STANDARD-BASED ELEARNING SOLUTIONS IN HIGHER EDUCATION

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Abstract

Computer and Automation Research Institute, Hungarian Academy of Sciences – further SZTAKI – has a really good and well-known international technology/research background. Because of this good track record SZTAKI has received the status of the EU Centre of Excellence in Information Technology and Automation. According to these experiences the staff of the eLearning Department is involved in several EU Leonardo, and Hungarian Info-communication Technology projects. We started to monitor the local eLearning market. The domestic eLearning projects have a typical weakness so far, that the created training materials can be used only in a specific Learning Management System – LMS. It is a big constrain and this is why we decided to build up a systematic method to overcome this problem.

Keywords: eLearning, LMS, standards, databases, courseware.

1. Methods

1.1. Survey of Framework Systems

It was really important to know, which companies and institutes are developers and users in the Hungarian eLearning market. But we did not a simply survey to make an inventory, but we were interested in details, what LMS, which software and hardware were used. We edited a questionnaire and could collect the relevant data from 12 companies, which have a leading role in the training market. The questionnaire consists of 10 sections: system requirements on the server/client side, presentation tools, courseware components, on-line/off-line courseware development, teacher tools, management roles and others.

These companies are using their own framework systems, or internationally sold softwares for eLearning solution:

Cisco
EDUWEB
HP – Easy Generator
KREA,
Silicon Graphics – WebCT,
Synergon – Poenix,
IBM – Lotus LearningSpace,
BioDigit Kft.,
BME-ELTE-Mimóza,
Oracle – iLearning,
Számalk – Qualitycator

The Comparison table of frameworks/systems can be seen on our website: www.sztaki.hu/elearning. We present the survey results on courseware components as an example in *Table 1*.

We invited the representatives of these companies to our eLearning Forum and they could present their framework systems and gave several applications as well. The events of our Forum accelerated building up partnership among the detached development workshops and laboratories.

1.2. Analyses of the Architecture of the Typical eLearning Systems

When we started to analyse the core elements of eLearning training materials, based on our framework survey we have identified the following components:

pictures,
voice,
video,
animation,
and HTML, XML editing.

We built up a functional model on analysing the system components as follows:

Text, multimedia elements of the courseware,
Learning content management systems (LCMS),
Courseware database,
eLearning management system (LMS),
Content developers/students/trainers/tutors.

Using our development platform we realized that it was to difficult, expensive and time-consuming to develop new export and import modules when we had to transfer the training material from one framework system to another one. Parallel with this development process we started to study and collect all the data about the standardization on eLearning training materials.

See [1, 2] as an example for further possible architectures of eLearning platforms.

Table 1. Comparison table on courseware components

Aspect Firm	Pictures	Animations	Bubble text on highlighted text	Pop-up window on high-lighted text	Audio	Music
Cisco	−	Flash	+	+	+	+
EDUWEB	+	Flash	+	+	+	+
HP Easy Generator	+	+	−	+	+	+
KREA	−	Flash	+	+	+	+
Silicon Graphics	+	+	−	−	+	+
Synergon	Optional	Optional	Optional	Optional	Optional	Optional
IBM - Lotus Learning-Space	Depends on the training material	Depends on the training material	Depends on the training material	Depends on the training material	Depends on the training material	Depends on the training material
BioDigit Kft.	+	Flash, MOV, AVI	+	+	+	+
BME-ELTE-Mimóza	+	+	+	+	+	+
Oracle iLearning	+	+	+	+	+	+
Számalk	Full size	+	+	+	+	+

1.3. Analysis of the eLearning Standards

There are several standards regarding learning technologies [3]. Some of them are not so frequently used, so we collected the most common and important ones:

ISO/IEC Joint Technology Committee Subcommittee on Standards for Learning, Education, and Technology
IEEE Learning Technology Standards Committee (LTSC) [4]
Advanced Distributed Learning Initiative [5]
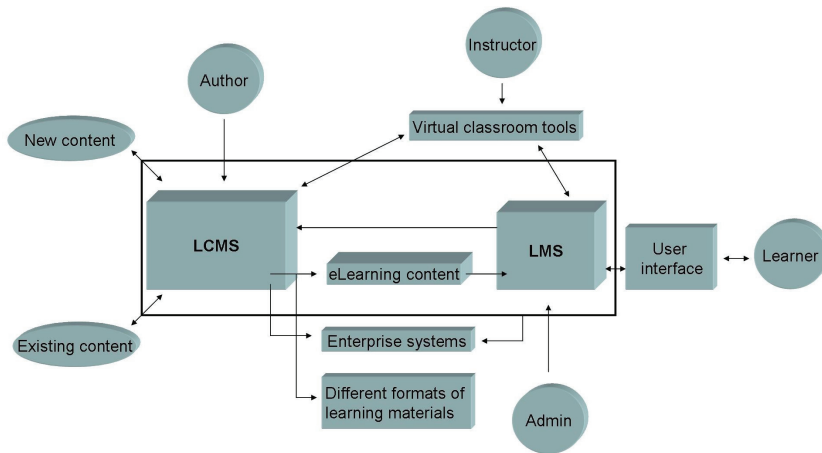IMS Global Learning Consortium [6]

Fig. 1. Connection among the elements.

