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CampusContent and the Repository Network edu-sharing

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I. The CampusContent Project

The repository network edu-sharing grew out of the R&D project CampusContent (Krämer, 2005), which the German Research Foundation (DFG) funded from 2005 to 2009 under the program “Centers of Excellence for Research Information”, sub-line “Digital Text and Data Centers”. The project’s main objective was to support the collection, sustainable management, and open sharing, reuse, adaptation and remix of research and teaching information. In this context, CampusContent set out to conduct trans-disciplinary research in a team of computer science and pedagogy experts to develop a repository and broker system for educational content and know-how that:

- Improves the visibility and sustainability of and the access to digital learning resources and codified methods substantially;
- Supports a sharing and reuse culture for high quality content and pedagogical best practices and enables collaboration across institutional boundaries;
- Addresses the heterogeneity of authoring and delivery systems the repository network would later interoperate with;
- Leaves the autonomy of system operation to institutional operators and control over their assets to content and know-how owners.

In principle, the repository network provides support for the whole research information lifecycle (see Fig. 1), but its core services primarily support the use of research and teaching information in educational settings.

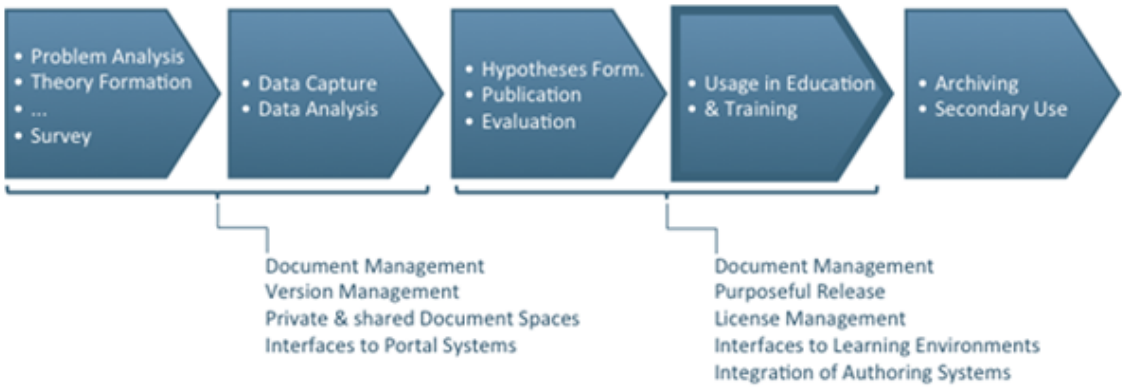

Figure 1: Research information lifecycle and edu-sharing functionality supporting individual phases

Research & Development Strategy

CampusContent focused on the daily practice of teaching staff and course authors who are the project's primary stakeholders. We chose to follow an iterative design and technology implementation process consisting of four phases. In the first phase, extending over the first two years, emphasis was put on the creation of solid conceptual and methodological foundations integrating computer science expertise with outcomes from educational technology and pedagogical research. In parallel to this conceptual work, the architecture and functionality of a first prototype of a learning object and scenario repository were designed and an operational system was implemented. This prototype was limited to core services including search, browse, upload, and (re-) combination of content items and scenario templates. The challenge was to reconcile the need for context-independence, which is a prerequisite for better reuse and adaptability, and the need for providing pedagogical context and customization, which effective learning settings require (Baumgartner & Kalz, 2005).

This prototype was evaluated and tested with future users in the second phase. To understand the needs of potential users and engage them in the further design process, we conducted field studies, organized focus groups, and performed task analyses along with informal expert reviews. We also evaluated the current market of open source content management systems we could use as a base component in the implementation of a second version of the repository software. Among the four final candidate systems, Alfresco, Fedora, Jackrabbit (Apache Foundation), and Slide (The Jakarta Project), we selected Alfresco because of its stability, its wide use in industry, and a growing developer community. Based on the findings of the prototype evaluation, an integrated work environment for educators, both content authors and instructors, was designed. It includes authoring tools, learning management systems, and a network of homogeneous content repositories with open interfaces to third party repositories and further end-user systems.

