A Model of an e-Learning Management System Based on Cloud Computing and Web Service

Thongchai Kaewkiriya*, and Nattavee Utakrit**

Abstract

This is the era of global communication which is a very exciting time in the field of information technology. Technical advances such as the internet combined with software applications aid and enrich our modern daily lives. Thus, large businesses and the private sector can see the benefits of embracing these applications to gain the advantage over their competitors. Moreover, this not only applies to businesses but also the educational field. This paper focuses on the particular technologies that have been applied to support education, for instance, learning management systems and e-Learning. This paper also covers the difficulties facing these approaches such as the limitations of the Internet, lack of expertise in development of media and digital content, the difficulty when collecting learning material distributed throughout the internet, and the cost of development. Therefore, this paper presents a conceptual model of distributed learning management systems by using Cloud computing combined with web service technology to solve the problems mentioned above.

Keywords: E-Learning, Web services, Distributed Learning Management system, Cloud computing.

1. Introduction

Worldwide communication is expanding rapidly and becoming cheaper with each technical breakthrough. For example, the use of the internet, web communications and web applications have all played a big role in this. Learning and teaching via the internet network is becoming more popular in many countries. Lectures and experts can teach over great distances via the internet network from the comfort of their own office or home. Thus, e-Learning has a significant role to play now in today's busy modern life style. [1] E-Learning can be defined in many different ways, learning and/or teaching in any broadcasted form in order to share knowledge throughout the world. For example, internet, intranet or TV signals, etc. This kind of learning has been introduced into the Thai market for awhile now, such as computer-assisted instructions, CD-ROMs, Web-Based Learning, on-line learning, distance learning via satellite or online video conferences, etc [2] The advantages of e-Learning has been widely covered, the main benefit would be long distance learning via electronic media as the medium. [3] E-Learning systems basically consists of three parts; [4] the learning management system (LMS), courseware and the technology which are the typical elements of e-Learning. Courseware or contents via internet networks can expand rapidly out of control if it isn't monitored correctly. This can be exacerbated by new technology/applications as knowledge spreads even faster using social networking, instant messaging. The organization and managing of e-Learning or learning material to learners via the internet is becoming more limited due to the development cost constraints of learning management systems. Currently, there are many systems which distribute learning material and web services [5], [6]. But they all suffer from many problems, the biggest being investment as development must be constant to remain up-to-date in the field of learning and teaching. Another issue is the requirement of a variety of experts, not only in education but also in digital media development. Thus, the most worrying prospect for a company outlaying this large amount of money would be the number of paying end users to justify the costs.

2. PROBLEMS AND PREVIOUS WORK

Social networks can be connected to each other which in turn forms a large network. Socialism online is becoming more popular as it's easy to interact and find people that are already connected in that network. Some people take advantage of networking for the management of e-Learning systems. In the past, researchers studied the problem of learning and teaching by applying e-Learning to resolve various issues.

* *Faculty of Information Technology, Thai Nichi Institute of Technology.*

** *Department of Information Technology Management, Faculty of Information Technology, KMUTNB.*

For example, the effectiveness of learning and teaching with e-Learning provides many benefits over normal classrooms [7] such as the presentation of contents being more visually effective and interesting [8]. In order to resolve the problem of contents and the effectiveness of learning, each part of e-Learning has to address a variety of issues. The main problem of e-Learning is the use of learning management systems with a variety of different forms. For example, the developed program [9,10] or developed program by companies as the business-oriented services, such as IBM, Oracle [11] or blackboard. The development of e-Learning's courseware has a very high cost, as well as the maintenance of the learning management systems. Some scholars have turned to use open source to assist in the development like Moodle [12]. However, free learning management systems require experts in programming, system development, and system installation to meet the needs of users. But the costs are also very high. Currently, the standard of learning technology is based on the reference of IEEE 1484.11 [13]. There are also important parts; the learner's profile, the transferring of learning contents, test and evaluation, and the recommendation. Thus, it's difficult for a single learning management system to cover all of these features. The analysis of learners is another area which needs to constantly be monitored, a model of learners would need to be created to aid the study progress. [14], [5] Also, raw data of learners and teachers requires sorting and storing. Including, learning profiles, learning behaviors, types of media, the quality of the media and the aptitude of learners, as well as the test-taking behavior, etc. These are the reasons why the organization of developed e-Learning systems or learning materials to learners via the internet is very limited at the moment. Since the education field requires the most up-to-date and accrete academic materials, a lot of resources need to used daily which the internet has the advantage over a normal class room or liberty. But the downside is that teachers must be confident with computers and modern applications. As mentioned above, a series of tests and evaluations also need to be analyzed to constantly monitor study progress or lack of progress. The creation of a model to aid distribution learning systems is the goal of most researchers in this area. One way to solve the problem of a e-Learning system requiring high investment would be to apply the concept of Cloud computing (later explained in detail), the system would greatly benefit from its web service technology.

