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An Analysis upon Application and Approach of Cloud Based E-Learning System

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Abstract – Cloud computing based e-Learning provides continuous (anytime, anywhere and any device learning) and collaborative learning. Cloud computing in an academic environment such as university will be benefitted by every students, faculties, administrators and research scholars. Most of the universities infrastructures are underutilized and in some cases over utilization of resources occurs in order to balance the usage of the resources we need an elastic technology. In order to develop an e-Learning platform for postgraduate students of computer science and research scholars new methodologies should be taken into consideration for project, problem based learning and virtual computorium. This type of cloud based e-Learning provides new blended learning methodologies for education. In this paper, an academic cloud framework is proposed in order to provide a new era in e-Learning.

E-Learning system, as a great product of modern information technology, is an important way to implement education modernization. Many e-Learning systems have been developed in recent years. Through the system teachers can involve in the E-Learning process of students directly. They can also obtain all the data of students-E-Learning through the database. The massive proliferation of affordable computers, Internet broadband connectivity and rich education content has created a global phenomenon in which information and communication technology (ICT) is being used to transform education. Therefore, there is a need to redesign the educational system to meet the needs better. The advent of computers with sophisticated software has made it possible to solve many complex problems very fast and at a lower cost. The use of monitoring system significantly improves the learning effect of those students with poor learning consciousness.

Cloud computing is a highly scalable and cost-effective infrastructure for running Web applications. E-learning or e-Learning is one of such Web application has increasingly gained popularity in the recent years, as a comprehensive medium of global education system/training systems. The development of e-Learning Application within the cloud computing environment enables users to access diverse software applications, share data, collaborate more easily, and keep their data safely in the infrastructure. However, the growing demand of Cloud infrastructure has drastically increased the energy consumption of data centers, which has become a critical issue. High energy consumption not only translates to high operational cost, which reduces the profit margin of Cloud providers, but also leads to high carbon emissions which is not environmentally friendly. Hence, energy-efficient solutions are required to minimize the impact of Cloud-Oriented E-Learning on the environment. E-learning methods have drastically changed the educational environment and also reduced the use of papers and ultimately reduce the production of carbon footprint.

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INTRODUCTION

University has various departments where many students need to access to the computing and resources such as highly available software and hardware. Cloud computing has the capacity of scaling and elasticity which is perfect for such an environment. A cloud computing service has ubiquitous access through a Web browser or mobile device with APIs or special desktop applications. Use of Cloud Computing on universities has many benefits such as accessing the file storages, databases, educational resources, research applications and tools anywhere, anytime on demand. Furthermore, cloud computing

reduces universities' IT complexity and cost. The main goal of an academic cloud is to manage effectively the technological needs of universities such as delivery of software, providing of development platform, storage of data, and computing.

The implementation of cloud services at universities provides various opportunities and benefits for the users of the university. For example, in a typical university scenario, PC labs and servers are under-utilized during the night and semester breaks. In addition, these resources are on high demands mainly towards the end of a semester, following a dynamic rule of use. The Physical machines are hold even when they are idle, wasting its full potential.

Every day that goes by, research and educational needs of universities' change with developing technology. All the software and hardware of universities' must be renewed in accordance with the changes. For example, there are office applications, programming language, and multimedia developing courses in computer education. Also every year, the new versions of applications were used for courses with respect to the needs of industry. As a natural result of this progress, new software cause new hardware costs. Students frequently use both the software and development platforms during the study. The large majority of university budgets are devoted to meet these needs. Students will have access to all software anytime, anywhere and any technological devices connected to internet by suggested cloud structure. Also, students will have access to development platform, develop their own applications and store on university infrastructure. In this way, lecturers will focus their basic tasks and not lose their workforce.

According to Educase, a survey says that nearly all institutions have a major interest in e-learning, at least at the level of some departments. Online courses are ubiquitous, with over 80% of institutions offering at least several courses online and more than half offering a significant number of courses online. So it is the high time to move the teaching-learning activities of the university to the cloud.

