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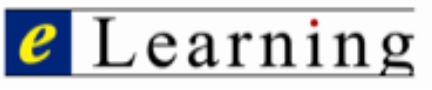

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Desk Research on Interoperability and Open Standards

Abstract

This desk research gives an overview of recent developments in the area of interoperability and open standards with a special focus on developments, initiatives, strategies and projects relevant for (virtual) mobile students of higher education. Most of the information was found on the internet and provided by the initiators of a project or initiative on their websites.

Contents

1 Main Developments in Interoperability and Open Standards

In this chapter we give an overview of the recent trends concerning open standards and interoperability of virtual learning environments and course descriptions, and describe some technical applications which can make life easier for the (virtual) mobile student. We also give examples of learning object repositories.

1.1 Interoperability of Virtual Learning Environments

Open standards make re-use of learning material possible, they stimulate collaboration between universities and they protect universities against vendor-lockin. In the last years the development of open standards for learning technology made a lot of progress. Several initiatives like IMS, IEEE, ADL, etc. (see chapter 4.2.2) have played an active role in this process with the goal to enable interoperability between different virtual learning environments (VLEs) .

In the beginning the development of open standards had its main focus on the technical aspects of e-learning: how to define learning objects and how to describe them with appropriate metadata. Recently the focus moved to more didactical aspects of e-learning, like the description of student portfolios, tests and didactical models.

But still a lot remains to be done. Interoperability between the various systems is not yet achieved. A central issue in the coming years will be the further harmonization and integration of the different standards by close collaboration between the different standardization initiatives. The reference model SCORM already made the first step in this direction. It also can be expected that the users of e-learning and VLEs will gain more and more influence on the development of open standards. Until now industrial partners and the distributors of VLEs, who have only a limited insight in education, dominated it. The commercial players could take the greatest advantage of the development of e-learning standards because they so could assure that their products comply with them. With the increasing success and the constant growth of users of e-learning it can be expected that the influence of user groups will increase and more emphasis will be placed on the didactical aspects of e-learning in the future [11].

1.2 A Standard for the Description of Curricula of Universities

Until recently the main focus of standardisation bodies has been on interoperability at the course content level. No specification has been produced to supports curriculum development and access to curriculum structures and properties. The first initiative in this field was CDM, which stands for Course Description Metadata and is an XML-based specification for educational data. The CDM specification proposes a set of common metadata and data structures to describe and publish HEIs curricula, course catalogues and all relevant information for students. CDM started as a Norwegian project in 2001 and has been presented in 2005 as a candidate standard for course descriptions [1].

CDM addresses the description of educational course units or other forms of educational offerings at all levels. It specifies the structure and semantics

of the key concepts used in course descriptions and supports the ECTS (see 3.1) and diploma supplement requirements. It is compatible with other related specifications such as LOM for course content. The metadata are intended to satisfy the following objectives:

- Facilitate description and exchange of information about educational course units
- Facilitate a standardization of course unit descriptions
- Facilitate the establishment of national and international course catalogues
- Facilitate the establishment of course portals and other services helping students

1.3 Shibboleth - Single sign-on to various applications

Shibboleth is a software which makes it possible to log in to different application with only one login. It is an initiative to develop an open, standards-based solution to the needs for organizations to exchange information about their users in a secure, and privacy-preserving manner. An open solution means both an open architecture and an open-source implementation. Standards-based means that the information that is exchanged between organizations can interoperate with that from other solutions. Shibboleth is an Internet2 middleware project, developing architectures, policy structures, practical technologies, and an implementation to support inter-institutional sharing of web resources and applications subject to access controls. In addition, Shibboleth develops a policy framework that will allow interoperation within the higher education community [16].

Shibboleth requires only a single user ID and password at a single institution for access to resources on several computers at numerous institutions. Only one institution needs to have personally identifiable information about the user. When a user requests information on a website at another institution, Shibboleth goes into action behind the scenes. The website forwards the request to a Shibboleth program that asks for the user's home organization and redirects the request there. The home institution asks for a user ID and password. Then a Shibboleth "handle server" generates a temporary name, or "handle", for the user. The information request goes back to the original site, this time on behalf of the "handle". The site considering the request doesn't know whom this handle represents, only that a trusted institution issued it. The site asks the home institution for the unknown person's attributes. If those attributes meet the requirements for access to the requested information, access is granted [5].

