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An Analysis on Various E-Earning System Architecture Model Using Cloud Computing

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Abstract – Cloud computing is becoming an adoptable technology for many of the organizations with its dynamic scalability and usage of virtualized resources as a service through the Internet. Cloud computing is growing rapidly, with applications in almost any area, including education. Now a day, e-learning is also becoming very popular and powerful trend, which is also broad. E-learning systems usually require many hardware and software resources. This paper presents the benefits of using cloud computing for e-learning. There are many educational institutions that cannot afford such investments, and cloud computing is the best solution, especially in the universities where the use of computers are more intensive and what can be done to increase the benefits of common applications for students and teachers.

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.

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INTRODUCTION

The Internet and advances in Information and Communication Technologies (ICT) have changed the educational setting, both in traditional and distance learning. As a result, there has been a change in the way that educational content is designed, developed and delivered to learners. Faced with these transformations, in recent years there is an increasing demand for open, scalable and flexible learning environments.

E-Learning is a form of learning in which the teacher/instructor and learner are separated by space or time through the use of online technologies. With web-based learning, it is possible for the learners/teachers to learn from anywhere, anytime, at their pace. Web-based learning brings unprecedented level of accessibility to courses in remote area, courses prohibited by budget constraints, courses updated to recently discovered knowledge, qualified instructors, and instruction at any time. According to Ellis, E-learning environment has specific features concerning pedagogical, technical and management issues. More important, learning environments should integrate with other enterprise application solutions used by human resources and accounting, enabling the management to measure the impact, effectiveness and overall cost of training initiatives.

E-learning also needs personalized mechanisms to help learners learn more efficiently. To provide personalized learning strategy is urgently needed for most e-learning systems currently. And the system has to consider learner/user preferences, interests, and browsing behaviors when analyzing learner/user behaviors for personalized services. That is, the ability of individuals may be based on major fields and subjects. Therefore, considering learner ability can promote personalized learning performance.

Technology is increasingly being used both inside and outside the classroom. Embracing new technologies and finding optimal ways of harnessing their benefits is crucial to maximizing educational outcomes. However, in order to gain benefits from technologies it is important to have an understanding of the benefits and drawbacks to their usage, as well as ensuring that they are implemented in ideal ways. The main purpose of this article is to assess the potential for using cloud computing in the field of education, to look at potential challenges to implementation, and outline ways to overcome them.

AT present, most of the conventional education forms are becoming not being suitable for requirements of social progress and educational development and not being able to catch up with the changes of learning demand in time, thus computer networks have

brought opportunities for it. However, in traditional web-based e-learning mode, system construction and maintenance are located in interior of educational institutions or enterprises, which results in a lot of problems existed, such as a lot of investment needed, but without capital gains to return, without development potential and staying power. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited.

As cloud computing has become a research hotspot among modern technologies, researchers pay more attentions to its applications. As concerned as cloud computing applied in the field of education, a lot of problems had been studied, such as the technology for future distance education cloud, teaching information system , the integration of teaching resources, teaching systems development.

In integration of e-learning and network, emphasis is placed on building of software and hardware platform of e-learning system, functional structure, network security management and training, information technology integration to teaching, campus network environment , online education, semantic web technologies-based multi-agent system .

From the above we can see that until now, scholars have made a lot of researches on the following two aspects: cloud computing used in the field of education, and integration of network and e-learning. The former places the emphasis on distance education, information system application, instructional system design, information resource development, online course-building, etc. The latter's emphasis is placed on construction of campus e-learning system, e-learning model on campus network, e-learning system based on agent model and e-learning grid and so on.

But until now the research applying cloud computing to elearning is not significantly reported. In order to give a full play for the advantages of cloud computing, in this paper, we tried to attach cloud computing to e-learning, build an elearning cloud, and made an active research and exploration for it.

CLOUD BASED E-LEARNING ARCHITECTURE

The e-learning cannot completely replace teachers; it is only an updating for technology, concepts and tools, giving new content, concepts and methods for education, so the roles of teachers cannot be replaced. The teachers will still play leading roles and participate in developing and making use of e-learning cloud. The blended learning strategy should improve the educational act. Moreover, the interactive content and virtual collaboration guarantee a high retention factor.