In the third phase core components were implemented and integrated into the target platform. The integration of existing open source learning management systems and authoring environments like Moodle (2009) and the QTI 2.1-compatible editor and test-suit

Onyx (2009), respectively, were subcontracted to the actual system developers. Meanwhile, a parallel subgroup designed and implemented new methods and tools for effective content creation based on predefined templates, and collected and evolved sample content to best practice examples (Krämer & Han 2009). A further subgroup codified widely accepted learning scenarios in the form of content-free didactic scenario templates and made them available in the repository (Krämer, Klebl and Zobel 2010).

The fourth project phase began with the deployment of the software in four different installations and their use in pilot applications with user groups from universities, schools and vocational education institutions. The rollout of the revised technology took place early February 2010 at the occasion of the LEARNTEC conference and fair in Karlsruhe, Germany.

From CampusContent to edu-sharing

Initially CampusContent aimed at higher education. In the course of the project, however, other educational institutions like schools and vocational education providers aspired to integrate the methods and technology developed by CampusContent in their e-learning processes. Especially local and regional school networks committed to technology-enhanced learning at different types and ages of schooling raised a strong demand for content sharing technology. To take this wider use of project outcomes into account, the product version of the repository technology was launched early February 2010 during the LEARNTEC (2010) conference and fair in Karlsruhe, Germany, under the name “edu-sharing” (2012).

II. Repository Network

In (Klebl & Krämer 2010a) we elaborated and extended the notions information management, information quality and variability from an e-learning perspective to lay solid grounds for the extraction of contemporary technological and pedagogical requirements for learning object repositories (LORs). We also reviewed the evolution of LORs in the light of pedagogical requirements, information quality demands, and e-learning technology standards. In the second part of this article (Klebl et al. 2010b) we presented repository solutions that particularly address the demands of open education movements and argued in favor of scalable network architectures for educational content management. We then presented edu-sharing as a network of homogeneous repositories for learning resources. We also discussed related content repository systems, including Connexions, Merlot, LON-CAPA, and the commercial Blackboard Content System.

edu-sharing typically spans a network of homogeneous learning object repositories. Each edu-sharing node comes with a local repository, is enriched by common community services, and can be embedded in locally preferred learning environments and authoring tools for content production (see Fig. 2). The default distribution includes several authoring tools and learning management systems (Moodle, metacoon, OLAT, Fronter).

