E-learning in Cloud Computing Infrastructure

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Abstract

Cloud computing introduces an efficient scale mechanism that can let construction of E-learning system be entrusted to suppliers and provide a new mode for E-learning. It provides a convenient, on-demand access to a centralized shared pool of computing resources that can be deployed by a minimal management overhead and with a great efficiency. Cloud Computing is a new model for hosting resources and provisioning of services to the consumers. Therefore, an E-learning system based on Cloud computing infrastructure is feasible and it can greatly improve the efficiency of investment and the power of management, which can make E-learning system development into a virtuous circle and achieve a win-win situation for suppliers and customers. This paper discusses the recent development in e-learning and incorporates it to cloud computing because it is proven to be an advantage. Here, the author also presented the e-learning architecture in the cloud.

Keywords: e-learning, cloud computing, E-learning Architecture, SaaS, PaaS

1. Introduction

The growth of internet has been a game changer in the education sector. The internet has made it easy to for learners and educators to share information interactively, which is vital in enhancing education. Nonetheless, the storage of the content of learning has led to the adoption of cloud computing in the education sector in general and in higher education in particular. The adoption of cloud computing is in line with the objective of saving resources/saving costs and improving the interaction between students and the educators. Cloud-based learning has been slowly gaining popularity, with researchers arguing that it has the potential of replacing/improving the traditional e-learning model [1]. It is worth noting safety of information and data remains a huge priority for individuals who want to the e-learning model the best learning model for individuals learning from home and for education providers as well. E-learning has developed quickly in significance for organizations and has been to a great extent encouraged through the environment of the virtual learning condition. In
the interim numerous understudies are making their very own learning surroundings by joining the different Web 2.0 administrations they find generally helpful. Distributed computing offers new opportunities for foundations to give dynamic and forward Internet-based, e-learning applications while guaranteeing the high level amounts of security, and consistence with institutional strategies and enactment. The cloud is quickly developing in its design, the administrations offered and the coordination of organization. It brings with it risks but also possibilities for learners and for educational institutions to reduce costs and enhance services. It is likely to severely disrupt the business model developed by existing vendors of VLEs who provide an integrated suite of e-learning tools, installed and maintained by the institution’s IT services department [2]. Cloud computing can connect different geographical distribution of resources including computers, databases, storage devices, into a relatively transparent to the user’s high-performance virtual computing environment. User can access to resources through education interface. They can also access to an existing resource management system for all teaching resources database services, and can get new teaching resource data from the repository. This study mainly focuses on the research of the application of cloud computing in E-learning environment. The research study shows that the cloud platform is valued for both students and instructors to achieve the course objective. The paper presents the nature, benefits and cloud computing services, as a platform for e-learning environment.

2. Background of the Study

Cloud computing technologies have changed the way applications are developed and accessed. They are aimed at running applications as services over the Internet on a scalable infrastructure. Today and during the recent years, the Internet is a place to read web pages that allow users to environmental education and implementation of software applications that is changing. As with rapid growth of the cloud computing architecture usage, more and more industries move their focus from investing into processing power to renting processing power from a specialized vendor but education field is no different. E-learning systems usually require many hardware and software resources. Now, Cloud computing that introduces efficient scale mechanism can let construction of E-learning system be entrusted to suppliers and provide a new mode for E-learning. Therefore, an E-learning system based on Cloud computing infrastructure is feasible and it can greatly improve the efficiency of investment and the power of management, which can make E-learning system development into a virtuous circle and achieve a win-win situation for suppliers and customers. Cloud Computing is a new model for
hosting resources and provisioning of services to the consumers. It provides a convenient, on-demand access to a centralized shared pool of computing resources that can be deployed by a minimal management overhead and with a great efficiency. The term "Cloud Computing" sprang from the common practice of depicting the Internet in pictorial diagrams as a cloud Internet. Cloud Computing providers depend on the Internet as the intermediary communications medium to deliver their IT resources to their consumers on a pay-as-you-go basis. By using cloud computing consumers can access resources directly through the internet, from anywhere by using any internet devices, and at any time without any technical or physical concerns. NIST (National Institute of Standards and Technology) defines, Cloud Computing is on-demand access to a shared pool of computing resources. It is an all-inclusive solution in which all computing resources (hardware, software, networking, storage, and so on) are provided rapidly to the consumers.

