

Interdisciplinary Cooperation Modules in Mobile Networks

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Summary

The contribution describes the didactical integration of wireless access networks for the campus of the University of Karlsruhe in the education of architects and engineers. It focuses on the development of an interdisciplinary communication network to encourage and promote the communication and collaboration between students. The project assumes that significant learning progresses in net-based learning scenarios are based upon the synchronous and asynchronous cooperation between the students themselves. The remote cooperation across borders of disciplines makes high demands on capacity in communicating and cooperating of the involved persons as well as on the supporting tools. Therefore, the collective acquisition of knowledge and cooperation has to be trained intensively during the studies. Based on the design and project oriented cooperation platform netzentwurf.de the authors developed the tools “Jobadmin“ to administrate multidisciplinary workgroups, the “Swarm Knowledge Catalogue“ to collect and store knowledge and “LivingCampus“, an instrument providing basic services for dynamic communication.

1 Introduction

The ability to cooperate with other disciplines and the preparedness for permanent education receives increasing attention. At the University of Karlsruhe, the cooperation platform netzentwurf.de has been developed in order to train these skills with students. The platform started in 1997 and offers a diversity of tools for cooperation and communication and supports the self-organisation of the students. [Netzentwurf.de](http://netzentwurf.de) can be defined as permanent construction site for different tools for communication and cooperation. This contribution describes recent developments, in particular the tools ‘Jobadmin’, ‘Swarm Knowledge Catalogue’ and ‘LivingCampus’ which have been developed in the context of NUKATH (Notebook University Karlsruhe TH) as a continuation of netzentwurf.de

1.1 Netzentwurf.de

The netzentwurf.de platform was implemented in three steps. The first version focused on retrieving and collecting information from internet and presenting the architectural designs using standard HTML and sketches. In the next step support functions were implemented allowing teams from different universities to work together across disciplinary borders on common engineering tasks [Russell, 1999]. With the third generation the netzentwurf.de platform integrated calendars, project diaries, mailings lists and chat functions.



Fig1: The collaboration platform netzentwurf.de with participants of architectural projects

Up to now the platform has been used by approximately 1,000 students, and 12 Universities in several countries. Since the best academic results were achieved by groups who worked together intensely, it was essential to improve the cooperation tools as well as to encourage the students to use them. The conventional didactical system could not be directly adapted to the net based training. The desired learning effects could not be obtained by simply presenting the designs and results in the internet. Furthermore deficits in the acceptance of new media and in the communication within the student groups occurred in the beginning of the use of the platform. The fourth step in the development of netzentwurf.de was supposed to solve these and the following problems:

- integration of mobile networks
- overcoming the problem of being anonymous in the internet
- promotion of direct communication between the students with audio- and videoconferences over the internet without the need of special hard-or software
- improvement of the competence in dealing with new media for all students

The modules „Jobadmin“, „SKC“ (Swarm Knowledge Catalogue) and LivingCampus were developed to realise these objectives.

1.2 Jobadmin

The didactical function of ‚Jobadmin‘ is to animate and support students in sharing and administrating tasks. Students describe a problem and situate it in a certain context. They then present it on the platform encouraging other students to cooperate and to build up a working group for this specific task.

“Jobadmin” offers further the possibility of presenting the own competence for a certain task and period. An entire scope of the task management training is available to the students allowing them to structure the problem by dividing it into subtasks and then describe sub-tasks systematically. The task management provides tools for the definition of a task, the fragmentation of tasks in subtasks and their temporal limitation as well as the connection of tasks with persons and competences. The definition of a task covers data concerning the content, time frame, necessary prerequisites and indications concerning the involved persons. The platform supports basic control functions by supervising the time frames and delays and by providing relevant information to the persons connected with the tasks. It allows the autonomous administration of work groups and the control of work packages within the runtime of the project.

Jobadmin is a browser-based internet-application which integrates the mentioned functions. The purpose of Jobadmin is to support the remote workflow between groups of students. A typical application is a student being confronted with a task which he or she is only able to solve without the assistance of other persons (other students or specialists).

