A Framework of Web Service Based Architecture for M-learning of a University Consortium Education System

Wasefer Zaman* and Pramatha Nath Basu

School of Education Technology, Jadavpur University, Kolkata, 700032, India

ABSTRACT

With the advancement of ICT (Information and Communications Technology) for customized anytime-anywhere learning, there is a need to develop a formalized academic cooperation between providers. The use of wireless technologies in education is known as mobile learning (m-Learning). The technology permits the change of traditional classroom teaching to digital learning or electronic learning (e-Learning), and then into wireless medium through handheld devices such as tablets or cell phones. As a mobile computing application, m-Learning is projected to be significant in delivering classroom learning content in a readily accessible format. In this research, we develop a mobile learning architecture that exploits existing web resources to generate learning material which fits the actual needs of the learner. The architecture constructs a personalized learning web for a mobile user who needs to learn about a specific topic. The system manages gathering, collating, authoring, packaging and delivery of learning materials for individual learners. This paper presents details of web services architecture which could be used for m-Learning. The proposed architecture would provide students and teachers opportunity to readily and easily access study material taught in classes, on their handheld devices through web services architecture.

Keywords: Domain knowledge, e-Learning, m-Learning, University Consortium, Pedagogy.

INTRODUCTION

Address for

Correspondence

School of Education

University, Kolkata,

700032, India.

@vahoo.co.in

Technology, Jadavpur

E-mail: waseferzaman

For a customized anytime-anywhere learning approach to take shape, there is a particular need to develop a formal academic cooperation between providers. University Consortium would offer courses by providing a common portal. This approach entails all consortium members to contribute to the overall management and administration of the consortium itself. All member universities act as local learning centers and assist students in face-to-face interactions whenever required. The institutions under such an umbrella of a consortium, must determine the academic framework to resolve issues such as which one among them shall act as the administering institution; what happens in case two or more institutes offer courses with identical names; which one among them would offer degree / diploma in case a student opts for cross modules across member institutions¹.

Consortium Information System is developed keeping in mind the current existing standards of e-Learning, and proposed service architecture of the University Consortium Information System. The service architecture has been designed to maintain interoperability of systems involved, using web services. To implement the quality of education and quality of the University Consortium Information System, the framework has incorporated certain criteria².

In the context of mobile phones, the specific configuration and profile typically installed is the Connected Limited Device Configuration (CLDC), supporting the Mobile Information Device Profile (MIDP). Java ME applications that run using this profile are known as MIDlets.

An important consideration for any type of mobile application is to strike a balance between network traffic, memory usage, and storage space. Given that network speeds across regions may not be uniform, nor support high-bandwidth traffic in many cases, a mobile application must devote its attention to carefully managing its real-time demands on network. While designing a mobile application and its support system, data transfer rates, cost of data transfer, memory management on device, and data persistency on the mobile device are all crucial factors which must be calculated and tested before deployment.

The paper presents the details of web services architecture that could be used for

m-Learning. The proposed architecture would provide students and teachers the opportunity to obtain almost all class related material on their handheld computers through web services architecture. The paper presents an architecture that can help develop a learner-oriented single-point integrated software solution. Integrated software will provide an access to a central home page that would allow for synchronous group meetings. instant messaging, and a gateway to other real-time audio/video applications whether commercial or open-source.

BACKGROUND AND RELATED WORKS

Future online interactive m-Learning based courses will have more multi-media based materials, texts and assignments. The present web-based asynchronous delivery method normally involves primarily text based material. This would change with the new m-Learning paradigm³.

Web services which enable application-to-application communication over the Internet are self-contained, modular applications with their public interfaces described using Web Services Description Language (WSDL). These provide access to software components through standard web technologies and protocols like SOAP and HTTP. A service provider develops and deploys the service and publishes its description and access details (WSDL) with the UDDI (Universal Description, Discovery and Integration) registry. Any potential client, who queries the UDDI, gets the service description and accesses the service using SOAP.

The importance of collaboration, community building, knowledge sharing, and social networking for learning highlighted the integration of new web concepts and social software in the learning process, and explored the use of mobile and concurrent communication technologies to enhance collaborative learning activities for mobile learning⁴.

