is the home of Europe's premier university computing facility supporting world class research and teaching in all disciplines.

Funding of UK Universities

Funding of the universities in the UK has been devolved to four national bodies representing England, Scotland, Wales and Northern Ireland. These four funding bodies together with other central Government funding provide about £6 billion per year to support this system. If you look at the four funding bodies you will see immediately they are not equal in size with the English body many times larger than the other three. Since the 1997 election, government policy is moving towards regionalisation and devolution. During 1999, new regional governments will be established in Scotland, Wales and Northern Ireland. There is now a trend in England to look towards some form of regionalisation. One of these regions will be the North West of England centred round Manchester and Liverpool. This trend has been a factor in the evolution of networking in the North West of England.

Computer Networks in UK Universities

The responsibility for providing all networking within each university rests with the university itself. However, a national network called SuperJanet has evolved which links all universities together in a private high speed back-boned network. This is funded centrally and provides the communication between universities and international links to the rest of Europe as well as transatlantic links. SuperJanet was a follow on from Janet which had existed for 15 years. Currently 180 universities, 40 research centres, 200 further education sites and 100 schools have been connected to SuperJanet.

As the network has evolved there has been a recent development of Metropolitan Area Networks (MANs) which provide a high speed networking capability within a metropolitan area of which Manchester with its large population is clearly one example.

MANs have a key role to play in the development of network technology for universities. They can:

- provide higher bandwidth locally

- support local and regional roles

- aid collaborative working

- provide organisational freedom.

This last point is important as it provides a potential for the institutions within the Metropolitan Area Network to move in different ways not possible because of funding models and resultant constraints. The national backbone onto which the MAN is connected is publicly funded and brings with it restrictions on usage. One of the advantages of a Metropolitan Area Network is that ownership of it rests with the local institutions and this provides opportunities to develop industrial links and links with other partners, for example, hospitals, further education i.e. technical colleges, and schools. This was one reason to encourage people to think about the development of Metropolitan Area Networks.

G-MING

G-MING is a consortium of the five universities in Greater Manchester and has established a high speed network linking these five institutions and 40 of their remote sites. These sites include four hospitals, 15 university halls of residence, the libraries of the individual universities and other remote parts of the universities. In addition, there are links to various industrial parks in Greater Manchester.

The universities are all connected at speeds of 155 Megabits / second as are the individual halls of residence, libraries and hospitals. The speed of this network has allowed many applications to run for the first time and the following have now been shared amongst all the universities:

access to all library collections

video conferencing

remote lecturing

high performance graphics

teaching software

tele-medicine.

Of particular interest is the extent to which G-MING has made a contribution to the economic regeneration of the region. The development of the MAN has received funding from the EU through its European Regional Development Fund and the result is that G-MING has played a part in building a city infrastructure linking business applications, multi-media applications, and a community network which stretches right throughout the Greater Manchester area.

Extension to the North West Region

It soon became apparent that what had been successfully achieved in Greater Manchester could extend to the whole of the North West of England which covered sixteen universities, three counties and a population of about 6 million.

The extension to this wider region was attractive due to the provision of higher bandwidth and lower costs between these institutions. It would also provide greater opportunities for collaboration amongst all sixteen universities. However, these were not the only motivating factors. There was a growing appreciation of the national political agenda for regionalisation and of the potential for obtaining funding from various sources working at a regional level. It was 1997 and at that time the extension of this network to become a Regional Area Network was a pro-active move in advance of political and educational moves towards a regional framework. This Regional Area Network is called Net North West.

Net North West was established in 1998. Sixteen universities are connected all at 155 Megabits / second except that Liverpool is connected to Manchester at 622 Megabits / second. Forty-eight other sites are connected to the network including four hospitals, fifteen halls of residence, five libraries / museums, six remote campuses, three public authority sites and three science parks. Five new sites are about to be added to the network including the world famous radio telescope at Jodrell Bank. A number of further education colleges are also connected by 2 Megabits / second.

In 1999, the Government policy of regionalisation in England led to the establishment of a form of regional government in North West England which covered the same geographical region as the Net North West Regional Area Network which had been established in 1998. The North West regional government body soon recognised the value of the Net North West which had been established for higher education. It has accepted that this will form the basis for the high speed infrastructure for the region as a whole - not just for higher education but for industry, commerce, schools, etc. As a result, this has already brought benefits to the network and £2.8 million has been allocated from local development funding to establish at the various universities learning for life gateways and an advanced telematics centre. With the Government's national commitment to invest heavily in the regions and in education we see great opportunities for further collaboration both amongst the universities themselves, with universities and other parts of the educational sector, such as schools, and between the universities and industry.

Before summing up, it is important to put this Regional Area Network in a national context. Although the development of Net North West in this part of England is the most advanced Regional Area Network, the national strategy is to gradually evolve into a national network linking a whole series of regional networks together. Many of the other Regional Area Networks are starting to form and when they do they will be connected through a national very high speed backbone which will gradually replace the current more dispersed system.

Summary

The creation of a Metropolitan Area Network linking perhaps a small number of universities in a metropolitan area has proved beneficial in terms of the opportunities for collaboration which have been presented as a result. These collaborations have been in research, in teaching, and in technology transfer between academia and industry. However, by extending this concept to a much larger area to create a Regional Area Network, the North West of England has an opportunity to realise significant benefits whereby a single network of very high bandwidth will be used to provide the backbone for all communications in the region, whether industrial, educational, government, etc. Such an integrated approach can be thought of as making a major contribution not just to the educational development of the North West of England, but also to the economic regeneration of the area.

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Quality Process as an IT Strategy

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abstract

The "Centre Interuniversitaire de Calcul de Grenoble", CICG, is Center for Information Resources and Technology shared by the five universities of Grenoble (representing 63,000 students and a number of renowned research labs). CICG provides Management Information Systems (MIS) and backbone networks. MIS software is Unix, Oracle client/server based. Major issues are availability, performance and security of data, as well as software maintenance and improvement.

Quality requirements led to the development of middleware around BMC Software "Patrol" knowledge modules. In this context, documentation about systems administration is designed according to ISO 9002 standards. Issues discussed include: staff incentives, control of computing activities, risk assessment, quality and performance requirements, reactivity to technical troubles.

Introduction

Our Support Group team at CICG maintains data center facilities, including all operating systems, Oracle/Unix system administration, software installations, automated network backups and security for all administrative applications of the five universities. This represents 69 university-wide data bases, 9 Unix servers, and 2 computer centers located in the 2 cities of Grenoble and Chambéry. The Support Group includes 3 teams merged in 1995 from the 5 universities: Systems Administration (3 engineers, 2 of them are the authors of this paper), Operations (2 technicians), and Users Support (2 technicians).