Shibboleth is based on open standards and already used internationally, e.g. at universities in Belgium, Finland, the Netherlands, the UK, and Switzerland.

1.4 Eduroam - Internet connectivity at various educational institutions

As researchers and students are becoming mobile they are expressing the desire to have their familiar environment, services and privileges available whenever they move from one site to another. The number of them "roaming" between

different domains is increasing and so is their demand to be able to get connectivity everywhere, at home, on the road and at educational institutions. In 2003, the TERENA[1] Task Force on Mobility was created to look at WLAN security issues and to formulate requirements to design an international roaming solution that would provide National Research and Educational Networks (NRENs) users with secure internet access at academic campuses (WLAN and wired) across Europe. The solution proposed was tested and proved to be very successful with more and more institutions joining it. This infrastructure is called Eduroam, which stands for "Education Roaming" and allows users of participating institutions to access the internet at other participants using their home institution's credentials. Depending on local policies at the visited institutions, Eduroam participants may also have additional resources at their disposal.

A user belonging to institution A provides his credentials to a server of institution B. The server of institution B discovers that it is not responsible for the institution A realm and proxies it to a national or European proxy server, which forwards the credentials to the home-institution of the user where they are verified. The "acknowledgement" of a successful authentication travels back over the proxy-hierarchy to the visited institution and the user is granted access [8].

Eduroam initially started as a proof of concept test between the Netherlands, Finland, Portugal, Croatia and UK, but the Eduroam community continues to expand. In April 2005 more than 350 institutions in 18 countries participated in Eduroam [6].

1.5 Learning Object repositories

1.5.1 The ARIADNE Foundation for the European Knowledge Pool

ARIADNE stands for "Alliance of Remote Instructional Authoring and Distribution Networks for Europe". The ARIADNE Foundation was created to exploit and further develop the results of the ARIADNE and ARIADNE II European projects, which ended in June 2000 and were supported financially by the European Union and the Swiss Government. The project's focus was to create tools and methodologies for producing, managing and reusing computer-based pedagogical elements and telematics supported training curricula. Validation of the project's tools and concepts took place in various academic and corporate sites across Europe.

The ARIADNE Foundation is a non-profit association, which endorses a few key societal objectives:

- Foster cooperation between educational bodies through the set-up and exploitation of a truly European Knowledge Pool.
- Keep social and citizenship aspects dominating education, combat an evolution towards making it a mere marketable item.

[1]TERENA - Trans-European Research and Education Networking Association - was formed in October 1994 by the merger of RARE (Réseaux Associés pour la Recherche Européenne) and EARN (European Academic and Research Network). The aim of TERENA is to promote and participate in the development of a high quality international information and telecommunications infrastructure for the benefit of research and education [17].

- Uphold and protect multilingualism and the use of national/regional languages in education.
- Define by international consensus what aspects of ICT-based formation should be standardized and what should be left local.

The ARIADNE Foundation seeks to increase the awareness of Europe's (and beyond) learning citizen of existing ICT-based training channels, convince and guide new potential users from the academic community - mainly public sector institutions - and to assist new users from the corporate world, where training and re-training is increasingly necessary [2].

1.5.2 Merlot - Multimedia Educational Resource for Learning and Online Teaching

MERLOT is a free and open resource consisting of a catalog of online learning materials, peer reviews, learning assignments, and user comments, organized by discipline. It is designed primarily for faculties and students of higher education. MERLOT is also a community of members who strive to share and enrich their teaching and learning experiences by contributing and sharing materials and resources to MERLOT. MERLOT's mission is to improve the effectiveness of teaching and learning by increasing the quantity and quality of peer reviewed online learning materials that can be easily incorporated into faculty-designed courses [14].

2 Major Findings of Projects

This chapter gives an overview of the aims and findings of some recent European projects concerned with interoperability in an educational context. CELEBRATE and cEVU already came to an end, LIFE just started its activities. CELEBRATE and LIFE have interoperability and open standards as their main focus whereas cEVU tackles this issue as one of its numerous objectives.

2.1 CELEBRATE - Context e-Learning with broadband technologies

The CELEBRATE project was running from June 2002 to November 2004 coordinated by European Schoolnet and supported by the European Commission. Its aim was to examine how learning objects can enhance teaching and learning in schools across Europe. The exchange of learning objects and their interoperability in different virtual learning environments was also a central focus. The partners in the project included ministries of education, universities, leading educational publishers, content developers and technology suppliers.