The system constructs a personalized learning web for a mobile user who needs to learn about a specific topic. The system manages the gathering, authoring, packaging and delivery of learning material. The architecture of the implemented system uses a set of web services to retrieve information and learning resources from the web⁵.

The proposed architecture would provide students and teachers the opportunity to obtain almost all class related material on their handheld computers through web services architecture.

m-Learning/Mobile learning

As our society is entering a knowledge-based, Internet/Web-driven economy, college education becomes a necessity for any individual who wants to be competitive and successful, regardless of his or her age, gender, and race.

To meet student needs, many universities offer self, or i-paced (course tutorials which can be taken anytime over the internet), online courses on the web with related technologies and application software; studies indicate that i-paced online learning can be effective. m-Learning has the potential to be a definitive step in this direction.

The evolution in education and training at a distance can be characterized as a move from d-Learning (distance learning) to e-Learning (electronic learning) to m-Learning (mobile learning). With advancements made in the field of Bluetooth, WAP (Wireless Application Protocol), GPRS (General Packet Radio System) and UMTS (Universal Mobile telecommunications System) technologies, robust and resilient structures of wireless telephony and wireless computing are now firmly in place. m-Learning, or mobile

learning, involves delivery of digitized content to either wireless phones hooked into laptops or personal handheld computing devices.

Constructivism is the main pedagogy used in online learning. This approach is used in the form of discussions, constructivist activity and conferencing to enable the learner to build an understanding and the meaning of the issues and to construct new knowledge on the basis of information

This form of e-learning would include online learning, web-based training, virtual universities and classrooms, digital collaboration and technology assisted distance learning.

For effective teaching in a m-Learning environment, teachers and students both need to understand the nature of the social relations, the quality of the interaction, and of communication will ensure communicative competence, which includes the exchange of information, knowledge, experience, and development of skills. Teachers need to understand the complex relationships of cognitive tasks, socio-emotional aspects of learning, and the social context of learning, in order to create those social spaces for reflective learning by students. Online learning and specifically mlearning is very different from the traditional face-to-face instructor-led teaching method.

With the advent of mobile devices such as portable handheld computers becoming the norm in business and in our daily lives, it is inevitable that the educational environment will realize that using these mobile devices would enrich the learning experience of students.

A m-Learning architecture based tool would enable students and teachers to quickly and easily access course curriculum and data whenever and wherever they need to. Students and professionals place high value on the ability to access data anytime anywhere.

Handheld-based learning programs would help students to solve and submit student homework assignments with lot of flexibility and may create a better learning experience in and outside the classroom.

Using m-Learning environment, teachers eliminate the need to write assignments on the chalkboard because they can "beam" instructions to students' handheld devices.

Web service

Benefits, or why web services

By integrating web service it can achieve many benefits that cannot be accomplished from common methods.

Some of the major benefits found in the architecture are as follows.

Web services are asynchronous messages that exchange XML documents across a network. Web services also are responsible for mapping the XML documents into and out of executable programs, objects, databases, and legacy applications.

Service-Oriented

The title of the paper suggests that our e-learning architecture is based on a web service-oriented approach. Using web service technology it can provide educational contents in the form of different services such as learning object repository, LMS, LCMS etc. The architecture can expand as many services as administrator likes by adding his web service layer.

Interoperability

One can develop web services using JAVA or NET platforms; both communicating using standard sets of protocols such as HTTP, XML and SOAP. One can easily integrate his e-learning system with other systems in this diverse web-based environment.

Reusability

The reusability of learning contents would increase with the help of web services. Any member university learning management systems can access our learning object repositories and other educational services, and utilize it in his own way through SOAP-based messages.

Scalability

Our architecture provides a scalable environment where the administrator can develop his own services easily without interrupting the core architecture. The administrator can add new educational web services and register his service using UDDI or other directory services.

Maintainability

Maintainability of educational services is facilitated because educational services are divided with respect to category and functions.

Flexibility

Agents are always flexible as they can move in a network to find information; our web service based agents can communicate with other web services in a network using standard-based protocols such as SOAP.

