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The course delivery process in LMS

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Abstract. Learning management systems (LMS) characterized by component architecture base on learning technology standards. Therefore, e-learning content can be developed by using different standalone authoring tools or repurposed from other applications content. SCORM and AICC are most popular standards. Requirements for SCORM e-learning components can be stated as: durability, accessibility, interoperability and reusability, therefore content standards include places for learning object metadata. Package includes content, metadata about the content, metadata about the course, and the course structure.

Keywords: e-learning system, e-learning content, SCORM, authoring tool.

Introduction

Distance learning has been developed in Lithuanian for ten years already. Throughout that period about 400 various e-courses only in the LieM network [1]. Different courses management systems (CMS), e.g. WebCT, LearningSpace Forum, Moodle, are used for creating courses. E-courses are provided in the same CMS where they have been created. It is rather complicated to transfer e-courses to another CMS, because these systems had not supported e-learning standards and learning content usually was monolithic and held captive to the development environment. E-learning has grown organically without a clear picture of the components of a typical e-learning system or how they interrelate [2]. Several years ago, the learning management systems characterized by component architecture appeared and interest in "learning technology standards" has boomed. In academic and corporate research and development, the themes of interoperability, learning objects, metadata, etc. have surfaced as important topics [3].

E-learning system components

Modern e-learning information systems combine software components from different vendors. These varied components work together to provide a comprehensive solution to the problem of learning management (Fig. 1). A learning management system (LMS) plays a key role in the e-Learning environment. Its primary function is to manage learner information, administration, complex tracking and reporting, access to courses [4], [5].

Course structures are stored within the LMS, while content files are stored on one or more content servers. Learning management system and Authoring tools for course development usually are separated.

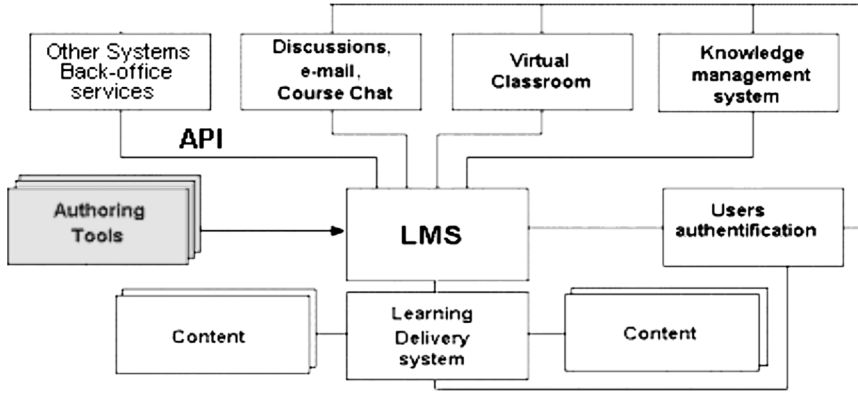

Fig. 1. E-learning information systems components.

E-learning standards

E-learning system should be constructed around an evolving set of open standards and specifications for the Internet, e-learning and learning management. This approach insures widespread interoperability of data between the various independently developed software components so that they can be used together. Applicable standards and specifications can be grouped into three major categories or layers [6]:

- **Infrastructure Core** – core specifications provide the basic Internet infrastructure for networking, data transport and data representation, independent of use. Any number of applications, both for a e-learning system and other computer systems, could use these specifications (UDP, TCP/IP, SMTP, MIME, HTTP, IRC, etc.)
- **Application** – application specifications layer on top of the core, providing the common web-based and Internet services. Application protocols and data formats provide standards and formats for information interchange between different tools or applications. Elements of the e-learning system are built using these specifications directly (HTML, LDAP, XML, VCARD, etc.).
- **E-learning** – e-learning specifications define explicit behaviour and data protocols used primarily in education and training (LOM, Educational Markup Language, AICC, SCORM, etc.). Based on accepted technology standards including XML and JavaScript, SCORM is fast-becoming the de-facto e-learning technology standard for web-based learning tool whose technical specifications allow users to reuse learning components across multiple e-learning applications. SCORM is widely embraced and supported today by world-leading corporations, universities, system providers, and content vendors.
  Requirements for SCORM can be stated as [7]:
  - the ability of LMS to launch content that is authored by using tools from different vendors and to exchange data with that content;
  - the ability of LMS products from different vendors to launch the same content and exchange data with that content during execution;

- the ability of LMS products/environments to access a common repository of executable content and to launch such content.

Standardization increases size of market and makes it worthwhile for content developers to invest in quality content.

Authoring tool

Content can be developed by using different authoring tools or repurposed from other applications. To increase e-learning efficiency and to reduce learning content development costs, content should be durable, accessible, interoperable and reusable, therefore all content standards include places for learning object metadata. Package includes metadata that describes the objects and the package. One resource can have many metadata records (author, title, technical requirements, rights management, etc.). Also includes instructions that tell the LMS how the courses are to be organized. The authoring tool creates course packages that can be imported into the LMS. An example of a package is a ZIP file, which contains all the files relevant to a course/subcourse: content, metadata about the content, metadata about the course, and the course structure (such as a table of contents with information about sequence and navigation) [7], [8].