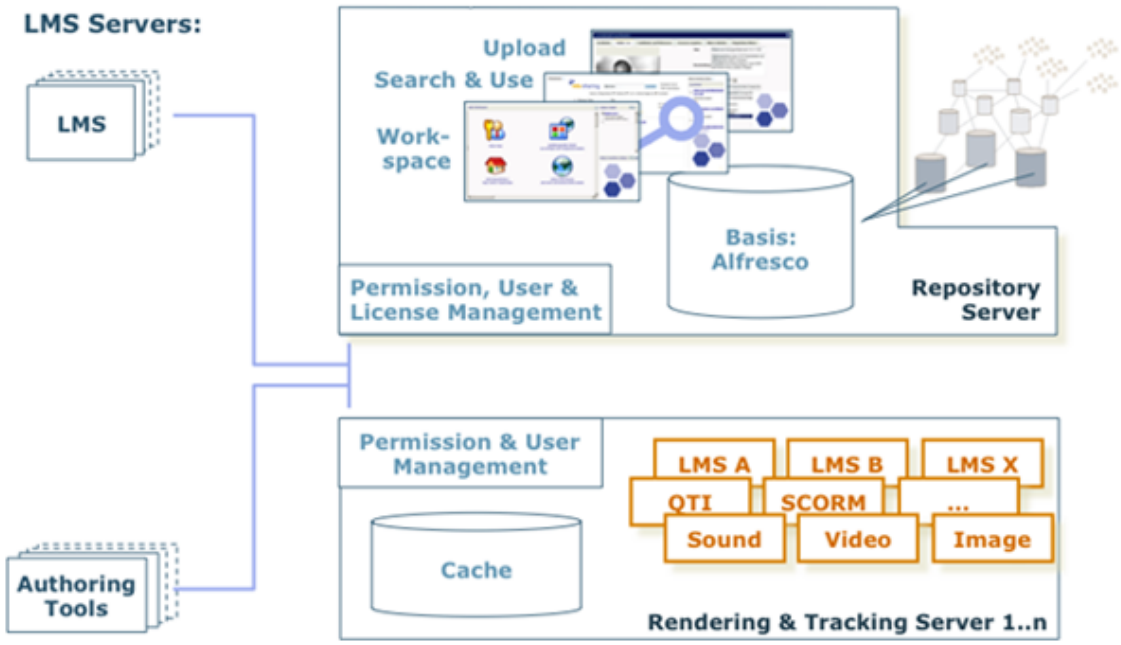

Figure 2: Architecture of edu-sharing

Figure 2 also shows some distinguishing features of edu-sharing, including remote rendering services, an extensible license manager, trusted interaction protocols between distributed edu-sharing repositories and between edu-sharing and third-party repositories, and standard-conformant service interfaces including the protocol for metadata harvesting of the Open Archives Initiative. edu-sharing's rendering services can handle a wide range of elementary media types, standardized exchange formats like SCORM and QTI but also complete courses that are written in formats (e.g., moodle or metacoon) not known to the actual client's learning environment.

III. Adaptable Content and Pedagogical Scenarios

Design principles for component software inspired the methodological and technological solutions CampusContent developed for content modularization. Boyle (2003) was the first to transfer the principles cohesion and de-coupling to an e-learning context and thus provided a well-defined and workable notion of learning objects. Cohesion is achieved because all content elements of a learning object have to adhere to a fine-grained learning objective, while de-coupling requires the renunciation of references to external resources. Boyle's approach has limits, however, because adaption of a learning requires "opening the box" using a specialized editor. To allow for adaptation in a black-box style, we transferred the software engineering principles parameterization and late composition to learning objects (Krämer & Han, 2009). To illustrate the approach, we developed a few configurable interaction patterns for concept classification and graph-based search strategies. They exploit Adobe's Flash Builder technology, which is able to generate Flash applications from XML specifications, and allow the instructor to configure the classification object with his or her preferred visual appearance, own concept categories, proper matches, and time- or error-based constraints controlling the maximal run of a test. Parameterization in

combination with late composition was illustrated with finite automata, a mathematical model used in many scientific and engineering disciplines. Late composition means that a learning task and scenario is combined with a proper content object (a graphical or table representation of an automaton, a regular expression etc.) at use not at design time. Mittag (2011) recently published a textbook on statistics that is accompanied by an impressive set of interactive experiments, mostly implemented in the form of Java applets. They make use of further parameterization facets, including language, notation, or controls.

Pedagogical scenarios capture best practices in educational activity and provide the pedagogical context of learning objects. A scenario models the dynamics of teaching and learning processes for a specific subject and a particular situation. It describes what learners, teaching staff, and other actors should do given a set of learning objects and tools. Scenarios can be composed to larger units and complete course modules. IMS Learning Design is an e-learning standard for describing pedagogical scenarios (see, e.g., Koper & Tattersall, 2005). As Learning Design is not yet well accepted in educational practice, we refrained from relying on this standard to formalize pedagogical scenarios and took a pragmatic approach (Klebl et al., 2010c). It can be viewed as a subset of Learning Design, while resembling the style instructors organizes their courses in Moodle in the form of nested and sequentially organized blocks, each describing a single learning path. The edu-sharing system provides an editor for configuring predefined scenario templates with application-specific resources and tools and for constructing new templates.

IV. iTunes U, iBookstore, and other Content Management and Delivery Platforms

Since the definition of the project in 2003, some unexpected developments occurred at the horizon that can be viewed as threads to edu-sharing. Late 2004 Blackboard, a commercial learning tool provider, published its new Content System. It is a file-based centralized repository for managing learning content. Blackboard users may be willing to buy in but it is no option for institutions that use other learning environments, even more so when they are proponents of open source solutions.

In May 2007 Apple Inc. launched iTunes U as a special portal of the company's iTunes Store through which higher education institutions can offer educational content (audio, video, text) and manage courses in their own section in iTunes U. The content in iTunes U is largely freely accessible but access restrictions for instructional material related to a course are possible through password protection. As of March 2012, 18 German and a few Austrian and Swiss universities are present in iTunes U with German content such as public relations features and content that aims to expose the depth and breadth of their profile in research and teaching, illustrate campus life, and make class material available to a broader public audience. Research-related content includes videos on outstanding research projects, electronic versions of dissertations and similar publicity-oriented materials. Educational offers include syllabi, recorded and other digital forms of lectures, and textbooks to name a few. Content offered in iTunes U can be stored on Apple or university servers and is just referenced from within the university's iTunes U track. Intellectual property rights remain with the rights owner. iTunes U is undoubtedly a prominent publicity channel for universities. It is visible worldwide and benefits from Apple's reputation as an innovation leader. But the courses offered are more elements of feasibility