Customization

The administrator can customize his 'user agent' by configuring memory usage, processor usage, frequency of getting information from server agent and many other things. User profile also plays a part in customizing user interests.

Interactivity

The main purpose of a user agent on the client-side is to provide interactivity with

the user. A user agent would be helpful in maintaining user attention towards learning objectives as well as developing learning contents. Contents are getting checked by a series of experts and communicate with the developers for the improvement to make the content usable.

There are several other benefits that can be realized after implementing this e-Learning architecture and it will enhance e-Learning experience.

Web service infrastructure

Web services are the next wave of distributed enterprise computing. They provide a layer of interoperability that allows applications to be described, published, located, and invoked irrespective of underlying architectures.

Architecturally, Web services are typically made available by use of a common transport mechanism, namely SOAP, through which agreements and binding can be universally facilitated. The directory, or repository, is accomplished through UDDI. The interface is described in WSDL, and the transport is managed seamlessly using SOAP, allowing users to communicate with the outside application regardless of what platform, system, or standards are being used behind the scenes⁶.

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.

The figure below 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 the desired 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. (See figure 1.)

Finally, the client requests the XML web service, and is enabled to utilize it. The server sends the required response to a client. To enable communication between disparate systems web services use open wire formats. Open wire formats are the protocols that can be understood by any system that is capable of supporting common web standards, such as HTTP and SOAP.

Web services architecture is a set of emerging protocols and standards. It offers a different approach to enterprise integration and development. Architecturally, Web services are typically made available by use of a common transport mechanism, namely SOAP, through which agreements and binding can be universally facilitated. The directory, or repository, is accomplished through UDDI. The interface is described in WSDL, and the transport is managed seamlessly using SOAP, allowing users to communicate with the outside application regardless of what platform, system, or standards are being used behind the scenes. (See figure 2.)

Web service based architecture for mlearning of university consortium education system

Mobile Learning is gaining popularity as a way of providing learners with educational material wherever they are, and at any time of their choosing. With new capabilities continually being added to mobile devices, one major challenge, and opportunity, is finding innovative ways to enhance the learning experience using these new technologies. Mobile learning is not just e-Learning on a mobile device, since much of e-Learning content is inappropriate for small devices (i.e. small screens make it hard to read a lot of text) as well as inappropriate in the context that these devices would be used in. In many mobile learning scenarios,a device may be used on a casual basis or as a tool to obtain knowledge when required. Therefore, course material must be packaged in short and student-focused learning units⁷. In this paper, we explore one possible approach to realizing a mobile learning framework, that would help deliver rich and interactive content to the mobile learner. We describe the architecture of the system; the overall framework, the communication mechanism used between the client and server, the data model used to capture learning content and student progress information, and aspects of the user interface. (See figure 3).

Learning Management Systems in other networks can be connected with our web service layer and access our learning object repository. Anyone can search for learning objects and assets using its metadata through SOAP-based messages. The main goal of ADL is reusability of learning distributed contents in а network environment. We have increased the reusability of learning contents as well as other learning services with the help of these web services⁸. The database is used to store user profiles and other relevant data and it can be accessed through web service.

Creating e-Learning material involves several components: once content is developed, it must be managed, delivered and standardized. Content comprises all instructional material, which can range in complexity from discrete items to larger instructional modules⁹. A digital learning object is defined as any grouping of digital materials structured in a meaningful way and tied to an educational objective. In order to improve the reuse of educational resources in digital format appears the concept of "learning object"(LO).

LOs represent discrete, self-contained units of instructional material assembled and reassembled around specific learning objectives, which are used to build larger educational materials such as lessons. modules, or complete courses to meet the requirements of a specified curriculum. A unit of LO includes not only educational content, but also metadata descriptions that describe the own object and make it easier for its use and location in other contexts¹⁰. An example of the metadata's standard is the LOM (Learning Object Metadata) XML scheme.

