

# Course Management in the Twinkle of an Eye — LCMS: A Professional Course Management System

Christoph Meinel  
FB IV - Informatik  
Universität Trier  
D-54286Trier, Germany  
++49(651)201-2827  
meinel@uni-trier.de

Harald Sack  
Institut für Informatik  
Universität Jena  
D-07743 Jena  
++49(3641)9-46313  
sack@minet.uni-jena.de

Volker Schillings  
FB IV - Informatik  
Universität Trier  
D-54286 Trier  
++49(651)201-2832  
schilling@TI.uni-trier.de

## ABSTRACT

In this paper we describe a course management system for university lectures and lab courses, called LCMS. Started as a simple registration tool for students, signing up for lab courses and examinations, LCMS has been developed into a powerful system, assisting the lecturer and the lab course administrator in the management of entire courses. LCMS tasks are ranging from course registration, student data administration, creation of course webpages, design and administration of exercises and test sheets, up to the design of certificates for successful course participation. For three years in use now, LCMS has become an essential tool for student administration. It is freely available and can easily be adapted to any kind of course management.

## Categories and Subject Descriptors

K.3.1. [Computer Uses in Education]: Computer Managed Instruction

**General Terms:** Management

**Keywords:** Course Management, Course Administration.

## I. INTRODUCTION

While more and more students attend University the staff for administration and teaching is constantly reduced due to financial shortcuts. For that reason and for relieving the burden of tedious course administration work of the lecturer we developed an entire WWW-based course management framework, called LCMS (Lab Course Management System).

In the beginning, LCMS was only intended to serve as a lab course registry for students, but over the years it developed to be an entire framework including all tasks required for course management, as there are:

- Student registration for courses, lab courses, or examinations

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- Administration of student data, course information, news, and maintenance of course related webpages
- Design, maintenance, and evaluation of exercise sheets
- Providing course related statistical information for lecturers and students
- Managing scores and certificates.

Thus, offering a huge variety of functions for the lecturer and the student, LCMS is on duty at the University of Trier for almost three years now and has been continuously advanced.

In this paper, in section 2, we first give an overview about the possibilities that LCMS offers to the lecturer and to the student. After presenting technical details about the implementation of LCMS in section 3, we give a short review of the experiences we've made during the last three years with LCMS at work in section 4. Section 5 concludes the paper with an outlook on future work.

## 2. COURSE MANAGEMENT TASKS

Before LCMS was introduced in our department, every lecturer had to take care about course administration manually. This means, students had to write their name and some administrative data in a list that was collected after the first lesson in the semester. Often it was a difficult and tedious task for the lecturer to get all required information about a student. The lecturer had to prepare exercise sheets for the lab courses, hand it out to the students, and to evaluate them after they had been delivered by the students. He had to maintain lists, either on paper or in a file on the computer, with information about the student's scores and performance. To get an overview about his coursework, a student had to collect all scores or he had to ask the lecturer about his performance. In the end of the semester, the lecturer had to evaluate, which students were eligible for examinations. For oral examinations he had to manage a difficult schedule, because the students had to register for the examinations in advance and to match them to their own schedule. When the examinations were over, he had to evaluate the student's scores and – if applicable – he had to write certificates for the students.

As long as if a lecturer had only to maintain a few courses with not too many students, there was no need to change this

workflow. But, the number of students is increasing while the budget for lecturers is not, with the obvious consequence that the lecturer has to take care for more and more courses and to administrate a growing number of students. In 1999 the department of theoretical computer science of the University of Trier, Germany, was facing this problem, too. Therefore, during the summer holidays, we started to create a framework – LCMS, the Lab Course Management System - with the purpose to assist the lecturer in his course administration work.

For **the lecturer** LCMS can provide:

- Easy access to all relevant student data
- Mailing lists, newsletters, bulletin boards, and webpage creation for communication with the students
- Maintenance of a database with lab course exercises and a database driven design tool for exercise sheet creation and publication
- Calendar for setting deadlines and examination schedules
- Statistical information on student scores
- Editor for certificates
- Passwords and security management.

On the other hand, **the student** has the following benefits:

- Early course registration for courses and examinations via the WWW without standing in queues
- Finding all relevant course information and news on the course webpage
- Downloading exercise sheets and uploading answer sheets
- Information exchange with lecturer and other students via mailing list or bulletin board
- Viewing exercise scores and statistical information.

For maintenance of LCMS **an administrator** account is set up with the following possibilities:

- Creating new courses
- Administration of different users and user privileges
- Maintaining security issues.

### 3. IMPLEMENTATION OF LCMS

#### 3.1 Server side infrastructure

LCMS is platform-independent on server and on client side (see Fig 1).

On server side an Apache web server [1] using cgi (Common Gateway Interface) is applied with Perl version 5 [2]. For safety reasons all implemented server side Perl scripts are entirely encapsulated with cgi wrapper [3] over SSL [4] secure connections. The scripts have access to the database via a standard interface provided by Perl. In our implementation we use MySQL [5] for speed and reliability. For load balancing, the individual components can be installed on different computers.

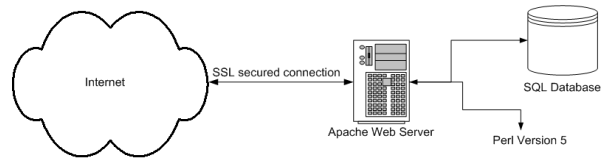


Fig. 1: Technical infrastructure

#### 3.2 Security issues

Since a course management system has to fulfill high security requirements, a designated Perl module was developed, which examines the various safety guidelines for each script. The module contains routines for system log in, administration of session variables, privilege monitoring and log off. Security relevant data like the session identification are automatically created and encrypted via MD5 [6]. After 30 minutes of inactivity a user activated session will be shut down automatically. It is possible to adjust all security issues by adapting the security module.

