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Rollout of CampusContent

DFG-Competence Centre for eLearning

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Abstract

CampusContent (CC) is a DFG-funded competence center for eLearning with its own portal. It links content and people who support sharing and reuse of high quality learning materials and codified pedagogical know-how, such as learning objectives, pedagogical scenarios, recommended learning activities, and learning paths. The heart of the portal is a distributed repository whose contents are linked to various other CampusContent portals. Integrated into each portal are user-friendly tools for designing reusable learning content, exercises, and templates for learning units and courses. Specialized authoring tools permit the configuration, adaption, and automatic generation of interactive Flash animations using Adobe's Flexbuilder technology. More coarse-grained content components such as complete learning units and entire courses, in which contents and materials taken from the repository are embedded, can be created with XML-based authoring tools. Open service interface allow the deep or shallow integration of the portal provider's preferred authoring and learning tools. The portal is built on top of the Enterprise Content Management System Alfresco, which comes with social networking functionality that has been adapted to accommmodate collaboration, sharing and reuse within trusted communities of practice.

Keywords: eLearning, reusable learning materials, learning object repository, open content

Project Facts

Approved by the DFG [1] in the summer of 2004, CampusContent [2] is one of the first four competence centres for research information (Leistungszentren für Forschungsinformation [3]). CampusContent is designed as a transdisciplinary project that - in developing its inventory of methods and a suitable technical infrastructure - combines software engineering principles, approaches and perceptions with pedagogical principles and expertise.

The project began its work on March 1, 2005, with a staff of five scientists and several undergratuate and gratuate students from various academic disciplines within the FernUniversität in Hagen. The scientific board directing the project included professors

Baumgartner (educational technology), Kaderali (communication systems) and Krämer (software engineering), who also served as the chair. With the expiration of the first funding phase after two years, the first prototype of a CC repository went online early in 2007 and was evaluated according to best usability and quality assurance practices. Prior to the beginning of the current funding phase of the project, the project team had to be reconstituted to integrate further software engineering know-how for the implementation of the product version of the portal. DFG support is scheduled to conclude at the end of March 2009.

Motivation and project objectives

The project was motivated by the observation that in the last decade or so in the numerous individual and institutional digital learning projects, a large number of digital learning materials have been developed. Among them are many worthwhile learning objects of interest to a wide audience that have been ignored because they are not visible in the Internet. In contrast to books and scholarly journals that are systematically catalogued, managed and cross-referenced by libraries, as yet no widely accepted archiving system exists that enables the systematic and effective storing, acquisition, distribution, and easy exchange of digital learning materials and codified teaching experiences (such as proven learning paths, pedagogical scenarios, and teaching goals). Another challenge is technological innovations that threaten the use of digital learning materials unless they are continuously adapted to such changes. But the costs of such adaptation activities are hardly bearable by individuals or single institutions that developed them. The imposing potential for the development of high quality contents has heretofore been largely dissipated because research and educational groups have worked in isolation.

CampusContent begins at this point with the goals of:

- reshaping the reuse and adaptability of digital learning materials and codified teaching experiences,
- implementing and evaluating design-for-reuse principles by means of reference materials, and
- supporting these tasks through a networked and integrated infrastructure.

In addition, the inclusion of social software will allow portal users to organize communities of practice autonomously and furnish them with collective knowledge spaces and functions for expressing recommendations, annotations and evaluations. It is expected that the quality of teaching gradually improves through the open access to mature and peer-reviewed learning resources and the culture of sharing and reuse will rapidly grow.

Anticipated characteristic use scenarios for this vision include:

- Author A uses resources from author B and author C, modifies them if licensing conditions permit, and adds her own content or pedagogical concepts to a seamless composition;
- author B and author C use the exact same material but for different pedagogical purposes or in different learning situations;

- a group of like-minded professors establishes a social network, e.g., on the topic ‘Service-Oriented Computing’ and sets up a peer review system for learning materials on this topic;
- pedagogical experts develop methods or arrangements for online teaching, codify them, and make them available in the expertise centre for other users.

