Computer Networks Course: Claroline-Based E-learning Model

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Abstract: Computer Networks is a course held at the Faculty of Science, Department of Physics. The goal of this course is to introduce to students network concepts and technologies used in the world of computer science and Internet. This course was held till the passed academic year (2004/2005) in a traditional manner (*ex-cathedra*). Starting this academic year, the course is held by the means of e-learning. In this article we will try to explain our motivation on designing the content for the mentioned course in on-line environment and the issues we encountered during the development of the materials. Technology used to implement this on-line course is based on the open-source LMS, Claroline.

Introduction

Computer Networks, is a course held at the Faculty of Science, Department of Physics (DoP in the following text). Students of the orientation physics and computer science (PCS in the following text) are taught to become future physics and computers science teachers (it is important to emphasize: the main difference in Croatian higher education system between the terms professor and teacher is the fact that the latter is eligible for work in primary schools, while the prior is eligible for work in high schools – junior and senior; the term K-12 does not exist in Croatian lower education system as such, therefore the difference).

One of the key goals of this project was to develop a high-quality on-line course to satisfy the needs of students, as well as lecturers. Also, the goal was to develop a system that gives the students quality-assured information, support, and to allow students to communicate and collaborate on a higher level. Motivation for such project, on the other hand, was to alleviate the pressure to students while attending the lectures on other courses, as well as introducing them to new learning methods in order to prepare them for life-long education. Till the passed academic year (2004/2005) this course was held in a traditional manner (ex-cathedra). Starting this academic year course is held by the means of e-learning. With the assistance of Darko Androic, PhD, the Computer Networks course chair, we devised a plan for such an implementation.

Since the content for this course is already developed, it only needs to be adapted for an on-line environment (development of the multimedia), thus raising the question of choosing of an appropriate Learning Management System (LMS in the following text). In current situation, we had two choices:

- WebCT and
- open-source LMS.

Using the WebCT for last few years we found that, in spite of the fact that it is free of charge for DoP (license management goes to CARNet, Croatian Academic and Research Network), it is also inconvenient for us. It is completely centralized, so we would depend completely on CARNet and its policies. That is the main reason we decided to use an open-source product.

We conducted a research according to our needs for a LMS. From all the available open-source LMS's, the top-rated was Claroline (developed mostly in Belgium, 1998/1999 -). Recent contacts with the development team enabled us to use it more efficiently than WebCT, and currently we are working on a localization of the whole LMS user interface.

Being SCORM 2004 compliant, Claroline offers us the possibility to use all objects in the manner we find fit, but it also allows students the same thing. We are able to reuse objects in a timely manner (e.g., when writing new exams we can choose from a previous pool of questions), thus giving us more time to spend with designing the course materials than the design itself.

Following figure shows the main screen of the Claroline LMS (using the Corporate layout).

Figure 1: Claroline main interface

As it can be seen, users need to be authenticated before they can use the application. After the successful login, students are able to enroll the course.

Computer Networks Course Program

Computer Networks course is held at the same time for students of two orientations – physics and technical culture (5th semester, PTC in the following text) and PCS (7th semester). In our experience it was shown that students of the PTC orientation often lack in computer science knowledge in comparison to students of PCS orientation. The reason for this claim could lie in the fact that those students (PTC orientation) are a year younger than their colleagues, but also it could be the fact that current educational system doesn't ask/give them the possibility to take additional computer science courses. While designing content for this course we tried to keep in mind this fact, but it was impossible to segregate the information concerning the main topic of the course. This is why we decided to segregate parts of the course in the following manner:

- lectures
- mid-term exams
- short exams
- seminar

Computer Networks Course Flow Chart

The following figure shows the Computer Networks course flow chart. All parts mentioned above are integrated in this chart:

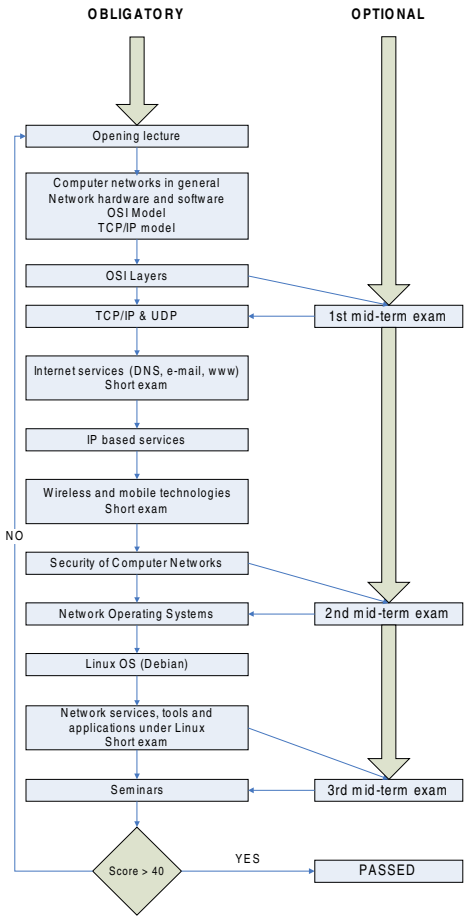

Figure 2: Computer Networks Course - flowchart

To successfully pass the course, students have to have a score higher than 40 points. Mid-term exams are not obligatory, but it is recommended for students to attend at least one of them. They can bring up to 60 points. Short exams bring up to 24 points, but they are obligatory. Also, seminar can bring up to 30 points, and is also obligatory. The grading scale is set from 0-100 points, but students can gather even more than 100 points (60+24+30=114). This is done so, because we included the possibility of legitimate absence during the mid-term exams, illness, etc. This way we give each student the possibility to get a higher grade, even in extraordinary situations.

On the other hand, if the achieved score is lower that 40 points, a student is obligated to enroll the course next academic year.

Lectures

While using classical methods of learning, we established that information students gather during lectures are insufficient. They have to spend more time at home learning because of the fact that information they gather (knowledge management) has to be on-the-fly. This kind of approach is quite negative because, e.g., in many cases students presented completely wrong answers at mid-term exams which is directly correlated with the fact that there is no knowledge management in classical approach, especially if the matter is extent (like in this case). We decided that there will be absolutely no difference between the lectures for both orientations.

Lectures are consisted of following topics:

- Computer networks in general; network hardware and software; OSI & TCP/IP model
- OSI Layers

- TCP/IP & UDP
- Internet services (DNS, e-mail, www)
- IP based services
- Wireless and mobile technologies
- Security of computer networks
- Network operating systems
- Linux OS (Debian)
- Network services, tools and applications under Linux

Mid-term exams & short exams

Mid-term exams are consisted of four types:

- multiple choice – unique answer
- multiple choice – multiple answers
- fill in blanks
- matching

Using the Claroline's capabilities for creating exams, we created a pool of approximately 500 questions, which we can expand at any moment, but the most important part is that we can always reuse questions. Roughly 200 questions are intended for students of the PTC orientation, and about 300 questions are for students of the PCS orientation.

We would like to emphasize the fact that the number of questions bears no relevance to severity of the course – this is done by a careful selection of questions concerning the orientations.

Mid-term exams are held at the DoP's computer lab under supervision because of the fact that it is impossible to ensure a non-cheating environment at the time of the exam at the place of their choosing.

Seminar

By the end of the first half of the semester all students are obligated to chose a seminar topic. Topics are constituted in such manner that students of both orientations are able to find a topic that fits them. Scoring of the topics is variable, since not all of them are equally difficult.

Claroline

Claroline is SCORM 2004 (Sharable Courseware Object Reference Model) compliant and platform independent. It is written in PHP, and demands it to be installed on the server-side, along with MySQL database and Apache web server software. Université catholique de Louvain encouraged the Institut de Pédagogie universitaire et des Multimédias (Institute for University Education and Multimedia) to develop and distribute this software. It became available as open source in January 2002. The software is free and is distributed under the terms of the GNU General Public License.

Installation of the software is quite trivial and is of no concern to this article, so it will not be explained in details.

