The Development of E-Learning Systems Application Based On Cloud Computing For Higher Education

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ABSTRACT

An E-Learning systems used internet technology to provide data base used for the activity of studying for higher education institution. In order to achieve the way of communication through information technology, cloud computing is a new science in the field of informatics that make the activity more fluent and easy to use. Managing students through e-learning will give positive impact to the development of e-learning systems.
This paper discusses about the development of E-Learning Systems Application Based On Cloud Computing as an immerge of information technology for higher education. There is aproposed model of E-Learning that can be applied to help students and lectures in the activity of education with terms of collaborating, coordinating and inspecting.
The results expected with this paper is that there is more preparation for higher education in providing and building their own systems by installing some important aspects such as security, viability and quick response to make internet as a smart media in achieving the goal of higher eduaction by using internet.

Keywords*: *Cloud Computing, E-Learning Systems, Implementation, Strategies.

1. Introduction

1.1. Developing Cloud Computing Based Information Systems

Information systems resources in higher education demands integrated management among academics activities through eletronic data processing systems. The trend of cloud computing has become a major choice to collaborate and put together information technology resources for the quick access of information sytems. Considering about cost savings as an impact of applying information technology resources, if customers of cloud services view an improved co-location service, it is likely that many of the more important benefits of cloud computing will go unused and likely the cost will be higher than an efficiently run self-hosted infrastructure.**[1]**

Cloud computing has a very close relationship with optimizing the information technology budgets.Nowadays, cloud computing is considered the next best thing when enterprise should optimize information technology budgets under the current economic environment. It's believed that it will become a key technology oriented at sharing in-frastructure, software or business processes. Cloud Computing is a way to serve the needs of computation through the virtualization of some resources through the Internet.[1]

Under a virtualized management, cloud computing must be accessible to users and other services through the internet technology under a pay per use payment system. Nowadays the cloud computing market includes more companies where every one of them developing the business more and more. The main reason is the acceptance and adoption of these revolutionary technologies. When speaking about Cloud Computing, risk management activities must take place throughout the life cycle of information, and risks should be re-assessed periodically or in case of a change. Therefore, companies and

organizations that have decided to use the services supplied within the Cloud must consider not only the implied savings and cost reductions but also the additional risks. Once risks are identified, a clearer picture will take shape at the level of management, of how cloud services will influence the structure and operations of economic processes. [1]

1.2. Advantages of Cloud Computing in Education

It is important to know that some benefits of using cloud systems that willbe be especially useful for both students and educators: [2]

1. Back Up availability :It is an important function of the Cloud that automatically saves content, making it impossible to delete any valuable material. This means that even if a computer crashes, all documents and content will remain safe, saved, and accessible in the cloud.
2. Storage: The Cloud allows its users to store almost all types of content and data including music, documents, eBooks, applications, photos, and much more.
3. Accessibility: Any data stored in the Cloud can easily be accessed from almost any device including mobile devices such as phones or tablets.
4. Collaboration: Because the Cloud allows multiple users to work on and edit documents at the same time, it enables effortless sharing and transmission of ideas. With this feature, group projects and or collaborative lesson plans can be optimized for both teachers and students.
5. Resource and Time Conscious: With the availability of content online, it is no longer necessary for teachers to spend time and resources printing or copying lengthy documents or lesson plans. Nowadays, students are able to access homework assignments, lesson notes, and other materials online.
6. Assignments:Students are able to access these assignments, complete them, and save them in a folder to be reviewed later.

2. Concepts and Theory

2.1. Cloud Computing Principles

Cloud computing can be defined as a model for enabling convenient, on-demand network access to a shared pool ofconfigurable computing resourcesthat can be rapidly provisioned and released with minimal management effort or service provider interaction.

There are two basic types of cloud infrastructures: internal and external. In an internal cloud, servers, software resources, and IT expertise are used inside the school system to build a scalable infrastructure that meets cloud computing requi rements. In an external cloud, service providers sell on-demand, shared services to a school. IT support, services, and expertise are included in the package; the school needs to run only the provided applications and services. [3] Cloud computing means a lot for school or district as explained below. [3].

1. Teaching and learning platforms: Servers can provide some or all software applications, operating systems, and Internet access, rather than having these installed and maintained on each platform separately. Servers deliver on demand, as needed by the school population, to the full spectrum of learning platforms and devices. For example, a single application might be shared by hundreds of students and teachers on notebooks, tablets, and desktops.
2. School IT: Cloud computing allows for costand energy-efficient centralization of school infrastructures. It takes advantage of server capabilities to adjust allocation based on demand—all invisible to teachers and students. Remote management and mai ntenance can save time and increase security. For instance, an application or operating system served by the cloud can be upgraded once at the server level, rather than on each individual

platform. Platform access can be restricted or denied in the event of a loss or theft.

3. Access: Along with the greater control for IT comes increased flexibility for teachers. They can select from the enti re pool of availabl e appli cati ons those which best complement their curriculum and students at any given ti me. The wi de range of Internet-based software and tools can also be quickly and easily served by the cloud.