The CELEBRATE project website [4] provides a database of digital learning objects and learning assets as well as guidelines on how to use these learning resources. Furthermore you can find an extensive list of links to books, articles, papers, and projects concerning interoperability, links to standards and specifications, learning object repositories, and virtual learning environments.

2.2 cEVU - A collaborative European Virtual University

The cEVU project was running from 1 November 2001 to 30 November 2003 and carried out with the support of the European Commission. It aimed at the development of validated e-learning models and ideas for a European virtual university. It was a collaboration between five existing international university networks: EuroPACE, EUNITE, ECIU, Coimbra Group and EUA.

One of the objectives of the cEVU project was the evaluation of existing interoperability solutions and tools; especially it has been studied how collaboration between different platforms, already in use at different universities who want to work together, has to be assured.

The results of the project are published in an online "Manual for a collaborative European Virtual University" [13] with recommendations and guidelines for decision makers, teachers, trainers, managers and technicians. There it is proposed to focus on the SCORM standard, since it is quite widely adopted and provides a first level of interoperability:

"SCORM is clearly not a perfect solution, but if it would be applied, it would be already a first step, and a good base for further enhancement. Waiting for the perfect standard will lead to use no standard, whereas using existing ones will lead to the raising of new expression of needs that will allow the standards improving. And SCORM is the more consensual candidate, which is the best quality for a standard."

2.3 LIFE - The Learning Interoperability Framework for Europe

The LIFE project is an e-Learning project funded by the European Commission, which started in January 2005 and has a duration of 24 month. The project has eight partners from government, industry and academia: the European IMS Network (The Netherlands), Bolton University (UK), University of Vigo (Spain), eStandards Project - University of Oslo (Norway), University of Paris X (France), CEDEFOP (Greece) and SUN Microsystems (France). European Schoolnet acts as a coordinator.

On the LIFE project website [10] the project aims are described as follows: A critical success factor for e-learning is the possibility to share, collaborate, twin, and move people and resources across Europe. The crucial enabler for this is interoperability. However, interoperability is not only about technology or standards. As practitioners find out, putting standards to use by, for instance application profiles, and the learning and political dimension are of equal importance. The aim of the LIFE project is to improve interoperability and the use of standards in the field of e-learning by increasing the effectiveness of learning technology standards and specifications. Expected results are:

- A "Roadmap to eLearning Interoperability", which will be published as a report and will not only be a practitioner's guide to interoperability, but also include policy recommendations concerning the practical application of interoperability
- Improved practice through European workshops, working conferences, and interoperability plugfests

- Methodologies that reduce the time required to adopt e-learning and strategies for improving quality outcomes
- Contributions to the e-learning standards and interoperability observatories
- Support to the e-learning standards and interoperability community

3 Governmental or Regional Strategies or Initiatives

3.1 ECTS - European Credit Transfer System

The European Credit Transfer and Accumulation System is a student-centered system based on the student workload required to achieve the objectives of a program, objectives preferably specified in terms of the learning outcomes and competences to be acquired.

ECTS was introduced in 1989, within the framework of Erasmus, now part of the Socrates program. ECTS is the only credit system, which has been successfully tested and used across Europe and was set up initially for credit transfer. The system facilitated the recognition of periods of study abroad and thus enhanced the quality and volume of student mobility in Europe. Recently ECTS is developing into an accumulation system to be implemented at institutional, regional, national and European level. This is one of the key objectives of the Bologna Declaration of June 1999.

ECTS makes study programs easy to read and compare for all students, local and foreign. It facilitates mobility and academic recognition and helps universities to organize and revise their study programs. ECTS can be used across a variety of programs and modes of delivery. It makes European higher education more attractive for students from abroad [7].

Universities can now apply for an ECTS Label, which is awarded to institutions that are able to demonstrate that they meet the following criteria:

- Apply ECTS credits correctly in all degree programs offered.
- Make accessible, through its website an ECTS Course Catalogue in the local language of instruction and in English (or only in English for programs taught in English).
- Use all other obligatory ECTS tools (e.g. Learning Agreements, Transcripts of Records, proof of recognition) properly for Erasmus mobility.

4 Background Information

Numerous publications and links can be found dealing with interoperability and open standards. We can only introduce a few of them, which especially attracted our interest. The links to websites of projects and initiatives already mentioned in the former chapters can be found in the reference list.