Finally, CampusContent will create a work environment including authoring tools and a learning management system that operate on top of a repository and enable teaching personnel and authors to find and access their own multimedia learning contents and those of others quickly and efficiently. This tools allows them to tailor materials for particular learning situations and learning objectives, to combine them with pedagogical context, and make the results available as learning objects, larger learning units or entire courses ready for use in learning management systems. The repositories of independent CC-portal installations can be linked to each other through web services to provide a single system view that makes the physical location of open content transparent. The autonomous operation of individual CampusContent installations provides the additional advantage that open and closed content can be maintained in the same way.

Target groups

Institutional target groups of the project are educational institutions such as institutions of higher learning, schools, and commercial educational facilities that would like to integrate CampusContent into their infrastructure. The primary target group within such institutions is the teaching personnel who aspire to present and exploit reusable contents and codified didactic experiences. But also students can use the system individually and in cooperation with their fellow students in evaluating, commenting upon, and recommending learning objects, as well as cultivating their own collection of contents in their personal work areas. To increase the students' involvement, additional information, such as education and career counselling or job openings, will be maintained. A further target group consists of specialists from science and business who wish to develop and distribute modular research and development content, use the content pool and authoring tools for cooperative publications, or make research results available as reference materials for individual continuing education.

Innovation potential

The vision behind the project on how to modify current teaching and learning practices through the exchange, improvement and repeated use of learning material and teaching practice, comprises three elements:

1. Through recourse to successful models and pioneering work of others, the creation and preparation of courses should be essentially improved and lead to the saving of time and costs. Teaching personnel from less technologically related subjects should be able to make use of the potential advantages of new media without having to develop special technical skills. As has been demonstrated for component-based software engineering, it is expected that an increased effort involved in the creation

of re-usable materials pays off with a small number of reuses and that their quality will increase in direct proportion to the frequency of use and cooperative refinements.

2. Teaching personnel should be inspired to undertake substantive and pedagogical changes in their teaching without having to sacrifice their personal teaching styles. Especially important in achieving this goal is to construct context free and modifiable modular learning contents as well as schematically devised and modifiable pedagogical scenarios and learning paths, which allow for easy embedding of thematically appropriate contents. The inherent contradiction between target audience and context-neutral contents on the one hand and the necessity of tailoring learning objects to the needs of the learner on the other is mitigated by a heuristic principle: contents, which we call information objects, are connected ad hoc with suitable pedagogical context to form learning objects. Since all the connections of this kind established in the repository will be perpetually maintained, the various usages of the information objects and pedagogical contexts can always be retrieved and inspire new combinations.
3. As in academic publication of research, it is to be hoped that the reputations of authors whose teaching objects are widely used will increase and that their commitment to the community will, in keeping with the best practices of the academy, be adequately compensated or rewarded.

The anticipated added value of the project resides in the benefit gained by teaching personnel from the previous work of their colleagues in areas where content and pedagogical methodology overlap; as a result, users will have at their disposal an additional capacity for the improvement in specific areas of teaching. To achieve this goal, a critical mass of contents and active participants in every discipline is necessary. For this reason ongoing discussions with university administrators and computing centres, parallel to the conceptual technological developments, are taking place in anticipation of acquiring additional network partners.

Architecture and functionality

The CampusContent portal has been designed as an open source solution. As is shown in the graphic below, it is based upon the open source enterprise content and document management system Alfresco [4] (the grey components). Open standards, such as WebDAV, JSR168 and 170 and web services, support Alfresco's expandability and ease of integration. The green components on the overlying architectural level represent the functions specific to the CC that will be available with the next release. Currently they include search, browsing and render services. Various open source authoring tools and a reference LMS rely on these services. On the top-level additional functional components, such as a community area, an information and help system for the CampusContent portal are located. In addition, a shallow integration of LMSs, external portals and content management systems is possible through open interfaces.

