Distance Learning

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Abstract

Distance learning is evolving at the same time as the technology and the learning methods evolve. Different kinds of tools have been developed to be in use in distance learning. These tools are designed to help to overcome many of the problems that come with distance learning concepts. Problems can be linked to data management or to security issues. This paper discusses some of the problems of the distance learning and tries to find out, if there are any proper tools to overcome these problems. To outline the paper, only a small number of the problems are discussed. These problems are defined and the tools are tested in practice to see, how they are performing. The analysis shows that the tools help protecting assets in distance learning.

1 Introduction

It is evident that everyone knows what is going to school. One wakes up in the morning, takes the bus and goes to the school. The student spends his day listening to teachers and then goes home. This kind of learning is called local learning, i.e. student is present in the classroom. The concept of distance learning is opposite to that of local learning. In distance learning the teaching is handled trough some media and it does not involve being physically present in the classroom.

Why do we need distance learning? Consider Australia, a huge continent, where the distances between cities or villages are enormous. To get all the people from home to the school might take a great effort. With the distance learning, one does not have to waste two hours to get to the nearest school, instead, the teaching can be done distantly with the aid of computer. For handicapped people this can bring major benefits. They can study from home.

When the distance between different places is not playing a major role in learning, it is easier to establish international courses. People from all over the world can participate the same course without crossing the states' borders.

Distance learning is not only about making things to look like local learning. It is a concept of a new learning environment and how is it possible to manage the huge amount of

information that comes with the courses. This paper is about the tools (software) that try to help overcoming of these problems. The problems of asset management are discussed and some of the available tools will be analysed. It will be discussed how well their manage to handle the security issues.

The remainder of this paper is structured as follows: In section 2, there will given some of the ideas behind the distance learning and some of the problems of distance learning will be stated. In section 3, a general introduction to distance learning tools will be given and some of the tools are represented and analysed. Section 4 compares the selected tools and in the light of analysis. Last section closes the discussion of the distance learning.

2 Theory and Problem Statement

2.1 Ideas behind distance learning

The terms *distance education* or *distance learning* have been applied interchangeably by many different researchers to a great variety of programs, providers, audiences, and media [5]. The term *e-learning* is also used in some contexts. The concept of distance learning is not only a concept of learning enabled while not present physically, it is also a concept of a new learning environment. When learning is no longer local learning, there has already been a change in the learning environment. In other words, distance learning is something that can be only done in a new learning enviroment. In literature this environment is called *Virtual Learning Environment (VLE)*. Naturally, this leads to people developing new VLEs. Mielonen states that one of the most important drivers to develop new learning environments has become from the world of education. A better understanding of the learning as a process has led to better educational models and environments. The teachers and the researchers have begun to understand that the current methods used for the learning, are not the best [6].

According to the study by Sandy Britain, the VLEs have two main purposes for their existence. First, their function is to provide oppotunities to improve the quality and variety of teaching and learning that are achieved using current methods. Secondly, the idea is to reduce administrative burden on teachers, thus allowing them to balance their workload more efficiently and to be able to give more time to individual students' emotional needs [12].

New VLEs have the following factors [7]:

- environments

- learners

- teachers

- different views of learning

- different methodology

- learning resources

- tools and means to use these (technologies and media)

These factors are presented to show that a learning environment is not only about physical place. It is also about factors that link to feelings, attitudes learning atmosphrere. Other aspect is technology and media. Technology is not prerequisite for a new learning environment, but it is the main factor. Easily, the technology may become the end in itself, if educational purposes and the students are forgotten [8].The psycological perspective and different methods of the learning are out of the scope of this paper and they are not inspected. Instead, the tools (technology) will be discussed.

2.2   Problems of distance learning and issues of asset management

To continue general discussion about distance learning, there are some negative aspects and problems with distance learning. First comes the unreliability of the technology. What if some network connection or server goes down? The distance learning system can't be used anymore until corrective acts have been taken place. Secondly, it might be expensive to purchase the needed equipment to be used. On the other hand, the savings that come with distance learning can be considerables. One does not have to travel 2 hours and waste a big amount fuel (and at the same time pollute the envinronment) to get to school. One poor side of distance learning is the communication between people. The communication is not as efficient in distance learning as in local learning. To give idea, consider signalling between two persons trough *chat*. While it is impossible to see other person's face, some of the messages can be understood incorrectly [1].