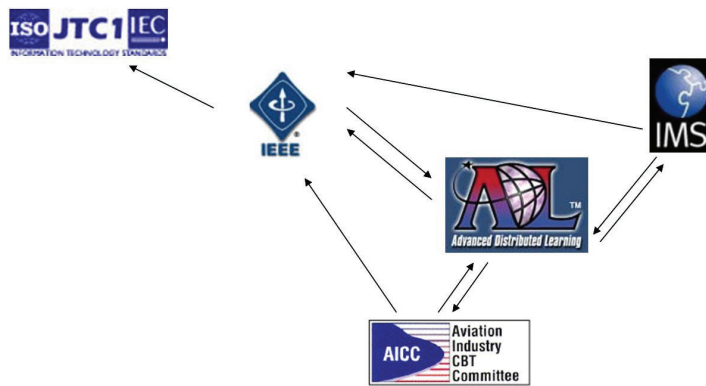Aviation Industry CBT Committee (AICC) [7]

Fig. 2. International organizations and bodies are establishing and managing standards

According to our model we selected the relevant standard systems on groups of information:

Metadata
Dublin Core
IMS Learning Resource Metadata
IEEE LOM
Courseware package format

SCORM Content Packaging

IMS Content Packaging

Framework-courseware communication

AICC CMI Data Model and API

SCORM Run Time Environment

ERP integration

IMS Enterprise

Student data

IMS Learner Information Profile

Test modules

IMS Question & Test Interoperability (QTI)

2. Courseware Portability in Practice

2.1. Market Analysis – CMI Tester

It was mentioned formerly that MTA SZTAKI set itself the aim of the continuous monitoring of the Hungarian market as the part of its expert activity in connection with eLearning. In addition to the survey of framework systems we pay particular attention to the eLearning systems with significant market participation in what extent they support the portability of the learning content.

We started to analyse the CMI-Computer Managed Instruction-system. It is really important to support students in the learning process. Through CMI calls we can be informed about the students, follow them in the implementation of learning process, store the results of tests etc. This supports also the cross communication between the training material and the framework. This is a core part of Run Time Environment – RTE. Towards the more exact survey of the systems in the aspect of standards we developed a little test system called "SZTAKI CMI Tester". The communication between the framework and the learning content can be analysed in very detail with the help of this tool, and the compatibility level of the framework can be qualified too. This test system can be freely downloaded from our web site (www.sztaki.hu/dms) as a standard SCORM content package. In the package loaded into the framework automatically appears a test side and the CMI processes are listed, after all of them it visualizes that the framework supports the given process or not i.e. our developed tester evaluates the CMI calls in the framework system and makes several classifications based on SCORM. According to these classifications we can test the adaptations of Learning Objects Metadata –LOM etc. At the moment we have made circumstantial test in the following frameworks: ADL RTE 1.2, Microsoft LRNViewer 3.0, Oracle iLearning 4.2, SAP Learning Solution, Számalk Qualitycator.
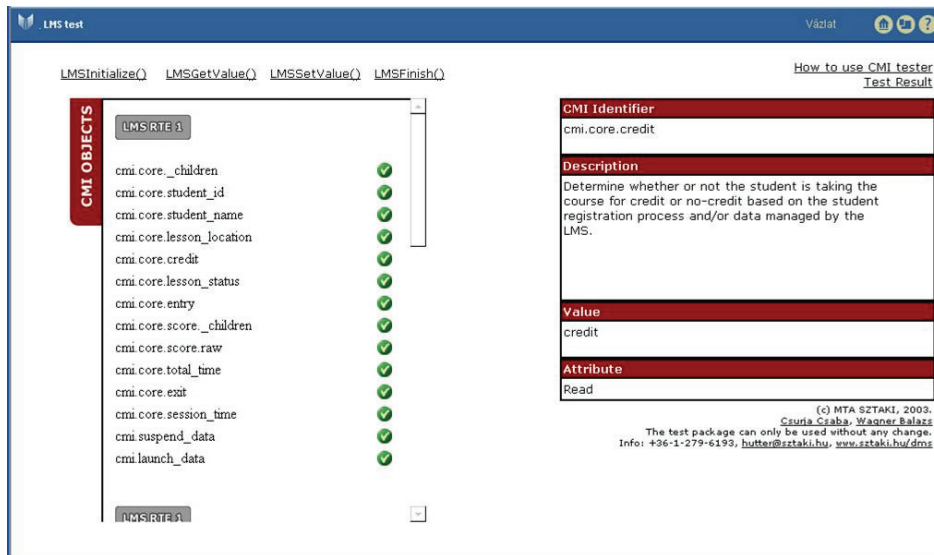
Fig. 3. SZTAKI CMI Tester