The services and deployment model of an academic cloud can be used by the educational institutions to provide a new way of learning. The services of an academic cloud can be charged based on usage of the cloud by the students/faculty/research scholars of the educational institution.

Government of India is having the ambitious plan to raise the present 16 million enrolments in higher education to 42 million by 2020 as well as interconnect electronically India's 572 universities, 25,000 colleges and at least 2,000 polytechnics for enabling e-Learning and content sharing across country. The lunch of low cost, affordable Aakash tablet PCs for the student community is likely to increase the number of users' for educational online resources exponentially. Around 45 million people will be in the age group of 18 to 20 years by 2020 in India. To make available quality education for them will be a challenging task.

An academic cloud framework is proposed for adapting e-Learning in universities using cloud computing in order to help the students, faculties, research scholars and administrators of the university to better utilize their infrastructure. This framework specifies the virtualization technology to be used to build an academic cloud above the existing university infrastructure in order to use the resources more effectively and also to support the QoS (Quality of Service) objectives such as high availability, performance, reliability, scalability, load balancing and security in the service models (IaaS, PaaS, SaaS) of the cloud.

Without appropriate technological support, training programs appear to be less effective. Research has shown that E-Learning proves to be an excellent way to achieve quality results in a short timeframe. Online-delivered learning, within a context of continuous education, is considered strategic because it:

- Keeps the workforce apprised of their job functions' developing requirements, enabling them to make a positive impact within their Organization and help that Organization achieve its aims and goals
- Aids succession planning, helping workers to acquire the knowledge and skills to help them progress within their Organization
- Allows Organizations to keep training budgets under tighter control, develop and retain existing employees and reduce the costs related to external human resources recruitment, selection and on-boarding

The current speed of change means that employees need to be trained continuously in order for Companies to avoid the dangers of being out-thought and out-maneuvered by competitors. Thankfully, entrepreneurs, senior executives and business managers recognize this.

Education or Learning is an important component of life and No human beings are able to survive properly without education. Now a days, there are lots of paradigms for getting knowledge or learn something. One of the most promising paradigms for education is e-learning. E-learning is commonly referred to the intentional use of networked information and communications technology (ICT) in teaching and learning. Some other terms are also used to describe this mode of teaching and learning including online learning, virtual learning, distributed learning, network and web-based learning. The growth of e-learning is directly related to the increasing access to ICT, as well as its decreasing

cost. The capacity of ICT to support multimedia resource-based learning and teaching is also relevant to the growing interest in e-learning. Poor or insufficient technology infrastructure can cause more damage than good to teachers, students and the learning experience. While the costs of the hardware and software are falling, often there are other costs that have not been factored into the deployment of e-learning ventures. The most important of these include the costs of infrastructure support and its maintenance and the appropriate training of staff to enable them to make the most of the technology. Cloud Computing is a new paradigm that provides an appropriate pool of computing resources with its dynamic scalability and usage of virtualized resources as a service through the Internet. The resources can be network servers, applications, platforms, infrastructure segments and services. Cloud computing deliver services autonomously based on demand and provides sufficient network access, data resource environment and effectual flexibility. This technology is used for more efficient and cost effective computing by centralizing storage, memory, computing capacity of PC's and servers. With the tremendous advantages of cloud computing, we expect this technology to revolutionize the field of e-learning education. Cloud computing applications provide flexibility for all educational universities, schools and institutions. The cloud platform in institutions' campuses provides effective infrastructure and deployment model for their dynamic demands. The benefits of cloud computing can support education institutions to resolve some of the common challenges such as cost reduction, quick and effective communication, security, privacy, flexibility and accessibility. "Cloud computing" is the next accepted action in the evolution of on-demand information technology services and products. Cloud computing allows to move the processing effort from the local devices to the data center facilities. The software is seen as a service and the applications and data are stored on multiple servers that can be accessed from the Internet. 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. Cloud computing has many advantages such as expected performance, reduced upfront investment (i.e., software, hardware, and professional staff to maintain servers and upgrade software), high availability, reduced launching time, infinite scalability, tremendous fault-tolerance capability, and accessibility, enhanced collaboration, and mobility, allow users to use any device, such as a mobile phone, personal computer (PC) etc. 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. This paper presents the impact of using cloud computing upon e-learning solutions development.