If we move to a topic of organizing a course, which will be carried out as distance learning course, there are issues that have to be considered. Because the course will be gone through with aid of software and computer networks, it will raise several different security issues. To start with, some kind of authentication has to be done with students who are participating the course. Because students are not physically present, the course managers must have some way of recognizing the participants of the course. They have to know with whom they are working with and to whom they are sending information and other teaching related staff. If students are returning home assigments or doing exams with the aid of distance learning system, the course managers have to know exactly who returned the answers. They have to know that it was really Jack, who submitted the exercises, not anybody else. There has to be also some indication that Jack sent the paper at some day at some time. Consider if Jack returns his exam by pressing 'submit' in his web browser, but the data was lost somehow. It should be possible to prove that Jack really pressed the button, not anybody else, who submitted the exam.

The data of the course management staff has to be kept out of the sight of the students. An example is the answers for the home exercises. If they were public, anyone could copy them. The work of students has to be kept confidental. The other students must not have access to other students' confidental data. If the students had access everywhere, they could plagiate home exercises and other private data.

Students must have easy access to course data and must have a possibility to control their own data. This means *high availability* for the data. They have to able to share their knowledge with other students and they must have a way to ask help from the course

managers. That is why communication services are needed in the distance learning system. Communication can be done with e-mail, videoconferencing, news, white-boards or chat. It is restricted only by current technology.

The submitting of homeworks and assigments has to be done in secure manner. When someone is submitting homeworks through the network, it is possible that some other person is listening the connection. The malicious person can grab the exercise answers from the network and use them as his own exercise answers. This means that users and the system must have some way of encrypting the data. In other words, the connection has to be reliable in the sense of privacy.

What about the exams that are organized with help of distance learning system? Is it possible to prevent cheating when students are answering the questions at home? Naturally, preventing of the cheating is a hard task, though some methodology has been suggested [2]:

- Requiring students to take proctored exams.

- Asking students to provide a writing sample at the beginning of the semester.

- Calling students periodically to ask how they researched their paper.

- Giving periodic quizzes during online chat sessions.

- Using the Internet to search on key words used in a student's paper.

- Requiring students to use a camera on their computer desktop for discussions and exams.

Distance learning is not only about making things to look like local learning. As already stated, it is a concept of a new learning environment and how is it possible to manage the huge amount of information. Using software and networks in distance learning raise up a number of questions of protecting assets. Fortunately, there are several different types of software, which try to help managing all the information. The next section illustrates these products.

3   Introduction and Analysis of the Tools

In the beginning of this section, there will be given a brief introduction what, in general, are the distance learning tools. Later in this section, the selected tools are tested and analysed, to see how they meet the issues discussed in the section 2.

The world is full of different kinds of distance learning tools. There is a number of commercial and non-commecial tools that try to make it easier manage a course or to facilitate learning that is done 'distantly'. Distance learning tools or VLE's, in general, have the same kind of user interface. They use a web browser as the client interface. Since this is the case, the systems are client-server architectures, where clients connect to a web server. In typical VLE, all users have their own personal workspaces. The personal workspace is something that user controls. User can add files, change outlook of his workspace or share

files with other people, to have an example. Normally there are different types of roles that users can have. The most frequent role types are teacher and student. Teachers have more privileges over the student, which means that the teacher can establish a course, but the student can't. The teacher can publish course material in the VLE, but the student can't. Roles can be predefined or they can be configured depending on the tool. Systems have also a special role for administrator, who has access everywhere. The administrator is the user who maintains the environment.

From the technical perspective, most of the systems are almost identical, including basic features. The basic features are listed by Britain: *notice board, course outline, e-mail (tutor, students), conferences, class list and student homepages, assignments and quizzes, assessments and grades, metadata, synchronous collaboration tools, multimedia resources repository, file upload area, calendar, search tools, bookmarking and navigation model*.

There are three major types of on-line courses in universities. Mason (1998) suggests following three basic models [16]. First, *Content and Support* which means that part of the course is conducted through VLE. This is the most usual one. The more advanced application of VLE is *Wrap-around*, where approximately 50 procent of studying are done in VLE. The most advanced is *Integrated model*. The main emphasis is in the dynamic content and it requires adaptation from all involved parties. Like Britain states, the setting is no longer teacher teaches and student receives information. Teacher is the manager of the information, like it is already in university level studies.