After a while, Support Group engineers concluded to various management needs:

To unify administration, operations and observation procedures,

To define a risk assessment strategy,

To write down Support Group's know-how to ensure duration of the business.

Distributed software for systems administration recently became available on the market, and seemed to be an interesting solution to points 1 and 2. Having done a comparative study, we bought the PATROL platform, from BMC Software.

In the same time, as the Group merged with various work cultures, the urgent need of a written documentation led us to start an ISO standards Quality Insurance process.

This approach allowed us to compare our relations with users to those of a private firm with clients. We thus decided to write a Quality manual.

Implementing quality indicators, validity thresholds and work procedures is a part of Quality process, as well as formalizing software administration with alarms and corrections setting.

We now present the two parallel and converging PATROL and Quality processes, and especially installation steps and difficulties, present state and expectations of the project.

The PATROL management platform.

"Our aim is to pilot, like in industry, the university MIS and to reduce the complexity of managing our heterogeneous environment".

We looked for an application-oriented distributed management platform when Grenoble MIS was reengineered within a nation-wide software consortium. CICG yet used the Cisco SunNetManager platform to manage the common Campus backbone network.

Tools to administrate Unix systems and Oracle databases were needed, such as data base reorganization, event management, detection of exceptions, and possible automatic correction. A log of all the significant indicators and an easy customization were also necessary. After a comparative study with the ECOTOOL suite, and a three month test period, CICG bought the PATROL Application Management products, by BMC Software.

The most significant points are:

Patrol is designed for distributed applications, databases and systems, fitting our needs to support in-house applications.

This platform allows unification and integration of our various home-made tools to maintain peak availability, reliability and performance of all Unix servers and Oracle data bases.

It includes tools to provide statistics and integrated tools for subsequent database reorganization.

After staff training, we noticed that that Patrol was really easy to use. Everyone in Support Group is now able to control events of his competence and thus to have a statistical log of the production.

Support Group engineers used immediately PATROL with the delivered knowledge modules (KM) for Unix and Oracle. They provide a common view on one console of our three Unix clusters. For example, for the student registration software (about 63000 students), operational tolerance for a service interrupt is only 5 minutes. PATROL event manager and KMs efficiently complement the IBM high availability system called HACMP.

PATROL is also used for DB-administration. A new knowledge module was developed for the student system, to track some well known availability risk-full events. A complete list of these events has been set up.

We experienced that:

PATROL is friendly-use, but its customization is quite time-consuming,

risk full events and corrective actions must be listed with care, and constantly updated,

statistics have to be kept online 5 days for Unix servers, to control computer activity, system administration and resource performance,

performance gain are easily evaluated. For example this appeared when backup library was upgraded or when the network became 100Mbs,

Patrol data bases reorganization module is more complicated to implement than the others.

The need to manage the applications grew up with the number and instances of Oracle data bases (the student system Apogée, the new financial application NABUCO, payroll, interfaces with the french Minitel and the WWW for 5 universities). Fixing Unix, Oracle, and users troubles became a major issue as the number of Support Group staff remains constant ...

To spread out Patrol, we are hiring 3 students (3 times 2 month) on two projects: one to improve and customize the Unix Knowledge Module, the other one to prototype an application Knowledge Module.

PATROL improved Support Group staff reactivity and efficiency. Errors have been avoided and incidents prevented. It is especially useful for daily actions like watching file systems space and CPU time, controlling printers.

The university environment is a brake and a driving force for the implementation of a system like PATROL. It is a brake because of absence of an industry culture and service quality notion, it is a driving force because the universities demand a continuous improvement of service.

Quality process

Support Group provides systems availability, reliability and performance, software maintenance and users support.

Individuals in Support Group are specialized and thus less interchangeable. They work generally in twos, and cannot easily replace a colleague of another two. Standardization of the two computer center sites procedures becomes also compulsory.

The Quality Process we started aims to:

- answer customer requirements,

- formalize, standardize, and spread out the know-how to ensure a good service.

It begun by developing documentation based on risk assessment. It is based on EN ISO 9002 standards for quality insurance in production, installation and services. The Quality Manual lists team activities and explains "Who do What Where When How Why". Its object is "TO FORESEE".

It also describes the responsibilities, authorities and relationships of staff who manage, perform, verify or review work regarding quality; it refers to the quality system procedures and instructions, and to a instructions for reviewing, updating and controlling the manual itself. It explains the vocabulary and describes the quality policy and, accordingly, stated and implied needs. This last point is very important because it induces the choice of quality indicators. In other words, the needs are translated into a set of entity requirements (process, product, organization...) to enable its examination and short or long term realization. Measure tools have thus to be standardized and used at defined intervals. We chose BMC Software PATROL as explained above.

A part of the quality manual deals with the quality system procedures and instructions. It checks off taken risks in regards to universities needs and analyze preventive and corrective actions to process. This section refers to:

- Documents about activities organization,

- Written specified ways to perform an activity,

- Records, documents which give evidence about activities and results.

Services / *Process*	*Unix administration*	*Oracle administration*	*Application administration*	*Hot-line*	*Operation*	*Person in charge of application*	*consortium support*
To maintain operating system	x			x		x	x
To administer operating system	x				x		
To maintain database management system		x		x		x	x
To administer database management system	x	x				x	x
To administer application			x	x		x	x
To manage database	x	x	x	x		x	
To preserve database	x	x			x		

This "process/organization" array is an illustration of quality approach formalization.

Corresponding process is described in the chapter "Processes control" of the quality process, referring to procedures, instructions and records.

PROCESS: To maintain Apogée database.

TASK : This process upgrades software used by test, training or production databases.

ACTIVITIES : Concerning APOGEE (the student system), a local update can be requested by Apogee team. This request must be written and must specify localization of the file to install, the name of this file, name of receiving file, name of database.

The application administrator follows directives of the procedure PR-SU/4.9/AA/01: he saves the current version of file, installs the new version and establishes required access rights. He updates tables of databases and reports to the caller. This one tests the DB and informs users if all is good.

The application administrator installs new versions following the installation note and the procedure PR-SU/4.9/AA/01. Next, he prepares the environment (setting up of a restricted session on database, storage redo-log files, specifics jobs) and verifies log files generated during updating.

If a problem occurs, he contacts the consortium hot-line to fix it. After that, he installs middleware developed locally. He informs hot-line and Apogée team that installation is closed. He notes database version change.

Schedule of the project.

