

A Framework of Service Architecture of a University Consortium Information System

Wasefer Zaman, Pramatha Nath Basu

Abstract – In this paper, a design of service architecture of an information system for a University Consortium is discussed. It foresees a situation where a consortium is to be formed by a number of universities from diverse geographical locations. The consortium will thrive for the conservation of resources by avoiding unnecessary duplication and by allowing healthy competition among member institutions. The information system is a conglomeration of service architecture and functional model.

During design of the functional model e-learning standards have been taken into consideration. Service architecture of university consortium information system has been designed using web services. Functional model consists of SCORM compliant LMS for tracking students' activity and LCMS for managing the process of assembling and delivery of learning content and credit calculation and credit transfer. In the service architecture, web services have been incorporated for the communication between consortium and member universities to maintain the interoperability of the systems. In the proposed framework of University Consortium Information System both quality of education and quality of the system functioning are taken into consideration.

Index Terms – Web services, e-learning, SOA, LMS, LCMS, SCO, SCORM.

1 INTRODUCTION

With the growing needs of the adult learners and demands for the customized and anytime-anywhere learning, there is a need to develop a formalized academic cooperation between providers. This will help cross validation and cooperative improvement of the quality of education. The need of the hour is the formation of consortium of a number of institutions offering courses in Digital Distance Education format [1].

University Consortium would offer courses by providing common portal. According to this approach all consortium members contribute to the management and administration. All member universities act as local learning centers and attend to students' face to face whenever required.

The suggested consortium will work with due considerations of institutions of dissimilar academic structure, dissimilar culture and practiced technicalities.

The institutions under the umbrella of a consortium, must determine the academic framework to resolve the issues like which institution will be the administering institution, what happens if two institutes offer courses by the same name, which institute gives the degree/diploma if there are cross modules opted by the student across the institutions. This would also answer the basis of eligibility qualification criteria, the process of counseling, admission, academic inputs, distribution and evaluation of assignments, conduction of examinations, evaluations, credit transfer, publication of result, award of certificates etc. [2].

To keep the autonomous nature of institutions academic coordination norm should be developed and would be applicable to

only those courses and modules offered through the consortium. The proposed functional model of the University Consortium Information System is developed keeping in mind the current existing standards of the e-learning [7] and a proposed service architecture of the University Consortium Information System. The service architecture has been designed to maintain the interoperability of the systems, using web services. To implement the quality of education and quality of the University Consortium Information System [6], the framework has incorporated certain criteria.

Learning through University Consortium is suggested as the next generation e-learning system [2]. It is an online learning environment where the students are getting customize learning content based on pedagogical input and learners' background / prior knowledge on that particular subject. The student group is heterogeneous. To be able to individualize and differentiate e-learning to a heterogeneous student group, it is necessary to find and describe the heterogeneity factors of the student group based on the learner's prior knowledge [3]. A holistic approach has been taken into consideration when describing the heterogeneous student group, avoiding that smaller parts not are viewed as more important than necessary. In the learning environment, students who come from different ethnic groups require different support.

There is a shift in which learning technology applications such as learning management system (LMS) or learning content management system (LCMS) move away from being a monolithic application towards more flexible components that expose services accessible to other applications via a loosely coupled standards-based interface. The adoption of service oriented approaches should enable these applications to integrate with an enterprise wide e-Learning solution.

Our aim is to investigate and design A Framework of Service Architecture of a University Consortium Information System using Web Services.

A University Consortium e-learning system should fulfill certain

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needs and requirements in a field of increasing demand for effective, fast and pedagogically correct learning experiences. University Consortium creates, operates and administers on-line learning activities. They also create and deliver questions and tests for learner assessments. They support collaboration between users. All e-learning systems administer virtual, distributed learning experiences where learners are geographically scattered and communicate via the Internet. An e-learning system is considered to be adaptive if it is capable of: monitoring the activities of its users. Adaptive e-learning system can be described as personalized system, which beside contents discovery and assembly, is able to provide adaptive course delivery, adaptive interaction, and adaptive collaboration support.

2. LITERATURE SURVEY

Personalized E-learning System (PES) is suggested as the next generation e-learning system. It is an online learning environment where the students are able to customize their learning environment based on pedagogical and personal choices. The student group is heterogeneous. To be able to individualize and differentiate e-learning to a heterogeneous student group, it is necessary to find and describe the heterogeneity factors of the student group. A holistic approach is necessary when describing the heterogeneous student group, avoiding that smaller parts not are viewed as more important than necessary. In the learning environment, students who come from different ethnic groups require different support [8].