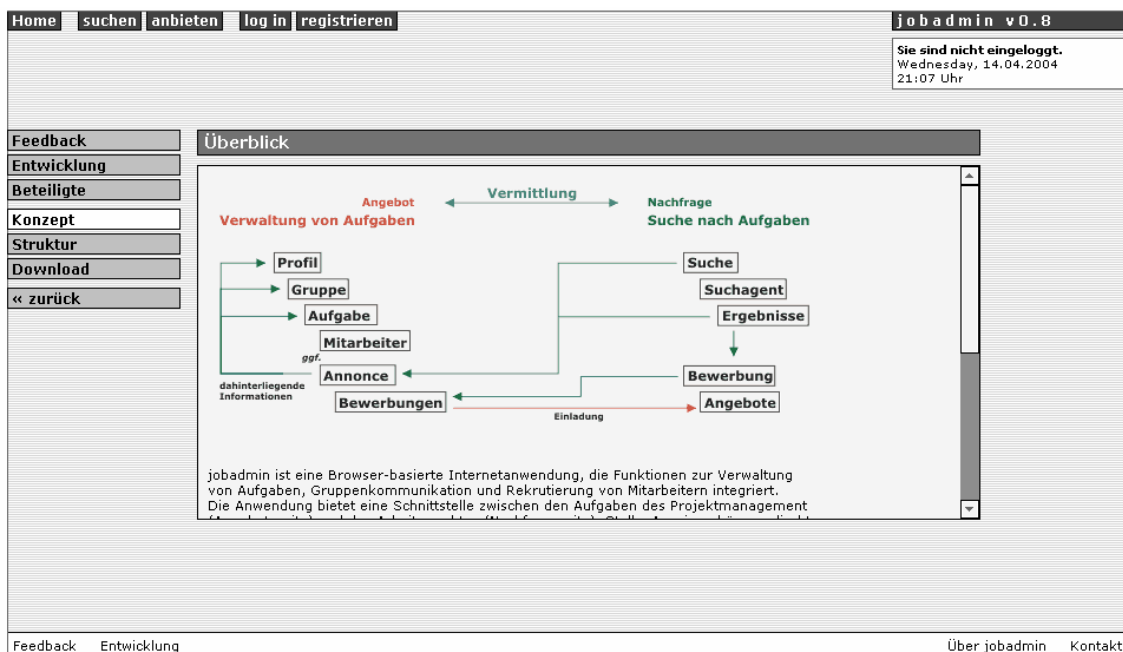


Fig2: The jobadmin tool for managing the work and support the workflow

1.3 Swarm Knowledge Catalogue (SKC)

While searching for knowledge to solve a particular design or knowledge problem, students have to collect, share and evaluate data. SKC is based on the assumption, that these tasks are essential for their apprenticeship and will have a central importance in their professional future. SKC combines a specific search engine and a document management system. It provides marking possibilities, document evaluating and connecting information to documents already found. It is a team-oriented tool and provides the opportunity of mutual evaluation. The SKC-module creates a dynamic student knowledge memory and allows the structured accumulation of specific knowledge. Here as well, emphasis is put on the collective operation of different people. The platform also provides options for managing the results of the individual members of the group, entering comments and classifications as well as linking related pieces of information. The complex results gained within these working steps are displayed in an intuitively understandable interface.

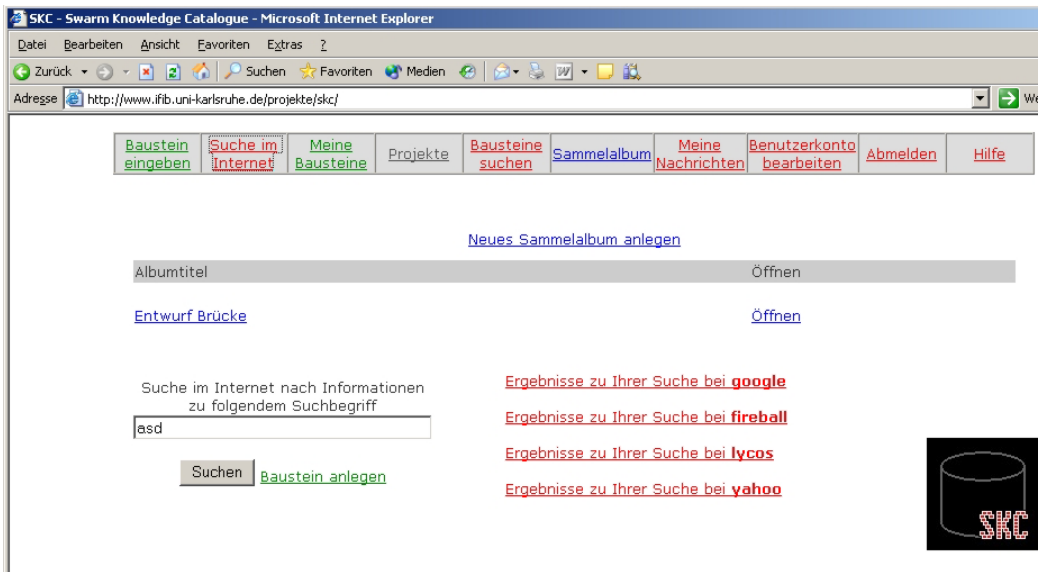


Fig3. The SKC-Module for collecting, weighting and storing data

Like all other tools, SKC is implemented with a web-based front-end and a server side database with scripting on the Web server. The new tools were implemented in the LAMP-Framework (Linux, Apache, MySQL, Php), instead of choosing the WISA-technology (Windows, IIS, SQLServer, Active Server Pages) used for the development of netzentwurf.de. By converting the netzentwurf Database from SQL-Server to MySQL technology, it was possible to use directly the same common data-repository without redesigning the whole application.