LOM defines a wide range of metadata to classify and characterize learning resources, which include: overall description (cataloging, annotations, and associations and relationships with other learning resources), technical data (file size, format, and installation/usage descriptions), and educational data (educational purpose, objectives. classification). learning and management data (intellectual property rights). The purpose of this standard is to facilitate search, evaluation, acquisition and use of LOs, both by students and instructors, or even automated software processes¹¹.

CONCLUSION AND FUTURE WORK

m-Learning offers unique opportunity for teachers and students in different kinds of learning environment settings. The unique feature of this mode of learning is that it enhances flexibility for students. However, it demands new pedagogies, and new approaches to deliver a course.

The proposed web services based flexible services architecture could become a new direction for developing web services applications for mobile education. The intersection of mobile computing and e-learning includes anytime, anywhere resources; strong search capabilities; rich interaction; powerful support for effective learning; and performance-based assessment.

m-Learning is a new paradigm that creates a new learning environment. Mobile learning is unique because learners can access the course material, instructions, and other course related applications anytime and anywhere. This increases daily attention to learning material, makes learning pervasive, and may boost the learner's motivation for lifelong learning. Moving from stationary to mobile learning allows ad hoc collaboration and informal interaction between students.

REFERENCES

- Zaman. Wasefer and Basu. Pramatha. Nath, "A Framework of a University Consortium Information System," in Proceedings Best Practices in Engineering Education, Pune, India, 2nd and 3rd February, 2007.
- 2. Zaman. Wasefer, Ghosh. Partha, Dutta. Kalyankumar, and Basu. Pramatha Nath, "A Framework to Incorporate Quality Aspects for e-Learning System in a Consortium Environment", in *International Journal of Information and Education Technology*, Vol. 2, No. 2, April 2012.
- 3. Sushil K. Sharma, Fred L. Kitchens, "Web Services Architecture for M-Learning", *Electronic Journal on e-Learning* (ejel), Volume 2, Issue 1, February, 2004, pp 203-216.
- Mohamed Amine Chatti, Satish Srirama, David Kensche, Yiwei Cao, "Mobile Web Services for Collaborative Learning", WMTE '06: Proceedings of the Fourth IEEE International Workshop on Wireless, Mobile and Ubiquitous Technology in Education, November 2006.
- 5. Mohammed Alzaabi, Jawad Berri, Mohamed Jamal Zemerly, "Web-based Architecture for Mobile Learning", *International Journal for*

Infonomics (IJI), Volume 3, Issue 1, March 2010.

- 6. Ujjainwal. Rahul, Zaman. Wasefer, and Basu. Pramatha. Nath, "A Web Services Oriented Architecture for University Consortium," in Proceedings 2nd National Conference on Recent Trends in Information Systems (ReTIS-08), Jadavpur University, February 7-9, 2008.
- Wasefer. Zaman, Pramatha. Nath. Basu and Kalyankumar Dutta "A Framework to Incorporate Quality Aspects for E-Content in a Consortium Environment," in Proceedings Annual International Conference on Education and e-Learning EeL 2011, Hotel Fort Canning, Singapore, November 7 – 8, 2011.
- Wasefer Zaman, Partha Ghosh, Kalyan Kumar Datta, Pramatha Nath Basu. "A Framework To Incorporate Domain Knowledge Modeling In An Education System", *International Journal of Research Mathematical Sciences International Journal*, Volume 2, Issue 2 (2013), pp.474-478.
- Partha Ghosh, Wasefer Zaman, "Improving Search And Retrieval Of Reusable Learning Resources In A University Consortium Environment By t-Concept Lattice And Fuzzy Graph", *International Journal of Research Mathematical Sciences International Journa*, Volume 2, Issue 2 (2013), pp.465-473.
- 10. Wasefer Zaman, Pramatha Nath Basu, "A Framework of Service Architecture of a University Consortium Information System", *International Journal of Scientific and Engineering Research* (IJSER). Volume 4, Issue 12, December, 2013, pp.1381-1385.
- 11. Wasefer Zaman, Pramatha Nath Basu, "A Framework of Functional Model of a University Consortium Information System", *International Journal of Advanced Research in Computer Science and Software Engineering.* Volume 3, Issue 10, October, 2013, pp.866-869.