Electronic Learning technology offers the opportunity to integrate and optimize the global teaching learning and distribution of learning resources. The computers of the various Institutions, located throughout the world, will communicate with each other to determine the availability of components, to place and confirm the related knowledge centers, and to negotiate delivery timescales. There is a need for effective and efficient communication among components in a multidisciplinary, cross-organizational architecture. The most recent, and quite network-based services, referred to as Web Service [9].

An interface acts as a crossing point for the back end web services and the learning software component model. Using the interface, the student can interact with the tutors regarding the course which they want to join. Based on students' requirements, the interface will provide an e-learning system with interactive materials. Thus online tutoring framework for e-learning system using web service technology is experimented to estimate the performance improvement compared to the works in terms of scalability, communication efficiency, speed of message transfer [11].

E-learning content can technically be combined with the recent standardization efforts that aim at content exchangeability and efficient reuse. A repository for learning object publication and search is proposed that essentially adapts the UDDI framework used in commercial Web Services to the e-learning context. To adopt Web Services technology towards the reusability and aggregation of e-learning services, the conceptual Web Services architecture and its building blocks need to be augmented. The objective of this research is to design broker based registry architecture for e- Web services

which facilitates effective e-learning content/service discovery for the consumption or composition [12].

3. WEB SERVICES

A Web Service is a software system designed to support interoperable machine-to-machine interaction over a network. Web Services expose only their interfaces to the public. Such an interface can be completely described using a Web Service Description Language (WSDL) document that characterizes the Web Service interface in terms of operations that the Web Service provides, messages that are exchanged to do so and data types that are used to construct those messages. An important characteristic of Web Services is that implementation details of the systems are hidden behind the interface. The consumer is aware that certain functionality is provided, but the internals on how this is done are abstracted behind the Web Service interface. Consequently, this involves that the actual functionality could be implemented in an arbitrary programming language and running on arbitrary platform. SOAP is an application-level protocol based on XML used for data exchange and remote procedure call in distributed applications, usually for accessing Web Services. Due to its XML- based design, SOAP is platform and programming language independent. SOAP messages are transmitted embedded into or on top of other application-level protocols such as HTTP, SMTP or JMS.

The Web Service Description Language (WSDL) provides the possibility to completely describe a Web Service interface through the use of an XML document that conforms to an XML Schema as defined by the WSDL specification of the W3C. WSDL provides machine-processable information on how to interact with a given Web Service to a Web Service consumer application. Since the Web Service is fully described by the WSDL document, it is possible to generate client code for interaction with a given Web Service by using the definitions given in the WSDL document. The Universal Description Discovery & Integration (UDDI) specification defines a Web Service registry that allows possible Web Service consumers to dynamically discover Web Services that provide a certain service. While WSDL describes the Web Service interface, UDDI allows the discovery of the Web Service interface by clients. The UDDI registry is actually a Web Service itself and makes use of WSDL to describe its interface. The main purpose of the UDDI registry is to allow client applications to dynamically discover Web Services that provide a required service. The use of UDDI allows the client applications to discover a replacement for failed Web Services. Web Service Notifications (WSN) is to allow Web Services to notify other interested entities of events that have occurred inside the Web Service. In the basic form of the publish subscribe interaction pattern, a Web Service publishes a topic of events to which other interested entities may subscribe.

Occurrence of an event inside the publishing Web Service then triggers the Notification of subscribed entities. Additional to this basic form, Web Service Notifications may also involve an intermediary Web Service, called a Notification broker that may introduce additional features and enhanced scalability to the Web Service Notification architecture.