The team manager gave at the beginning Quality directions and nominated a quality manager. A monthly meeting is dedicated to quality, improvements in organization, etc... These meetings help to:

- motivate the team about quality,

- track down the weakness of our structure,

- choose the best way for each process.

- give directions to write quality manual and other organization's documents.

In the same time, we draw procedures, instructions and record frames. Attendees of quality meetings relate in detail for each process "what, when, how, and why" they do so, and explain their choices. But some people do not like to write notes about what they process, and quality approach don't succeed if the staff don't subscribe. We thus decided that some descriptions can be verbal depositions to the quality manager, who checks accuracy and concatenations of actions and writes procedures according to ISO9002 standard and defined vocabulary. Development is then reviewed by concerned staff.

A first evaluation of our quality approach can be done:

- the extra work it involves is sometimes a problem, especially when new computers or systems have to be installed. But the work progress is now satisfying,

issues are usual ones in similar cases: some are afraid about possible judgement of colleagues, or to loose their power. Somebody told these tasks did not valorize their authors. Bad past experiences can also be argued.

Discussions and debates during the meetings seemed to sweep away reserves and hostility. Today, the complete group is involved and motivated, especially as the first results of the quality approach can be seen.

- analyze of practices show some failures in our organization, which we correct immediately. For example, we thought we had the same backup cycles in the two computer centers, which was not true.

moreover such an approach shows daily tasks complexity and valorizes everybody's work.

Technicians jobs can be improved by giving them new procedures.

communication with clients is also improved.

These results will be even better when the quality manual will be finished. We'll then be looking forward to .. total quality !

Conclusion

First aims of PATROL tools were to make the production easier and to unify the various operation and observation procedures. Today PATROL is integrated the quality approach which driven by the development of the quality manual. The quality approach introduced changes in staff work and organization. It is being emerging as a management tool with some impacts on others teams of the computer center.

Maintaining MIS for the five universities of Grenoble, managing the archives of all treatments, preventing risk, ensuring the transmission of know-how, all these important goals become today the key target for our team. We are close to reach our objectives, as it is for example showed by the quick

integration of a new engineer. We hope to be able, as soon as the quality manual will be ready, to ensure a full service in case of absence (vacation, illness) in the team.

Developing the quality manual and improving software administration contributed to establish a climate of confidence inside our team and with our colleagues and clients. Quality approach encourages us to try always better to satisfy universities needs.

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INTRODUCING INFORMATION AND COMMUNICATION TECHNOLOGY FOR TEACHING IN FRENCH UNIVERSITIES

Organisational and Technical aspects

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Abstract

This paper summarises the research carried out by three workgroups of French university faculty members (engineers and education specialists) between 1997 and 1999, organised by the scientific group GEMME.

It lists the objectives of introducing information and communication technology in universities and their consequences, organisational and technical. It concludes on necessary co-operation of services to resolve organisational problems. It proposes some technical solutions especially to provide students with necessary resources and tries to evaluate some costs, financial and human, of all this process.

1. Missions and Objectives of the University :

In 1999, the University must become part of the information and communication society. This means that its work and its teaching purposes must adapt to the new constraints of society. This process is long, expensive and it has to go through a number of steps.

The first step is to allow the different actors in the University to master ICT techniques. These techniques must be made available to all the students in all the subjects, but it is also necessary to organise the required training structures.

The University must provide students with the necessary multimedia equipment (hardware, software and educational resources). Today, the number of students who own their equipment is considered to be 5 to 10 %. The University, being a public service, must supply the workstations. But even if this ratio was higher, the University would have to supply the equipment because some of the resources cannot be available anywhere else and the student's training will also be made inside the University: the use of ICT is not innate, an apprenticeship is necessary.

The next step consists in inserting ICT into teaching practices for two reasons: it will not be presented as an additional subject; it is an efficient way of reducing academic failure by involving the student into his own learning process.

Finally, the last step consists in designing, creating and distributing teaching products. Developing these products involves time and especially a questioning of traditional teaching methods.

In order to help the University to achieve these purposes, it is necessary to follow at least three lines:

supply students and faculty members with access to necessary resources;

fit all the rooms dedicated to teaching with multimedia equipment and connect them to the net;

promote the distribution of resources and teaching products to the widest possible audience.

2. A new organization for a new University?

As different activities are now getting closer to each other (computer science, video, documentation and information), the internal organisation of the university is evolving. In some cases, the changes are spontaneous, in others they are the result of a choice.

Introducing ICT requires a solution to many organisational problems.

Research shows that many factors can facilitate or handicap the solution to these problems. Some of the factors result from the structure and operating mode of the university, others from the way the universities make their decisions.

2.1. Structure

Due to the large number of subjects and substructures, there is scattering of responsibilities and a lot of idiosyncrasies, which is very unfavourable to the creation and functioning of resource centres. There is dangerous tendency to the proliferation of double services, independent and ignoring each other with divergent equipment and functioning policies.

Geography is clearly a critical element. Geography here refers either to the number of geographical sites or to their location: scattered sites in the same city or in different cities. With some political commitment, this scattering can have positive aspects by creating a necessity to face it through a real networking. It can also have negative impacts because of the financial and structural costs.

2.2. Operating mode and policy of the University

No significant action can be carried out without a strong political commitment of the University managers. But this commitment is useless without the necessary collective reflection. An association of all the necessary actors is an important element of success, and when it has not occurred, decisions made without dialogue have quickly shown the limits of their effects.

Another necessity is to consider the University as whole. All the subject areas must be involved and no particular unit must be favoured: an equal access for everyone to teaching resources must become a leitmotiv. This involves a good knowledge of what already exists: resource centres, products used, available tools, competent services, committed teachers and technicians.

When these conditions are satisfied, some actions appear fundamental:

- The first one is the connection to the net of all the buildings and services dedicated to management, research, teaching or documentation.

- Another key factor is the development of a training policy for University staff.

It is also necessary to have a successful policy of human resources. It is important to ensure a double recognition of the educational work of faculty members, in their career (together with research work) as well as in their everyday practice.

- Finally, there is the question of the modification of the existing structures: merging of different services, or co-ordination and co-operation between them.

2.3. Favorable elements

The experience the University has already acquired.

Its involvement in University co-operation in France but also world-wide.

Local conditions when local government is committed to the promotion of a renewal of education and

training.

3. Production, distribution and documentation

3.1. Needs

Students need educational products in different situations: in front of the teacher, in a self-training situation inside the University with or without an advisor, in full autonomy at home.

