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## Design and implementation of the middle-class web-portal for cooperation with students team

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### Abstract

The article describes the designing process, implementation and development of the middle-class computer project, accomplished by the students of University of Łódź. The project, which is called SUL, is a WWW-based portal with several set up purposes. Services for students ( news, e-mails or private web pages including secure and reliable communication between the students and Dean's offices) and centralization of information were its the main aim. The project started in 2002/2003 and since year 2004 it has been deployed at the University and proved successful.

### 1. Preface

Two persons of the scientific staff of the Faculty of Mathematics and the group of students, who are the participants of the SCI group (Students Computer Science Centre) in 2002 came up with the idea of setting a central information portal for all students of University of Łódź (UL).

At the beginning we will explain the motivation roots for this project. We may group them in three basic categories: requirements from work of Dean's office, requirements from student and student community. Now we will discuss them.

The deployment of the USOS (University System for Courses Handling) started in 2003. The system USOS is widely described in [1] and the process of its deploying in the UL in [2]. The system USOS is for aiding work in the Dean's office, it is for attendance in the didactic process. It was planned that the system would have been deployed by October 2004 in all departments of the University (it has been done). As the system appeared, which simplified integrity of attendance of the didactic process, one question arose if it is possible to simplify flow of information among students and Dean's office (or generally between organizational units of the UL ). The answer was positive and as the

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result there was created a special communicator to assure safety and private information exchange of information between the students and the Dean's office.

There is the additional system USOSWeb, which cooperates with USOS and enables enrollment on the university courses on studies (if a department has deployed the ETCS system). After deploying this program it was possible to avoid queuing in front of the Dean's office. It is possible to limit students visits in different units of UL planning creation of student-dean office central information system.

Finally, Let us discuss the motivation roots of the student community. Most departments of the UL have their own server resources, accessible also for students, and for student scientific groups.

This solution has several disadvantages like:

1. Most of faculties do not have professional administrators for server with proper qualifications. Even if it does, these people are busy administrating more important things and do not have enough time for student equipment.
2. Students from other departments need not be computer literate. That is the reason that they do not have enough students with passion for administration of server.
3. As the result of these two points, majority departments give an access to very simple and modest services like e-mail, often without possibility of personal web pages even in HTML or PHP script language.

The above mentioned reason motivated the employees of the Faculty of Mathematics for talks with these students to take part in designing central communication portal called SUL (Students of University of Łódź). We are going to describe main features that this portal should be characterized by

1. *Electronic mail* – each student should have possibility of opening an e-mail account on portal. Access to mail should be assured through interface as well as POP3S and IMAPS protocols.
2. *WWW pages* – each portal user should have possibility of opening the personal WWW page using PHP language as well as of keeping web pages for other student organizations.
3. *News* – mechanism allowing to publish messages concerning students from the whole university as well as individual departments. Distinguishing of such messages should be grouped by faculty etc., after logging a student should obtain a message concerning his department.
4. *Popup* – available, from each level of underside of SUL, should make intercommunication between the logged users of portals in real time.
5. *Communication system* – we discuss it more widely in section 4., because of its non-typical specification.
6. *Disc space* – each student should have his own limited disk space for personal storage of documents, e.g. created during studies. There should be

also a mechanism to manage this space by practising such actions as: creation and deleting of catalogue, backup, transmitting etc.

7. *Science resources* – the catalogue of science resources useful for students and grouped by themes, faculties etc. The documents are supposed to be published by students and teachers.

It is obvious that one of the most important problems of this project was, in the context of its complexity, developing it by students who did not possess any experience either in large project developing or in teamwork. Most of such problems and methods are described in sections 2 and 5.

## **2. Creation of group and preliminary plan of work**

It was decided, that the executive group will be composed of students exclusively, if necessary, they obtain take opinion from the scientific staff of the faculty. One of the authors of the article became formally indicated as the scientific supervisor, however, the role was limited to occasional meetings and conceding of advice about current problems. The scientific trustee knew from the start of creation of application what errors may be made in this application, however, there was unique opportunity for many students of computer science to participate in the real information project.