2.2. *SZTAKI SCORM LCMS*

In addition to the monitoring and testing of the wide-spread frameworks from the point of view of standards we deal with creating SCORM-compatible learning materials. We developed a complex content developer infrastructure called SZTAKI SCORM LCMS. For the time being this system is used for supporting our work, but we plan to open it for public usage during 2004, it is possible that the system will be an ASP service.

As you can see on *Fig. 4* the SZTAKI SCORM LCMS is an XML/SQL database platform with web based editor and administration modules, workgroup supporting tools, the key of the portability the Export/Import modules and a learning material library which can be accessible through the web.

The database platform has a native SCORM support what means that the inside database structures are completely suitable for the learning material structure specified in the SCORM package specification and the LOM metadata structures. Considering the present technology of the system it is based on Linux/Java platform with MySQL and Xindice database management system.

To any elements of any pages in the learning material being in the database can be assigned write/read right separately and in groups too. On the basis of this the **in the distance** working content developers can upload and replace the content elements (assets, SCOs) according to their rights, and they can modify the structure of the learning material.

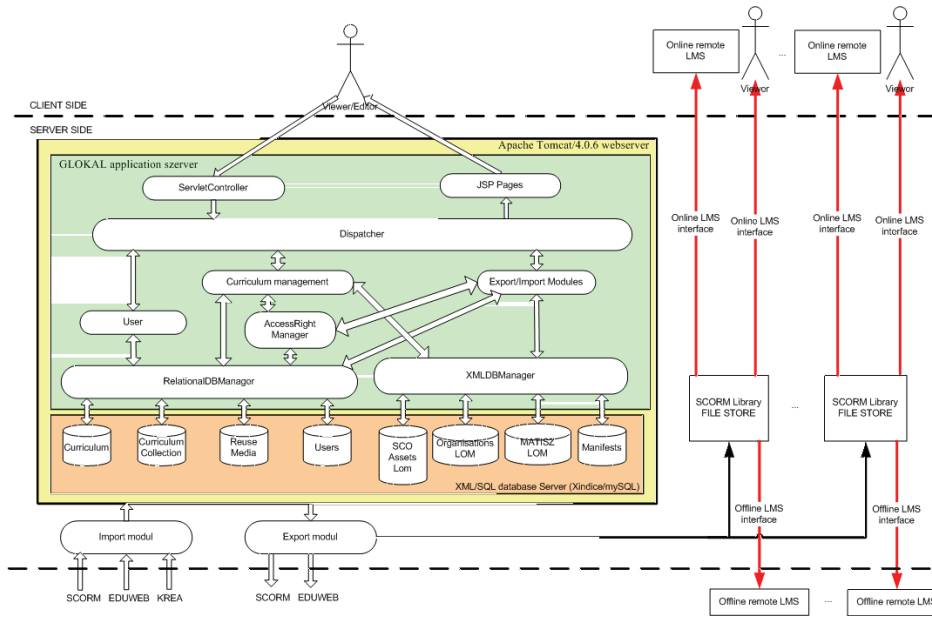Of course the export-import modules are able to generate SCORM 1.2 com-

Fig. 4. SZTAKI SCORM LCMS

patible packages from the learning materials being in the database and import this packages, but over and above this we support some not-standard and then again some special learning material formats of popular eLearning framework being in the home market in the interest of the practice portability.

The SCORM eLibrary module is a SCORM compatible "store" of training packages users can view and download according to their autorization. System does not support the interaction, but it is a cheap entry point to the deployment of SCROM compatible learning materials. The next step can be the usage of a professional SCORM compatible Learning Management System.

