Virtual University / FernUniversität-Online

Preparing and offering teaching material in different network environments

Firoz Kaderali
Professor for Communication Systems at FernUniversität Hagen
Director of FTK - Research Institute for Telecommunications
Dortmund/Hagen/Wuppertal, Germany
firoz.kaderali@fernuni-hagen.de

Thomas Demuth
Reasearch Assistant, Faculty for Communication Systems, FernUniversität Hagen
thomas.demuth@fernuni-hagen.de

Dagmar Sommer
Reasearch Assistant, Faculty for Communication Systems, FernUniversität Hagen
dagmar.sommer@fernuni-hagen.de

1. Introduction

First concepts for online teaching via computer networks were developed at the FernUniversität Hagen, the only distant teaching institution at university level in Germany, more than two years ago. In the meantime a prototype of the *Virtual University* has been implemented and tested in practice with over a thousand students.

The Virtual University is mainly structured as an online service using powerful workstations. Internet, modems, ISDN (Integrated Services Digital Network) and broadband ISDN (on ATM - Asynchronous Transfer Mode basis) are used to access the Virtual University. Further local area networks (LANs) and high speed local area networks (HSLANs) at university campus and at study centers are also used.

For a student of the Virtual University three functional areas are encountered in an integrated surrounding:

1. The Presentation and Administration Area, in which he receives diverse information on courses and lectures and where he can enroll to different events,
2. The Course Area, where he finds prepared teaching materials and
3. The Communication Area, where he can communicate with the lecturer and fellow students.

2. The Presentation and Administration Area

The Virtual University is presented on a WWW (World Wide Web) server using HTTP (Hypertext Transfer Protocol). The homepage of the Virtual University (Fig. 1) is the starting point to all the offered services.

Fig. 1 Homepage of the Virtual University
(http://virtuelle-uni.fernuni-hagen.de)

Here general information about the FernUniversität (*Information*), its Faculties (*Fachbereiche*) and their research is available (Fig. 2). One can visit the central institutions (*Zentrale Einrichtungen*) such as the library or one can read the news (*Neuigkeiten*). In the area of the different offers one can go shopping or enter the cafe to exchange general information. In Registration (*Anmeldung*) general administrative functions are offered.
In the surface layout the different services are represented as different symbols and colours. This scheme forms a corporate identity which aims at avoiding the lost in cyberspace effect.

3. The Courses

The course material (Fig. 3) can differ widely in the degree of the multimediality. The span reaches from text oriented courses over screen oriented courses with little text and mainly pictures, sound, animations and videos up to highly interactive courses with integrated working and experimental surroundings.
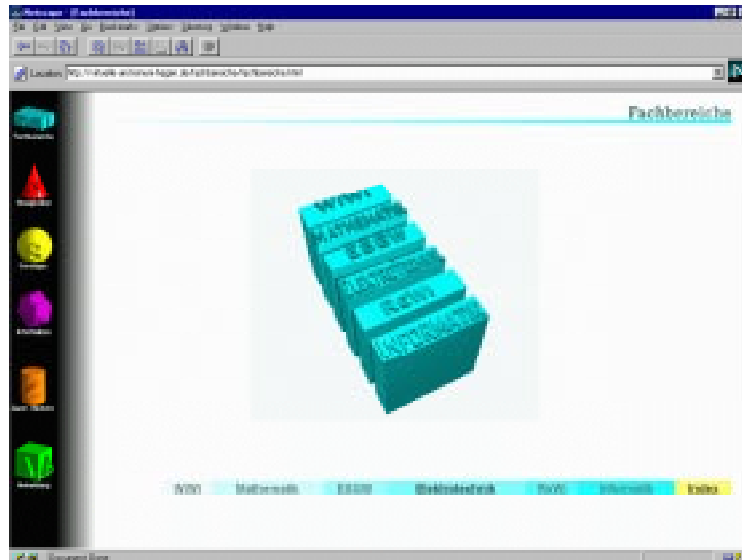
Fig. 2 The Faculties