4. SERVICE ARCHITECTURE OF UNIVERSITY CONSORTIUM INFORMATION SYSTEM

distributed. Standard compliant learning information presented by XML that is wrapped with the SOAP specification is exchanged between the requester and provider. The provider publishes a WSDL file that contains a description of the message and endpoint

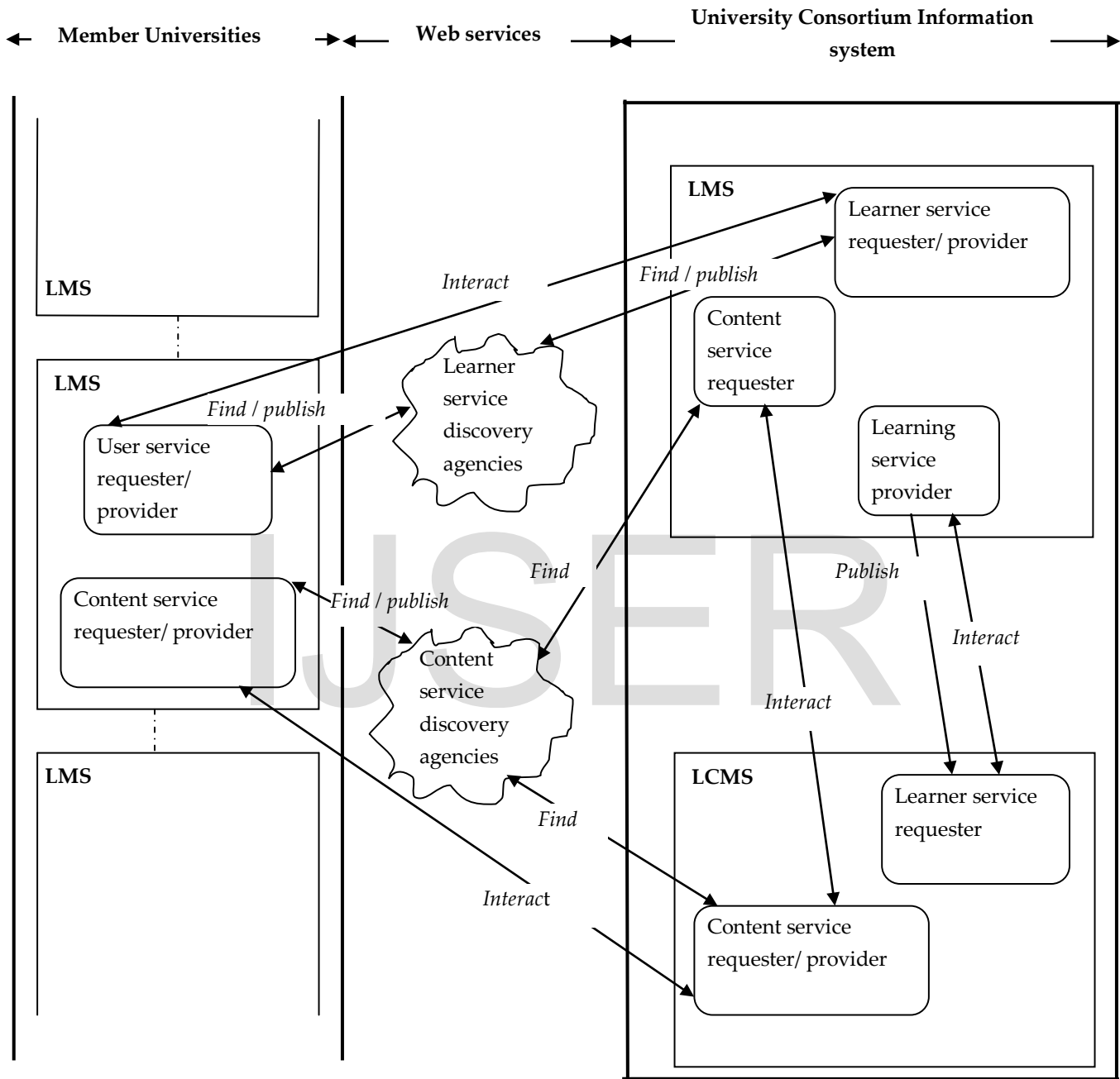


Figure 2. Service architecture of University Consortium Information System

The above (Figure 2) architecture defines how University Consortium information system and information system of the participating universities exchange messages through the interaction of Web Service agents.

In Web services Discovery Agency is a searchable set of service descriptions where service providers publish their service descriptions. The service discovery agency can be centralized or

information to allow the requester to generate the SOAP message and send it to the correct destination.

Effective infrastructure is required to support web services in terms of three roles – service provider, service requester and service registry and describing the interaction between them: publish, find, and interact. 'Interact' is the step that allows an application to connect to a web service at a particular web location and start interaction with it.

