

Using wireless technologies for context sensitive education and training



Local System Design - Corvinno Studio

Summary

This paper shows the system architecture established for handling context and location sensitive learning at Corvinus University of Budapest. The system has two main components: the Corvinno Studio, an ontology based content management system, and the CooSpace, a mobilized Learning Management System (LMS). Through this infrastructure location sensitive learning content will be delivered for students.

Mobile learning at the Corvinus University of Budapest

Being mobile while studying is not a new idea. It has been incorporated into teaching activities and official curricula a long time ago in the form of field trips and on-the-spot training. The appearance of mobile technology in education in the mid 1990s has extended the scope of teaching and led us into a new world of education. At the same this transition has its institutional limitations. In traditional educational institutions, like in the Corvinus University of Budapest, learning technology should be an integral part of knowledge transfer between students and lecturers, but it can not be the only platform of teaching.

However it is essential to keep up with students' demand – which forces institutions to involve technology more and more in their everyday teaching activities, enabling students to be flexible in their learning – and construct F2F based learning platforms, which provide elasticity in course content development and delivery. To meet the challenges, emerging from combining ICT enhanced learning and traditional classroom education, a blended service

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framework has been elaborated. This service portfolio designed by the educators of Corvinus University of Budapest is described in Figure 1.

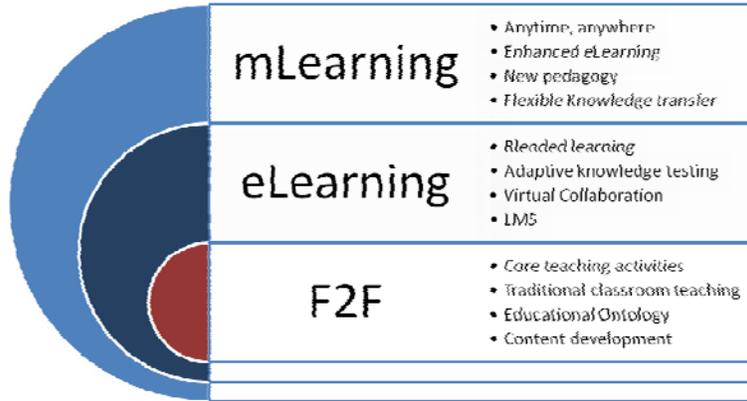


Figure 1: Service Portfolio of Corvinus University

The core element of the portfolio is F2F education. The scope of curricula taught in the training programs is represented by the recently developed educational ontology, which is going to be the domain of future content development as well. On top of traditional classroom teaching a Virtual Learning Environment (VLE) supports individual learning, enabling the use of different independent learning styles.

As Figure 2 indicates, there are three different aspects of Mobile Learning that is being covered at Corvinus University of Budapest.

Learning infrastructure

Providing technology for being a mobile learner

- *mLMS*
- *Adaptive testing*
- *Ontology editor*
- *Content management*
- *Administration system*

Collaboration

Providing services to enhance student – teacher and student – student communication

- *Mobile forums*
- *Mobilized notice boards*
- *Administrative SMS communication*

Content - pedagogy

Providing content, which makes students mobile

- *Mobilised F2F materials*
- *Location based materials*
- *Standardised content*
- *Teacher trainings*

Figure 2: Aspects of Mobile Learning at the Corvinus University of Budapest

Learning environment

To exploit the advances of mobile technology it is indispensable to transform the traditional learning environments into mobilized learning spaces otherwise users can't benefit from mobility. Challenges of limited resources of mobile devices have to be tackled and fitted to the long-established campus-workstation based services. In the Corvinus case, the mobilized infrastructure provides an access point to selected services using a mobile phone.

Collaboration

One of the main driving factors of mobility is collaboration. Fostering interaction between the stakeholders of learning processes is a key benefit that has to be supported with reliable services. Collaborative functions like forums, notice boards and messaging services are available in Corvinus's system.

Content – pedagogy

When content is created for the mobile learner, the creator should establish learning scenarios that can be guidelines for content mobilization. On the one hand lecturers want their lecture notes available for their students anytime, anywhere. On the other hand there are some applications (quizzes, games or evaluations), which are easy and fun to use on a mobile phone. At the same time being a mobile learner also means that the student uses content, transferred by the above mentioned means of educational infrastructure, in context. Getting learning content on the right spot at the right time makes formal and informal learning mobile.