Fig. 3 The Course Materials

Generally special tools are used for the production of multimedia teachware. Courses available at present were produced using *Adobe Acrobat* (Fig.5), *Toolbook*, *Authorware* and *Shockwave* (Fig.6), *Director*, and *HMCard* (Fig. 7) and *HTML*, enriched using *Java Applets* (Fig. 8).
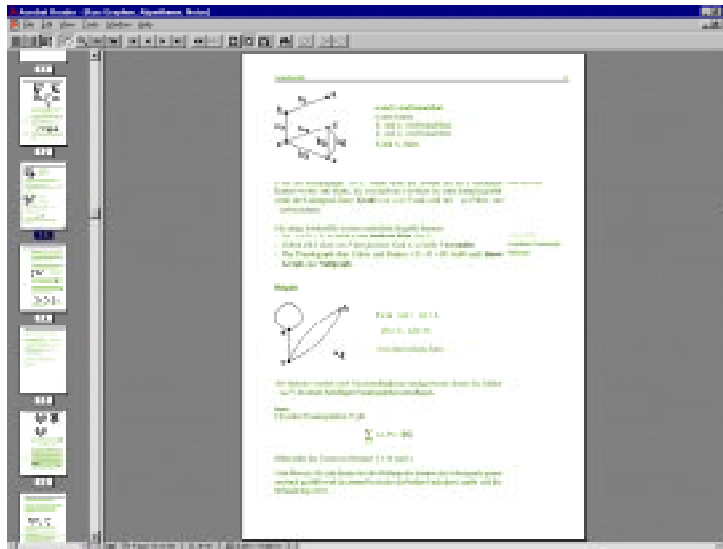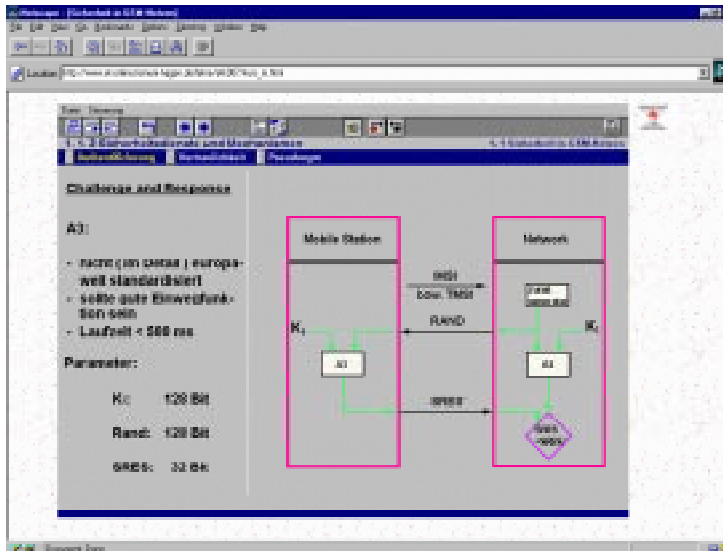
Fig. 5 Example using Adobe Acrobat

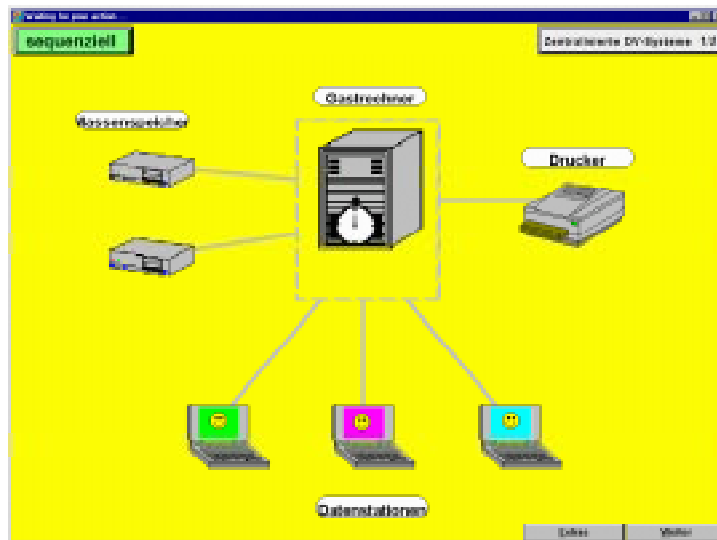Fig. 6 Example using Authorware and Shockwave

Fig. 7 Example using HMCard

The security concept consists of the authentification at accessing each course module.