E-LEARNING

E-learning includes all forms of electronically supported learning and teaching. The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process. This often involves both out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum. Abbreviations like CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning.

E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual education opportunities and digital collaboration. Content is delivered via the Internet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio. It is commonly thought that new technologies can make a big difference in education. In young ages especially, children can use the huge interactivity of new media, and develop their skills, knowledge, and perception of the world, under their parents' monitoring, of course. Many proponents of e-learning believe that everyone must be equipped with basic knowledge in technology, as well as use it as a medium to reach a particular goal. E-learning is widely used today on different educational levels: continuous education, company trainings, academic courses, etc. There are various e-learning solutions from open source to commercial. There are at least two entities involved in an e-learning system: the students and the trainers. Some benefits of e-learning are discussed below: Time: One of the key benefits of online study is that one can learn or take a course through e-learning at any time as it is convenient for them. Podcasts and downloadable lectures mean that students are no longer constricted by a conventional timetable of lectures. Location: Neither are students restricted by their physical location. With an Internet connection, they can attend live online tutorials, participate in dedicated discussion forums or download course material and notes regardless of where they are. Communication: Another key advantage of online study is that it encourages and enables students to collaborate and communicate with their fellow students as well as their tutors.

Improved training and material costs: With e-learning, each time the course is accessed our return on investment improves because users are dividing the fixed production costs by number of uses. We also have savings through decreased travel, reduced

material, and hopefully improved (and more efficient) performance.

Increased productivity: Because e-learning is not bound by geography or time, you can control training's impact on production by training people during down times. In addition, with the current economy, you're asking people to do more with less. So e-learning is a great way to give them the tools and skills needed to enhance their performance.

CLOUD COMPUTING

Cloud Computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth.

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

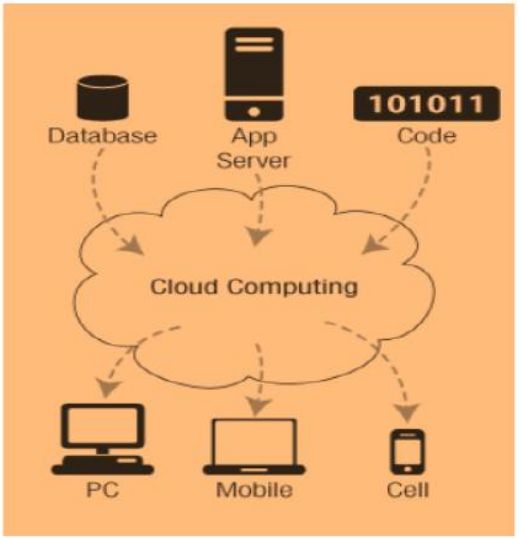

Figure 1: Cloud Computing.

According to the official NIST (National Institute of Standards and Technology) definition, "cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." The NIST definition lists five essential characteristics of cloud computing: on-demand self-service, broad network access, resource pooling, rapid elasticity or expansion, and measured service. It also lists three "service models" (software, platform and infrastructure), and four "deployment models" (private, community, public and hybrid) that together categorize ways to deliver cloud services. The definition is intended to serve as a means for broad comparisons of cloud services and deployment strategies, and to provide a baseline for discussion from what is cloud computing to how to best use cloud computing. Cloud computing employs a service driven business model. Cloud offers services that can be grouped into the following categories:

A. *Infrastructure as a service (IaaS):*Hardware resources (such as storage) and computing power (CPU and memory) are offered as services to customers. This enables businesses to rent these resources rather than spending money to buy dedicated servers and networking equipment.. As examples in this category, Amazon1 offers S3 for storage, EC2 for computing power, and SQS for network communication for small businesses and individual consumers.