4.1 Reports, Articles and Papers

W. Hodgins, M. Conner: Everything you ever wanted to know about learning standards but were afraid to ask [9] In this article the authors explain what standards are and who is building them and give plenty of resources with related materials.

E. Masie: Making Sense of Learning Specifications & Standards: A Decision Maker's Guide to their Adoption [12] E-Learning Consortium members at the MASIE Center formed a working group to make 'Sense of Standards and Specifications'. This document provides an overview of learning standards and serves as a "primer" for those interested in learning about standards and how to apply them.

M. Sanz Prieto: Policies and strategies on standards and interoperability in eLearning in compulsory education in Europe [15] This study, carried out by European Schoolnet at the request of the Swiss Agency for ICT in Education, aims at providing an in-depth understanding of the position of education ministries and specialized agencies with respect to issues of standardization and interoperability and on mechanisms they have developed to gather information, exchange ideas and make decisions.

E. Boyle: Content Exchange Evaluation Report [3] The CETIS Educational Content Special Interest Group (EC-SIG) carried out a set of interoperability experiments to see how well different tools handled IMS Content Packages. Eddie Boyle of the EC-SIG tried to export content from one tool and import it into another - resulting in a report that demonstrates how well - or otherwise - the tools performed at interoperating with one another.

4.2 Links

4.2.1 Portals on Standardization and Interoperability

http://standards.edna.edu.au/ The Education Network Australia (EdNA) Technical Standards website is a gateway to standards, protocols and specifications relevant to learning, education and training. It provides an overview and introduction to a wide range of technical standards as well as authoritative resources for each of them.

http://insight.eun.org/interoperability INSIGHT - knowledge base for new technology and education: Insight is a service focusing on e-learning in schools in Europe. European Schoolnet (EUN) provides it in collaboration with its consortium members. They publish news and analysis on e-learning policies, school innovation and information communication technology in education. The Insight portal is structured around four areas: policy, interoperability, school innovation, and thematic dossiers. The interoperability area features issues related to interoperability, standards and harmonization of e-learning services, both systems and content. It regularly provides the "Monthly insight to interoperability" in which international expert are questioned on the current issues in the field. It also reports on EUN actions on interoperability dealing with

e-learning content and related services, as well as on the LIFE (Learning Interoperability Framework for Europe) project (see chapter 2.3).

http://www.jisc.ac.uk/ The Joint Information Systems Committee (JISC) supports further and higher education by providing strategic guidance, advice and opportunities to use Information and Communications Technology to support teaching, learning, research and administration. JISC is funded by all the UK post-16 and higher education funding councils.

4.2.2 Standardization Initiatives

http://www.adlnet.org/ The ADL is an initiative started by the US Department of Defense and the White House Office of Science and Technology Policy. Its goal is to accelerate the standardization within the online learning industry. Specifically, its Sharable Content Object Reference Model (SCORM) project focuses on next-generation open architecture for online learning, including standards for run-time communication, course structure, and content meta-data.

http://www.aicc.org/ The Aviation Industry Computer-Based Training Committee (AICC) is an international association of technology-based training professionals that creates guidelines for the development, delivery, and evaluation of training technologies. The AICC pioneered the most widely accepted interoperability standards for computer-based and web-based training. Its relevant publications for standards are the AICC Guidelines and Recommendations.

http://www.cetis.ac.uk/ CETIS, the centre for educational technology interoperability standards, represents UK Higher and Further Education on international educational standards initiatives. CETIS advises Universities and Colleges on the strategic, technical and pedagogic implications of educational technology standards. It also provides strategic and technical input to JISC programs and the e-learning framework programs. It disseminates information on learning technology standards via workshops, conferences, publications and fora. CETIS is funded by JISC, the Joint Information Systems Committee of the Higher and Further Education Funding Councils, and is managed by the University of Bolton, in partnership with a variety of Higher and Further Education institutions.

http://dublincore.org/ The Dublin Core Metadata Initiative (DCMI) is an organization dedicated to promoting the widespread adoption of interoperable metadata standards and developing specialized metadata vocabularies for describing resources that enable more intelligent information discovery systems.