1.4 The LivingCampus Tool

While evaluating different teaching platforms and having a long experience in teaching with internet based services, we recognized that there is a need of a cooperation tool, as kind of a basic service for dynamic communication. The main functions had to be:

- To promote the use of internet based education tools.
- To give students the ability to deal with new media.
- To promote communication between the students themselves via internet-based tools.
- Solving problems in realtime, without meetings and telephone calls

To support more direct remote communication and contacts between the members of the university, a central, virtual campus (LivingCampus) for meeting, collaboration and communication was implemented at the University of Karlsruhe. Students are able to create their own buddy-list, consisting of friends, teachers and members of current working groups. When connecting to LivingCampus, an automatic search for other members of the group takes place. If a member of the group is also on the campus, or just entered it, a videoconference screen opens and it is possible to see the partner and talk to him. Of course all these functions are optional and can be activated or not by each partner. LivingCampus works without installing client software or paying for telephone fees. External partners from other countries or universities are also able to take part in the conferences. A new type of conference and communication room is created. Whereas conventional conference systems can be described as static rooms with a fixed number of persons and a static address to take part with, LivingCampus creates as many individual conference rooms as implied students. It connects the different audio and video streams from each individual team and models them in the database. LivingCampus becomes an ad hoc dynamic collaboration network.

1.4.1 Dynamic positioning on the campus

If requested by the user, there is a possibility for automatically retrieving his own position and publishing it to the team partner. The location based service used a 4 layer method consisting of:

- the use of global positioning system (GPS) on a PDA
- the use and positioning in wireless LAN- cells
- the use of wired LAN
- manual input

There is a sequential search with the goal to determine the position of the user on the campus. This function uses a graduated mechanism to get information from the logged-on user.

1.4.2 GPS with a PDA

The first search is initiated by the server-sided scripting at the Web server to which the user is logged in. There is an examination, if the user is transmitting GPS-Data. If true, the search-queue is stopped and the server is taking the GPS-Data from the client. This Latitude/Longitude data will be recalculated by the server and transformed into "Gauss-Krüger" coordinates. These coordinates are used with the map of southern Germany and these are again recalculated and transferred on the single pixels of the campus-plan.

For this feature a C++ Client for Pocket PC was developed. It queries the Com-Ports of a GPS-Receiver and transmits the results via TCP/IP Sockets to the Internet-Server. The Client can use any internet connection. For the campus it will approve the given Wireless-Lan Network, but can either use GPRS or the upcoming UMTS technology to transmit the data. Today only 1% of all students and teachers have the possibility to use the GPS on a PDA location based service, because there is not yet much hardware supporting it. But as well as cellular telephones integrate the possibility to take pictures; handhelds with integrated GPS-receiver will probably be soon available.

1.4.3 Dynamic Positioning in wireless-cells

If there are no results from a GPS-Device, there is a switch-back, looking for information from the Wireless LAN Network. At the University of Karlsruhe exists a complete covering Wireless-LAN with about 210 access points. These stations are mostly inside a specific lecture-room or in an isolated area of a building.

The possibility to identify the position in between wireless LAN cells was analysed. First of all, we mentioned to measure the field intensity and to calculate the position with three or more field-strengths from different access-points with known coordinates. Since an accuracy of 100 metres is enough, this was not necessary.

It was then the better way to query the access-points, to determine whether there is a client logged on or not. A special syslog server for the used Access Points was programmed to collect the data of users that are logged on the LivingCampus.

The users had to reveal the hardware address of his wireless LAN-adapter and the access points for this address were queried. If successful the coordinates of the current access point for the positioning on the campus were assumed. This is a simple, but effective method to solve the problem. Under use another problem occurred. If the user is close to more than one access point, he switches several times per minute from one access point to another although he does not move at all. By programming a timelock and a condition of new messages in a given period from the new access point the location in the cooperation database was changed.

1.4.4 Static IP-Adress mapping

If a client did not send any GPS-information or wasn't logged on with wireless LAN, his TCP/IP-Address used to communicate with the server was checked. In the university static and fixed IP-addresses are almost exclusively used. That's why it was possible to map the addresses to buildings and institutes and it was an ease to estimate the current location of the user on the

campus. Of all possibilities, this was the most frequent success fullmatching function. There was only one possibility leading to wrong results. If the institute or faculty had more than one location and it was using a V-LAN it was not possible to determine in which building a user was.