B. *Software as a service (SaaS):*In this model, software applications are offered as services on the Internet rather than as software packages to be purchased by individual customers. One of the pioneering providers in this category is Salesforce.com offering its CRM application as a service.

Other examples include Google web-based office applications (word processors, spreadsheets, etc.), *C. Platform as a service (PaaS):*This refers to providing facilities to support the entire application development lifecycle including design, implementation, debugging, testing, deployment, operation and support of rich Web applications and services on the Internet. Most often Internet browsers are used as the development environment. Examples of platforms in this category are Microsoft Azure Services platform6, Google App Engine7, Salesforce.com Internet Application Development platform8 and Bungee Connect platform9. PaaS enables SaaS users to develop add-ons, and also develop standalone Web based applications, reuse other services and develop collaboratively in a team.

CLOUD COMPUTING IN E-LEARNING

In these days Cloud computing is acting as an emerging technology. It is a kind of computing which uses virtualized and highly scalable resources that can be shared by the users. Users need not be aware of the resources that they are using through cloud computing. A user on the Internet can communicate with many servers at the same time and these servers exchange information among themselves. Cloud Computing also known as on demand computing or internet as platform is currently one of the new technology trends will have

a major impact on teaching and learning environment in coming days.

Cloud Computing technology makes e learning solutions possible for mobile phones and other devices such as tablets, smart phones, PDAs etc. In recent days many companies emerge in market to offer the cloud power to many technical solutions to make their products more cost effective and enhancive with the cloud power. The accelerated development in Information Technology and the necessity for enhanced learning environments by harnessing existing technologies and resources has created a need to teach students more effectively.

Cloud Computing appears to be one of the most beneficial technologies for this purpose due to its numerous characteristic such as: availability, scalability, agility, elasticity, and reliability for on demand services. These characteristics, among many others, can give the impression that Cloud Computing could significantly enhance the learning environment.

One of the most interesting applications of cloud computing is educational cloud. The educational cloud computing can focus the power of thousands of computers on one problem, allowing researchers search and find models and make discoveries faster than ever. The universities can also open their technology infrastructures to private, public sectors for research advancements. The efficiencies of cloud computing can help universities keep pace with ever-growing resource requirements and energy costs. Students expect their personal mobile devices to connect to campus services for education. Faculty members are asking for efficient access and flexibility when integrating technology into their classes. Researchers want instant access to high performance computing services, without them responsibility of managing a large server and storage farm. The role of cloud computing at university education should not be underestimated as it can provide important gains in offering direct access to a wide range of different academic resources, research applications and educational tools. Usually, E-learning systems are developed as distributed applications, but not limited to. The architecture of an e-learning system, developed as a distributed application, includes a client application, an application server and a database server , beside the hardware to support it (client computer, communication infrastructure and servers).

There are numerous advantages when the e-learning is implemented with the cloud computing technology, they are:

A. *Low cost:* E-Learning users need not have high end configured computers to run the e-learning applications. They can run the applications from cloud through their PC, mobile phones, tablet PC having minimum configuration with internet connectivity. Since the data is created and accessed in the cloud, the user need not spend more money for large memory for data storage in local machines. Organizations also need to pay per use, so it's cheaper and need to pay only for the space they need.

B. *Improved performance:* Since the cloud based e-learning applications have most of the applications and processes in cloud, client machines do not create problems on performance when they are working.

C. *Instant software updates:*Since the cloud based application for e-learning runs with the cloud power, the software's are automatically updated in cloud source. So, always e-learners get updates instantly.

D. *Improved document format compatibility:* Since some file formats and fonts do not open properly in some PCs/mobile phones, the cloud powered e-learning applications do not have to worry about those kinds of problems. As the cloud based e-learning applications open the file from cloud.

E. *Benefits for students:* Students get more advantages through cloud based e-learning. They can take online courses, attend the online exams, get feedback about the courses from instructors, and send their projects and assignments through online to their teachers.