From several to several dozen persons took part in creation of portal at different time. Several people became members of the Core team, whose task was maintenance of cohesion of conceptual system. Four persons became members of the group, which took part in the project design of portal from functional parts as well as flow data. The leader has been appointed, who supervised informally till the end of project.

At the beginning there were made discussions about technologies that should be chosen to create the portal. It was clear that all wanted to base on the Open Source solution. It was decided, that the main part of application would be written in PHP and database PostgreSQL.

Moreover it was known that it will be necessary to take advantage of such instruments as servers of protocols IMAPS, POP3S, HTTPS and many others. From the beginning the group could use workstation for tests, computer Sun Workstation or as server SUN Server (2 x UltraSPARC 400 MHz, 2GB RAM). Both of these computers worked using Solaris and this software was Open Source in use. Presently the server, DELL is working on FreeBSD OS.

In the preliminary step the group was divided into the project subgroups:

- database,
- logic of application,
- presentation.

Later the group was divided rather relating to division into modules (see point 3.). Exchange of persons between was modules introduced, in order to exchange knowledge in different units. This turned out to be the worst in this project. It

was not possible to find responsible people for individual fragments. It should be mentioned here that trustee pointed out to the same errors, however, the group distinctly preferred organizational freedom.

It was decided that the group would mainly use structural methodology in the project design. Several arguments were for:

- a) this methodology is simple and intuitive enough,
- b) students learnt many subjects in modeling basics in addition to assistance of scheme ERD in the course of study,
- c) students did not have subjects in UML.

Additionally as the language PHP owns pure object features (in version 4 they are very pure), nothing points to objects oriented methodology. It does not change the fact, that application includes many objects. Despite freedom in the groups there was one person who designing the administrative panel used analysis and project in UML.

### **3. Architecture of system**

The system SUL has been designed to divide it into several independent parts to carry out possible changes in the manner of system operation. On the other hand the system SUL consists of several large independent modules (described in section 2.) including such “pseudo-unit” as staff logging/authentication unit for the student or the staff. So, there were used two divisions: horizontal (on layers) and vertical (on modules).

Horizontal division:

- a) user interface (showing and receiving forms, graphic layout),
- b) data processing layer (logic and data processing),
- c) database layer (communication with database).

Such a division gave great flexibility if it works about implementations and possible changes in the project. A neighboring layer has to be communicated besides assistance of proper interface. Such organization gives also other advantages: if change of database is required (e.g. from the point of view of production capacity or necessity of using other features), it will change the third layer without changing the others. It provided change of logic of operation system without interference in appearance and changes of presentations without interference in the system logic.

Vertical division, or division into units was obvious and became indicated through the functional demand which was set for the system (section 2). Within the confines of given modules design of special communication interface among three layers and possible interface provided for other units should be made. For example, module of logging and authentication should provide function for checking if there is any user logged and return his logging.

Division into units was important not only from the point of view of good functional modeling capability of the system, but also from the organization of

work over the system. It was established that division of duties in the group will refer not to the horizontal division but to the vertical one therefore, the established group of persons work upon the concrete module including all three layers.

#### **4. The communication system**

Improvement of communication is related to the project of communicator among the Dean's offices and the students. Certainly the first demand which came to the mind was proficiency and reliability. Confidentiality and authenticity of message were not less important. Its usage for e-mails was rejected for obvious reasons.

Communicator is a non-typical instrument enabling communication among students and faculties of the UL. That is why it is represented, at the level of application, by two separate units: module of student and module of employee. Let us mention the basic features of this problem:

- a) sending message by employee for students and vice versa.
- b) assurance of message delivery. This system served for sending messages about crossing out from the list of student and other information, which should not be lost.
- c) confirmation of message reading by student.

As a several problems appeared:

- a) identification of person – employee with the administration unit. Firstly, the employee can be employed in more than one unit. Secondly, the employee can be on discharge or holidays and then, other staff should have insight into the message address of the employee,
- b) the employee should have possibility to send messages for a definite group of students, e.g. for all students from the Faculty of Mathematic,
- c) how to assure that student cannot cheat and read messages without informing about this fact.

We have more detailed expectations after the further analysis. Let us mention them now.