Learning Infrastructure

A learning infrastructure had to be developed that can actively support the whole learning cycle, independently from its form (e.g. workstation- or mobile phone-based learning). The user logs into the Student Administration system through a mLearning Management System (Coospace), where the given teaching materials are implemented, and accessible for studying. The mLMS is connected to the ontology-driven environment. This environment consists of

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the Educational Ontology and the Repository that are the two major pillars of the whole solution and the Adaptive Testing Engine as well. Finally some external modules – offering extra services – will be discussed that are also connected to the mLMS. Figure 3 depicts how the system elements are connected to each other to provide a comprehensive solution. The two main components (STUDIO and CooSpace) of this architecture are described in the next two chapters.

STUDIO - Ontology Driven Learning Environment

Motivation, background

Accordingly the primary objective of the Studio approach and system is to provide support in exploring missing knowledge areas of candidate students in the frames of an electronic learning environment in order to help them to complement their educational deficiencies.

Ontology Driven Learning Environment

The major role of this learning environment is to actively support the whole learning cycle, independently from its form (e.g. workstation- or mobile phone-based learning). This learning infrastructure consists of an Ontology Repository and a Content Repository — that are the two major pillars of this solution —, a Content Presentation tool, a Test Bank, an Adaptive Testing Engine, and some additional support tools as well. The figure below presents how the above mentioned system elements are connected to each other to provide a comprehensive solution.

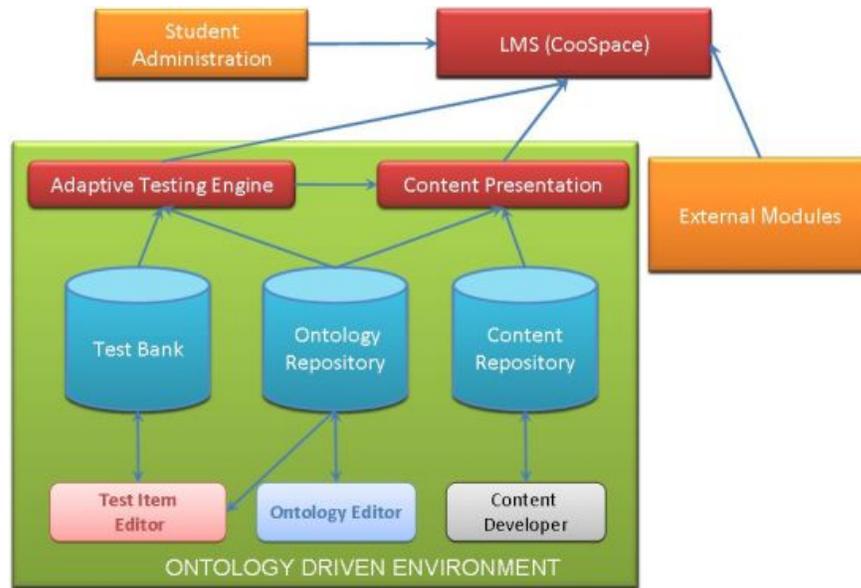


Figure 3: Corvinus Mobile Learning Infrastructure

Ontologies – that are stored in the Ontology Repository – are the central elements of the content authoring processes. Several domain ontologies are stored in this repository. These ontologies constitute the core of every other component in the system. Curriculum content may come in many forms and formats, from different departments, with different internal structures and even in different languages. The ontology-based approach provides support for

capturing regularities in a single framework, general enough to model the curriculum content management requirements of multiple institutions.

The electronic learning objects are stored in the Content Repository in this system. Additionally, there is also a Content Developer application, which offers content management functions to the content authors; and a Content Presentation component, which is entitled to present the stored content pieces to the users. Content submitted to the system is not format dependent, all widely used text and multimedia file formats are accepted, recognized and supported.