Faculty members need to collect existing documents and products or to create new ones. For the simplest tools, which are usually linked to lectures, they need training and technical support. For more elaborate products, designed for autonomous practice by the students, they need production structures allowing interdisciplinary co-operation. The role of the teacher is always to create the scenarios of the different products.

3.2 Functions: production / distribution / use / evaluation

There are three levels in the multimedia production for teaching:

First level, digitised on-line courses, with possible addition of pictures and hyperlinks, must be available to teachers who already use word processors.

An intermediate level, electronic publishing, projection of digitised pictures, interactive documents, requires a little more technique but it should still be available, if teachers can find resource sites supplying them with the necessary tools, help and training.

The third level deals with more important projects for which the assistance of external companies or university co-operation will be necessary.

Then comes distribution which requires documentation, cataloguing and indexing. Distribution can be made on-line or via media that will be made available through documentation centres. It is clear that their role is very important at this stage.

Using the products requires a technical structure which is described below.

Finally, the products must be evaluated in their conditions of use.

Last, the evaluation of the cost of these operations as well as of the time required in production and in preliminary training is of the utmost importance.

4. Students' access to ressources

All this involves an important technical structure. This part deals with the crucial question of supplying the students with the individual equipment. Other types of equipment should also be considered: collective equipment necessary in amphitheatres and lecture halls, those to be used individually by teachers and those of production centres, big and small, which should be created and developed in the universities.

4.1 The workstation and its environment

The workstation is a micro-computer fitted with a floppy drive. This equipment makes it possible for the student to work on his tasks again at home or in a different room. The workstation must also be

connected to the university network and to the Internet, and equipped with the software necessary to access the different resources.

This imposes a constraint: the safety of the network prohibits anonymous login. Access to the software of the workstation will be possible only with registered name and password.

Each workstation should have access to a printer. One printer per ten workstations seems to be sufficient.

These workstations should be located in 15-student rooms, alternately dedicated to lectures and open access. There could be fewer workstations in libraries and information and documentation centres. In all cases, the rooms are specialised and supervised.

Whenever possible, these rooms should be general-purpose, in order to save money. It should be possible to do everything in every room: no specific room for languages or self-training, because the opening time would not be sufficient. The equipment and support staff must be made the most of.

The rooms should be located in the same place rather than scattered: supervision, maintenance and support will be easier.

Self-access must be sufficient: 45% lectures and 55% self-access seems to be a satisfactory compromise.

Access must be as easy as possible for students, but as safe as possible for the administrator of the rooms. As a consequence, several aspects have to be taken into account:

The question of access to the rooms: for a satisfactory access to computer resources, the rooms should remain open from 7:30 a.m. to 10 p.m. with a possible access on Saturdays and during a part of academic holidays.

Security: it can be done in two ways, through the control of access to the building and halls but also and especially through the protection of the workstations: each PC can be protected against opening with an alarm.

Lending of multimedia supports: inventory, storing and loan must be carried out by an organisation placed under the responsibility of documentation centres.

Supervision : its first interest is to lower the costs of security. Of course, it has a price but human presence is the best protection against theft. Second, it prevents people from using the rooms as a "cyber café" and makes it possible to monitor the time of use of the workstations by each student. The rooms that work best are those with a constant supervision. The advisor has different roles: keep an eye on the machines, first-level maintenance, assistance to the users and assistance in training.

Before moving to a completely digital environment, it is preferable to keep traditional audio and video equipment next to the multimedia computers.

4.2 Software available through the workstations

Providing the common software requires an access through Windows. The necessity to check the identity of the user leads us to consider the choice between two solutions as to the nature and operating system of the machines:

PC with NT Workstation;

PC with Linux or terminal X operated via a Unix system with a dedicated server (WinCenter, WinDD, etc.) providing the Windows applications.

The software that must be provided is: office equipment, Internet tools, self-training software and

specialised software in each subject.

Too few of these applications can be distributed for free. This will lead to substantial costs and different problems with the administration of licences (unless one day the decision is made to develop and use free software). It is better for universities to have a global policy of acquisition of software licences and be in a position to develop the notions of site licences and educational licences with the publishers.

4.3 Local network

The closest server, which must be able to administer as many as 50 machines, must enable access to software and printer.

Other -less numerous- servers on the university network must supply the other necessary services:

Documentation: the local Web tool seems to be necessary in order to circulate the educational, administrative and cultural information to the students;

Electronic mail: it is therefore necessary to make the creation of mailboxes for the students an automatic process via the administrative registering software;

Video on demand: live and recorded television programmes, video bank;

Interactive audio and video in distance learning: this has more to do with the external network, but it requires great changes in the local network in order to develop.

As far as the operating system is concerned, a choice must be made between:

the payable software Windows NT with its range of applications which are payable but widely used and hence inescapable especially in the area of office software;

the free software Linux with free applications which are mainly Internet-oriented.

The setting up of an access to several CD-ROMs on the same server often leads to difficult problems of installation and management. With the quick development of networks, this support does not seem to be viable for current and repeated access for documentation. Access to documentation will be made more and more often on-line towards dedicated servers, local or distant.

The use of the data network for video broadcasting is not yet economically interesting. But commercial and technological evolutions may be quick. Anyway there is a need to transport video on the data network for applications other than broadcasting, hence the necessity to install video cards on the workstations with the use of the MPEG compression format or to have a software solution.

The problem is the same for video-conference: no satisfactory transport on the data network is available, so there is a necessity to have distinct connections for this application.

The current protocol is Ethernet with a 10-Mbps speed. Servers are beginning to be connected at 100 Mbps. Evolutions will be: increase of the speed (1 Gbps) and massive introduction of switching (Ethernet and perhaps ATM).

This leads to the idea that the use of coaxial wire, still widely used in the universities, has become obsolete, and that twisted-pair cabling and re-cabling operations still have to be planned.

4.4 External network

E-mail: the connection of the internal mailing service to the outside is not a problem. The bandwidth necessary for the transfer of mail must not be underestimated, however.

Access to documentary information: external access is considered useful but with some restriction: many faculty members consider that, during their lectures, necessary accesses are limited to a small number of usually well-known sites.

Students' web pages: it is necessary to separate the students' pages from the official pages of the university and the problem of legal responsibility requires a constant supervision of these pages.

So, the use of the Internet by the students is possible and we have already said that it was necessary. Three problems remain to be solved:

the best possible securizing of accesses, keeping in mind the growing problems of network security;

an evaluation of the cost of this use for the universities, in order to control it and to compare it to the cost of connections for research and management;

and the crucial problem of the "barnacle-student", hooked to his computer for hours, just to surf the Web.