In the following paragraphs, there has been gathered the features that will be analysed. They all concern asset management of distance learning tools. The analysis will follow same kind scenario for all the tools inspected. The paragraphs below are gone through one by one and the questions are asked. Then the system will tested to find the answers to questions. The explanations for descriptions are given according to Benvuti [15].

Authentication Authentication is a process of reliably verifying the identity of the user by means of password, an object (smartcard), physical charasteristics or trust.

In this context, following features are tested: How the users are identified? How is this information stored? How is it transmitted to system? If users are identified with username and password, what kind passwords the system approves? Is it required to change the password periodically?

Availability If the system is unavailable when an authorized user needs it, the result can be as bad as having the information that resides on the system deleted.

What kind of database system uses? Can earlier versions be recovered? What are the backup possibilities of the system?

Communication By communication it is meant the different ways to communicate with help of the system.

What kind of communication possibilities the system provides?

Confidentiality Protecting information from being read or copied by anyone who has not been explicitly authorized by the owner of that information.

Is the connection to server secure? How are the personal assets stored and protected in the system?

Non-repudation By non-repudation is meant the ability of the receiver of something to prove to a third party that the sender really did send the message.

If home assigments can be submitted through the system, is there an indication that something was submitted? How the submitting of the exercises is carried on?

Three of the distance learning tools will be analysed: FLE, OTUS and WebCT. The explanations for the acronyms will be given when the tools are introduced. FLE was chosen because it's designed in Finland and it is available for home installation. OTUS was chosen, since it will be in use in Helsinki University of Technology for course management. The other reason is that it's possible to access the prototype of the system. WebCT was chosen because of it has been use in Helsinki University of Technology. WebCT is also one of the most frequently used platforms in universities [17].

3.1 FLE

In the MediaLab of University of Art and Design (Helsinki, Finland), the staff suddenly understood one problem: They are teaching and studying new media, but they are not actually using telecommunications and information technology. This resulted in a research and development project called Future Learning Environment (FLE) [9]. The project was funded by TEKES (Finnish Technology Center), Finnish Ministry of Education and indrustial research partners. It started in 1997 and the project had three main aims:

- To research and develop innovative ways of using new media in the field of collaborative learning.

- To develop www platform supporting collaborative learning and thinking

- To build new ways of sharing educational www based multimedia material

FLE works in collaboration with the BSWD (Basic Support for Collaborative Work) developed by GMD - German National Research Center for Information Technology. The archtecture of the system is presented in figure 1. In short, BSCW enables collaboration over the Web. Web pages describe the BSCW as a 'shared workspace' system which supports document upload, event notification, group management and much more [10].

The basic structure of the FLE constructs of the following modules.

Virtual WebTop Virtual webtop is shared workspace of the user to share share digital materials with other users and to access the other tools.

Knowledge Building Module In practice, this is discussion board.

Jam Session Module This is a place for storing different versions of objects being developed. This is place, where elaboration of the object can be seen graphically.

Library Library is for shared documentation, in different formats. This is a place to publish and browse multimedia learning material.
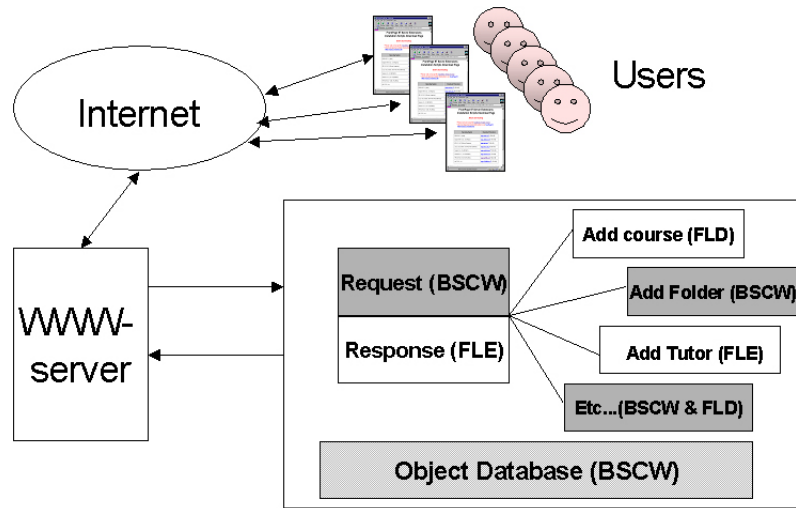
Figure 1: FLE Architecture [18]

People User database and a place for defining users.