2.2. Cloud Service Models

We can summarize the essential characteristics of the Cloud as below: [4]

1. *On-demand self-service*: A service consumer can automatically make use of the computing capabilities, such as server processing time and network storage without requiring human interaction with each service's provider.
2. *Broad network access*: Cloud capabilities (HW and SW) are available over the network and accessed through various platforms (e.g., mobile phones, laptops, and tablets).
3. *Resource pooling*: The provider's computing resources (HW and SW) are pooled to serve multiple consumers using a *multi-tenant* model, with different physical and virtual resources dynamically assigned and reassigned according to users demand. Multi-tenancy is the most important feature of the cloud-based application.

It is characterized by the location independence feature in which the customer has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction. Examples of resources include storage, processing, memory, network bandwidth, and virtual machines. [4]

1. *Rapid elasticity*: Capabilities can be rapidly and elastically provisioned; it can be quickly scaled out, and quickly scaled in. For the user, the capabilities available for provisioning appear to be unlimited and can be purchased in any quantity at any time.

2. *Measured Service*: Cloud systems automatically control and optimize resources use by leveraging a metering capability in which resources' usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service. The advantage here is that you are paying for exactly what you are using.

The cloud services can be categorized into *software services* and *infrastructure or hardware services*. In terms of maturity, software in the cloud is much more evolved than hardware in the cloud.

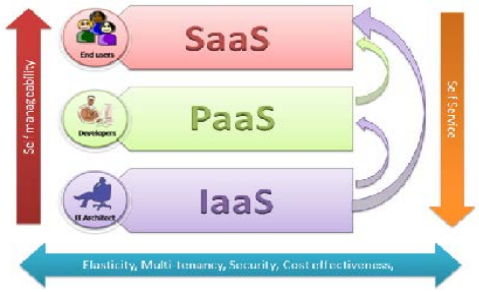

Figure 1. Cloud Service Models [4]

Cloud Software as a Service (SaaS) is basically a term that refers to software in the cloud. It represents the capability provided to the consumer to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through an interfacesuch as a web browser. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities.SaaS systems have some defining characteristics: [4]

1. *Availability via web browser :* SaaS software never requires the installation of software on your laptop or desktop. You access it through a web browser using open standards or a browser plug-in.

2. *On-demand availability :*You should not have to go through a sales process to gain access to SaaS based software. Once you have access, you should be able to go back into the software any time, from anywhere.
3. *Payment terms based on usage :*SaaS does not need any infrastructure investment or complex setup, so you should not have to pay any massive setup fees. You should simply pay for the parts of the service you use as you use them. When you no longer need those services, you simply stop paying.
4. *Minimal IT demands :*SaaS systems don't require a high technical knowledge for their configuration.
5. *Cloud Platform as a Service (PaaS).* The capability provided to the consumer is to deploy into the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider.
6. *Cloud Infrastructure as a Service (IaaS).* The capability provided to the consumer is to make use of processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications.

2.3. Abstract Layers

To begin understanding cloud computing insome sort of detail, it is necessary to examineit in abstraction layers beginning at the bottomand working upwards. Figure 2 illustrates thefive layers that constitute cloud computing.A particular layer is classified above another ifthat layer's services can be composed of servicesprovided by the layer beneath it. [5].

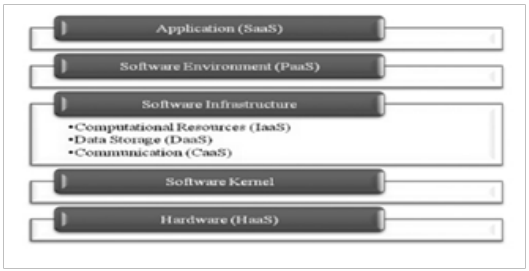

Figure 2. Abstract Layers of Cloud Computing [5]

2.4. Cloud Computing Models

There are several different cloud pricing models available, depending on the provider – the main three are tiered, per-unit, and subscription based pricing. Amazon.com's clouds offer tiered pricing that corresponds to varying levels ofoffered computational resources and service level agreements (SLAs). SLAs are part of a cloudprovider's service contract and define specific levels of service that will be provided to its customers. [5].

		Public Cloud	Private Cloud	Hybrid Cloud
Pros	1.	Simplest to implement and use	Allows for complete control of server software updates patches, etc.	Most cost-efficient through utilization flexibility of public and private clouds
	2.	Minimal upfront costs	Minimal long-term costs	Less susceptible to prolonged service outages
	3.	Utilization efficiency gains through server virtualization	Utilization efficiency gains through server virtualization	Utilization efficiency gains through server virtualization
	4.	Widespread accessibility	–	Suited for handling large spikes in workload
	5.	Requires no space dedicated for data center	–	–
	6.	Suited for handling large spikes in workload	–	–
Cons	1.	Most expensive long-term	Large upfront costs	Difficult to implement due to complex management schemes and assorted cloud center
	2.	Susceptible to prolonged services outages	Susceptible to prolonged services outages	Requires moderate amount of space dedicated for data center
	3.	–	Limited accessibility	–
	4.	–	Requires largest amount of space dedicated for data center	–
	5.	–	Not suited for handling large spikes in workload	–

Figure 3. Summary of Public, Private and Hybrid Cloud [5]

Many cloud-providers utilize perunit pricing for data transfers (as mentioned in the preceding paragraph's example of AWS Import/Export) and storage space. GoGrid Cloud Hosting, however, measures their server computationalresources used in random access memory (RAM) per hour. Subscription-basedpricing models are typically used for SaaS. Rather than charge users for what they actually use, cloud-providers allow customers to know in advance what they will be charged so they can accurately predict future expenses. [5].

