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Cloud Computing for E-learning

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Abstract—*India always has been a centre of education, research and learning. it has a long history of organized education system in the form of gurukulas. To provide and get education is one of the characteristics that differentiate human beings from other living things. And for better education human beings are continuously improving their teaching-learning tools and techniques. Each revolution of the human society had its impact on education. The developments in information and communication technology (ICT) have brought psychological, sociological as well as technological changes in the field of education. The most recent influence of the ICT in the field of education is recognized as e-learning and cloud computing. Cloud computing based e-Learning provides any time, anywhere and any device learning. 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. E- Learning is a new tool which has the potential to enhance and support the traditional learning system. It has become an integral part of the learning tools used by every educational organization. It has been widely used because of its flexibility and the ability to work at one's own pace. Cloud computing is growing rapidly, with applications in almost any area, including education. Cloud based e-learning is the sub division of cloud computing on educational field for e-learning systems. It is the future for e-learning technology and its infrastructure. Cloud based e-learning has all the provisions like hardware and software resources to enhance the traditional e-learning infrastructure. The paper highlights the concept and services provided by Cloud Computing. This paper highlights the benefits of using cloud computing for e-learning and also focuses on Cloud Computing initiatives.*

Keywords*: cloud computing;e-learning, Saas ,IaaS, PaaS*

1. INTRODUCTION

The developments in information and communication technology (ICT) have brought psychological, sociological as well as technological changes in the field of education. 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 nature of the Internet was constantly changing from a place used to read web pages to an environment that allows end-users to run software applications. E- Learning is a new tool which has the potential to enhance and support the traditional learning system. It has become an integral part of the learning tools used by every educational organizations. It has been widely used because of its flexibility and the ability to work at one's own pace. Also, the e-learning systems need to keep the pace with the technology, so the new direction is to use cloud computing. 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.

The cloud computing is considered as fifth generation of computing with reference to mainframe, personal computer, client sever computing, and the web (Bechtolseim, 2008). In essence, cloud computing is a construct that allow you to access applications that actually reside at a location other than your computer or other Internet–connected device; most often, this will be a distant datacenter. It allows the viewers like student, faculties and staffs to use applications and access the information from any computer with internet access. The National Institute of Standards and Technology (NIST) defines cloud computing as a model for enabling on demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management efforts or service provider interaction. Cloud computing is a general term for anything that involves delivering hosted service over the Internet. The beauty of cloud computing lies in the fact that, other company hosts your application and they can handle the costs of servers and manage the software updates, and on the basis of the contract one will pay less for services. (Mell, 2009). Cloud computing based e-Learning provides continuous (any time, anywhere and any device learning) and collaborative learning.

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. 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. (Madhumathi.C, 2013)

2. TYPES OF CLOUD COMPUTING SERVICE

Currently, cloud computing customers can expect to get three types of services from cloud service providers and those three are:

1) *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, Amazon offers S3 for storage, EC2 for computing power, and SQS for network communication for small businesses and individual consumers.
2) *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.),
3) *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.

3. CLOUD BASED E-LEARNING

Cloud based e-learning is the sub division of cloud computing on educational field for e-learning systems. It is the future for e-learning technology and its infrastructure. Cloud based e-learning has all the provisions like hardware and software resources to enhance the traditional e-learning infrastructure. Once the educational materials for e-learning systems are virtualized in cloud servers these materials are available for use to students and other educational businesses in the form of rent base from cloud vendors. Cloud based e-learning architecture is mainly divided into five layers called hardware resource layer, software resource layer, resource management layer, server layer and business application layer.

- Hardware resource layer

This is bottom most layer in the cloud service middleware where it handles the essential computing things like physical memory and CPU for the total system. This layer is most important for the total infrastructure of the system. With the help of virtualization, physical servers, network and storage are grouped and called it as upper software platform. To offer the uninterruptable power to the cloud middleware services for the cloud based e-learning systems, physical host pool is expanded dynamically and memory is scalable at any time to add additional memory.

- Software resource layer

This layer is created with the help of operating systems and middleware. With the help of middleware technology, many software solutions combine to offer the grouped interface for the software developers. So, software developers can create many applications for e-learning system and able to embed those in cloud, which helps the cloud users to compute those applications through cloud.

- Resource management layer

This layer plays an important role on get loose coupling of software and hardware resources. With the help of virtualization and scheduling idea of cloud computing, it brings the uninterrupted on-demand software distribution for different hardware resources.

- Service layer

Service layer is divided into three levels namely IAAS, PAAS, and SAAS. These service layers help to cloud customers to use the various forms of cloud resources for their products like software resource, hardware resource, and infrastructure resource.

- Business application layer

Business application layer differs from all other layers in cloud based e-learning architecture, because this layer acts as important business logic of e-learning, and frames the expansion of group of components for e-learning. Business application layer mainly consists of content creation, content delivery, education platform, teaching evaluation and education management.