Administration This is a place for creating, removing and editing courses.

The system inspected is the first version of the FLE, but currently there is third version called FLE3 tool available. The terms FLE and BSCW to mean the same thing.

Authentication issues begin the discussion. FLE uses username and password for authenticating the users of the system. The registration to the system is a two-way process. First the real name and the organization with phonenumber are entered and then the administrator of the system sends the URL in e-mail to user for actual registering to system. There is no minimum length for the password, only empty passwords are not allowed. User can change his password to a new one without knowing the former one. Passwords are stored in the system using hash algorithm. If connection is not utilizing SSL, the passwords are sent in HTTP - header using 'POST'. There is no support for any other types of authentication.

FLE uses internal database that is implemented in BSCW. Backups of the database base can be made manually with specific command or this can be automated with the help of the scripts. Old backups can be recovered easily by administrators.

Communication methods of the FLE include discussion groups and event notification by e-mail. Notification means that when creating a new folder to workspace, the event be notified to other users by using e-mail. Every user can create an own discussion group. The user has all the rights over own discussion board. He can grant different privileges to different users. While this is true, there can a great number of discussions, which can make navigation cumbersome.

How the data protection is handled? Every user has his own workspace, where he can upload different types of data. The user can make his private folders to be public. In this case, other users have access to public a folder. Files have to be set explicitly public, so they are out of sight of anyone automatically, if settings are not touched. For the data, the user can define different access right, like read only or edit. The owner of the workspace

can define the users who have access to certain data. In BSCW there are three different predefined roles: Manager, member and restricted member. The system administrator can add more predefined roles through the web interface. If roles like teacher and student are wanted, system admisnitrator can add those. The restrictions are about access right and some minor features. There are altogether 77 different features that a new user can have, starting from reading and editing rights. The BSCW can utilize *SSL* to make the connection secure. BSCW does not require any encryption methods. The general security issue of http and has nothing to do with BSCW. So to make connection secure, the server have to utilize SSL.

It is possible to return home assigment with help of the system, but it is not a built-in feature. While this function is not automated, the user has to use normal file upload to submit exercises. If user uploads an object (text files, images etc.), there will be shown a timestamp that inidicates when the upload was done. The teacher can check the timestamp to verify the time of upload.

3.2   OTUS

In the Computer Science Department of Helsinki University of Technology (HUT) there have been development and implemetations of several different course management tools. These tools have been constructed typically to solve, for example, following problems:

- Distributing exercise material.

- Receiving home exercises and feedback

- Management of WWW - pages

By using these tools, it has been possible to reduce the rutine work in the courses, especially courses that have many students. There have been experiments with integrated learning environments, but there have been two main problems. The teacher has to accept the functionality of the tool and its restrictions. The other one concerns the strict integration. In some integrated systems, the e-mail has been integrated to the system and that is why there have to be two different handlings of the e-mail: usual e-mail and the integrated mail [11]. The same is true with the *news groups*. The effort to correct these problems and several others resulted in development of OTUS (OPetuksen Tuki Systeemi). The demo version of the system was developed by Innofactor Oy.

Figure 2 shows the architecture of the system. Project was funded by HUT.

The software is currently under experimental use in some courses in Computer Science Department in HUT. Since OTUS is under development, a full usage was impossible and in the analysis the manual will be referred of OTUS will referred in certain cases.