As the status of the student is in question, it is necessary to facilitate the acquisition of personal equipment, and so, to think about the access of these workstations to the university resources.

4.5 Evaluation of financial cost

In order to make this evaluation, we have started with a first objective of one workstation for 40 students, which seems to be the minimum necessary equipment today. It is clear that a more widespread use of ICT in educational methods will require an evolution towards a ratio of one workstation per 15 students.

Starting from this ratio and from the figure of 1,700,000 students, we reach the number of 42,500 workstations. The price of a workstation is about 1,500 Euros. Total cost: 65 million Euros. A renewal of the workstations every 5 years is a minimum. An equipment budget of about 13 million Euros a year is already necessary.

If we add the cost of printers, servers, active network equipment and software, the previous sum rises by 70% to 22 million Euros a year.

The rest is more difficult to estimate: mail and documentation servers, video servers, proportion of the cost of the university network backbone dedicated to teaching, and the cost of cabling if necessary.

4.6 Evaluation of human cost

We have already talked about the importance of advisors who can be postgraduate students. The problem is to find a legal status to hire them for about 10 hours a week.

The administration of the important number of workstations we have described, of the dedicated servers, of the network, necessitates numerous technicians and engineers:

1 technician for each set of 50 computers and one local server (that is 10 people for a 20,000-student university, with a possible slight decreasing effect);

2 engineers to administer central servers;

1 section head to manage the whole structure.

Geographical scattering dramatically increases the number of necessary staff.

It is estimated that the network backbone is administered by a network team (at least 5 people for one

university) and it is necessary to take into account the proportion dedicated to teaching in the work of this team.

Other specialised technical staff will also be necessary in order to help faculty design and create multimedia products.

5. Recommendations

The suggestions made by the workgroups deal with the co-operation of services, the policy of human resources and the general policy of the universities.

For each identified objective, a technical and pedagogical answer must be supplied. It is impossible to imagine that a single service could deal with all the aspects of the question. The solution of the organisational problem requires:

exchanges and co-operation;

taking into account the pre-existing elements;

services common to the whole university;

working in distributed mode to solve geographical problems.

As far as the human resources policy is concerned, the university must solve a certain number of problems linked to the status of staff members, reinforce technical staff and have a real policy of training.

The ICT policy must be part of the general policy of the university. A delegate, helped by a light co-ordination group is necessary to help with the planning, the realisation and the assessment of this policy.

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Collaboration as a challenge:

New learning environments embedded in old traditions

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Open Univiersity, United Kingdom

Abstract

The European tradition in higher education is built on the authority of professors appointed to a chair undertaking research as well as teaching their students. This medieval structure of universities still operates, so that the university represents one of the few European institutions which can trace its roots back to the twelfth or thirteenth century. Lecturers and their students came together at real places at real times to undertake scholarship. These crucial conditions have determined universitas litterarum, the university. Over time this basic structure has developed a wide variety of institutional forms. The European sector of higher education consists of a complex of institutions operating within different academic traditions and different national policy guidelines for education. Organizational differences between institutions are considerable and reflect dissimilarities in staffing structures, student recruitment, course assessment, programme validation and even the very language of instruction. Add commercial and industrial organizations to the equation and the differences are compounded. In principle these fundamental conditions have to be considered when we are talking about collaboration in Europe. Collaborative projects and knowledge networks that fail to take into account the traditional self-image of universities as well as the fundamental differences in the institutional cultures of partner organizations are not very likely to get off the ground. When the potential of virtual learning environments is added, the traditional university system faces new challenges such as student-centred, personalized and flexible learning combined with inter-cultural approaches to provide adequate structures of transnational collaboration. All in all we are witnesses of developments towards a new quality of universitas litterarum, namely a step towards a new way of collaboration among European universities in which resources are shared, different ways of thinking about a topic are confronted, trans-national and comparative studies are supported and learners add a European dimension to their learning experiences. This paper examines the potential of the new learning environments - in particular in the area of the Humanities - in the light of a number of current projects [e.g. the Coimbra Humanities Model; the CEFES project etc.] utilizing European networks and considers the way that the application of new technology is beginning to blur the distinctions between traditional universities and distance education providers. It also offers an assessment of the pedagogical, professional and technical conditions required for the mainstreaming of collaboration in the university curriculum.

Collaborative Course Development

The notion of institutional collaboration between different educational providers in the university sector

is inherently attractive. Pooling resources for the joint development, production or presentation of courses offers the prospect of enhancements in quality through the sharing of expertise and operational economies in the sharing of costs. Add a European context to the process and the benefits can be multiplied.

It was thinking along these lines which led to the creation, over a decade ago, of the European Association of Distance Teaching Universities (EADTU) and the formation, within this association, of a number of programme committees charged with the task of providing a European dimension in the university curriculum through the mechanisms of joint course development, transfer and exchange.

Ten years on these ambitious Europe-wide schemes have become tempered by the harsh realities of institutional practice. While there have been some small-scale successes – e.g., a programme in European law, a diploma in European business administration and, in the humanities, the appearance of *What Is Europe?*, the first jointly developed ODL course in European Studies to be offered on a pan-European basis –-we are still a long way from the goal of a distinctively *European* university curriculum.

Some of the tensions surrounding the issue of academic collaboration are nicely illustrated by the *What Is Europe?* project cited above. Under the aegis of the Humanities Programme Committee of the EADTU five institutions from Denmark, France, Germany, The Netherlands and the United Kingdom co-operated in the development of a course on European identity. Even though the five partners all belonged to the same association, the differences in respective methods of working, in the use of educational media, in the length and assessment of courses and in the structures for student support were so significant that it took more than a year to develop a mechanism for collaborative course development that was sufficiently attuned to the different institutional cultures within the partnership. This model – course agenda-setting at an inter-institutional level; decentralization of responsibilities for constituent modules; pooling of separate institutional contributions to form a master-set of course materials; production in different formats; and autonomy in the presentation of the finished product – has been elaborated elsewhere (Bang, Baumeister and Wilson, 1995). While it offers an essentially practical approach to the task of joint course construction the model has not been widely deployed by other practitioners. More to the point, the course itself, which was awarded the Daimler Benz prize in 1994 for its contribution to the integration of European education systems; which served as an agenda for an international conference on European Studies in 1995 attended by almost one hundred academics from all parts of Europe (Baumeister 1995); and which is highly regarded by students for the way it enhances their understanding of contemporary Europe (Chambers and Winck, 1996; Clennell and Proctor, 1997) has made little headway into curriculum provision in the traditional university sector in Europe, though the four course texts published by Routledge in 1995 have made their way onto European Studies reading lists for undergraduate students.