On the other hand, E-learning cloud is a migration of cloud computing technology in the field of e-learning, which is a future e-learning infrastructure, including all the necessary hardware and software computing resources engaging in elearning. After these computing resources are virtualized, they can be afforded in the form of services for educational institutions, students and businesses to rent computing resources. E-learning cloud architecture is shown in Fig.1.

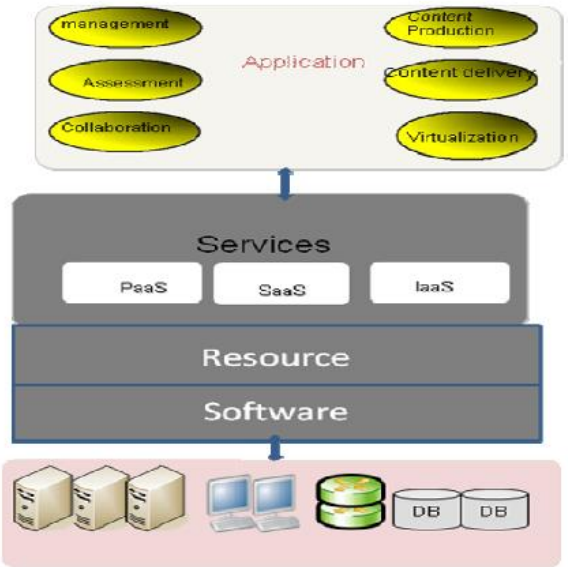

Fig. 1 E-learning Cloud Architecture.

The proposed e- learning cloud architecture can be divided into the following layers: Infrastructure layer as a dynamic and scalable physical host pool, software resource layer that offers a unified interface for e-learning developers, resource management layer that achieves loose coupling of software and hardware resources, service layer, containing three levels of services (software as a service, platform as a service and infrastructure as a service), application layer that provides with content production, content delivery, virtual laboratory, collaborative learning, assessment and management features.

A. Infrastructure layer is composed of information infrastructure and teaching resources. Information infrastructure contains Internet/Intranet, system software, information management system and some common software and hardware; teaching resources is accumulated mainly in traditional teaching model and distributed in different departments and domain. This layer is located in the lowest level of cloud service middleware, the basic computing power like physical memory, CPU, memory is provided by the layer.

Through the use of virtualization technology, physical server, storage and network form virtualization group for being called by upper software platform. The physical host pool is dynamic and scalable, new

physical host can be added in order to enhance physical computing power for cloud middleware services. The following Fig. 2 depicts this in a clearer view.

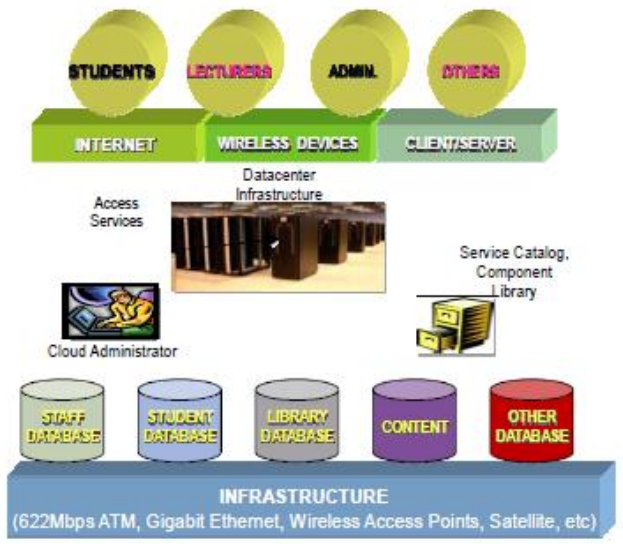

Fig. 2 Proposed Infrastructure Layer in an expandable view

B. Software resource layer mainly is composed by operating system and middleware. Through middleware technology, a variety of software resources are integrated to provide a unified interface for software developers, so they can easily develop a lot of applications based on software resources and embed them in the cloud, making them available for cloud computing users.

C. Resource management layer is the key to achieve loose coupling of software resources and hardware resources. Through integration of virtualization and cloud computing scheduling strategy, on-demand free flow and distribution of software over various hardware resources can be achieved.