http://ieeeltsc.org/ The Institute of Electrical and Electronics Engineers (IEEE) Computer Society Standards Activity Board has chartered the Learning Technology Standards Committee (LTSC) to develop accredited technical standards, recommended practices, and guides for learning technology. The LTSC coordinates formally and informally with other organizations that produce specifications and standards for similar purposes.

http://www.imsproject.org/ The IMS Global Learning Consortium is a nonprofit corporation developing and promoting open technical specifications for interoperable learning technology. Several IMS specifications have become worldwide de facto standards for delivering learning products and services. IMS began with a focus on higher education. Today, they have expanded their specifications and projects to address a wide range of learning contexts, including school, university, corporate, and government training.

http://www.okiproject.org/ The Open Knowledge Initiative (O.K.I.) develops specifications that describe how the components of an educational software environment communicate with each other and with other enterprise systems. O.K.I. specifications address broad interoperability agreements that allow adaptation and further specification by communities of practice. In this way, O.K.I. seeks to open new markets for educational tools and content.

http://www.openves.org/ OpenVES is a non-profit educational organization with the mission to help create standards, to provide a reference implementation of an open architecture, public, standards based PK12 e-learning platform, and to use those standards, and that platform to help teachers and students transform PK12 education, one classroom at a time. There are currently five OpenVES Working Groups: Governance, Technology, Standards, Education Research and Development, and Education Marketspace.

References

[1] Course description metadata (CDM): A relevant and challenging standard for universities. WWW document. URL: http://www.e-quality-eu.org/pdf/seminar/e-Quality_WS2_MPezeril_article.pdf [as at December 10, 2006].

[2] Ariadne. Ariadne foundation website. WWW document. URL: http://www.ariadne-eu.org/ [as at October 17, 2005].

[3] E. Boyle. Content exchange evaluation report. Technical report, CETIS, 2002. URL: http://www.cetis.ac.uk/groups/20010809144711/FR20020301142909 [as at October 19, 2005].

[4] Celebrate. Celebrate project website. WWW document. URL: http://www.eun.org/ww/en/pub/celebrate_help/index.htm [as at October 18, 2005].

[5] Duke University news website. Shibboleth relieves password overload, enhances computer privacy. WWW document. URL: http://www.dukenews.duke.edu/2004/09/shibboleth_0904.html [as at October 12, 2005].

[6] Eduroam. Eduroam project website. WWW document. URL: http://www.eduroam.org/ [as at October 12, 2005].

[7] European Commission. ECTS - European Credit Transfer and Accumulation System. WWW document. URL:

http://europa.eu.int/comm/education/programmes/socrates/ects/index_en.html [as at October 18, 2005].

[8] L. Florio and K. Wierenga. Eduroam, providing mobility for roaming users. In *EUNIS Conference*, 2005. URL: http://www.eduroam.org/docs/eduroam-eunis05-lf.pdf.

[9] W. Hodgins and M. Conner. Everything you ever wanted to know about learning standards but were afraid to ask. *Learning in the New Economy e-Magazine (LiNE Zine)*, 2000. URL: http://www.linezine.com/2.1/features/wheyewtkls.htm [as at October 19, 2005].

[10] LIFE. LIFE project website. WWW document. URL: http://life.eun.org/sites/life/index.cfm [as at October 18, 2005].

[11] J. Manderveld. State of the art open standaarden. *E-learning trends*, pages 8–10, 2004. (in Dutch).

[12] E. Masie. Making sense of learning specifications & standards: A decision maker's guide to their adoption. Technical report, The Masie Center, 2003. URL: http://www.masie.com/standards/s3_2nd_edition.pdf [as at October 19, 2005].

[13] cEVU. Manual for a collaborative European Virtual University. WWW document. URL: http://www.cevu.org/manual/index.htm [as at October 18, 2005].

[14] Merlot. Merlot website. WWW document. URL: http://www.merlot.org/ [as at October 17, 2005].

[15] M. Sanz Prieto. Policies and strategies on standards and interoperability in elearning in compulsory education in Europe. Technical report, European School Net, 2004. URL: http://eunbrux09.eun.org/shared/data/insight/documents/Standards_and_Interoperability_Study_v3p1.pdf [as at October 19, 2005].

[16] Shibboleth. Shibboleth project website. WWW document. URL: http://shibboleth.internet2.edu/ [as at October 12, 2005].

[17] TERENA. TERENA website. WWW document. URL: http://www.terena.nl/ [as at October 17, 2005].