studies than comprehensive educational offers – simply because there are not enough available. It is possible to share complete courses but content providers are not allowed to maintain DRM software in iTunes U. In addition, sharing and reuse at a finer level of granularity, which is the focus of edu-sharing, is not practical in iTunes U. Community building and cooperation through shared workspaces is not feasible. Apple's recent policy is that books are opened in iBook, videos, PDFs and audio content in a special app. These new features are, however, rarely used at universities and the rendering software (iBook reader and iTunes U app) are only operational under IOS. In contrast, edu-sharing guarantees a rendering service for each content type and prominent browser. Finally Apple has complete operational control and nobody knows how long the company's service will be free and available.

Although no longer the only app store on the planet, Apple's version seems to be ahead in terms of learning apps and educational iBooks. These solutions definitely leverage expectations on the quality of digital content for education, both from a media and instructional design perspective. But currently, the focus here is on pre-school and k12 education, while little can be found for higher education. iBooks will most likely be used for complete courses, while educational apps seem more appropriate for implementing small grain learning objects. Again, quality assurance and distribution are solely controlled by Apple and – in the future - other app store providers, and the division into pro- and cons-IOS, Android or Windows camps is not supportive for open education and unconstrained sharing of educational content.

V. Conclusions

The project began its research and development in the spirit of the emerging movement to make educational content freely available over the web in the form of so-called open educational resources (OER), which later culminated in the open education movement (Cape Town 2007). An OECD study (2007) comprehensively defines core concepts in the domain, describes stakeholders and their interests and roles, discusses copyright issues and sustainability problems, and organizes all elements in a conceptual map (OECD, 2007, p. 31). This map clearly shows that OER is more than just content, namely a whole set of development and delivery tools and implementation resources, too. In (Krämer & Klebl 2011) we argued that edu-sharing nicely matches all element of the OER conceptual map with a resilient technical infrastructure, including:

- a network of homogeneous repositories for educational content and know-how at its core,
- open (service) interfaces and secure communication protocols to interconnect with foreign repositories and heterogeneous end-user systems like authoring environments and learning management systems,
- a comprehensive portal with custom-designed applications for searching, browsing, cooperation in protected spaces, and content brokering supported by an extensible digital rights management (DRM) component.

The DRM component supports Creative Commons licenses by default but can be extended by other licenses as well. The need to admit the coexistence of different licenses, including commercial ones, arose from lessons learned in pilot projects, e.g., at schools in Germany, where hardly any OER but plenty of commercial content is in use. In the context of viable business models for educational content and knowledge sharing, these issue where also discussed in (Geser, 2007, pp. 64-70). Through shared workspaces members of a (geographically and institutionally) dispersed community can cooperate in protected, license-free spaces in the repository network. But once content or templates developed cooperatively are published in the repository, they have to be assigned one or more licenses.

Another outstanding feature of edu-sharing is the capability to virtually integrate arbitrary end-user systems, including authoring and learning tools or leaning management systems at various levels of integration - from deep to shallow. This allows, for instance, a search in or an upload to a repository in the network from within a learning management system (LMS) or authoring tool.

As of March 2012, four LMS, Moodle, metacoon, OLAT, and Fronter, are integrated with edu-sharing and the integration of Ilias is under development. In addition, a few commercial content pools have been connected to edu-sharing in such a way that users, e.g., school students, who are authorized to access commercial content will get access through trusted protocols established between interconnected components. This way edu-sharing not only provides a single system view to all resources in the network but also provides a uniform and custom-designed functionality made available through an extensible portal.

A persistent problem with educational content for higher education is that - although we find a plethora of content on web pages, in learning object repositories, and other content silos - it is mostly tailor-made for specific courses and lectures. What we need, however, is reusable and adaptable content produced for a market, as it exists, for example, in the school sector, which is dominated by professional publishers, at least in Germany. With edu-sharing we aimed to make appropriate provisions for an emerging market for educational content and know-how, both free and commercial.

A further element of this portal is an evolving information system gathering all kinds of information relevant to the e-learning community, including short survey articles, best practice examples, guidelines and more on media and instructional design, technical and legal topics, and social software. Articles in the information portal can be referenced from and included on other web sites.

