INTELIGENT LEARNING CONTENT MANAGEMENT SYSTEM USING WEB SERVICES TECHNOLOGY FOR E-LEARNING PERFORMANCE

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Abstract: *In recent years, e-learning started to attract a lot of attention from researchers as well as practitioners. Many of the existing architectures of e-learning systems are mainly based on plain client-server or peer-to-peer architectures and are therefore suffering from drawbacks like poor scalability or complicated interchange of content. In this paper, we present a distributed, service-oriented architecture for e-learning systems based on Web services, and describe the extensions to support software agents. Moreover, we show what advantages such an architecture may have to offer and propose the usage of intelligent software agents for the distributed retrieval of educational content. The implementation of these services enables a reuse of functionalities of an e-Learning platform. The present research has identified and created common services, which essential for the creation and authoring stages of typical e-Learning system architecture by utilized Learning Objects (LO). These services are Web Services based and will provide a common interface between various components leading to platform independence and interoperability between learning system.*

Keywords: e-Learning, Web Services, Inteligent Learning, Content Management

1. INTRODUCTION

E-learning platforms and their functionalities resemble one another to a large extend. Recent standardization efforts in e-learning concentrate on the reuse of learning material, but not on the reuse of application functionalities. Our LearnServe system builds on the assumption that a typical learning system is a collection of activities or processes that interact with learners and suitably chosen content, the latter in the form of learning objects. This enables us to subdivide the main functionality of an e-learning system into a number of stand-alone applications, which can then be realized individually or in groups as Web services. The implementation of these services enables a reuse of functionalities of an e-learning platform.

There are a lot of supplementary factors to reach the target and concept of educational technology. For example, the rapid development in information technology has produced a faster and better not only hardware but software also. As the result, by utilizing them, humans can improve their skill and work much better. All the factors will very promising to various targets anytime, anywhere and anyone to use the technology.

The Internet provides a distributed infrastructure for sharing information globally with an estimate that the on-line population will reach 6,300 million users in 2004 [1]. The very large user market becomes a great motivation for new technologies enabling one to build the next generation of the web based application. In particular, it is very attractive to develop collaborative the application linking of the growing number of diverse clients with rich media web content.

Many institutions are currently offering courses for tertiary education. In order to pass a course, participants receive checklist that describe the content of teaching. Based on the these description, the learners can freely choose the content from various providers. Traditional e-Learning platforms do not provide the flexibility a learner needs in tertiary education. Platforms are normally centralized and offer courses with well-defined content instead of checklists. Learners do not have the ability to choose from content offered by different authors and styles within a course, and, moreover, the content is usually not selected and adapted to a learners needs at all [2].

A general agreement seems to exist regarding roles played by people in a learning environment as well as regarding the core functionality of modern e-Learning platforms. The main players in these systems are the learners and the authors; others include trainers and administrators. Authors (which can also be teachers or instructional designers) create content, which is stored under the control of a learning management system (LMS) and typically in a database [3, 4].

Existing content can be updated and also reused in other e-Learning systems. The administrator controls the learning management system (LMS). The LMS interacts with a run-time environment, which is addressed by learners, who in turn may be coached by a trainer. The interesting aspect of this idea is the fact that these three components of an e-Learning system can be logically and physically distributed, i.e., installed on distinct machines and offered by different providers or content suppliers. In order to make such a distribution feasible, standards such as IMS and SCORM ensure plug-and-play compatibility to a large extend [5].

We consider the approach to construct (standardized) wrappers around e-Learning content more promising. In particular, we follow a service-oriented approach that encapsulates educational content inside a Web Service in order to increase interoperability and re-usability. In addition, we also propose a general service-oriented architecture for e-

Learning systems, in which the different components are implemented as Web Services [7, 8, 9]. The expected advantages are that system components and content can be distributed all over the Web and offered by different vendors.

In this paper, we present collaboration between literature review and experimentation about e-Learning system included Web Service Architecture, Learning Object Materials, and LCMS concept. Moreover, we show what advantages such a web service architecture may have to offer and propose the usage of e-Learning System for the distributed retrieval of educational content.

2. E-LEARNING STANDARDIZED

This section briefly introduces some fundamentals relevant to our work, which consist of e-Learning, and Web Services approach.

2.1 E-Learning

E-Learning has attracted a lot of attention in recent years from researchers as well as practitioners.