Basis of this authentification procedure is a Database System, which is under development at present. It is embedded in the WWW-Surface of the Virtual University and supports the administration of courses. Further it enables the student to identify himself to the system once and then to access all the courses he has enrolled. Furthermore the Database System creates an individual view of the Virtual University for each student. After authenticating the student is offered the courses, data and facts that are relevant for him. He can set bookmarks in the courses he actually works on to be able to continue at the same point where he leaved in the next session.
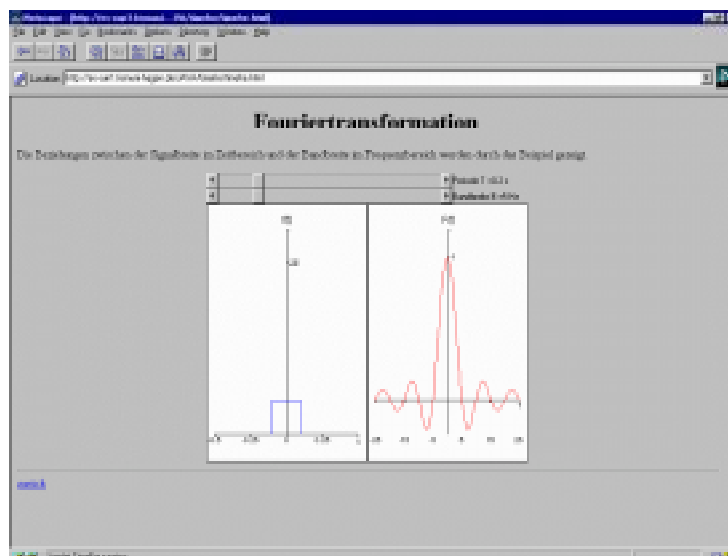

Fig. 8 Example using HTML and Java

Since it is not possible to protect pure text from being copied, hidden watermarks are to be used as copyrights of the Virtual University.

4. The Communication

Different tools are used to enable text oriented and video oriented communication.

UseNet with *News Servers* and *News Groups* are examples of text oriented asynchronous communication methods in which one can read and provide contributions to a particular subject of discussion as on a black board.

For the direct supervision of students, various talk and write programs, which enable a synchronous dialogue between two partners, are used. Discussions with more than two participents are organised in form of multipoint conferences; here *IRC Tools* (Internet Relay Chat Tools) are used.

Further there exists another cheap way of communication: *audio conversation tools*. It is simple for a student to contact his tutor to discuss questions without calling him by telephone, which is more expensive, especially in case of long distance calls.

In the mean time tools for organising text oriented communication with speech addition and white boards for joint editing of text documents and graphics are available. Tools for joint editing are particularly useful for technical and mathematical subjects.

For video communication *ProShare*, *CU-SeeMe* and *Sony* systems are used. These video systems offer an opportunity for face-to-face-communication.

Fig. 9 ProShare Conference with Shared Applications

5. The Distribution in different networks

In the Virtual University the courses are offered in two different ways. They can be studied online by using the HTTP protocol or they are compressed in appropriate modules (single chapters or whole courses) which can be downloaded by FTP protocol and studied offline. Studying courses offline offers the advantage that do no transmission costs arise while the student is working on a course.

For downloading these teaching materials there has to be found a suitable granularity of the learning units being transmitted via the communication network. In order to do this, varying influences have been taken into consideration:

- the different networks with their typical transmission rates,
- the maximum transmission duration which a student would still accept,
- the costs of data transmission and
- the necessary number of access points to the Virtual University for each network.