For interested readers, a demo version of edu-sharing is accessible under: http://demo.edu-sharing.net . On YouTube interested readers can find several videos illustrating the use of edu-sharing, for example, a preview on version 1.6 or a training session .

VI. References

Baumgartner, P.; Kalz, M.: Wiederverwendung von Lernobjekten aus didaktischer Sicht. In: Tavangarian, D.; Nölting, K. (Eds.): Auf zu neuen Ufern! E-Learning heute und morgen. Waxmann, New York, München, Berlin, 2005, pp. 97-106.

Boyle, T.: Design principles for authoring dynamic, reusable learning objects. In: Australian Journal of Educational Technology. 2009, pp. 46–58.

Cape Town: The Cape Town Open Education Declaration. http://www.capetowndeclaration.org/read-the-declaration (not available 2012-04-03) alternate URL: http://www.open.uwi.edu/sites/default/files/P11Capetown.pdf (last check 2012-04-03)

edu-sharing (2012): www.edusharing.net (last check 2012-04-03)

Geser, Guntram (Hrsg.): Open educational practices and resources: OLCOS Roadmap 2012. Salzburg, Austria: Open Learning Content Observatory Services, 2007.

Klebl, M.: Educational Interoperability Standards: IMS Learning Design and DIN Didactical Object Model. In: Ehlers, Ulf D.; Pawlowski, Jan M. (Hrsg.): Handbook on Quality and Standardisation in E-Learning. Springer, Berlin. 2006, pp. 194-215.

Klebl M., Krämer B. J. (2010a): Distributed Repositories for Educational Content. In: eleed, Vol. 7., 2010 (urn:nbn:de:0009-5-27716), eleed.campussource.de__/archive/7/2771 (last check 2012-04-03)

Klebl, M.; Krämer, B. J.; Zobel, A. (2010c): From Content to Practice: Sharing Educational Practice in edu-sharing. In: British Journal of Educational Technology. Vol 41(6), 2010.

Klebl M.; Krämer B.J.; Zobel A.; Hupfer M.; Lukaschik C. (2010b): Distributed Repositories for Educational Content. In: eleed, Vol. 7. (urn:nbn:de:0009-5-27748), eleed.campussource.de__/archive/7/2774 (last check 2012-04-03)

Koper, R.; Tattersall, C. (Eds.): Learning Design: A Handbook on Modelling and Delivering Networked Education and Training. Springer, Berlin, 2005.

Krämer, B. J.: CampusContent: Competence Center for eLearning with Reusable Learning. In: e-learning and education Objects, Vol. 1, 2005. (urn:nbn:de:0009-5-940), eleed.campussource.de__/archive/1/94 (last check 2012-04-03)

Krämer, B. J.; Han, P.: Educational Content Creation and Sharing in a Technology-rich Environment. In: International Journal on Advances in Software. 2(2&3), 2009, pp. 188-201.

Krämer, B. J.; Klebl, M.; Zobel, A.: Sharing educational knowledge and best practices in edu-sharing. International Conference on Mobile, Hybrid, and On-line Learning. eL&mL 2010. Second International Conference on Mobile, Hybrid, and On-line Learning. IEEE Computer Society, 2010, pp. 53-59.

Krämer, B. J.; Klebl, M.: Open Educational Resources and the Repository Network edu-sharing. The Third International Conference on Mobile, Hybrid, and On-line Learning (eL&mL 2011), 2011. http://www.thinkmind.org/index.php?view=article&articleid=elml_2011_3_20_50043 (last check 2012-04-03)

LEARNTEC (2010): Netzwerk-Plattform edu-sharing wird freigeschaltet! http://www.learntec.de/cgi-bin/x-mkp/info.pl?language=1&eve_id=9&inf_type=7&inf_id=1458 (last check 2012-04-03)

Mittag, H.-J.: Statistik: Eine interactive Einführung. Springer, Berlin, 2011.

Moodle: Moodle Course Management System, 2009. http://moodle.org/ (last check 2012-04-03)

OECD: Giving Knowledge for Free: The Emergence of Open Educational Resources. OECD Publishing, 2007. doi: 10.1787/9789264032125-en (last check 2012-04-03)

Onyx: Onyx Test-Suite, 2009. http://www.bps-system.de/cms/index.php?id=43&L=1 (last check 2012-04-03)