3. Discussion

3.1 E-Learning Systems

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. As e-learning has a lot of advantages like flexibility, diversity, measurement, opening and so on, it will become a primary way for learning in the new century as in Fig. 4. [6]

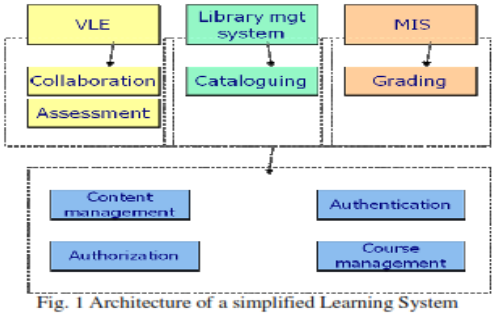

Fig. 1 Architecture of a simplified Learning System

Figure 4. Architecture of A Simplified Learning System [6]

In traditional web-based learning mode, system construction and maintenance are located inside the educational institutions or enterprises, which led to a lot of problems, such as significant investment needed but without capital gains for them, which leads to a lack of development potential. In contrast, cloud-based e-learning model introduces scale efficiency mechanism, i.e. construction of e-learning system is entrusted to cloud computing suppliers, which can make providers and users to achieve a win-win situation. The cloud-based environment supports the creation of new generation of e-learning systems, able to run on a wide range of hardware devices, while storing data inside the cloud. [6]

3.2. Architecture Review

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.

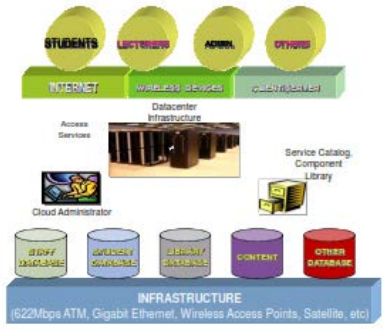

Figure 5. Proposed E-Learning Cloud Architecture [6]

The proposed e-learning cloud architecture can be divided into the following layers: Infrastructure layer as a dynamic andscalable physical host pool, software resource layer that offersa unified interface for e-learning developers, resource management layer that achieves loose coupling of softwareand hardware resources, service layer, containing three levelsof services (software as a service, platform as a service and infrastructure as a service), application layer that provideswith content production, content delivery, virtual laboratory, collaborative learning, assessment and management features. [6]

1. 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 intraditional teaching model and distributed in different departments and domain. This layer is located in the lowestlevel of

cloud service middle ware, the basic computing powerlike 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 toenhance physical computing power for cloud middle wareservices. The following Fig. 4 depicts this in a clearer view.

2. Software resource layer mainly is composed byoperating system and middleware. Through middle ware technology, a variety of software resources are integrated toprovide a unified interface for software developers, so theycan easily develop a lot of applications based on soft ware resources and embed them in the cloud, making them available for cloud computing users.
3. Resource management layer is the key to achieveloose 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.
4. 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 computingservice is provided to customers. As is different from traditional software, users use software via the Internet, not toneed a one-time purchase for software and hardware, and notto need to maintain and upgrade, simply paying a monthly fee.
5. 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 theteachers, 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 progressmay 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.

3.3. Adoption of Cloud Computing in Higher Education

In many technology arenas, higher education exhibits two behaviors. As regards networking and high-performance computing, higher education enjoys a reputation as an innovator. The world's first computers were developed atHarvard, MIT, the University of Manchester, and the University of Pennsylvania, and the first four nodes of the Arpanet were located at UCLA, Stanford Research Institute, UC Santa Barbara, and the University of Utah. [7] On the other hand, higher education is a relative late adopter in the applications and IT support arena.This relates chiefly to the unique policy environment that regulates the acquisition, storage, and dissemination of higher education information and also to a unique perspective that arises from viewing one's organization as perpetual. On a less noble note, colleges and universities rarely account for the totalcost of delivering IT infrastructure, services, and support and rarely pay for key cost drivers such as space andutilities directly and hence have no easy means of comparing the costs of self-operation and sourcing alternatives. Colleges and universities also have legitimate and pressing IT security concerns and a high sensitivity to adversepublicity. [7].

4. Conclusion.

Cloud computing is a new innovative systems using technology where in higher education, all academics activities are supported with coordination and collaboration according to academics calendar. A proposed model of cloud computing where e-learning applied must go through some steps that have been tested

and ajustable for higher education. As the application of systems can be designed economically, it is our choice now as the decision makers and actors who can make the systems run well with the help of information technology in good planning under higher education campus.

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