As the Virtual University offers teaching materials as an online service in a heterogeneous network environment all the different alternatives to access - internet, modems, ISDN, Infocity and HSLANs (on basis of ATM) at university campus and at study centers - have been investigated.
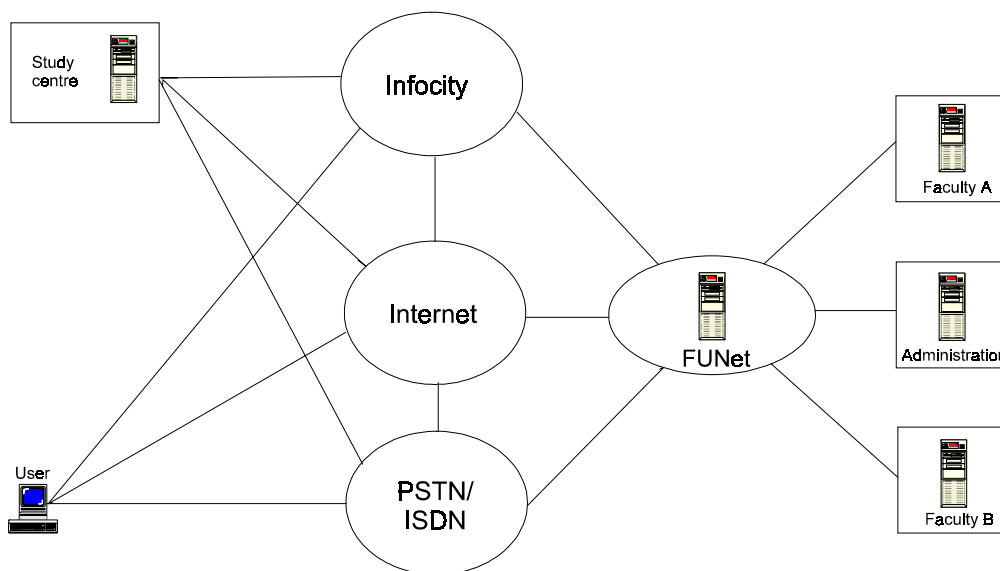

Fig 10: The heterogeneous network environment

In accordance to the concept of synchronous education, the learning units are offered in a fixed time interval. Therefore the amount of necessary access points in dependence of the number of participants and the specific network had to be evaluated. It was supposed that the calls to download courses arrive uniformly distributed, which gives a lower bound for the required infrastructure. The investigation has shown, that already, if only few students take part in the Virtual University, the access via ISDN is superior to modem and internet in respect to the investments into the hardware on the part of the Virtual University.

Another important aspect in finding the right granularity of learning units is the transmission duration and the resulting costs. Further the maximum transmission time accepted by a participant must not be exceeded. On the basis of the transmission time, the arising costs have been calculated. In case of the internet, only the costs for the connection from the user to the

nearest access point have been taken into account. The charges of the internet provider still have to be added. Comparing the resulting costs for the transmission of one learning unit, the use of ISDN is distinctly cheaper than the use of internet.

Under the condition of an intensive use of the Virtual University, the transmission via ISDN offers at present the most economic alternative for students and university in Germany. ISDN enables the shortest transmission durations, subsequently the least costs for the student and the lowest investments in infrastructure on the part of the university.

To improve the process of downloading learning units a new tool, the *Offline Navigator*, a powerful combination of graphical user interface and communication and installation tool, is under development.

As we have ascertained, most of the students are connecting to the Virtual University via telephone lines and so they have to pay in dependence of the time they are online. Further they have to go through several steps which are the same in each session. To minimize the time and the transmission costs these steps are carried out automatically by the Navigator.

The student has to establish two, but therefore much shorter sessions: In the first and very short session he, respectively the Navigator, connects to the Virtual University and investigates, which new learning units, dates or other information is available for the student; each student gets his individual information this way. This online phase only takes a few seconds. In the next step the student chooses, also with the help of the Navigator, the items he is really interested in. In the next step, again online, the selected items are downloaded and installed.