The above mentioned three components (Content Repository, Developer and Presentation) constitute a Content Management System (CMS) specialized for the needs of the ontology-driven environment. With this approach content is also structured according to the ontologies, meaning that every concept in the ontology is connected to a specific piece of content, describing details or relations of the concept with other items in the same ontology. Students' knowledge is evaluated with the help of multiple choice questions. All questions and possible answers reside in the Test Bank and are connected to one specific concept in the ontology. This way, the learners' knowledge about a certain concept can be evaluated. The Test Item Editor component is responsible for visualizing the ontology structure and letting the user to assign questions to each node in the ontology.

For students the Adaptive Test Engine is a key application, which is also embedded into the LMS. In the course of testing the Adaptive Testing Engine walks through the ontology structure and asks questions about concepts of the ontology. It evaluates the student's answers and decides on the following knowledge elements to be tested. At the end, the user's knowledge is mapped thoroughly and a tailored learning content is offered to be learned. This customized material consists of pieces of learning objects, which are offered by the Content Presentation component.

CooSpace mLMS

The significance of information society lays in the fact that – thanks to the use of computers – communication devices are functionally dynamic. This feature of these devices enables them to meet new requirements very quickly. Parallel to this the preparedness of individuals is changing more and more rapidly and sharply. The relevant preparedness tends to mean the ability to access and obtain awareness itself rather than the ability to store information like an encyclopaedia. Thus heading towards the information society should establish research and education systems that are suitable for the mobilization of skills of the society.

On the basis of the above-mentioned facts the Coospace developers decided that using

Internet Technology in the Hungarian educational sector should not be only a possible, but a necessary element of the local education and research system.

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CooSpace LMS platform is also a communication-centered solution. Real cooperation takes

place on the virtual scenes of this application. Participants must join the particular scenes through their roles.

What does scene stand for?

The education and research are co-operating in the interest of reaching common goals:

support learning. The scenes of CooSpace are supporting the co-operation of the members of

the groups by the ways of assuring numerous forms of communication between them.

A scene is a virtual space of an existing group. It is an interesting feature of the cooperation scene that participants can form smaller groups allowing to create a subscenes, where they can work on a particular task on their own. CooSpace certainly provides participants with

basic contact information (address, e-mail address), but the participants also have a possibility

to upload their photos to make their relationships more personal. The shared document composition tool of CooSpace with its simple structure and practicability should be regarded as a novelty even in comparison with other systems. This tool makes it possible for a group of participants to work together on a common project using only an Internet browser.