Functional demands for worker's module:

- employee can choose a working administrative unit if he works in more than one,
- employee can send messages for student or groups of students. It is possible to define a group of students in many ways (faculty, year, type of studies, etc.),
- employee may review all messages sent by students for the administration unit, which was currently set as the employee unit of administration,
- employee may review all messages from his current working unit and can check the list of message receiver with the information who already read it and who not,

- each employee may check which of other employees is responsible for optional message and, if such requirement exists, change responsibility for optional message taking liability,

Functional demand for student's module:

- student can review message only when he is on the lists of receiving messages,
- student can not delete any of received messages,
- student can send message for each employee, registered in the system or, if does not have such requirement, generally for optional administrative unit,
- student can review message in the e-mail box and who can check, who can take care of message from the employee,
- student can not delete message from the e-mail box.

The message in the meaning of this communication system is only a plain text with a given subject. Sending attachments or any other data is not allowed. The full description of this communication system you can find in [3].

## **5. Problems**

The described problems with which we struggle during creation of the system are not the only ones.

Division of human resources and division of liability was the one of grave problems. Unfortunately, most students working on the project were individualists. There is not an exception in the computer science projects. However, if we add the lack of experience in writing of big projects and the lack of ability in the group, that will cause many serious problems. Part of these problems must be solved or decided by trustee. Unfortunately, till the end of work the students did not want to accept some rules, normally used in such groups which, of course, resulted in an organization-mess. Informal chief of the group tried to oversee this project. It was no doubt, a hard and unthankful task, to be a chief of your colleagues.

Another important problem was of technical nature, synchronization of modules. All modules were most often worked by a group of persons who knew not enough about the manner how modules written by other groups operate. The use of certain stocks rendered accessible by other modules was necessary. It should be taken into account that most part of the unit was written simultaneously and facilities of this stock were not possible at once. At first common interface is established and dummy interface is created. When the real interface is ready, this dummy interface is replaced.

The final working system was not the only aim of the SUL project. Another purpose was to teach the students how to work in a team, how to develop and deploy a big application and how to polish their programming skills. Certainly, not all pieces of work were done perfectly and many of them had to be done again, sometimes even for several times. It caused time delays. There was the

situation when it suddenly turned out that the concept made at the beginning was bad and big changes should be done in several parts. It demands large time slips. As a result the whole project, instead of being done in one year, was made in one and a half years. But taking into account all the aspects, including the team structure, it could be considered as a good result.

In this consideration the deploying process deserves special attention. The SUL portal was launched for testing in 2004 in the Faculty of Mathematics. The next step was made in October 2004 when four other faculties were chosen for setting up the advertising company and the first training both for students and workers. It has to be noted that training of Dean's office workers had to be done with special care. Only this training took a few days in each faculty. Another problem was to persuade students to use this communication system instead of queuing in front of Dean's office doors. Unfortunately, there is no full success yet, students prefer queuing and thinking, that it is more efficient to achieve useful information and help. However, we believe that it is just a matter of time and everybody will find out how many advantages this new form of communication has.

## **6. Bugs tracking system**

Problem of testing and reporting errors has emerged soon after beginning of system implementation. Obvious solution was the use of instrument for reporting these errors and correction procedures following them. Several solutions were given in this situation – either use already existing instruments and customize for personal requirements (e.g. Bugzilla) or make the own one. The second solution had many advantages. Firstly, it was more adapted able for personal requirements. Secondly, as it was decided, Bugzilla also emerges from the same engine, as the SUL system, it had to be also as a field for testing new ideas and solutions, which have to be used later in the SUL system. This idea seemed good, because the SUL system was already partially accustomed to the Faculty of Mathematics and experimentation on productive system was not a good idea.

## **Conclusions**

The pPortal SUL is no doubt an interesting and not small project realized almost exclusively by students. A large group of people took part in this project, about big fluctuation, so students had possibilities to experience many problems, which they can come across in real big commercial projects. Practically, all participants of this project are satisfied with work in this group. Certainly it does not mean, that they have only nice memories and that they are satisfied with work quality. However, there is no doubt that they are satisfied with experience which they gained. Ten persons in this group already work (some of them are in

the last year of studies) in different firms participating in realization of commercial projects and they all are satisfied with the gained earned experience.

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