Working with the new infrastructure, which combines web service technology, not only helps distributing information but can also aid learning and teaching registry and much more. Web services and the integration of a Cloud computing model can resolve the high cost of development, increase the performance of management, and monitor security.

3. BACKGROUND

3.1 Learning technology standards.

Standards of e-Learning and learning technology are developed by IEEE 1484.11 Learning Technology System Architecture (LTSA), and presents compositions of learning. The standard architecture of learning and training uses information technology. Details about the design and required composition consists of four parts; learners, contents delivery, evaluation and teachers. Also, the standard Sharable Content Object References Model (SCORM), which is the standard XML language for learning between agencies and institutions.

3.2 Learning management system (LMS)

Learning Management System is the software system that is responsible for learning management which is developed in many forms. Some systems served only to store and manage learning management such as web-portals which collects web links for learners or video libraries to help learners in searching. Some systems provided tests in order to introduce learners to the next level. Some systems have learning records but these systems are designed and developed in unique positions. The limitations of working with various media instructions can be diverse and fragmented.

3.3 Web services

The most important applications and widespread uses of the internet includes, web programs, web servers, and web browsers. Focusing on the needs of users to be abile to view various types of texts, images, and sounds easily from the web browser is the priority of any web service. Users should be able to enter text which refers to the required information (URL). Then, the web browser requests the web server to deliver data back in different formats such as text, html, gif, jpeg, etc. These requests and responses are called protocols such as "http" which is easily and widely to use.

-*Service Requestor* is anyone who wants to run the service from the service provider which can be searched from the UDDI registry, the service registry or contact directly to the provider.

-*Service Registry* acts as an intermediary to register the WSDL file by using a detailed description of the company and the services offered. Which may or may not be used.
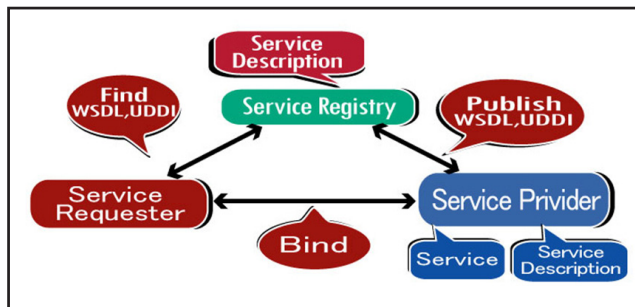
Figure 1 *Principle of Web Services Methodology.*

-*Service Provider* is responsible for the opening service to request services from the requestor. Principles of web services are the same but instead of the user (a person) can see the information through a web browser. Currently, XML is the standard of assigned details in protocol formats. The structural work is shown in Figure 1.

3.2 Cloud computing

Cloud Computing is an internet service that gathers necessary resources and links them together centralizing the coordination. The resource is called the third-party provider or third party's service which is responsible for collecting basic needs [15]. Cloud Computing will work with an applicant and send a request to the software system. Then, the software system will request resources to allocate and serve to meet further needs of applicants. The applicant is responsible for paying for the services without knowledge or understanding the principle's background.
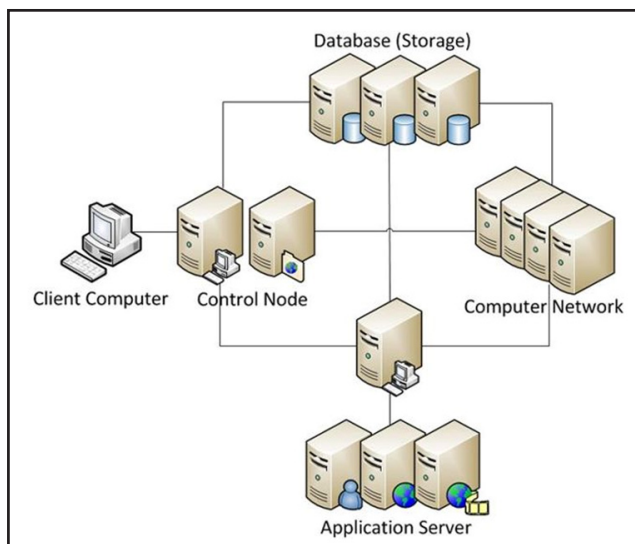