3. Cloud Computing

The Cloud Computing environment ascends as a natural platform to provide support to E-Learning systems. E-learning with the combination of cloud computing provides the concept of virtual teaching and learning process. Cloud computing is attractive technology for the teaching institutes with its dynamic scalability and usage of virtualized resources as a service through the Internet. According to NIST cloud computing means "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. This cloud model is composed of five essential characteristics, three service models, and four deployment models." [4]. Cloud computing is a new computing model which is based on the grid computing, distributed computing, parallel computing and virtualization technologies define the shape of a new technology. It is the core technology of the next generation of network computing platform, especially in the field of education, cloud computing is the basic environment and platform of the future E-learning. It provides secure data storage, convenient internet services and strong computing power. Figure 1, shows the cloud computing infrastructure.
Three widely referenced service models have evolved, below the following:

- **Software-as-a-Service (SaaS):** Only hosted applications are provisioned. By using this model you can reduce the cost of hardware and the software development, maintenance and operations.

- **Platform-as-a-Service (PaaS):** In this model, the customer can develop his application on the provider supported platform. By using this model you can reduce the cost and full management complexity. The customer can manage his required software components of the platform. The development environment is determined by the cloud provider. The cloud customer has control over applications and application environment settings of the platform.

- **Infrastructure-as-a-Service (IaaS):** The Provider hosts the consumer’s virtual machines and
provides networks and storage. By using this module the customer avoids purchasing and managing the hardware and software infrastructure components, and is provided with all resources virtualized through a service interface.

4. What is E-learning?

The growth of Information and Communication Technology has significant effects on all people around the world. With this growth, people are able to connect with each other, especially through the Internet. These days, the Internet itself is drastically varying the provisions of services and goods, simply because of its features: immediacy, openness, ubiquity, and global reach. The approach of e-learning has become a powerful way to deliver knowledge considering the increase in on-line users. E-learning is a new education concept by using the Internet technology, it delivers the digital content, provides a learner-orient environment for the teachers and students. E-learning can be defined as technology-based learning in which learning material is delivered electronically to remote learners via a computer network. E-learning could be seen as a professional level of education but with the advantages of lower time and cost. Some other advantages of e-learning include larger learner population, shortage of qualified training staff and lower cost of campus maintenance, up-to-date information and accessibility. In a typical e-learning environment the lecturers, students and information are in different geographical locations and are connected via the Internet. The e-learning promotes the construction of life-long learning opinions and learning society. E-learning is a broad concept and it consists with different types, namely Synchronous and Asynchronous e-Learning. Both methods have different characteristics and they use different methods to broadcast the learning materials. Asynchronous e-learning occurs when students begin and complete their training courses at different times according to their own schedule. Synchronous e-learning allows real-time interaction and raises a sense of community among learners. Figure 2, shows the e-learning architecture [7][8].
The security is very crucial in developing an e-learning system. Current emotion-aware systems still strive to provide a means to effectively deal with important issues in e-learning such as: students’ lack of self-confidence, high dropout rates, low motivation and engagement, self-regulation and task performance. Consequently, many learning systems have been produced from current research in the areas of adaptive and personalized learning, which certainly need to consider and incorporate emotion-awareness features to enhance their ability to adapt to the real internal world of each student and to be capable of providing effective personalized feedback to a spectrum of student needs. The integration of emotion awareness can greatly advance the frontiers of educational technologies and provide an added value to enhance and improve the overall distance learning experience, as well as deliver cost-effective training programs [9].

5. Benefit of Cloud Computing to E-learning

Cloud computing, a flexible and internet-based data storage hosting service, allows eLearning providers to host their proprietary software over a centralized network. The cloud allows users to access eLearning content from anywhere with a network connection, and for the university computer lab updates are no longer a hurdle. By supporting Big Data and multimedia stream,
cloud commuting liberates providers from bandwidth limitations. E-Learning is the topic related to the virtualized distance learning by means of electronic communication mechanisms, specifically the Internet. They are based in the use of approaches with diverse functionality (e-mail, Web pages, forums, learning platforms, and so on) as a support of the process of teaching-learning. The Cloud Computing environment rises as a natural platform to provide support to e-Learning systems and also for the implementation of data mining techniques that allow exploring the enormous data bases generated from the former process to extract the inherent knowledge, since it can be dynamically adapted by providing a scalable system for changing necessities along time. The following are the advantages of e-learning.