After the installation, LMS administrator can create arbitrary number of courses and users, and grant some/all of them the rank of a Course Manager. Following figure shows the Course Manager's view of the Claroline LMS:

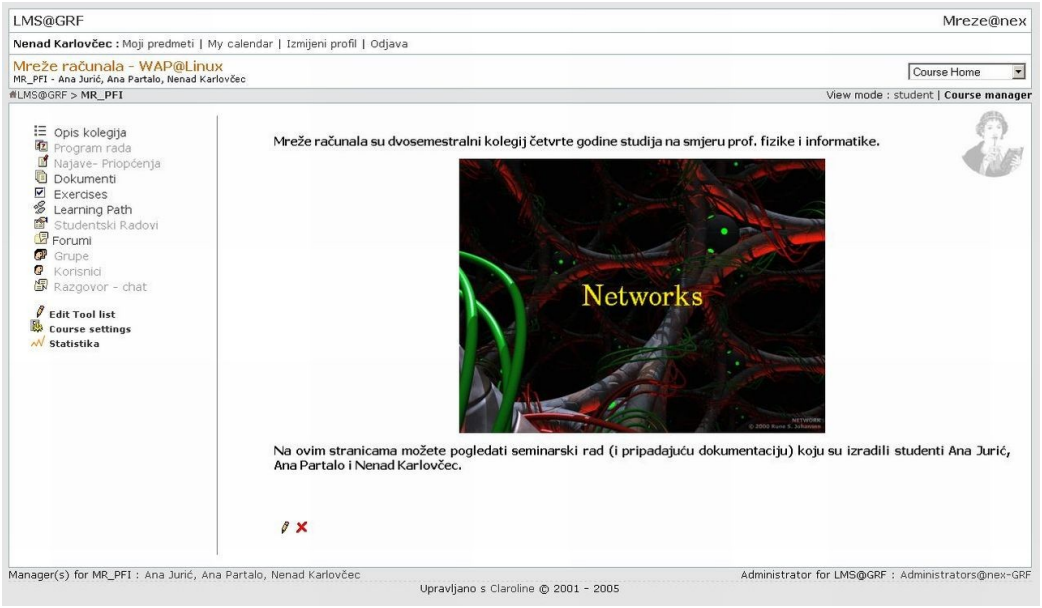

Figure 3: Claroline LMS – Course Manager's view

As it can be seen in the figure above, Course Manager has all the options that are needed for creation of an on-line course. In production of this course, content is published on a weekly basis, as an experimental model. If this shows to be successful, we will continue with this practice.

Work in Progress & Work to be Done

Currently we are working on a localization of the Claroline software. Another very important part is also statistics (generated by the Claroline itself), which we will compare to statistics of the Computer Networks courses held by classical methods. It will provide us with useful information on which we can plan further actions (points for improvement). If statistics will show a positive trend, we are planning to start projects which will implement the Claroline-based e-learning model on all of the adaptable courses at the DoP.

Also, after the winter semester, we will, based on the feedback from students, try to implement their ideas into the learning process of the course.

Conclusion

Since this is the first course at the DoP that is fully (or in very big extent) following the concepts of e-learning, we cannot give an exact conclusion (also, because of the fact that this is a work-in-progress).

On the other hand, we have concluded it is a worthwhile project, since it gives the DoP, hence the Faculty of Science as an organization providing higher education, opportunity to collect all the information needed to implement e-learning at the level of the whole Faculty. As a part of the Croatian National Strategy, e-learning should be implemented in all areas, not only organizations providing higher education. We are of belief that this project can show how, with very low expenses but without the loss of the quality, education can be implemented without boundaries concerning the geographical, social and cultural aspects.

One of the main reasons for Croatian society, hence the Government, to embrace e-learning as a powerful method of learning (education) is also the admittance to European Integrations.

E-learning gives the opportunity to learn about and adapt to new technologies. It also gives us opportunity to educate graduated students, giving them the information they would not receive if we would use classical methods of learning.

Concerning the Computer Networks as an undergraduate course, it will be in experimental phase for the current academic year. Statistics at the end of the semester will show us if it will be a model for other courses that are adapting to e-learning.

Claroline is under constant development, and as long as it fits our needs, it will be our first choice as LMS.

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