Prima facie it might be expected that a ready-made course on European identity drawing on different academic traditions and different national perspectives and itself the subject of a highly satisfactory peer group review would prove an attractive proposition for hard-pressed academics in the humanities and social sciences coping with the demands of ever-increasing student numbers and the pressures of time for their own research output. Such expectations have not been realized.

The reception of the *What Is Europe?* course – and by extension the out-put of other collaborative projects - within traditional universities reflects an understandable scepticism about the utilization of teaching materials developed in an extra-institutional context. Apart from the reluctance of individual academics to relinquish control of their own lecture and seminar programmes there is the question of accommodating established teaching structures to new arrangements, particularly when this involves the deployment of open and distance learning materials in conventional teaching situations. Rigidities of this kind often impede experimentation even in cases where the additional costs of buying in materials can be borne by departmental budgets.

New teaching initiatives need to work *with* and not *against* the grain of established practice. As the HUMANITIES project developed by the Coimbra Group demonstrates, the closer that ODL methodologies and new technology can mesh with standard mainstream teaching provision the greater

their chance of success. (SCIENTER ed. 1998, pp.12-16) Lectures and seminars are the dominant teaching instruments in universities and if new developments such as those involving the application of new technologies are seen as a means of challenging rather than supporting existing arrangements then resistance will be the order of the day.

The use of e-mail and computer conferencing for educational purposes is a case in point and again this can be illustrated from the experiences derived from the *What Is Europe?* project. This course was developed in the early 90s before electronic exchange began to open up new possibilities in the area of course collaboration. Since then the widespread use of new technology has begun to shift the emphasis from joint course development and production for separate institutional groups towards trans-national teaching arrangements involving students and tutors from different institutions. At least these are the conclusions being drawn on the basis of the CEFES project.

Creating a European Forum

CEFES is an acronym for Creating a European Forum in European Studies. Building on the platform of the *What Is Europe?* course it uses computer conferencing to provide a series of Europe-wide seminars in European Studies that can be geared to mainstream teaching provision in associated institutions. The context, involving academic discourse in seminar situations, is traditional; the delivery mechanism, utilizing computer conferencing and the Web, is new.

The CEFES project is grounded on the following assumptions:

that European Studies, because of the nature of its subject matter, can be enriched by trans-national exchanges between students and tutors

that new technology can be successfully deployed in facilitating such trans-national exchanges providing there is an awareness of cultural differences in approaches to teaching and learning and a differentiated learning environment is constructed

that flexibility is crucial in order for the partner institutions to ensure that the European seminars can be structured within existing courses/programmes

that tutors involved in promoting trans-national and inter-cultural dialogue by means of new technologies would benefit from a skills-based training programme.

In essence new technology can facilitate academic discourse between students and tutors of different institutions providing that the procedures are integrated within established structures and frameworks.

Learning Environment

Based on the FirstClass®-software a web-based virtual learning environment has been established for the CEFES seminars with the following main goals:

- to facilitate on-line communication between all participants in the academic discourse (mainly computer mediated conferencing, but also individual e-mailing),

to allow the integration of other media into the conference exchange (texts and documents, web sites, pictures and graphics), with the intention, eventually, of harnessing the full power of new technologies for bringing new qualities into the academic discourse,

- to provide clear orientation for students and academics to enable both groups to follow the discussions and to contribute to them,

- to support the administration of the project.

A tested and uncomplicated technical platform was considered vital for the support of the kind of academic discourse envisaged.

At the outset, the partners opted for a clearly structured virtual learning environment to facilitate the transition of students from face-to-face seminars to CMC.

Six CCs have been established (sometimes with sub-folders):

(1) National CCs for students and tutors to facilitate internal discussion/orientation

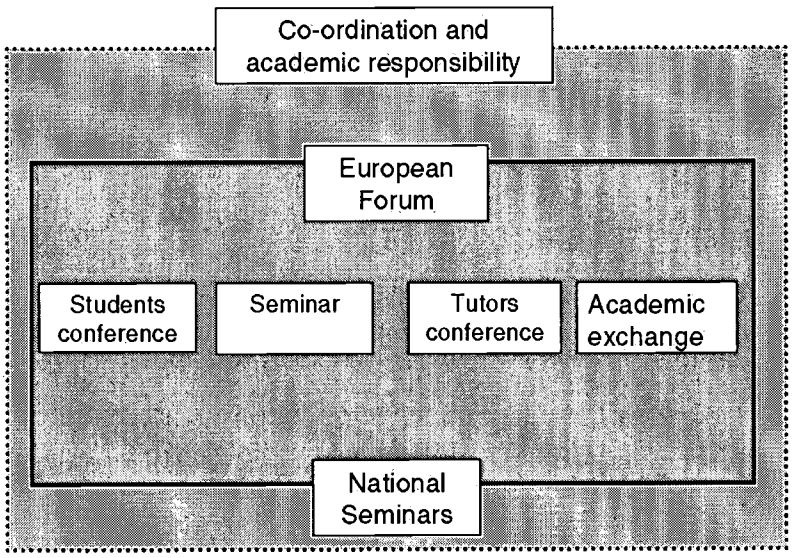
(2) European Forum CC(the European virtual seminar)

(3) International CC for tutors to exchange teaching experiences

(4) CC for the evaluation team

(5) CC for the steering committee

(6) CC for students (chat facility)



Content of the CEFES Seminars

Academic discourse within CEFES has focused on European identities.

In the first year (1997-98) three seminars were offered, viz:

- *The Identity of Europe: A Historical Phenomenon*

- *The Europe of Identities: A Political Phenomenon*

- *Globalisation and European Identity*

The seminars have a common structure. After brief general information on CEFES and its virtual

learning environment, the objectives, themes/questions and student tasks are introduced. A list of obligatory and optional readings as well as useful URLs completes the structure. In particular the reading list includes texts from the ODL-course "What is Europe?". In this way CEFES is directly contributing to the further development of this existing curriculum - a welcome by-product.

Each sequence lasts for eight weeks; four of these constitute a European Forum whilst the participating institutions run a national conference of (as a rule) three weeks in advance for preparation, reading etc. and one week for evaluation afterwards (as far as the institutions' study schedules allow).

The content of the seminars revolves around the term "Identity" and its different implications for Europe. This gives the sequences a coherence which enhances the flexibility of the whole model, namely, to offer each sequence separately but also as a series of related seminars. The CEFES formula sketched above is also flexible enough to respond to new requirements from within the partnership. Thus in the second year of presentation (1998-99) the ordering of the sequences has been changed and new teaching personnel introduced.