1.4.5 Manual, standard settings

If all search functions are not leading to a result, the standard-settings are used from the database. Thus the user is able to enter his position by hand, which is not very frequent anyhow. In most cases the user is not changing his position, the main advantage comes from the dynamic mapping of group members and seeing whether they are on the campus and available or not. The privacy issues of all individual users are protected.

There is no logging function and the user has to explicitly agree, if he wants to be located to show his position to his friends and working partners.

With additional functions like “do not disturb” or, “hide my location” the security and privacy needs were satisfied. On the whole, the audio and videoconference is working without the use of the location based service. The following screenshot shows the LivingCampus with three Users of a team logged on. There is the possibility to handle one hundred current users simultaneously on the LivingCampus, and each with his own, dynamic working group specified. The users are able to initiate a browser-based realtime audio and videoconference without additional software to be installed.

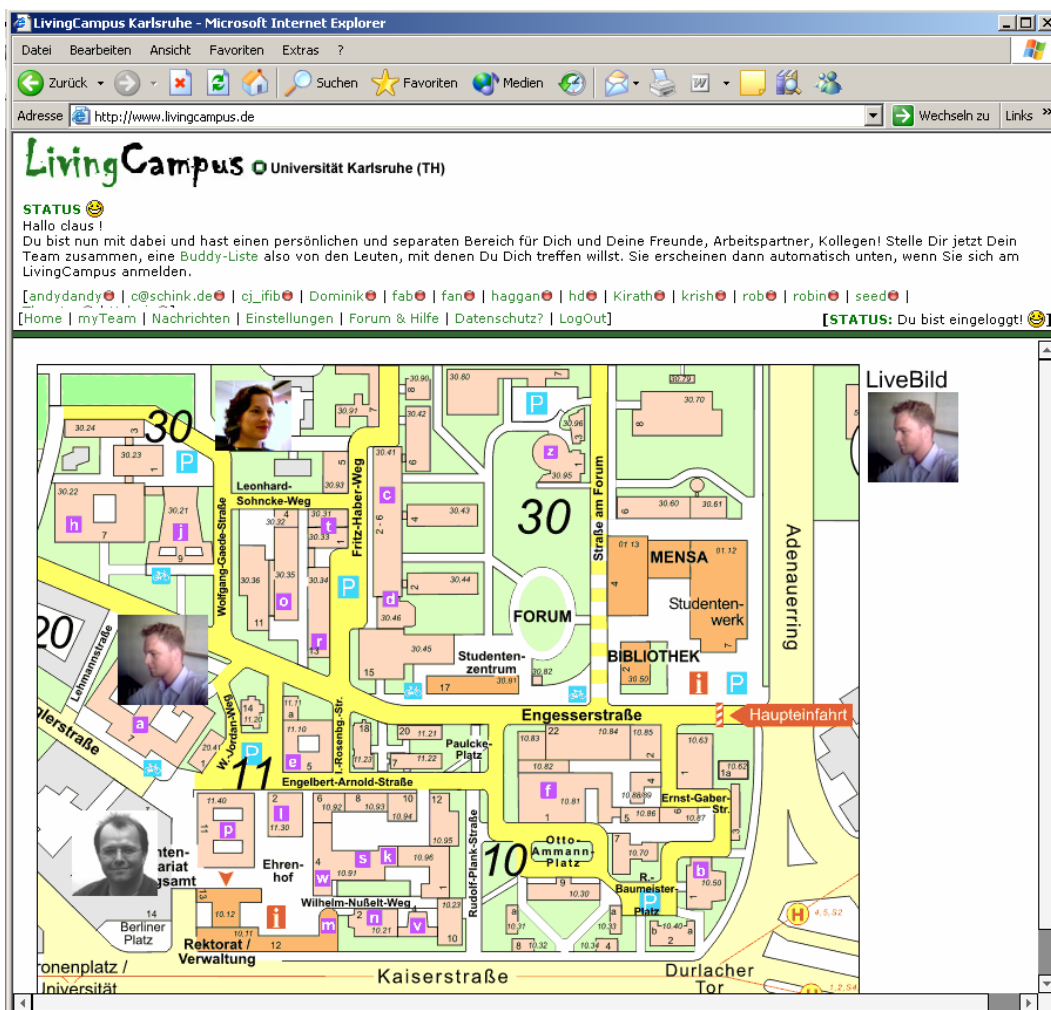


Fig.: Screenshot of the LivingCampus

Each group and of course each user has a separate network of audio- and videostreams. The connections are made of the individual teams. The users are able to solve problems directly and launch additional applications like file sharing, the SKC, or other teaching and learning tools.

By offering the possibility to connect personal and academic issues Living Campus leads to an increased identification and acceptance of the campus as a place to live and work in. Further on the tool can help to overcome inhibitions concerning the use of new technologies in education and cooperation.

2 References

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