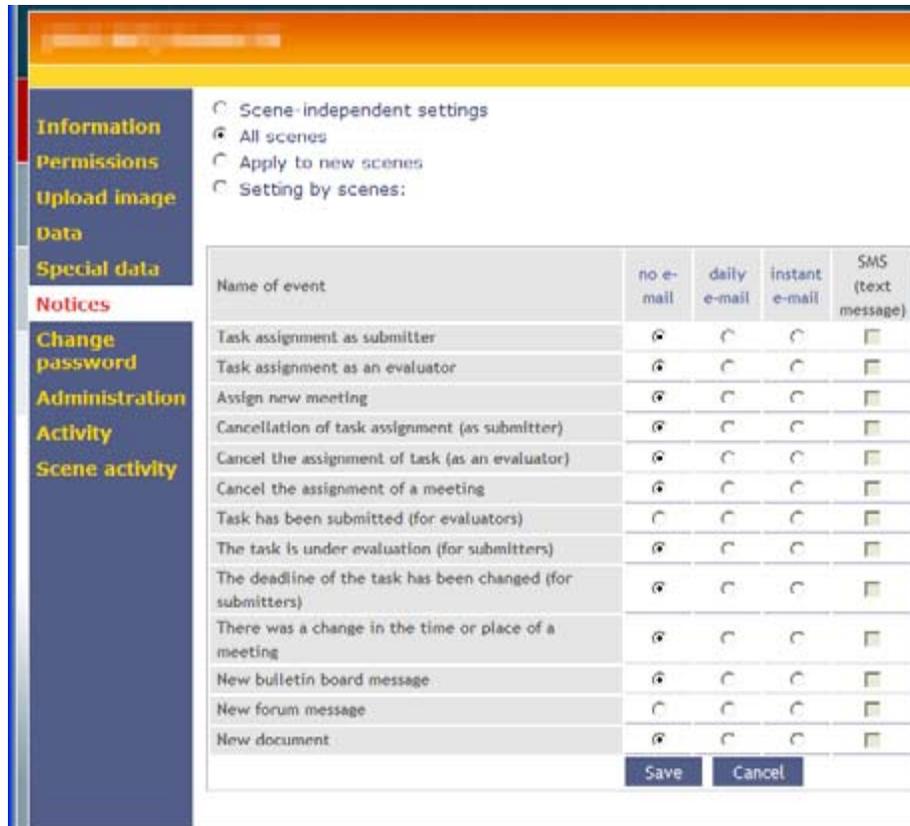


Figure 4: CooSpace Scene settings

Communication

CooSpace provides numerous ways of communication within a selected scene between the members. The actors can proceed dialogues, can discuss different topics in the frames of

freely definable thematic forums (direct correspondence), or via chat (in real-time). It is

possible to congregate virtual or personal meetings.

With the help of easily tuned messaging system the personalized follow-up of the events or

other changes in the scene administration is possible. With the use of SMS and e-mail

messaging possibilities the actors of the research area can earn knowledge of a changes and events important for them.

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Task management

With the help of CooSpace the involved researchers and students can co-operate in an

organized way and can publish their achievements for the closer and the wider circle of publicity. Besides these tasks, the distribution and division of research assignments, the evaluation and traceability of distinct subtasks can be reached.

CooSpace supports the management of tasks emerging during the operation of a distinct team/group. It is possible to appoint tasks for the whole group or for individual members of the group. They can also submit their documents, regarding these tasks which can be later evaluated. One can set out deadlines to tasks, which appears in the time schedule of the scene.

The calendar management gives an overview of the different tasks in the research areas. It is also possible to view a summary of the tasks, results and achievements of a scene, which can be saved in a format available for other office applications. Assignments can be provided and the papers can be submitted in electronic format. Other participants can evaluate these. Tutors can also produce an automatic tests.

Documents

The educational or research documents can be accessed in a unified way. A shared document storage provides an easily accessible, common repository of the achievements, templates and draft documents. Users can share documents, media files and with the compilation of bibliographies they can set out curricula, working papers.

In addition exchange of information is also assisted by messages about automatically generated events. CooSpace provides the possibility of registering data about documents. The management of the documents is independent from scenes, but they can be connected to a scene, for instance to create a bibliography.

User rights management, web access

The user rights management is being handled by a strict set of rules with the help of Microsoft Active Directory Services technology, providing a possibility of Single Sign In. On the web

interface of CooSpace every important function (e.g. To Do List, Co-Operation Scenes,

Messages, Forum, Document Storage) is only 'one-click away'.

Technology

From the technology point of view, CooSpace is a web-based, multi-tire computer

application. Regarding the platform, it works with a Microsoft 2003 server, with an MSSQL 2000 database server in .Net framework IIS6/aspx. The developing environment is VisualStudio .NET. The system can be connected with other system – which means data

synchronization and single sign authentication. The system is capable to integrate ETR (one of the strongest education administration systems of the Hungarian market). The development was accomplished by DEXTER Ltd.

Mobile Learning environment

To exploit the advances of mobile technology it is indispensable to transform the traditional learning environments into mobilized learning spaces otherwise users can't benefit from mobility. Challenges of limited resources of mobile devices have to be tackled and fitted to the long-established campus-workstation based services. In the Corvinus University case, the mobilized infrastructure provides access point to selected services using a mobile phone. All mobilized content is uploaded to the Coospace, which is reachable via the following URL: <http://coo.uni-corvinus.hu>

Within the Coospace a Mobile Learning Space has been created for the students, where all the mobile phone compatible teaching materials are being collected. (These are the various contents in HTML and WML versions) The rest of the material was assigned to the additional lecture notes section. Students, who were logging in the system from a mobile phone, using the mobile interface of the LMS, can access and read the content, which is in the Mobile Learning space. The format of the material there is readable for mobile devices as well. They can also download documents, which are not assigned to the Mobile Learning space, but probably they can't open and read the documents, however this might be possible with some of the latest handheld devices.