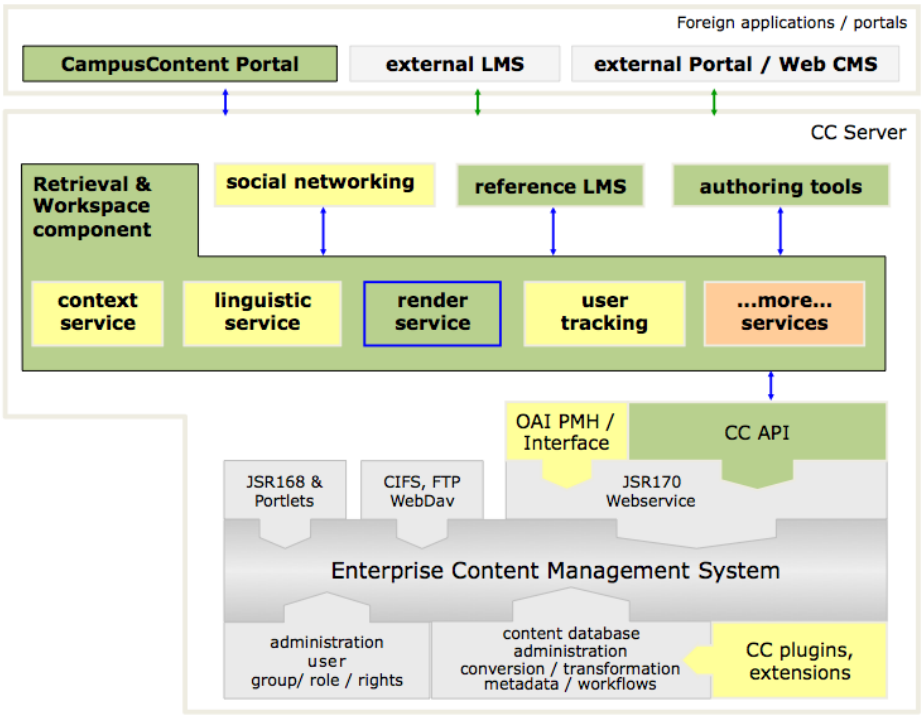

Figure 1 – CC-Portal Architecture

The yellow components in the architecture will be available at a later development stage. The integration of social software will enable the self-organization of communities of practice and allow the community to furnish them with shared knowledge spaces and useful community functions providing, e.g., enabling recommendation, annotation and evaluation. Context services will make possible the derivation of metadata for learning materials from the work context and profiles of the authors. Linguistic services will exploit lexical relationships between concepts, such as synonymy, subordination and others, to find matches when search terms are not matching metadata maintained in the repository. Services for user tracking will collect use data for content objects both during their creation process and during the real learning process in interaction with an LMS. This user data will be evaluated, condensed and presented in appropriate form. A user interface that will implement the 'Protocol for Metadata Harvesting' [5] of the 'Open Archives Initiative' [6] (OAI PMH) will enable the exchange of metadata with heterogeneous repositories.

A Flash animation [7] illustrates typical use scenarios in a series of screen-shots taken from the portal. They include, e.g., the search in the repository and the interaction with one's personal working area, authoring tools and the originals for the learning sequences.

Technical integration of existing systems

Potential users from higher learning institutions typically operate a range of systems forming their digital learning infrastructure. University management systems, for example, HIS-LSF und HIS-POS, were or are being connected to the respective LMSs. Through CampusSource [8] the project will provide an open source reference implementation. In this way users can connect their own LMSs and authoring systems to CampusContent. Smaller institutions can also use CampusContent as a complete system. Following the example of other open source projects, integration is possible on several levels.