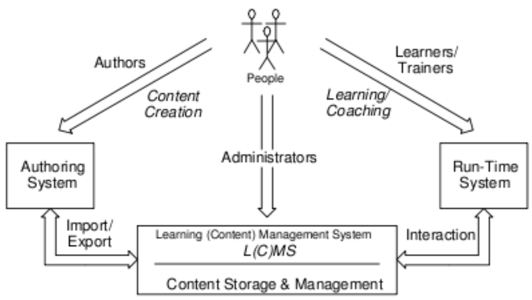

Figure 1. General View of e-Learning System

As depicted in Figure 1, a general agreement exists regarding roles played by people in a learning environment, as well as the functionality of e-Learning systems required in general [9]. In a typical learning environment, there are several groups of people involved: authors and learners, which are the main players, and administrators and trainers. Authors can be teachers or instructional designers who create e-Learning content by using an authoring system.

The core of an e-Learning system, which is under the control of an administrator, typically consists of a learning management system (LMS) or learning content management system (LCMS). An LMS provides functionality like managing learners and their profiles, tracking their progress, easing collaboration, or scheduling events. An LCMS is aimed at managing learning content which is typically stored in a database.

Content consumed by learners and created by authors is commonly handled, stored, and exchanged in units of learning objects (LOs). Basically, LOs are units of study, exercise, or practice that can be consumed in a single session, and they represent reusable granules that can be created no matter what kind of delivery medium is used. The LOs can be accessed dynamically, e.g. over the Web. Ideally, LOs can be reused by different LMS and plugged together to build classes that are intended to serve a particular purpose or goal [10]. Accordingly, LOs need to be context-free, which means that they have to carry useful description information on the type and context in which they may be used. For example, a LO dealing with the basics of SQL can be used in classes on software engineering, database administration, and data modeling.

2.2 Web Services

Web Service is a technology that has been developed to provide various types of services over a web. The main advantage of using a Web Service technology is cross-platform communication. At present (i.e in 2005) there are two major competitors in Web Service technology Microsoft and Sun. As far as implementation is concerned both use common standards and protocols, such as Simple Object Access Protocol (SOAP), Extensible Markup Language (XML), Web Service Description Language (WSDL) and Universal Discovery Description & Integration (UDDI). SOAP is an XML-based message exchange protocol that is used to communicate between Web Services and their clients [12]. With the help of this lightweight protocol we can easily exchange structured information in a decentralized distributed environment.

WSDL provides description of a Web Service. Each Web Service has a WSDL file which is basically an XML file that describes a set of SOAP messages and how the messages are exchanged between Web Services and clients [13]. UDDI is often called the Yellow Pages of Web Services [13]. A UDDI is a directory of Web Services having XML files describing a business and the services it offers. We will use
UDDI in our architecture.

In essence, Web Services are independent software components that use the Internet as a communication and composition infrastructure. They abstract from the view of specific computers and provide a service-oriented view by using a standardized stack of protocols. In a typical invocation of a Web Service, a client may use a UDDI registry and the Universal Description Discovery and Integration Protocol to find a server that hosts a service. It then requests from the server a WSDL document written in the Web Services Description Language, which describes the operations supported by a service [11].

2.3 Web Services Architecture

In a Web Service-based computing model, both clients and the Web Service providers are unaware of implementation details. If the client wants to consume a Web Service, he will have to go through four stages. These four stages are directory, discovery, description and data which is also called wire format [13]. Figure 1 presents a Web Service infrastructure. At the first stage (directory), a client is searching for a Web Service. Directories services such as UDDI provide a central place for storing published information about Web Services. The client searches a directory and finds a URL.

In the second stage a client sends a request for service description documents. The server returns the discovery document that enables the client to know about the presence of a Web Service and its location. In stage three the client sends his request for a particular Web Service. The service description is sent by the server in XML format which specifies the format of the messages that the Web Service can understand [14].