All the materials are also reachable via the normal internet interface as well. PDAs, smartphones with Wireless LAN function are capable to enter the LMS via the normal interface.

In case the WAP browser of the mobile phone is not capable to access the website. We recommended the students to use the Opera Mini browser, which is a free internet browser application for wide range of mobile phones. This Java based browser runs on almost all commonly used devices. The downloading instructions for the Opera browser were provided through the LMS as well.

Context and location sensitivity

In the General System Design the Contsens project partnership came up with several technologies and scenarios for context and location based learning content delivery. The Corvinno pilot will be organised around Scenario number 5:

“Cormac is a telecommunications field engineer. He is out in the field fixing a particular node. When he arrives on site, the system knows where he is and recognises the correct revision of the node. Cormac can pull or the system will push the necessary information to fix the node recognising the device Cormac has with him. Cormac finds a smarter way to fix the node so he pushes that information back to the server which stores it until the next time that node needs to be fixed, thereby adding to the original information.”

The plan is to organise the content development and delivery around our learning management system and based on the location and contextual information the mobile device provides, we push content automatically towards the learner. The Corvinno Studio system

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together with Coospace LMS is capable to handle this location and context aware educational situation. Figure 5 shows the general contextual learning scenario:

1. The user has to log on to the Corvinus' mLMS using wireless infrastructure (mobile networks, Campus (or any available) wireless network, GPS, QR tags, etc...) with a handheld device, using the previously installed application or (depending on the learning situation) a mobile web browser.
2. After the logging in, the application attempts to localize the user. At the moment this is only possible if the student possesses the appropriate (GPS enabled) device.
3. Based on the location of the user, selected learning content and/or learning services will be provided to utilize the learning.
4. The system follows the movement of the student. In case the location changes, different learning units will be available for the user.
5. The user always has the freedom of changing the content or denying the location related content and study something else according to her needs.

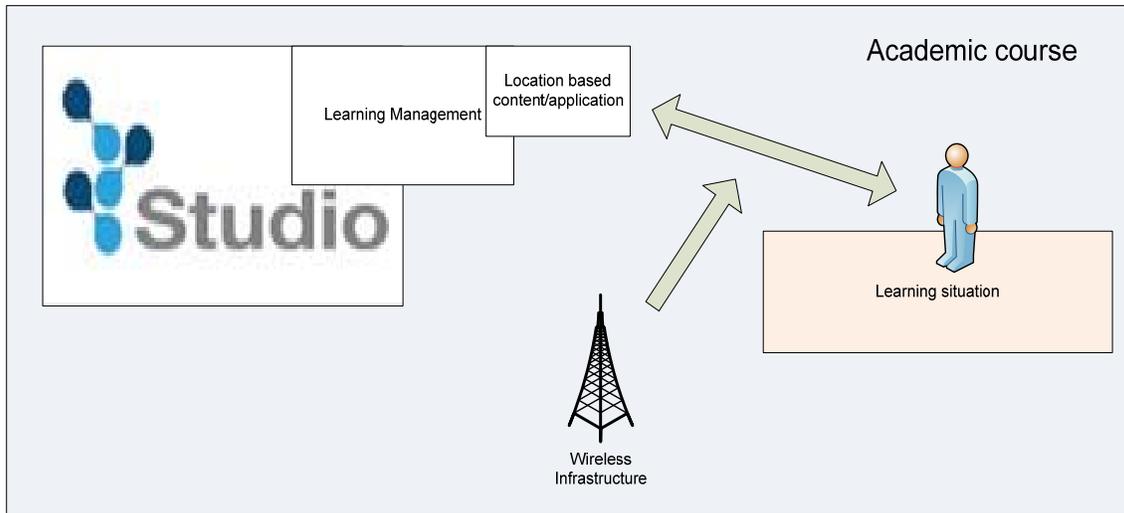


Figure 5: Context aware content distribution

It is important to emphasize that the Studio is an Ontology based system, which enables the content creators to consider various location and context sensitive issues when putting together the learning content. Basically, as it is also visible on the figure above, with little effort from the user broad amount of services, from different layers of the Studio system will be available automatically.