At VGTU, in Department of Information Technologies, we test Lotus Authoring tool. The authoring tool is a stand-alone component of the LMS. The authoring tool creates SCORM-based course packages; content automatically adheres to the SCORM 1.2 runtime standard and is packaged appropriately for importing into the LMS. The authoring tools also enables to add meta-data elements to describe and catalog a course and its items; moreover it enables to add ordering information to a course to ensure that activities are completed in a specific order. Course developers can also specify scoring requirements for activities.

Lotus authoring tool can import [9]:

- SCORM packages,
- AICC Files,
- Microsoft PowerPoint files,
- Macromedia (Flash) files,
- Courses from LearningSpace.

Course deployment

Before a course can be offer in the LMS, it must be import and register in the system. This process distributes the course content and structure so that the system can launch activities and track student progress correctly. [9], [4] A course goes through the following phases before it can be distributed to students:

- Packaging
  The LMS Server imports any course that is compressed into a course package. This package contains one or more XML manifest files that define the course structure, a list of the files it uses, and any additional data associated with the course.

Each course package processed through the authoring tool contains a unique package ID and a version number. This allows courses to be updated correctly in the system later.

- Importing
  The course administrator initiates the importing. This process sends the course package to an FTP server, where the LMS Server imports and extracts the structure and content files.
- Registering
  The LMS Server creates a course master and enters information about the master into the database. This is an unregistered master. The course administrator uses the Learning Management System user interface to locate the course master in the Masters Catalog and then registers the master.
- Offering
  Each offering is unique with its own Delivery and Content Servers, availability schedule, instructor, location, enrolment list, and so on. The LMS sends the course content to the Content server (Fig. 2).

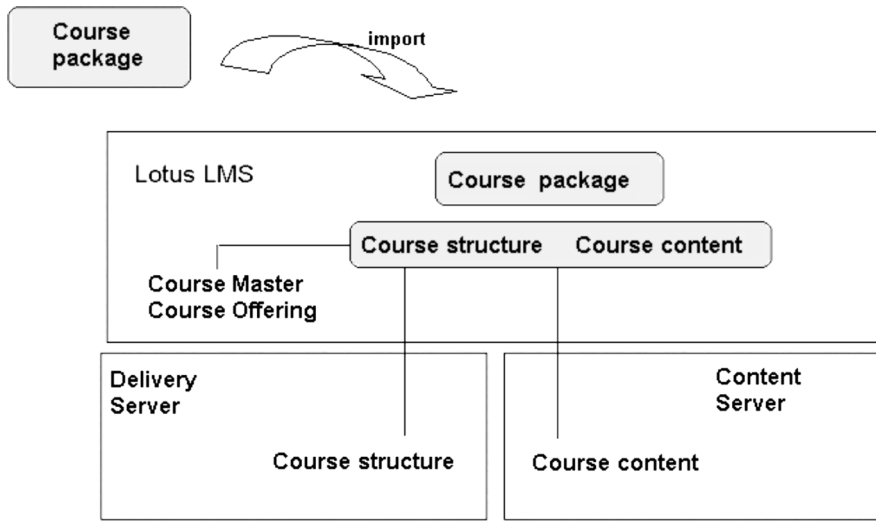

Fig. 2. Course information storage diagram.

A course package is like a component with contractually specified interfaces to the LMS and no other dependencies on the LMS. Therefore, a standards-based package can by deployed on any LMS that comply with e-learning technology standards, and can be searched, reused, and assembled with other packages.

Conclusions

After learning management systems appeared, the approach to creating courses has changed. The result of standards is a freedom of choice: courses are not adapted to any

particular learning management system. Courses from different vendors can be loaded into an LMS. Courses and their units can be used repeatedly.

In conclusion, it is useful to remember that Web-based learning technology standards do not yet exist in widespread form.

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REZIUMĖ

R. Kulvietienė, J. Stankevič, I. Šileikienė. Kursų tiekimo mechanizmas mokymo valdymo sistemoje

Mokymo valdymo sistemoms (MVS) būdinga komponentinė architektūra, kuri leidžia mokymo turinio kūrimui naudoti skirtingus autonominius el. mokymo standartais paremtus kursų kūrimo įrankius. Dauguma MVS palaiko SCORM ir AICC el. mokymo standartus. Tai leidžia pakartotinai naudoti el. kursų mokymo elementus, kadangi SCORM standartas šiems elementams apibrėžia tokius reikalavimus: prieinamumas, nepriklausomumas (mobilumas), patvarumas, daugkartinis panaudojimas. Į MVS įkeliami el. kursų paketai, kuriuose saugomi mokymo elementai, meta-duomenys ir kursų struktūra.