D. Service layer has three levels of services namely, SaaS (Software as a service), Paas (Platform as a service), IaaS (Infrastructure as a service). In SaaS, cloud computing service is provided to customers. As is different from traditional software, users use software via the Internet, not to need a one-time purchase for software and hardware, and not to need to maintain and upgrade, simply paying a monthly fee.

E. Application layer is the specific applications of integration the teaching resources in the cloud computing model, including interactive courses and sharing the teaching resources. The interactive programs are mainly for the teachers, according to the learners and teaching needs, taken full advantage of the underlying information resources after finishing made, and the course content as well as the progress may at any time adjust according to the feedback, and can be more effectiveness than traditional teaching. Sharing of teaching resources include teaching material resources, teaching information resources (such as digital libraries, information centers), as well as the full sharing of human resources. This layer mainly consists of content production, educational objectives, content delivery technology, assessment and management component.

E-LEARNING APPLICATION MODEL BASED ON CLOUD COMPUTING

With the progress and application of technology, the emergence of cloud computing offers e-learning good opportunity to develop, so we are convinced that it also can resolve the problem mentioned above properly. School or the enterprise neither needs to worry about the construction of the environment of e-learning software and hardware nor invest enormous capital and human and material resources to construct the system. All those issues can be handed to service providers of e-learning cloud, who can customize for users.In e-learning cloud model, data storage is highly distributed, data management is highly centralized and data service is highly virtualization, all of which offer a much safer data service. Intelligent business policy-making. E-leaning cloud environment provides large data center in which mass data storage, high-speed computation. This architecture for the cloud platform provides a variety of user interface forms, such as Web Service interfaces, Java interfaces, C interfaces, Shell interface etc. Cloud computing platform provide resources services to teachers and students in the form of rental. A module is designed to which is based on the consumption billing to ensure that users only pay for the resources they have used.

A promise of the cloud computing is the virtualization will reduce the number of servers required. Therefore, the key is to identify the user to meet the expected demand for the infrastructure needed to balance the amount of cloud: too few computing resources, the request from the user must wait for the release of resources or reject those requests until more hardware is added to the environment. Too much computing resources, hardware costs and other expenses will be denied cost-cutting promises of cloud computing. In the cloud platform, teachers and administrators enter their requests for IT resources website (server, software, storage, etc.), can immediately know whether these resources are

available. If resources are available, submit a request immediately and automatically routed to the cloud administrator for approval. This process is automated, so it can be met in a very short period of time. Resource use planning and management are important activities of the cloud. Handled properly, the plan will provide needed capacity computing resources to create new solutions and to meet application performance goals, promote teaching and researching goals.

The VDC-OS expands virtual infrastructure along three dimensions. First, it delivers a set of infrastructure services (called Infrastructure vServices) to seamlessly aggregate servers, storage and network as a pool of on-premise cloud resources and allocate them to applications that need them most. Second, it delivers a set of application services (called Application vServices) to guarantee the right levels of availability, security and scalability to all applications independent of the operating system, development frameworks or architecture on which they were built to run. Third, the VDC-OS delivers a set of cloud services (called Cloud vServices). Unlike a traditional OS, which is optimized for a single server and supports only those applications written to its interfaces, the VDC-OS serves as the OS for the entire datacenter and supports the full diversity of any application written to any OS, from legacy Windows applications to modern distributed applications that run in mixed operating system environments. With one of a number of available resources expressed in the form of virtual resources. Virtual resources will select a physical resources to achieve the requirement based on specified criteria.A data center is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, A growing trend in the IT world is virtualizing servers. That is, software can be installed allowing multiple instances of virtual servers to be used. In this way, we can have many virtual servers running on one physical server. Virtualization allows multiple operating systems with different virtual machines independently on the same physical machine running in parallel. Each virtual machine has its ownset of virtual hardware ,it can be loaded in the hardware operating system and applications. No matter what the actual physical hardware components used, the operating system will treat them as a set of consistent, standardized hardware.