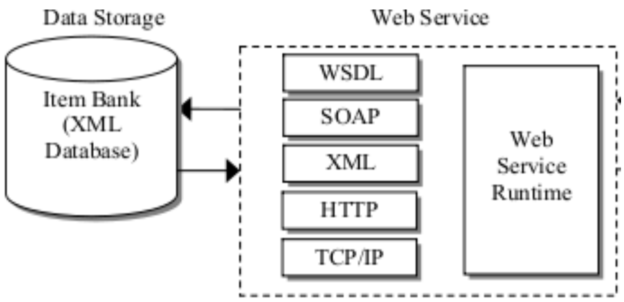

Figure 2. System Architecture

Figure 2 shows the overall architecture by applying a SOA concept. The architecture is separated into the two parts; data storage, and Web Service. In data storage, the XML database stores items. An item bank data structure is described in an XML document. The item structure is a subject to a XML schema developed according to the most standards. This database structure is designed by using the basic data structure of the general testing parameters, such as question, multiple choice, and answer.

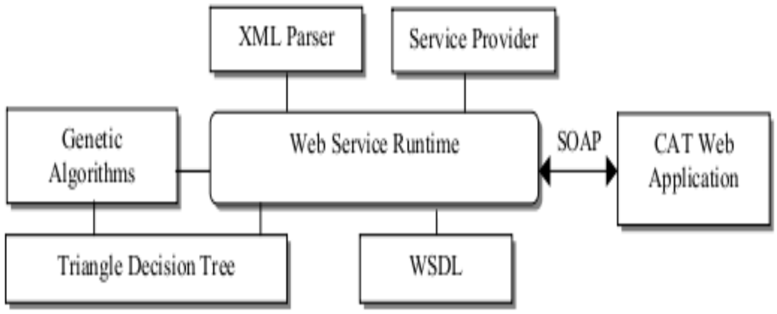

Figure 3. Web Service Architecture

In Web Service design, a set of standards for describing, publishing, discovering, and binding application interfaces are consisted of WSDL (Web Services Description Language), SOAP (Simple Object Access Protocol), UDDI (Universal Description, Discovery and Integration). WSDL is a format for describing a Web Service interface [15]. It describes services and a way they should be bound to specific network addresses. The descriptions of services and messages are generally expressed in XML (eXtended Markup Language). SOAP provides the envelope for sending messages via the Internet (Figure 3).

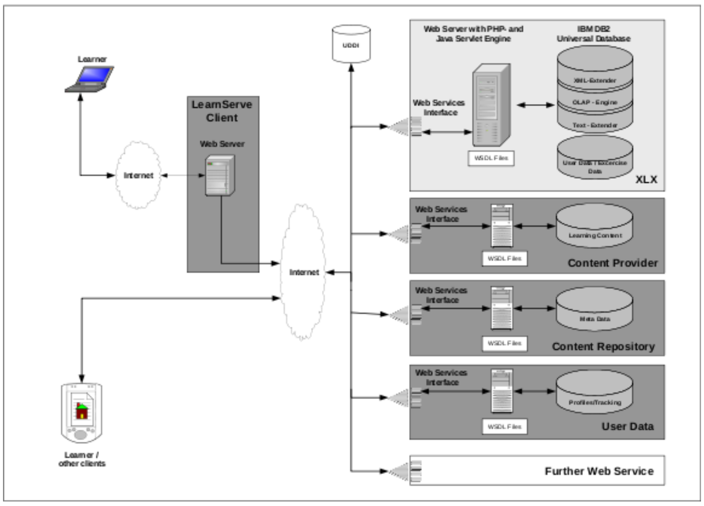

Figure 4. High Level Web Services Architecture

3. RESULT

3.1 Web-Services-Based LCMS

In this section, it will presents a service-oriented architecture of an LCMS based on Web Services, which is extended to support software agents. We assume that the entire LCMS functionality including the learning contents are implemented as Web Services.

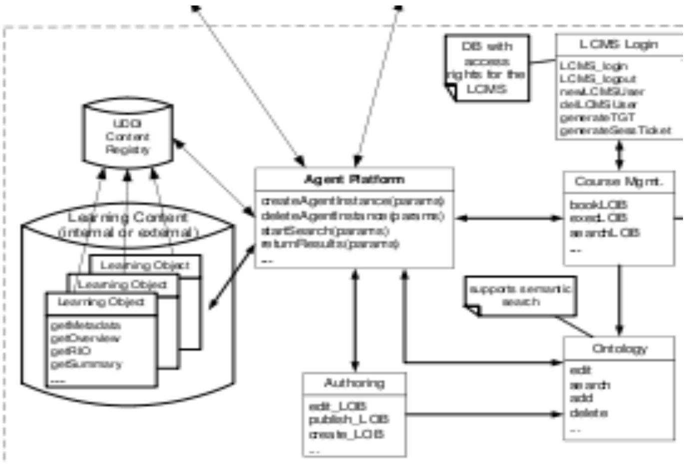

Figure 3. Learning Content Management System

In this figure, Web Services are depicted as rectangles containing a name as well as the most important operations. Furthermore, the architecture is designed in such a way that a learner only needs an Internet browser to use the LCMS. We explain the architecture shown as well as most of the operations listed in this figure in more detail in the following subsections.