Figure 2 *Principle of cloud computing.*

Figure 2 shows the working system which can be divided into two parts; client and server. The side of the client has only a computer which is the web browser running the operation. The server is responsible for the processing of applicant data.
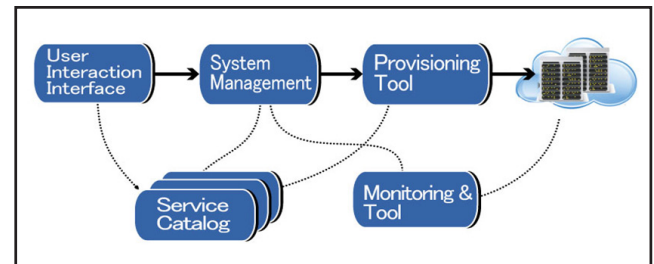
The structure of Cloud computing.

Figure 3 *Structure of cloud computing.*

The number of Cloud servers are in the tens of thousands or hundreds of thousands, these are computers located in the same cloud and connected together by a network as a Grid system. This system uses software virtualization which works with applications.

• User interaction interfaces are responsible for receiving service's requests from users in the form of web protocols.

• Services Catalog will collect and manage the services. Users can browse available services from here.

• System management is responsible for generating suitable resources when users run the service. When users request a service, the information of the request will be passed to this section.

• Provisioning services occur when the administration deals with this section. To reserve resources from the clouds and the appropriated web application. When the application is ready to run, the result will send to users.

• Monitoring and metering to charge or collect data which improves the system.

4. METHODOLOGY

Lately, developers have developed various learning management systems, such as learning management systems that cater for the needs of inexperienced users [16] however, those developed learning management systems have a lot of problems. For example, it is difficult to manage single distributed management on the internet and cover the needs of all users at the same time. [17] For this reason, we have to develop a learning management system with our own programs. But, we cannot meet the demand of users due to the lack of distributed learning material. The most important issue is the high cost of development as stated earlier. Adding or expanding the system also requires more investment. Most of the cost problems come from the needs of service and maintenance. So, to solve this problem, we present a new model for learning management systems by applying Cloud computing with Web services.
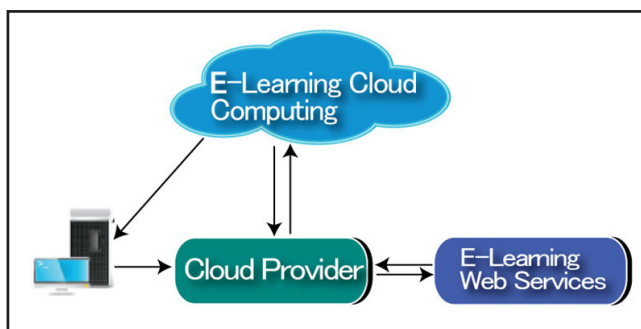
Figure 4 Model of e-Learning Cloud Computing and Web services.

Figure 4 shows a model using distributed e-Learning using Cloud computing with Web services. The user sends a request to the provider of Cloud Services. Then, the cloud provider will manage the resources and services that the user wants and connects to the e-Learning cloud. In addition, to serve the user who sent a request to cloud, the cloud provider must connect to other web services which link data resources on the internet. This model of learning management is effective and reduces the cost of development and provides the ability to collect distributed learning material via the internet. The processes and steps of a working e-Learning Cloud are depicted as below.
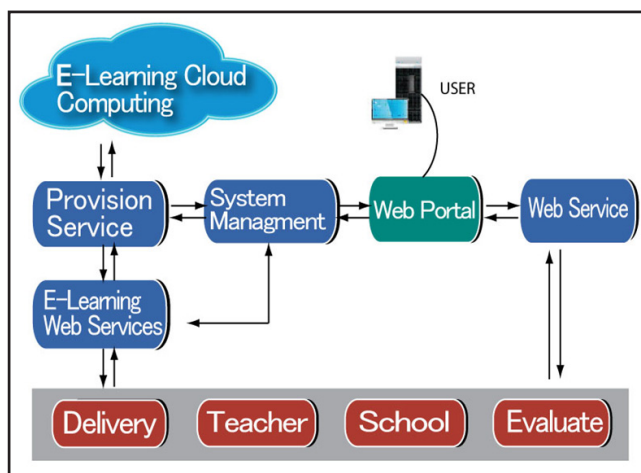

Figure 5 Model of integrated learning management system

The process begins with learners or users sending a request to the web portal. Then, the request travels through the system's management which is responsible for the decision of appropriate resources. For learners who use this service, the information referring to the request will be forwarded to them and deliver the required resources. The last part is the evaluation. All Sub-modules of e-Learning services work independently of other web services. The modules of web services are responsible for opening web services registry. So that, the distributed learners on the internet can collect data and learning materials from web service registry, including,

learning profile and learning information that's connected from each other. As a result, a model can work as the distributed learning management system and run on the Cloud computing system successfully. Moreover, the cost of investment and maintenance is a lot lower.