The authentication is done with username and password. Since OTUS uses the same password database as *WWWTopi*, the password scenario of the WWWTopi was tested. WWW-Topi is management tool for courses in the HUT and can be found in web http://webtopi.hut.fi. It is not required to change passwords periodically and there are no special requirements
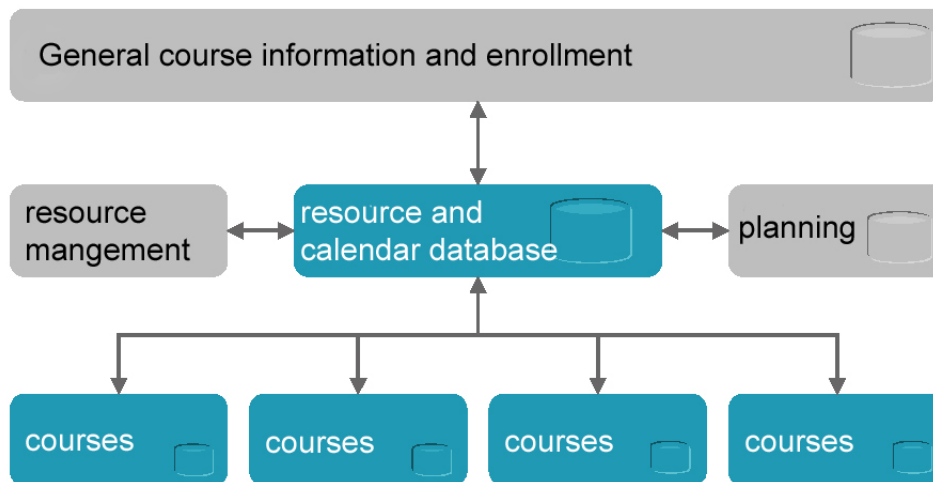
Figure 2: OTUS system [3]

for passwords, like minimum 8 characters. The passwords are delivered using *SSL* connection. There was no information found where and how the passwords were stored. There were no other authentication methods than username and password.

OTUS uses relational database. There are two separate database parts, where the other one is for course related staff and the other contains resource and calendar information. OTUS can interract with other systems, with the help of *SOAP-*, *SSH-* and *SMTP-* protocols. There was no information available for backup possibilities of OTUS system.

For communication facilities OTUS include sending e-mail notifications and constructing web sites. There is also a possibility to send a *SMS*. OTUS doesn't use integrated communication structures, because basic idea was to keep them separate from it.

How is the personal information protected? There are three different usertypes in OTUS: course manager, student and teacher. They are depicted in figure 3.

In the student's private workspace, the student can browse course information and do course related actions such as enroll to some course or join some teaching group. It's also possible to follow, what tasks the student has performed and what are missing. Student can't share documents with the other students or upload documents to their private workspace.

The basic action of the manager is designing the structure of the course. Other important actions are ordering different study groups and the managing of the course teachers. The manager can give different privileges for different users. There are many features, which make the management of assets easier. For example, when establishing a new exercise group, manager can use some of following scenarios to divide the students to groups: random, random with priorities, free student allocation, obligation. In the priorities random, the student can choose best groups put them in the order. An algoritm is then used to choose courses. There is also a module for making exercises, feedback or surveys. If we take an example of making exam, the manager can use random generator to get different questions for different people. There's also auto-correction for multiple-choice questions.
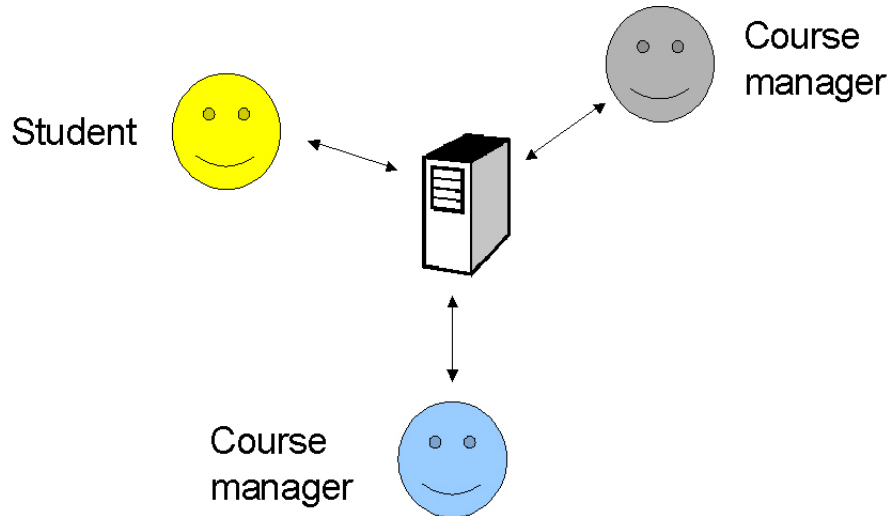
Figure 3: OTUS users [3]

All the answers are saved to database. Statistical information can be formuled from the answers. There is no shared workspace for the users. The one who can share information is course manager or teche in the form of webpages.