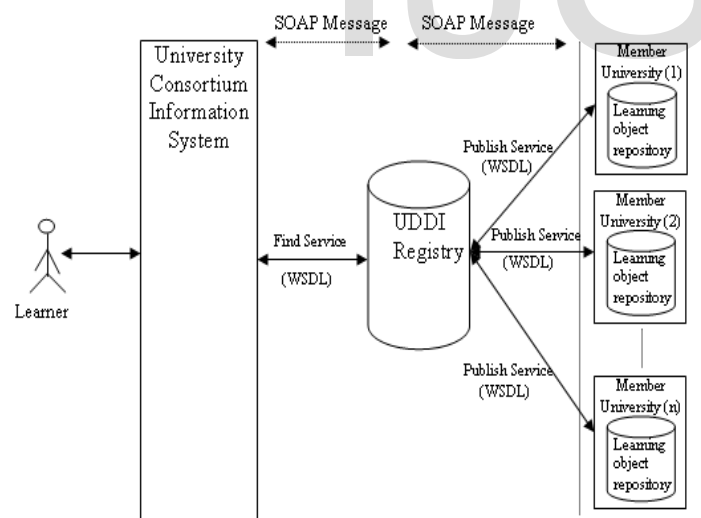
A service description is the metadata describing the service. This metadata must include sufficient information for a service requester to access the service it describes including its interface and location.

A service provider publishes a service description to a service registry. A service requester then finds the service description of the service registry.

Contents are improved in terms of quality and become ready to use or reach on approved state [5]. For these it is assumed that whenever the system wants to develop and deliver a new learning resource (module), it aggregates all the required SCOs (Shareable Content Object) using SCORM SCORM (Shareable Content Object Reference Model) Aggregation Model. The system first searches its own repository [4] and then it searches the UDDI registry using standard metadata to collect the SCOs. The system also checks the UDDI registry for the approved SCOs for this module.

Clear and explicit teaching strategy (sequence of the learning objects) of the learners need to be designed according to the learner types, needs and context using pedagogical design principles. The framework suggests storage of these strategies in the pedagogical repository. During delivery of the content to the learners, teaching strategy of that type of learners would be taken into consideration by taking input from pedagogical repository. The framework supports would remain so that necessary paths for the experts to update pedagogical inputs regularly are provided in the proposed framework.

According to the learners' performance appropriate feedbacks and suggestions are given. After creating a new session, taking inputs of these two modules, the appropriate content is served to the learners. In other words, dynamic sequencing of the SCOs is done based on the individual performance at run time.



University Consortium Communication System

Web Services technology remains a possible technology in academic business that is incorporated in the management of resources to support e-learning activities such as running courses, support students as well as background process seamlessly, between member institutions and University Consortium. Web services are a distributed middleware technology that uses a simple XML based protocol to allow applications to send and receive data across the Web. Services are described in terms of the communication received

and response sent. Information regarding digital learning resources can be retrieved by sending a SOAP query to the UDDI Registry which is like a remote database. To get the desired learning resource, a request is made based on the query retrieved from the UDDI Registry to the WSDL repository. This could be sent over a transport protocol like HTTP. Then finally, the WSDL document containing the description of the desired learning content is retrieved and forwarded to the LMS by sending an SOAP request over HTTP. The learner or the discoverer is able to discover the digital resources simply by sending a SOAP query over HTTP.

Service Provider is a service container, which is used to exchange messages. Service Requester is the application that is looking for and invoking or initiating an interaction with a service. Discovery Agency is a searchable set of service descriptions where service providers publish their service descriptions. The service discovery agency can be implemented by the web service. Web Services are perfectly feasible for implementing the interoperability of information systems for the following reasons:

- ✓ LOM, IMS Content Packaging, all have standard XML binding.
- ✓ Web services architecture is platform and language independent.
- ✓ Web services can be used in Private Intranet as well as Public Internet services.

5. CONCLUSION AND FUTURE WORK

Many universities all around the world are offering online courses. Formation of University Consortium is to facilitate wider choice, greater flexibility to students globally and also for greater content reusability.

The proposed University Consortium Information System has two parts – functional model and service architecture. In functional model, e-learning standards have been incorporated and in service architecture, web services concept has been taken into consideration. There are many challenges for implementing such University Consortium Information System because web services, e-learning standards and both quality of education and quality of the system functioning are all emerging and promising technologies and are undergoing rapid changes and developments.

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