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Information Technology in project-organized electronic and computer technology engineering education

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Abstract

This paper describes the integration of IT in the education of electronic and computer technology engineers at Institute of Electronic Systems, Aalborg University, Denmark. At the Institute Information Technology is an important tool in the aspects of the education as well as for communication among students and teachers.

Key words: Information Technology, engineering education, project organized studies

Introduction

At Aalborg University the curriculum for the education in engineering as well as in natural science is project organized studies. The projects can be design-oriented problems, which can be solved by theories and knowledge from lectures or it can be problem-oriented work dealing with unsolved problems in science and industry. In many ways the project work reflects the work process in an industrial company.

The duration of each project is one semester. In a semester half of the time is distributed to project work and half to courses related to the project or to the curriculum.

A project-group consists of 4 to 6 students. Each project-group requires the use of an office at the university and continual supervision by a faculty member. This curriculum demands - in addition to the facilities in traditional universities - good facilities for inter-communication among the student within a project group and for communication between the project group and the supervisor. These demands has be important in the development of the IT structure at the Institute of Electronic Systems.

The IT-structure in Institute of Electronic Systems

The main objective of the IT infra structure is to offer a uniform location independent, cost effective and high performing IT environment for faculty staff, Ph.D., master and bachelor students with no difference in access. The system serves approximately 150 VIPs and 400 students. The IT system is at the moment based on SUN UNIX enterprice 450 quad CPU machines and older SUN UNIX server machines all interconnected by 100 Mbit networking. The system provides standard facilities as mail, news, web and a common file system. The backbone network is connected to the danish 140 Mbit research network.

The network is open 24 hours a day and the use of the system is un-

limited to students as well as faculty staff. The system is locally accessible through Linux based diskless X-terminals (known as kompromiX), windows PC's as well as Linux and local SUN workstations.
So computing power is available own machinery as well as SUN UNIX login machines.

The students also have access to the general network from private computers in the students project rooms and via modems and telephone network or cable TV network from their flats and student hostels.

Each student room housing 4 - 6 students is equipped with an X-terminal, and each staff member and Ph.D. students have their own PC and/or X-terminal. In addition there is access to the general computer facilities in laboratories and in lecture rooms.

The IT solution offers internet access in addition with Web, email, news, ftp and a set of software packages relevant to the project work and courses. Major software packages are Matlab, simulink, LaTeX and office suites. Besides these commercial packages a very large number of public domain UNIX/Linux software is available. The main principle is to base the system on public domain SW as much as possible to obtain a cost effective system.

The laboratories are an integrated part of the IT-infrastructure with the same facilities as in project rooms and in addition to that a number of packages for integration of laboratory setups. Packages like VxWorks is the basis and makes it possible to do laboratory tests and data collection and control locally as well remote.

Information technology used in the education system.

For the students studying full time at the university the project work is mainly carried out at the university. The project work must be done in a close collaboration between the students in a group as the results must be presented in a joint report. The content of this report is the basis for the examination of each student in the group. This concept for project work implicates demands on a well functioning communication and a consistent editing and updating of documents.

Information technology can be a part of the solution of these problems. In the following relevant use of IT implemented in the project work in the engineering education are presented.

As the students are studying electronics and computer technology software development nearly always is an integrated part of the project. A selection of programming languages suitable for different applications and problems are offered. Examples are C, C++ and Java. In addition projects often includes demands for advanced mathematical calculations. For this purpose the tools Matlab, Simulink and Mable are available to the students.

Most projects include work on a setup in laboratory or in industry. It can convenient to be able to do remote data collection or control on a setup. The VxWorks offers these possibilities.

Software engineering and electronic are disciplines undergoing a fast evolution. To obtain the latest international results the internet is a useful tool.

Information technology can be a useful help in an effective supervision of a student project. Email is a good and well functioning supplement to the weekly meetings between the project group and the supervisor. It gives the opportunity of quick questions and answers when problems suddenly appear in the projects. Discussions of main issues within the proj-

ect have advantages of face to face group meetings.

In a project carried out in a group of students the updating of documentation and report writing are complex. To solve this problem the system offers tools for information exchange in project environment. An example of such a tool is Basic Support for Cooperative Work (BSCW). The BSCW acts as a modern file server doing all the trivial management of folders, reference and documents making it easier to keep the comprehensive view of the project, the documentation and the report.

In 1998 a research project has been established for development of a new environment for cooperative collaboration for students and faculty members.

Half time of a semester is used for courses. The main concept in these courses is a two hours lecture followed by two hours exercises. The lecture plan, the topics for the lectures and the exercises are presented on a semester homepage. After the lectures exercise solutions are presented at the homepage.

As a new initiative several programming courses are accessible as online courses. The idea behind the concept is that the easiest way to pick up programming languages is by short introductions and as much hands on experience as possible. The courses are a combination of on-line lecture notes supplemented by literature references and programming examples. The exercises are programming problems to be solved online with access to online help and solutions.

Four years ago a technical college situated 300 km from the main university was associated to the university. A consequence of this is that several engineering specialization are offered on two locations and served by one group of faculty staff. For this purpose the above mentioned communication and course tools are

heavily used for distance education. In addition a direct high-speed network link has been implemented between the two locations. As a supplement a video conference system is established. The system makes it possible to see each other on screens, to talk, to show a blackboard and to fax documents. Some of the meetings between project groups and supervisors and a number of courses are successfully arranged via this system after important introducing face to face meetings.

Life long education and open university courses is a fast growing part of the university education system. The students attached to this part of the education system are typically permanently employed and settled in all parts of the country. The studies are mainly based on homework in combination with educational weekends at the university. The information technology based communication systems and information exchange systems as well as online courses are an evident and important part of the education.

Evolution and Implementation

The basic principle in introduction of IT in the institute for educational purposes is the individual right to choose the level of ambition. No one has been forced to integrate IT in education but all has the opportunity to do it. This is regarded as one of the main reasons to the unproblematic IT evolution in the institute.

Security

When dealing with open IT systems security principles must be handled in an operative manner. For that reason critical applications like finance is totally isolated from the general IT system. The security is based on a combination of supervision and high internal justice among the students. Abnormal behavior is very seldom. Penalties are ranged from warnings to lose of permissions to use the IT infra structure and in

very extreme cases involvement of legal authorities.

Funding

In Denmark education is as a principle free for everybody and the universities are financed by the government. This set some natural limits on budgets. To obtain an optimal outcome of the resources a basic principle is to base the IT infrastructure on public domain software as much of possible. It has shown to be a sound way to go.

Conclusion

The purpose of paper has been to describe the integration of Information Technology in an electrical and electronic engineering education. The combination of Information Technology and modern educational principles as project oriented work in combination with courses has shown good results. In addition distance education and open university courses take advantage of the described concept.

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