The returning of home assigments can done with the help of e-mail or with the upload feature from the web interface. If students are using e-mail, they are required to encrypt and sign the documents using *PGP*. When the submission is received by the system, it verifies the signature signed by the student from the PGP database. If the signature verifying succeeded, the system saves the file in the database in encrypted form. When assistant or course manager wants to grade the submitted exercise, he fetches it from database and decrypts it manually. If the home assigment was done by a group, the course assistant can determine who is going to return the assigment.

3.3   WebCT

According to WebCT's web site, WebCT Inc. is the world's leading provider of e-learning solutions for higher education [4]. Why was WebCT developed initially? "I wanted to explore the effectiveness of the web as a teaching and learning tool so I had to teach a web-based course, but I found there was very little out there to help me set one up", states computer scientist Dr. Murray Goldberg, who started the developing the WebCT platform. In January 2001, more than 148,000 faculty members at over 1,570 colleges and universities were using WebCT. According to web site of the company, just in Finland, it has 54 customers, mostly educational organisations, but also a couple of cities [4].

In general, WebCT is a tool that helps to manage courses and course information. It has defined five different user schemes: Administrator, Helpdesk User, Designer, Teacher and Student. They differ in what kind of privileges they have over the system. Administrator has most privileges descending all the way a student. WebCT has tried to make a real integrated learning environment, in which one can distribute course material, make home

pages, communicate and so on.

The authentication in WebCT is done with username and password as in other two tools inspected. There are no special requirements for password, like the use of numbers in password. This means that password can be anything. If the WebCT server does not utilize SSL, the password is sent as plaintext to server. There was no information found where or how the passwords are stored. Password can be changed by the user. If user has forgotten his password, he can enter his e-mail address to web form and the password will be sent to corresponding e-mail address. There is no support for any other authentication types.

WebCT uses three different databases to store user information:

Global Database Stores global records for every user, such as global id.

Homearea Database This stores the information about every user's homearea (myWe-bCT), including password information to get to the homearea.

Course Database This stores the data for users within a particular course. Each course has its own database.

Backups of the course information can be done from command line or with a web interface. Since WebCT system resides in a single directory backups can be made easily. In windows Winzip can be used or in UNIX systems tar and gzip.

WebCT offers different communication methods. It allows communication in the system through e-mail, online chat, whiteboards or discussion groups. The course manager can decide what kind of communication system will be used during the course. If the administrator allows, e-mail can be forwarded to any address or to restricted address space.

How the personal assets are protected? To see how the data is organized in the system, the system is inspected a bit. WebCT is used specially for organizing a course and there are two main roles: course manager and student. Course manager can be a teacher, to whom has been granted more privileges. They both have same kind of workspaces. The teachers workspace includes tools that can used to manage a course. The student can change nothing. He just gets what is available. The teacher has several tools to manage a course. First, he can fill the course basic information, like the name of the instructor and name of the course. Teacher has to construct the course also. To do this he has to use the calender tool, where he can add specific events on specific date and time. He can create own discussion groups for the course and add course material to web. There is possibilitty make an e-mail tool to be used to communication tool within the course. The teacher can make quizzes that the students can use to test their information. The students have their own workspaces. They can browse the course data where they have enrolled. They can send e-mail with the integrated tool or join the discussion, if the course manager has created one. There can be also online chat, of course only if the manager has created it. It is impossible to enter other users workspace without loginname and the password, which means that access to private data is restricted. It is possible to submit answer for the home assigments to teacher through the system.

To check non-repudation capabilities of the system, we'll check the home assigment returning system of WebCT. WebCT allows uploading and submitting the home assigments through the system. The procedure follows this: First, the teacher publishes assigments.

After the publication, the student can download the exercises. When student has finished with the assigments, he first uploads the answer data to WebCT for personal workspace and then he submits the data to teacher. There is an indication when the paper was submitted or error if it was not possible. While the submission is done in the system, the teacher can be sure who submitted the answers. In the place, where the assigments were downloaded, there is shown an indication what have been submitted and what hasn't. In this workspace the student can check the grades what he has gained from the assigments.

4   Comparison

In this section, the features that were analysed are compared.