4. WHY CLOUD COMPUTING FOR E-LEARNING?

E-learning is an Internet-based learning process, using internet technology to design, implement, select, manage, support and extend learning, which will not replace traditional education methods, but will greatly improve the efficiency of education.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.

The students

- Take online course
- Take exams
- Send feedback
- Send homework, projects
- The teachers:
- Deal with content management
- Prepare tests
- Assess tests, homework, projects taken by students
- Send feedback
- Communicate with students (forums)

Cloud computing has a significant place in higher education in that the appropriate use of cloud computing tools can enhance engagement among students, educators, and researchers in a cost effective manner. There are security concerns but they do not overshadow the benefits. By using Cloud Computing educational institutes can concentrate more on teaching and research activities rather than on complex IT configuration and software systems management. Complexity can be reduced with Cloud Computing. Cloud solutions can be used to support cooperative learning and socially oriented theories of learning, using computer technologies to support collaborative methods of instruction. Cloud computing offers many benefits to e-learning solutions by providing the infrastructure, platform and educational services directly through cloud providers and by using virtualization, centralized data storage and facilities for data access monitoring. Using cloud computing educational institutions can collaborate with each other and create a common virtual there by reducing the expenses and the man power required to install a well equipped computing lab. Because of the following reasons like costs increase, institutional performance, competition, Cloud computing becomes an important requirement for many educational institutions. (Vitkar, 2012).

5. ADVANTAGES OF CLOUD BASED E-LEARNING

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

1) 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.

2) 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.

3) 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.

4) 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.

5) 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.

6) 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.

7) 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 provide some major security benefits for individuals and companies that are using/developing e-earning solutions. (R.Sulke, 2014)

6. CLOUD COMPUTING INITIATIVES

There are good number of cloud computing initiatives undertaken by Amazon, Google, Microsoft and others offering various types of cloud computing services for the organisations, businesses, and individuals. Some services offered by these initiatives are:

Amazon Web Services (AWS)

Amazon is perceived as one of the major players in the business, offering a wide range of prominent cloud computing services such as elastic compute cloud (EC2),simple storage service (S3), simple DB and simple queuing service (SQS). It provides a reliable, scalable,low-cost infrastructure platform in the cloud that powers hundreds of thousands of businesses in countries around the world (About AWS, 2015). Some of the solutions offered by Amazon through cloud computing include application hosting, web hosting, backup and storage, enterprise IT, content delivery, and databases. To help new users, Amazon also offers a free service for a period of one year on all its cloud computing services to launch new applications, test existing applications in the cloud, or simply gain handson experience with AWS.

Google Apps
Google Apps cloud services, a multi-tenant, internetscale infrastructure, offers faster access to innovation, superior reliability, and security, and maximum economies of scale as compared to on-premises, hosted and software plus services technologies (Google.com. Google App Engine., 2015). Google Apps is available free for individuals and organisations (limited up to 10 user accounts), educational institutions and US non-profitable organisations and for a price to businesses and organisations. Google apps offer Gmail, Google Docs, Google Sites, Google video and other services on the cloud. Google Apps helps organisations to move their e-mail services, web services and office applications on the cloud. In addition to Google Apps, Google also has 'Google App Engine' service, which enables organizations and businesses to build and host web apps on the same systems that power Google applications. It offers fast development and deployment; simple administration, with no need to worry about hardware, patches or backups; and effortless scalability (Google.com. Google App Engine., 2015).

Microsoft Windows Azure
Windows Azure is a cloud platform from Microsoft Corporation that empowers organisations to develop and run applications with unbounded scalability and ease-ofuse. With this flexible platform one can easily scale up or down to meet the demands of business. With the pay-foruse business model, i.e., one is paying for the services which are actually used while one is not paying for the services which are not used. Windows Azure allows developers to develop and run applications quickly, while leveraging current skills to develop applications with .NET,PHP, or Java (Microsft.com. Cloud Platform. , 2015). Some of the scenarios offered by Windows Azure for businesses and organisations include SaaS, storage, computing, database management etc.

Rackspace Cloud
The Rackspace cloud is a cloud computing platform that offers three types of services for organisations and businesses viz. cloud servers, cloud files and load balancers. Cloud servers are available to organisations in different sizes and are measured by the amount of physical memory reserved for an instance and range from 256 MB up to 30 GB on Operating system of their choice to run various web services. Cloud files provides an easy to use online storage for organisations to store files and media which can be delivered globally using Akamai's content delivery network (CDN). Its third service Cloud balancer helps organisations to enhance their server capacities and to balance the load factor and this service is extended only on-demand (Rackspace.com. The Rackspace Cloud., 2015)

7. 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 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.

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