F. *Benefits for teachers:* Teachers also get numerous benefits over cloud based e-learning. Teachers are able to prepare online tests for students, deal and create better content resources for students through content management, assess the tests, homework, projects taken by students, send the feedback and communicate with students through online forums.

G. *Data security:* A very big concern is related to the data security because both the software and the data are located on remote servers that can crash or disappear without any additional warnings. Even if it seems not very reasonable, the cloud computing provides some major security benefits for individuals and companies that are using/developing e-learning solutions.

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 e-learning. 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. 2. 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.

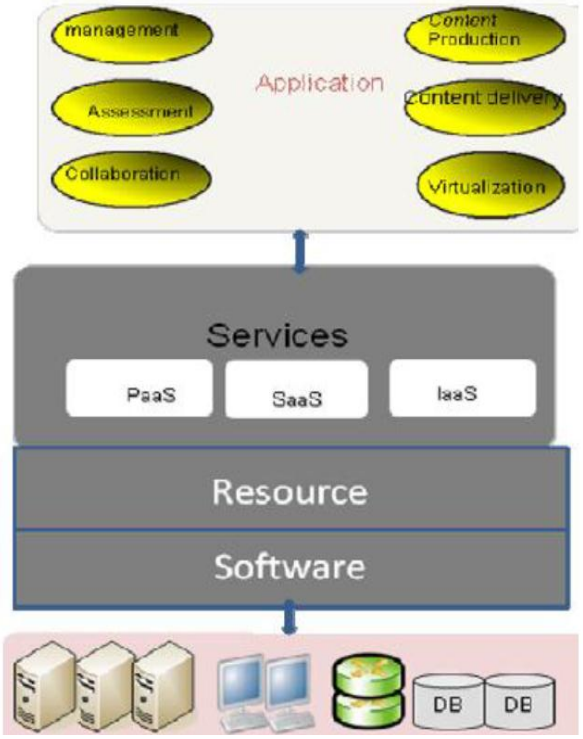

Figure 2. E-Learning Cloud Architecture.

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. 3 depicts this in a clearer view.

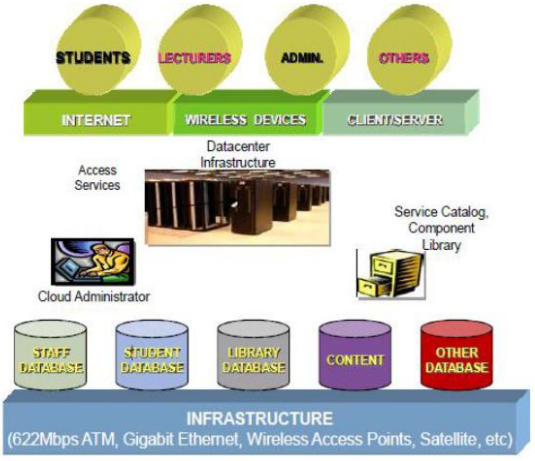

Figure 3. Proposed Infrastructure Layer in an Expandable view.

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. 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. 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. 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..

CONCLUSION

Cloud computing has recently emerged as a compelling paradigm for managing and delivering services over the internet. The rise of cloud computing is rapidly changing landscape of Information technology and ultimately turning to the long-held promise of utility computing into a reality. Cloud computing can help communities and nations, can transform education. An entire world of knowledge can now be made available to teachers and students through cloud based services that can be accessed anytime, anywhere, from any device. By helping countries worldwide, lowering the cost and simplifying the delivery of educational services, cloud computing enables students across the globe to acquire the 21st-century skills and training they need to compete and succeed in the global information society. Present economic situation will force different educational institutions and organizations to consider adopting a cloud solution. Universities have begun to adhere to this initiative and there are proofs that indicate significant decreasing of expenses due to the implementation of cloud solutions.

This paper will be the base for the development of an academic cloud based on the framework in a more effective way and it will be implemented on simulation environment / cloud test beds using standard machines, in future the same can be deployed over the real cloud environment to enhance usability of e-Learning in cloud environment for students/faculties/research scholars of universities.

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