Programme for tutors' professional development

Operating as a tutor in an inter-institutional, electronic environment requires a distinctive set of skills. It is therefore not surprising that a programme for the professional development of tutors is an integral part of the whole project. The project offers face-to-face seminars for tutors as well as on-line training.

Major *topics* for the seminars are:

- reports on experiences with on-line learning in the participating European countries

- teaching and learning attitudes in the participating European countries

- introduction of the software capabilities

the Internet as a resource for teaching/learning material

conferencing techniques

- practical exercises – protocols and procedures for generating on-line discussion

- discussion of experiences within the project.

Apart from the upgrading of tutor's on-line skills, the seminars also provide an opportunity for participating tutors to build working relationships which facilitate the ensuing on-line exchanges.

Interim Evaluation

At the time of writing the CEFES seminars are part way into their second year of presentation and evaluation is on-going. (Chambers and Winck, 1998) Inevitably in an experimental project there have been hiccups. There have been a number of technical difficulties with the installation of the software, particularly in the first year. Some students whose first language is not English have been inhibited about participating in the European Forum. There are problems in recognizing CEFES seminar work for credit purposes. However on the basis of an interim evaluation of the first presentation in 1997-98 it is worth stressing two findings.

1. Communication among students and tutors in different European countries via the new electronic technologies is not only feasible but is also a highly appropriate teaching/learning strategy to adopt in the field of European Studies.

2. Participating students believe that such a European Forum, in enabling them to expose their knowledge and beliefs to those in other national/cultural groups, and to challenge one another, has the

potential to transform their understanding of the subject.

Further Perspectives

In a wider perspective the CEFES model, understood as a virtual seminar model, is little by little changing European universities in a more radical way than ambitious centralised ideas for distinctively European university curricula or mega-institutions.

Virtual seminars or discussion fora respect the close integration of education in everyday life and take advantages of these differences in local/national cultures by making the differences the starting point for exchange of ideas and discussion of viewpoints. Open dialogue is a challenge to chauvinism and narrowness and carries the best of the old qualities from universitas litterarum into the digital age. New technologies reanimate the old university tradition in which dialogue is the proper way to acquire knowledge.

By offering a Euro-wide dialogue between students and teachers/tutors from different European universities studying similar topics on relevant issues in a cross-cultural European perspective, the model enhances trans-learning outcomes.

As an essential feature the virtual seminar model is based on joint collaboration on equal terms among European academics and institutions, rather than on export of already produced courses or course units. The autonomy of the institutions and the characteristics of national curricula are respected, but also challenged in academic discussions.

Over the years collaboration among institutions may extend into sharing of educational materials and academic expertise. But this should be done in an open and flexible way, leaving each participating institution with the option to adapt the course materials for local use by adding to or selecting from a common resource bank. On a multi-disciplinary and multi-cultural basis academics could, within their fields of expertise, develop new learning materials in dialogue with each other. They do not have to agree, but they should disagree in a discursive way to the benefit of the students/learners.

Each institution should still apply its own evaluation standards and examination formats. Further collaboration in this respect is an institutional policy issue to be developed over the years.

In this way the collaborating institutions may in the future create virtual departments – or even virtual faculties – sharing resources and expertise and adding a European dimension to national curricula.

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Note: The partners in the CEFES Project are:

Danish Association of Open Universities/DAOU, DK

Deutsches Institut für Fernstudienforschung/DIFF, D (co-ordinating institution)

The Open University/OU, UK

Universidade Aberta/ UA, P

Universidad Nacional de Educación/UNED, E

University of Surrey/UoS, UK

Poster abstracts

Use of Information Technology in Learning and Teaching

Information Technology in University Management

Security Issues

Co-operation Within and Between Universities

Towards Meaningful Computer Uses in Education

Jaakko Kurhila
Department of Computer Science
University of Helsinki, Finland

Erkki Sutinen
Department of Computer Science
Purdue University, USA

Jorma Tarhio
Department of Computer Science
University of Joensuu, Finland

We describe how the technical and methodological innovations developed at the Department of Computer Science, University of Helsinki, can contribute to education. The spectrum of innovations range from software applications to schematic models and intercultural collaboration. The research has been multidisciplinary: experts from different domains have shaped the realization of the innovations.

Geoinformation Systems for Telecommunications Learning

Veaceslav SIDORENCO
Technical University of Moldova, Moldova

Modern Geographic Information Systems (GIS) are special powerful desktop software systems initially oriented to adequately reflect and process geo-spatial information. Such systems can be successfully used as convenient instruments for training future engineers in all technical domains of spatially distributed objects presentation, projection and analysis. Particular experience of using GIS for telecommunications systems learning is presented in the paper.

The Role of New Technologies in Education Process at the University

Rok Rupnik, Marko Bajec, Marjan Krisper
University of Ljubljana
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University is an amphibian. It conducts pedagogic and educational activities on one hand, research and project activities on the other. Therefore an integrated university information system supporting all possible activities in the university is a rather complex system. The paper will discuss the structure of integrated university information systems. It will try to define the role of new technologies in the education process at university.

Project VIRPI: A Virtual Learning Environment for Small and Medium-Sized Enterprises

Kirsti M. Lindh
Janne Matikainen
University of Helsinki, Finland

Time is well-known to be the minimum resource for many SME's trying to arrange the in-service training needed for their personnel. Yet the rapid development of an information society creates a strong challenge for companies to increase their competence in networking and telecommunication skills. The project VIRPI, A Virtual Learning Environment for SME's, aims at helping companies save time and resources by developing new methods of in-service training via the Internet, according to the spesific needs of small companies. During the first year pilot phase of the project, a set of prerequisites and criteria for a successful learning process was collected from three different point of views: the participating enterprises, the educational organisation and the implementation of a learning environment model. In the spring 1999 the virtual learning environment is further developed according to the experiences of the pilot phase and training is arranged for an extended number of enterprises. In our paper we share the main experiences on the developing work of the virtual learning environment, both positive and negative compared to the ideal given by the enthusiasts of information technology.

Distance Course Designed and Developed for Deaf-and-dumb People

Eva Burianova, Zdenka Telnarova

Ostrava University, Czech Republic

This poster describes the approach to developing and realisation of bachelor distance study focused on Application in Informatics for students who can not take part in full time study. These students are from all the Czech Republic and they are deaf-and-dumb people. The poster is focused on specific requirements of this form of study.