The SCORM standard does not contain specification concerning the layout, inside structure of the pages of the learning materials, but in the practice, during the development of the learning material, it is practical to define learning material templates to the typical learning material-types and the content development can speed up with the usage of those. The modules of the SZTAKI SCORM LCMS Page Editor support the quick construct of the pages of the learning material. In connection with this we would like to point out our learning material structure by the fantasy name "sPresentation". sPresentation is an effective presentation technology for „Lecture oriented" courseware with synchronous playing and browsing in the video/audio stream and multimedia elements (JPG, slides, demo video shots, etc.)

It is a flexible technology:

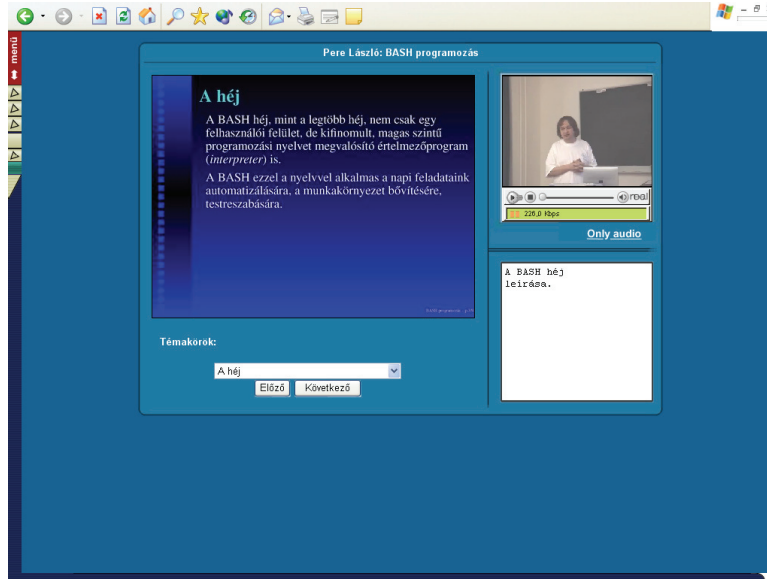Real Player, Microsoft Media Player, standard MPEG support
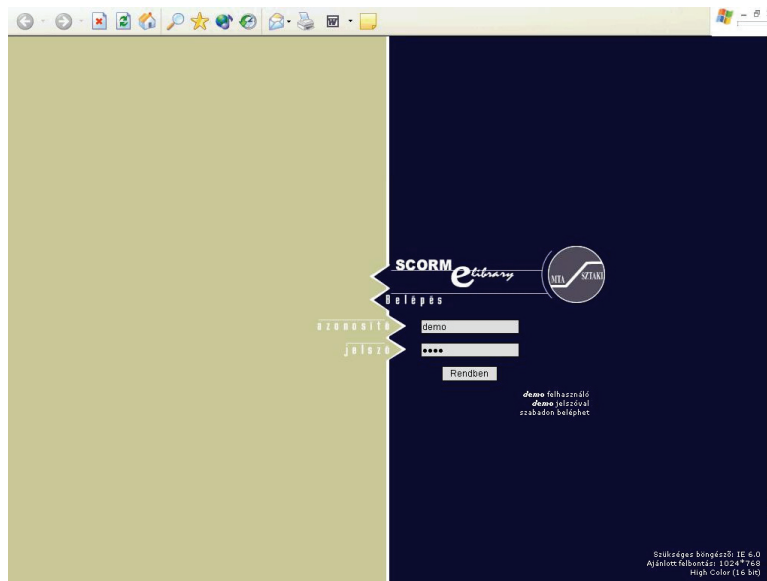
Fig. 5. sPresentation

Fig. 6. SZTAKI eLibrary

Off-line and on-line environment

Easy-to-use development environment supporting the sychronization of stream position and multimedia elements.

3. Results in Higher Education

National Information Infrastructure Development (NIIF) eLearning Program is supporting the application of eLearning training materials in higher education based on NIIF infrastructure. We started to establish SZTAKI SCORM eLibrary platform:

Not a real database, but file based package store

SCORM compatible training material packages

Authorization

View/download

For cheap „entry point" standard based eLearning environments.

We developed together with our partners an eLearning portal: http://minerva. szie.hu/elibrary/index.php and using meta database software we started to fill up our eLibrary with training material.

In the database we have some demo training material:

Official ADL SCORM 1.2 demo – Maritime Navigation Course

MTA SZTAKI – Kotra Károly: Road rules

Ed's SCORM Course English, Spanish and Hungarian

Böszörményi, L.: "Distributed multimédia systems, Hungarian sPresentation

Pere, L.: „Bash programming" Hungarian sPresentation.

The authorized users can see or download the full materials.

References

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[4] ltsc.ieee.org

[5] www.adlnet.org

[6] www.imsproject.org

[7] www.aicc.org