Authentication issues will start the discussion. All the tools analysed used normal login-name and password scenario. Inspected tools didn't have minimum lenght for the password and the user was not obliged to change it periodically by the system. This is a minor problem, if the system doesn't utilize SSL. If the connection is not secure, it doesn't matter how long the password is, since anyone with enough skill can grab the passwords from the network. In FLE, the passwords were stored in the system using hash, but in other systems, it wasn't clear how the password was stored.

Every tool had some sort of database underneath the system. In FLE and most likely in WebCT the database was internal implementation, while OTUS used relational, possibly external database. Backups and restoring earlier version of the backups can be made easily in FLE and in WebCT. WebCT had even web based user interface for this.

WebCT had most communication possibilities built in the system. It had almost everything integrated to the system, starting form e-mail, including real-time chat. Chat was something that was missing from other systems inspected. An interesting feature in OTUS was sending text message to GSM phones. This is something special that other tools didn't have. In FLE, the most important way to communicate was the discussion board. The Jam Session is quite a good idea to view object elaboration graphically, which is, in one way or another, communication feature. The object that is elaborating can be for example a text document that many persons are editing. In FLE, the only concrete way of communication was discussion boards and OTUS didn't have in practise any, if SMS is left outside.

All of the tools used username and password to identify the users. With the help of this, also access to personal work spaces were prohibited without permissions. In every tool, the other users' access to private data was prohibited. There was also a possibility to share data. In WebCT and OTUS, the only user who can share data was teacher. This feature can be used in WebCT to put course material in the system. In OTUS, it is possible to put content in the system in form of web pages and it is possible to include in the web pages whatever data. In FLE, there was a possibility to student to share his own data. This wasn't possible in WebCT or OTUS. In OTUS and in WebCT it was possible to upload and submit home exercises with the help of the system. In FLE, there was no direct support for submitting home assigments, but the behaviour of the system allowed uploading documents to teachers public workspace. If the amount of students is huge, the uploading will most likely become cumbersome or even chaotic, since it is not build-in feature. Data integrity was handled excellently in all tools.

Non-repudation was the last criterion that was considered. By non-repudation, the returning of the home assigments will be estimated. WebCT had an appropriate way of returning home assignments. As analysed, the date and information whether the assigment is returned was shown to student. OTUS had quite a similar system. Uploading is possible or the use of e-mail. A remarkable feature in OTUS was the oblication for PGP, when returning assigments as e-mail attachments. In FLE, there wasn't any build-in feature for returning home assignments.

5   Conclusion

This paper was looking for answer, if there are any tools to facilitate course management and to make the distance learning easier. We have seen in the previous section how different tools protect assets. We had a small set of different assets to be protected and we analysed how the tools protect these assets. After inspecting the tools, it has to be admitted that these tools really protect assets. If we take a look at the problems with asset management mentioned in section 2, it seems that the tools can come over most of the problems that come with asset management.

If the issue of managing a course is considered, OTUS and WebCT are proper tools for it. The FLE wasn't about managing a course. It was more or less about using some learning methods with the help of media. To put it simply, FLE is not a good tool to manage a course. It misses some of the features that would be nice in distance learning, like returning home assigments and handling grades. In OTUS and WebCT it was possible for the students to follow, how there are advancing in the course. In FLE, this was not the case.

The three tools can be separated to different categories. WebCT was a tool that really tried to make a new learning environment. It tried to integrate evrything in the same package. OTUS was a tool for managing students. It wasn't a tool for managing all the information that come up with a course, like material and communication staff. It seems that it's been quite succesful in what it tried to do. FLE was something different. It was not a course mangement tool. It was more a sort of shared workspace.

To sum up the features analysed. The password scenario should be improved. The password should changed peridiodically and there should some check for the password characters. The tools are good at making data private and visible only to user. This means that private data is out of sight of unwanted people. Every tool had some sort of way to grant different levels of privileges to different users. In other words, users can have different roles in the system. Non-repudation can be checked, if there are some build-in features for returning homeassigments or exams.

An overview of the distance learning tools is quite similar. There is number of features that a new learning environment should have. One could say that the more features a system has, the better it is. On the other hand, one can't be the best in all fields. The same is true for distance learning systems. The tools inspected here, at least in theory, solve many of the problems of the distance learning.

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