* Easy and Quick accessibility Available to anyone 24/7.
* Reduce time and cost.
* Modular.
* Wide participation.
* Accommodating different learning styles and levels.
* A positive impact on learners, tutors, as well as the educational system as a whole.
* Effective technologies use many evidence-based strategies (e.g., immediate feedback, online content management, frequent testing and assignments, etc.).
* Proof of completion and certification, essential elements of training initiatives, can be automated.
* No cost of institute building’s rent because learning is online.
* Easy to track and prove progress for your tutors and learners.
* The institute is free from the management of different time schedule.
* Reduces overall costs of education institutes, which includes the cost of travel, lodging, meals, tutors salaries, the west of employee work time, rent of room/building, production and distribution of the course materials.
* Centralized data storage – losing a cloud client is no longer a major incident while the main part of the applications and data is stored into the cloud so a new client can be connected very fast.
* Self-paced, means learn with their own speed, so it improves the satisfaction and reduce the level of stress.
* Student motivation and Confidence that refresher or quick reference materials are available reduces burden of responsibility of mastery.
* More opportunities for distance extended learning.
A Learning Actor is any entity involved in the learning process like management, students, instructors, lab staff etc. There are four types of resources that can be provisioned and a Learning Actor can consume over the Internet [6].

- Infrastructure resources including computing power, storage, and machine provisioning.
- Software resources including middleware (cloud centric operating systems, application servers, databases) and development resources (development, testing tools, and deployment tools).
- Application resources. Educational Software applications are delivered through Software As A Service
- (SaaS) model or mashups of value-added applications.
- Learning processes. Applications exposed as utilities or tasks. Learning process sharing is the learning driven application outsourcing that supports provisioning, reuse and composition.

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, like the following:

- Improved improbability - it is almost impossible for any interested person (thief) to determine where is located the machine that stores some wanted data (tests, exam questions, results) or to find out which is the physical component he needs to steal in order to get a digital asset;
- Virtualization - makes possible the rapid replacement of a compromised cloud located server without major costs or damages. It is very easy to create a clone of a virtual machine so the cloud downtime is expected to be reduced substantially;
- Centralized data storage - losing a cloud client is no longer a major incident while the main part of the applications and data is stored into the cloud so a new client can be connected very fast. Imagine what is happening today if a laptop that stores the examination questions is stolen;
- Monitoring of data access becomes easier in view of the fact that only one place should be supervised, not thousands of computers belonging to a university, for example. Also, the security changes can be easily tested and implemented since the cloud represents a unique entry point for all the clients.
6. Cloud Based E-learning Architecture

The cloud based e-learning architecture is composed of six layers. The Physical hardware layer, Virtualization layer, Education middleware layer, Application program interface layer, Application program interface layer, Management system and Security system.

Physical hardware layer is a basic platform in model, including servers, storage equipment, and network equipment.

Virtualization layer with the feature: dynamic configuration, distributed deployment, fee measurement realizes the five characteristics of cloud computing. The goal of virtualization layer is to break completely information islands based on existing regional through the distributed technology and virtualization technology. This layer also consists of three parts: virtual servers, virtual storages, and virtual databases [3].

Education middleware layer is the core layer, because it is the basic business platform. This layer is different from existing, and all information attached to it on different computing node including ordinary file and database. So, all application systems on the middleware layer have.

Application program interface layer can guarantee model’s scalability. Because of the diversity of the existing application system and an application system cannot satisfy all the needs of customers. In this layer also provide the necessary interface beside, and still need to be able to provide hosting service [3].

Management system mainly watchers physical condition, virtualization software, hardware and software, open API. Management system can enhance the safety of the software platform.

Security system includes identity authentication and authorization, single point login, virtualization software and hardware access control and audit, the education middleware and open API access control [3].

The major players in the field of cloud computing are Google, Microsoft, Amazon, Yahoo and some legacy hardware vendors like IBM and Intel [5]. Many education institutions do not have the resources and infrastructure needed to run top e-learning solution. Moodle the biggest players in the field of e-learning software, have now versions of the base applications that are cloud oriented [5]
7. Conclusion

As cloud computing is emerging technology which can be utilized by a common handheld device it’s a beneficial to an institute so as to lower the cost of the infrastructure. In spite of storing the digital contents into a single place, cloud supports the storage in distributed manner so the access becomes concurrent and unlikely centralized systems the idle nodes are utilized, making optimal use of the applications & resources, there are several tools like Microsoft Azure using which the users can develop the cloud applications. This study mainly focuses on the research of the application of cloud computing in E-learning environment. The research study shows that the cloud platform is valued for both students and instructors to achieve the course objective. The paper presents the nature, benefits and cloud computing services, as a platform for e-learning environment.
References