Implementation, use and development

The resilience and utility of the software are guaranteed by means of professional development processes and a group of developers exhibiting long-term experience in software companies that introduced and administered widely used digital learning systems. The seamless integration of a reference LMS and widely employed authoring tools will be made possible through the close cooperation with a team offering open source tools and platforms through CampusSource. In addition, the practical demands derived from the years of consultation with ten universities, various schools and educational facilities during the use, adaptation and further development of digital learning platforms and tools contribute to the design of the portal. The same is true for the experiences gained in the coordination of requirements with computing centres and university administrations.

During the development of the technical system, universities and other educational institutions were approached to acquire them as potential users of CampusContent. Simultaneously the cooperation of additional open source communities for the purpose of integrating and development of digital learning tools is actively being sought.

The project assumes that by the time of the rollout a stable user community will be in place, so that service and further developmental costs for each participating party can be made very attractive. After the financial support from the DFG terminates, at least two or three service provider companies, in cooperation with the chief developers of the CC portal, will be available for support, modifications and additional development. Future development costs are to be financed through new research and development projects, open source community projects, service providers, and networks.

Reuse

From the outset the project has pursued the goal of inspiring teaching personnel to effect changes in the contents and pedagogical methods used in their classrooms without at the same time having to abandon their own personal teaching style. Especially important in achieving this goal is to construct context free and modifiable modular learning contents as well as schematically devised and modifiable pedagogical scenarios and learning paths, which allow for easy embedding of thematically appropriate contents.

The inherent contradiction between target audience and context-neutral contents on the one hand and the necessity of tailoring learning objects to the needs of the learner on the other (1) is mitigated through a heuristic principle: contents, or the so-called information objects, are connected ad hoc to the pedagogical context of the learning objects. Since all the connections of this kind established in the repository will be perpetually maintained, the various usages of the information objects and pedagogical contexts can always be retrieved to inspire new combinations.

Based upon the concept of the software components and the related design principles, such as cohesion, decoupling, genericity, and parameterization, new formal principles for reusable learning contents were conceptualized. The concept of ‘pedagogical parameterization’ of learning objects presented in (2) was demonstrated by means of finite state machines (3). An environment implemented in Java supports various finite state machine designs, enables their li nking to educational tasks addressing six different cognitive levels of the taxonomy presented in (4). It uses known algorithms to interactively monitor the equivalence between the graphic representation of a state machine, its corresponding regular language, and its tabular representation.

As a reference example for generic objects, a configurable version of an animation for the classification of concepts, which can be useful in many fields, was developed (5). The number of concept categories, their designation and visual representation, the terms that belong to each category, the maximum runtime or permitted number of mistakes, the annotations for students and other parameters are adjustable.

Licenses

The components of the portal are supplied free of license costs and as open source software. Potential users are thus able to tailor the software to their infrastructural needs. Originally open content licenses such as Creative Commons [9] were favoured for the learning contents. But in user surveys it turned out that this imposed an unacceptable restriction to many users and would lead to a limitation on the use of CampusContent. For this reason the form of licensing is to be determined by the user or operator.

The authors and users of the system are being informed of the licensing strategy by information ads. Upon storing a content object or a pedagogical model, authors can decide upon the licensing conditions themselves. Should the license be already fixed by the educational institution, this condition will be indicated. The licensing conditions and their implementation are currently coordinated with the partner organizations. An expert in media law has recently been involved in the project to take responsibility for this task.

Outlook

After three years of research and development, the competence centre CampusContent will launch a comprehensive e-learning portal offering a range of added-value services in the fall of 2008. The methodology and tools developed in the project will be documented in an online information system and publicly accessible in the portal. An eLearning

Sommerakademie [10] (summer academy) including three days of expert presentations and round-table discussions and three days of hands-on training is scheduled for September 8-13, 2008, in Jena and Weimar.

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[4] http://www.alfresco.com

[5] http://www.openarchives.org/OAI/openarchivesprotocol.html

[6] http://www.openarchives.org

[7] Flash animation of CC-portal functionality

[8] http://www.campussource.de

[9] http://de.creativecommons.org (German)

[10] http://www.elearning-sommerakademie.de (German)