The proposed models is based on the IEEE1484.11 Learning Technology [13] which is related to the compositions referring to the instructor, learner and the content's delivery. In addition, the application of web services presents a model of distributed learning management systems using web services [5]. Also, the performance is test by a sample group in order to develop a better prototype in the future. The results were found to be at a very good level with high user satisfaction. [6] The proposed model of a distributed learning management system still has one or two problems such as speeds depending on the user's available internet connection and content available in the desired language (Thai).

5. CONCLUSION AND DISCUSSION

Courseware or learning and teaching through media such as over the Internet are rapidly growing in popularity. Knowledge is continually expanding and the need to manage such grate amounts of data is becoming larger daily. Organizations that embrace e-Learning via the internet stand to gain the biggest advantage over their competitors. But, due to the development of such systems requiring a lot of investment, many have problems. This paper presents a conceptual model of distributed learning management systems applying Cloud Computing with web service.

The next step of this concept is to further develop the presented model. The next trial will focus on the application in a real world situation. Also performance tests and comparisons of Cloud computing to other web services. This proposed method can solve many of the problems of traditional learning management systems successfully.

6. REFERENCES

[1] A. Lester Gerhardt, "The Future of Distance Learning The Process and the Product," *Annual International Conference*, *ITHET 6th IEEE*, pp. F1A-1 - F2A-2, 2005.

[2] Chia-Hu Chang, Yu-Tzu Linyand Ja-Ling. "Adaptive Video Learning by the Interactive e-Partner," *International Conference on Digital Game and Intelligent Toy Enhanced Learning, IEEE*, pp. 207-209, 2010.

[3] Yi Jin, "Research of One Mobile Learning System," *International Conference on Wireless Networks and*

Information Systems, *WNIS 09 IEEE*, pp.162-165, 2009.

[4] M. Tuentong, "Courseware Design and Devalopment for CAI," *Book of KMUTNB* ,Vol.1, pp. 371, 2005.

[5] T. Kaewkiriya, and N. Utakrit, "Design and Development of Distribute Learning Management System using by Web services and Virtual system on Social Network," "Japan-Cambodia Joint Symposium on Information Systems and Communication Technology" *JCAICT*. pp. 35-38, 2011.

[6] T. Kaewkiriya, and N. Utakrit. and Hiroshi Tsuji. "Experimental Evaluation of Distributed e-Learning Management System" *IEEE TENCON*, pp. 1,044-1,048, 2011.

[7] Tuangsang n Nakorn, "Design e-Learning concept," *Ramkumhang Journal* ,BKK Thailand , pp.143-145, 2004.

[8] S. Nattakorn, "A Development of Computer Game for Enhancing Agricultural Comprehension on Chinese Cultivation," *Journal of KMITL*, Thailand ,Vol.2,

pp. 1-15, 2005.

[9] http://lms.kmutnb.ac.th, access date : 27 Oct, 2010.

[10] http://cmuonline.cm.edu, access date : 15 Aua, 2010.

[11] http://www.elearninglearning.com/lms/oracle

[12] http://moodle.org, access date : 15 Aus, 2010.

[13] IEEE LTSC, IEEE P1484.11 D9, 2002, URL: http://ltsc.ieee.org/

[14] S. Kamolphiwong, "A Design Framework of Interactive Distance Learning in Distributed Systems," Preceedings of the International Conference on Computers in Education (ICCE'02) IEEE,Vol.2, pp. 580-584, 2002.

[15] http://en.wikipedia.org/wiki/Cloud_computing

[16] T. Heepthaisong, M. Tuentong, "Devalopment of Instructor and Administrator Management System," *NCCIT'07*, Thailand , pp. 445-450, 2007.

[17] A. Pisuta, *The Effects of Interactive Learner-Centered Model through Computer Network*, Research of Mahasarakam rajchapat university BKK Thailand, pp. 1-56, 2010.