3.2 LCMS Architecture

The architecture of our LCMS is aimed at coordinating all learning-related activities and the management of learning materials. The PC of a learner interacts directly with the LCMS during a learning session [9]. All Web Services of the LCMS should also be accessible via Web pages, so that the learner only needs a Web browser to utilize the LCMS.

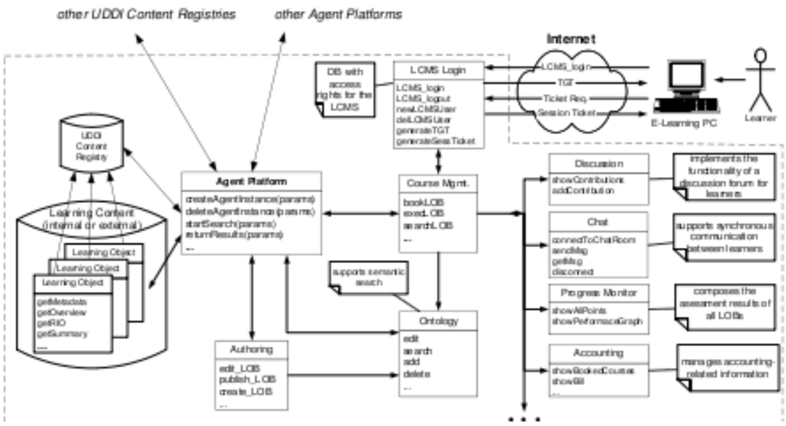

Figure 4. Components of a distributed, Web-Services-Based LCMS

In a first step the learner has to authenticate in the LCMS, which is done by a LCMS login service. This service draws on a database with access rights and uses an authentication mechanism based. When the learner is logged in and authenticated, he or she can access a Web page for course management, the functionality of which is implemented in a course management service. The learner can look for suitable courses with a searchLOB operation, which searches for learning objects with the help of the agent platform, also implemented as a Web Service. The bookLOB operation is called to enroll for a course that was found by an agent. A class can be attended by calling the execLOB operation on the remote LO.

3.3 Learning Objects (LO) and Metadata

Learning objects (i.e., educational content) is provided in form of Web Services. In general, LOs may have any desired structure. From a conceptual point of view, however, LOs typically contain parts like Metadata, Overview, Summary and one or more Reusable Information Objects (RIOs), which in turn contain a content part, a practice items part, and an assessment items part for the generation of online tests [3].

Learning objects can be stored in a relational or an object-relational database and are typically a collection of attributes, some of which are mandatory, and some of which are optional; a more concrete proposal appears in. In a similar way, other information relevant to a learning system (e.g., learner personal data, learner profiles, course maps, LO sequencing or presentation information, general user data, etc.) can be mapped to common database structures. This makes interoperability feasible; moreover, it allows for a process support inside an e-Learning system that can interact with the underlying

Database appropriately [10, 17].

Metadata in reality is data describing data and it can be used to describe any digital resource. There are various metadata elements which describe different aspects of digital resources. For example the IEEE LOM specification [17] has metadata elements which enable the description of digital resources [18].

4. CONCLUSION AND DISCUSSION

Many custom e-Learning platforms can only present their material inside the platform; and on the other hand, Internet-based Web Services are becoming ubiquitous, both at a professional and at a personal level. A service-oriented e-Learning system results from a perception of the various tasks and activities that are contained in such a system as processes or as work-flows; using appropriate encodings of objects and tasks in UDDI and WSDL forms and documents enable broad exchanges, flexible compositions, and highly customized adaptations possible.

We also identified the essential services in the functioning of a typical e-Learning based. These services (with real time Web Services technology) would provide a common interface between various components leading to platform independence and interoperability between learning systems.

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