RELATED WORK

Cloud computing (hereinafter: CC) is an abstract, scalable and controlled computer infrastructure that hosts applications for the end-users. CC is an area of computing that refers to providing customers with highly scalable IT capacities as a service via the Internet (Sultan, 2010). Services and data coexist in a shared and dynamically scaled set of resources). Virtualization is one of prerequisites for the realization of CC. It allows for an efficient usage of resources, because several virtual machines (hereinafter: VM) can operate on one physical machine. CC is an infrastructure that can bring a new value to an e-learning system, as educational services can be delivered in a reliable and efficient way. It also provides a suitable environment for ubiquitous learning activities. As a result, efforts to introduce CC in e-learning environment have been initiated over the last couple of years and are ongoing across the world. However, shifting from a traditional IT infrastructure to a cloud based infrastructure is a complex task for an educational institution.

The background for this research can be found in the works that explain the benefits of using CC infrastructure in e-learning. In the authors explain the key benefits of the CC application in e-learning: improved improbability, virtualization, centralized data storage, costs. Doelitzscher et al. (2011) notice that universities' information systems have periods of intensive usage, when available hardware and software resources have to be efficiently used. Dong et al. (2009b) give a good theoretical and practical basis about using CC infrastructure in e-learning. They presented main layers of an e-learning ecosystem: infrastructure, content and application. Further, they propose four ad hoc modules for managing the e-learning ecosystem: monitoring, module, policy module, arbitration module, and provision module. The authors emphasize the importance of cloud services integration into an e-learning system. The architecture of BlueSky cloud framework includes six layers: user interface, application, common service, capability, data information, virtual infrastructure. However, most of the research in the area of CC application in e-learning systems did not involve any learning domain; instead, the research mainly focused on the investigation of motivation, advantages, and technical possibilities, but no concrete implementation of the proposed models could be found.

Considering the existing IT infrastructure in an educational institution, the CC paradigm can be implemented with various approaches. An important issue is to choose the deployment model appropriate for the educational institution. Depending on the type of ownership of physical resources and infrastructure the following deployment models of cloud computing can be developed: a private cloud, a public cloud, a hybrid cloud, and a community cloud. The characteristics of each deployment model from the standpoint of infrastructure are management, ownership and location; from the point of users these are access rights to cloud resources. Researches and case studies pointed out the most common approaches, not only within universities, but in the other fields of CC solutions, are private and public cloud. Accordingly, these two models are discussed and analyzed in the following text.

Public clouds are owned and operated by third parties, i.e. cloud service providers. Main advantage of a public cloud is that they may be larger than an enterprise cloud, thus providing the ability to scale seamlessly, on demand. Educational institutions do not need to invest and house large IT infrastructures for educational and research purposes. The first concrete implementation of the CC concept in e-learning included hosting on providers' infrastructure. In (Malan, 2010) the author presented an example of a computer science course realized within the public cloud. Using the Amazon Elastic Compute Cloud (EC2), a load-balanced cluster of VMs for 330 students was developed at Harvard College. Other universities provided a variety of cloud based e-learning services via well-known cloud providers such as: Google, Microsoft, Amazon, etc. For instance, the University of Westminster used the Google Apps for Education platform that provides a set of Google services (e-mail, document management and collaboration tools) for the realization of a teaching and learning process (Sultan, 2010). A similar approach was presented in (Herrick, 2009) where Colorado State University migrated to Google Apps for Education. However, in these solutions, there are no tools and interfaces for teachers to supervise students; no integration with existing IT infrastructures has been performed, and no adaptive learning services have been developed.

CONCLUSION

A scalable E-learning systems will be possibly to facilitate the development of information technology in education and should support multi cloud environment for ensure the further improvement of the quality of teaching and learning activities for changing the pattern of learning and teaching. The various limitations concerning Cloud are availability of services, data lock-in risk, reliability of data, data transfer bottlenecks, performance unpredictability and software licensing are raised. The adoption of Cloud and SOA results in a service full cloud computing environment that enables highly dynamic and effective organizational collaborations. In such collaboration each of the participants behaves according to the predefined and mutually agreed upon business logic and service level agreement.

Through the research we believe that, we can create an e-learning application model based on cloud computing by means of cloud computing's mass data storage, high-speed computing capabilities, as well as its ideal allocation and the sharing mode of resources. Some problems such as platform security, technical standards, regulatory and other services are not well resolved yet in practice, pending further research and exploration. Either way, e-learning application model based on cloud computing will not stop its pace to proceed. As the cloud computing technologies become more sophisticated and the applications of cloud computing become increasingly widespread, e-learning will certainly usher in a new era of cloud computing.

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