#### 3.3 Other Components

A substantial part of LCMS is the administration of lab course exercises. Esp. for computer science and mathematics, the use of mathematical formulas is rather important. For this reason, we have added a special support of mathematical formulas using LaTeX [7] import. LCMS is able to convert LaTeX based exercise sheets semi automatically into HTML for publication over the WWW. The single exercises are stored within a MySQL database and can be searched by keywords, areas, and level of difficulty (see Fig.3).

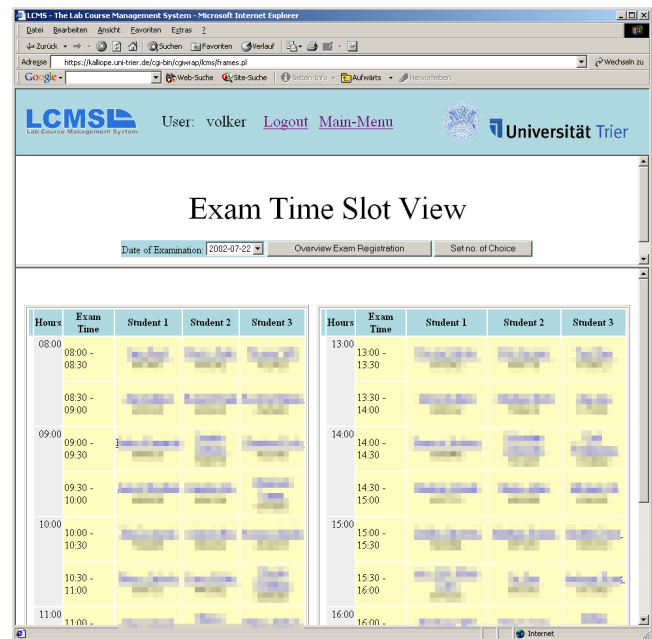


Fig. 2: Exam registration

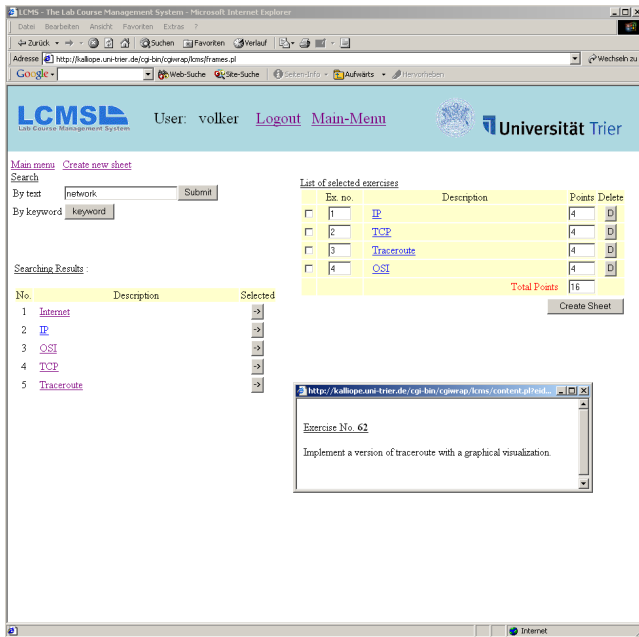


Fig. 3: Generating exercise sheets

## 4. WORKING EXPERIENCES

We started with the development of LCMS in summer 1999 and it was first deployed the same year for the autumn semester. For the freshmen in computer science, courses with up to 150 students have to be managed. The lecturer however should put his effort in teaching and not in too many course administration tasks and thus, LCMS was accepted by lecturers and lab course administrators very well.

Now, LCMS is deployed for all courses in the theoretical computer science department, as there are e.g. "Discrete Mathematics and Logic", "Basics of Computer Science", "Technical Foundations of Electronic Publishing in the WWW", "Information Security", and many more. LCMS is easy adaptable to courses of all kind of subjects.

On the other hand, the students got accustomed to the use of LCMS immediately. For them, it is much easier to register for courses and examinations via the web interface at home, instead of waiting in line in front of an office to put their name on a list (see Fig. 3). Also it is rather convenient for them to get exercise sheets via the WWW, to solve them at home and to deliver them by a simple upload. They can look up there scores anytime and

they can be sure not to miss important dates because they will be reminded on the webpages and also via email.

## 5. OUTLOOK

For three years now LCMS is in permanent use and has proven its efficiency. It is subject to frequent updates, because it is adapted to new courses, covering many different subjects. To provide even more convenience for the students, a pager interface for mobile access is under current development.

LCMS offers the possibility to design exercise sheets containing different types of exercises. The exercise database supports regular exercises, where the student has to give the answer in his own words, and multiple choice questions, where there is a set of different answers already given together with the question. Esp. the evaluation of multiple choice tests can and will be automated in the next release of LCMS.

For more detailed information on LCMS see our guided tour at:

<http://www.informatik.uni-trier.de/~lcms/>

LCMS is completely platform independent, easily adaptable to all kind of courses, and freely available to everybody. It can be downloaded including all required sources from the given webpage.

## 6. ACKNOWLEDGMENTS

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