The improvement by the usage of an offline navigator is oblivious: The student only works online first to authenticate and receive his personalized list of courses and second to download the desired modules. He does not pay the connection for the time while he is choosing which courses he will download and even more important, he does not have to browse and look for the different locations from where he can receive the learning units from each of his courses. Especially the student can utilize the online time to browse through the Virtual University while the Navigator is downloading the units.

5. Some remarks on the Project

The work on the Virtual University began more than two years ago. The concept was developed at the Department of Communication Systems (Prof. Kaderali) and the Department of Practical Computer Science I (Prof. Schlageter), both at the University of Hagen, Germany. The Faculties of Electrical Engineering and Informatics are preparing their teaching materials accordingly and are probing the technical platform of the Virtual University. The responsibility of the technical platform is carried by the project team, that of teaching by the Faculties, respectively by the university professors (Fig 11).
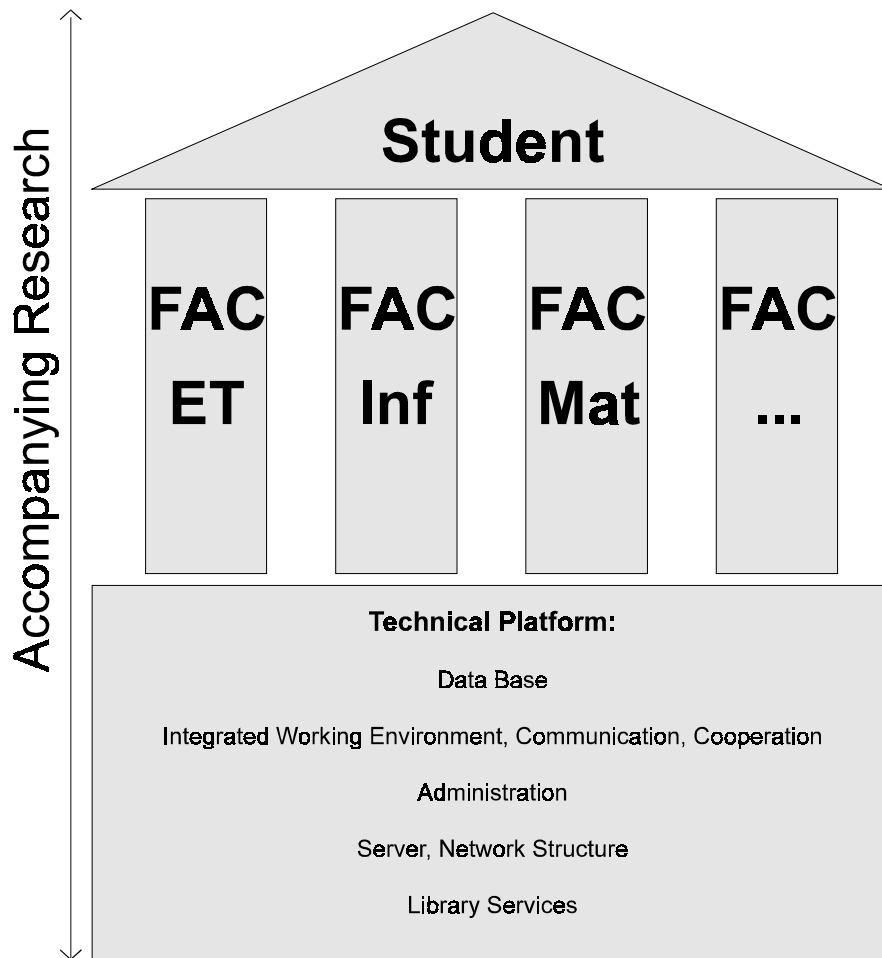
Fig. 11 Project Structure

The first classes and lectures using the technical platform of the Virtual University were probed in winter term 1996/97 and in summer term 1997. More details can be found under *http://virtuelle-uni.fernuni-hagen.de*. The work under Virtual University is partly financed by the local Ministry of Science and Research (MWF NRW). Further funding is pending.