Distance Learning Organization for small countries on Northwest of Poland

E.Kushtina, M.Barsz
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Institute of Computer Science & Information Systems
Szczecin, Poland

The development of student project DL for Northwest of Poland in frame school reform. It is examined possibility of using Wireless Local Area Network (WLAN – BreezeCom) for telecommunication maintenance between DL-Center and learning workstation in small countries (including disable person traning).

UniCafé: the development of a virtual learning environment in Surrey, UK

Stylianos Hatzipanagos
University of Surrey, UK

UniCafé is the name of an innovative project which is currently under development at the University of Surrey. The innovation of the project is that it intends to provide new means of delivering higher education outside the confines of tertiary institutions, into the community. The paper describes the background of the project and such aspects as modes of delivery, technical and academic frameworks, evaluation and trasnationality.

Information Technology in University Management

Information technology in the Lithuanian University of Agriculture

Stasys Martišius
Lithuanian University of Agriculture, Lithuania

Lithuanian University of Agriculture (LUA) is the only higher school in Lithuania training agricultural specialists. Total amount of students in five faculties is about 4670. The staff is: 32 professors, 234 associate professors, 132 senior assistants, 62 assistants, 50 researches and 765 supporting and administrative staff. LUA library has about 561000 books. LUA campus is in 10 km. distance from Kaunas center towards south-west near the highway to Marijampole and Warsaw cities. There are five academic buildings, student campus and, situated on the other side of highway, teachers' settlement.

The Year 2000 Challenge and the University Information Systems

Viljan Mahnic
University of Ljubljana, Slovenia

The paper consists of two parts. The first addresses the symptoms of the Y2K problem as well as possible solutions and tools. In the second part we describe our experience in solving the Y2K problems affecting the student records information system at the University of Ljubljana. A strategy for solving the Y2K challenge in Clipper applications is presented, and a description of two tools (source code scanner and data aging tool) is given. Finally, some statistical results that illustrate the size of the problem and enable comparison with similar efforts are presented.

Information Technology Strategies in Vilnius University

Marijus Jurgutis, Gediminas Murauskas
Vilnius University, Lithuania

New version of information system (IS) is under development in Vilnius University. Both the client/server and three-tier architecture are used for IS implementation. Read-only IS users have access only to replicated data.

Timetables – Planning for the future, managing today

Jim Warder
Scientia Limited, UK

Scientia provide a range of planning and scheduling software applications, one of which (Syllabus Plus) is widely used in Higher and Further education institutions around the world. As well as producing a comprehensive range of timetables (staff; location; equipment; students and their groups, degree programmes, faculties, equipment) with tools to optimise, reprocess and manipulate data; Syllabus Plus is also widely applied as a modelling tool. Users report a wide range of benefits to be derived from the software, from speedier production and publication of timetables, to saving in space requirements and more flexible delivery combinations.

Development of United Information System of Higher Education in Latvia- Problems and Solutions

Laila Niedrite, Andris Buhanovskis
University of Latvia

Currently in Latvia information systems are used in some of the higher educational establishments only. Exchange of information among the universities, Ministry of Education and Science (MES) and State Statistical Bureau is in the form of Word documents or written papers. The obtaining of the full statistic data is burdened. Latvian Education Informatization project, a part of which is Information System of Higher Education (ISHE), enables to improve the present situation in Latvia. It is expected to develop a united classification of study programs and the register of programs and students. ISHE is developed in ORACLE, Internet browsers and Oracle WebServer being user's interface. The existing problems and solutions concerning the development of ISHE will be under discussion in this report.

The Role of Information Technologies within University Fine Art Studies

Robert Hamilton
University of Lethbridge, Canada

Information Technologies (IT) are becoming an integral tool in the education of Fine Arts at the University level. Universities are scrambling to find additional funds and IT instructors/professors for their Fine Arts departments. In addition, new students specifically seek out institutions that include IT with their major study. It is happening so quickly that many educators do not possess the fundamental background or skills in IT to integrate it with their curriculum. There seems to be a gap between the needs of the students and what Universities are able to provide in relation to IT.

Security Issues

Secure Data Transmission and Electronic Signature of Documentation in a medium-sized academic institution. Deployment and Implementation within the University of Las Palmas

Manuel Galan-Moreno
Luis Alvarez-Alvarez
Antonio Ocon-Carreras
and Enrique Rubio-Royo
CICEI - Univ. of Las Palmas de G.C. - SPAIN

In the following paragraphs we will try to give a textual explanation of the poster presentation to be held in Helsinki during EUNIS'99.
We describe the two most important standards in Secure Data Transmission: SSL and PGP, and we enumerate some recommendations done for their implantation within the University of Las Palmas de Gran Canaria. Some details about the implementation are also given.
The drawbacks arising from the splitting of the implementation in two somehow competing standards, as much as the legal problems that rise due to the export restrictions of strong cryptographic software, have meant a brake in the necessary process of integration of these technologies in the application of Information Technologies, not only within the institutions but also in the communication among private individuals.

Latvian University Information System security aspects in different application environments

Aivars Niedritis
University of LATVIA

Latvian University Information System development project started at June 1996. There is used existing system experience. Data from FoxPro systems were transferred to new application environment: Oracle, UNIX and WWW. In the following document the main system production stages and security aspects are described.

Co-operation Within and Between Universities

Strategy of development of Academic Computer Network in Moldova

Dr. G.Secrieru, Dr. P.Bogatencov
The Center of Information Technologies of ASM, Moldova

Computer networking technologies for science and education are now actively developing in Moldova. The process of uniting efforts of different scientific and educational organizations on creation of the National scientific-educational networking segment is observed. As the result of this activity AMNET project was started. The objectives and stages of project realization, existing and future network infrastructure, detail program of the network development and project realization financial support are described.

The Interaction between University Network and Industry

N. Andronati, I. Andronati
Academy of Sciences of Moldova

Abstract: Last 30 years great human, material, industrial, technolgic and scientific potential was accumulated in the Republic of Moldova.
Now due to the economic problems specific for tranziction period this potential is less required.
To stop the process of loses of technologies and know-hows we want to realize a new mechanism to preserve and to propagate of obtained results and to reorient to new direction of activity. In this scope we want to use both of existing mechanisms and new ones. We want you to know some aspects of curent situation we are and our visions too.

The Concept of Typical Integrated Information System for Universities of Ukraine

A.M. Luganski, P.I.Orlov
University of Internal Affairs, Ukraine

Realization of overall informatization program and development of information-controlling system in University of Internal Affairs (Ukraine) are described. The basic principles of advanced integrated university information system creation are considered. Original balanced interpretation of automation aspect of having business-processes and information supporting environment for creation of new technologies and scripts of information processes is offered.

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