



# Cloud Computing: An Application in Higher Education.

Author: Sharmila Rajesh Ponnoran, PhD in Computer Science from Sri Satya Sai University of Technology & Medical Sciences-Sehore, MP.

## Abstract :

Distance learning is a term which is known to almost everyone. In the olden days, many students used distance learning. However, the concept of learning was different because there was no internet at that time. In the past, the institute sent research materials to students and took the exam by mail or in physical mode at the institute itself. Students need to study independently.

Distance learning was just one of the experiences that demonstrated the value of the cloud in business. In a sense, the cloud is a second generation remote learning engine, essentially Rev. 2.0. Cloud computing solves many problems and brings many opportunities to educational institutions. Multimedia interactive instructions from cloud providers improve the quality of education by allowing ideas to be explained in any combination of images, sounds, texts, or media, thereby improving the level of knowledge acquired. It shows the possibility. Today, in a pandemic situation, everyone understands the importance of e-learning.

Key words: cloud computing, higher education, distance education, e-learning

## I. Introduction:

Cloud is the most powerful term in the IT industry right now. Cloud computing(CC) – a relatively recent term, builds on decades of research in virtualization, distributed computing, utility computing, and more recently networking, web and software services (Vouk, 2008). One of definitions for a Cloud OS is simply a simplified operating system that runs just a web browser, providing access to a variety of web based applications that allow the user to perform many simple tasks without booting a full scale operating system (Betonio, 2011). A study by McKinsey (the global management consulting firm) found that there are 22 possible separate definitions of cloud computing. A more commonly used definition describes it as clusters of distributed computers which provide on demand resources and services over a networked medium (usually the Internet) (Sultan, 2010).

In recent years, the concept of "cloud computing (CC)" has emerged as a viable and promising solution to the challenges of distance learning. Providing IT budget solutions and escalating IT requirements. CC is a model for convenient on-demand network access to shared pools of configurable computing resources (networks, servers, storage, applications, services, etc.). These devices are quickly provisioned and released with minimal management or interaction with the service provider. Users can access these resources from any computer using a high-speed Internet connection without having to make other connections to the hardware hosting the source software [4]. Because the calculations are done on a remote server, the user's hardware and software requirements are much lower than usual, reducing both cost and maintenance[5]. For this reason, CC is very important for higher education institutions that want to reduce their IT budget.

The role of Higher education (HE) for overall development of society is very important. The collaboration between universities, government and industry, researchers and students has proven their contribution to the transformation of society and the entire world economy [1]. During the last few years, the universities offering higher education are making transition to research universities [2,3]. Universities/institutes use IT infrastructure as foundation for their educational activities and Science research. With the evolution of technology and due to pandemic situation all around the world all educational services migrates from traditional form to the online form. These educational services, requires an adequate IT infrastructure using the proper technologies, guaranteeing the access of large number of users, fast and secure service access.

Cloud computing provides economies of scale through the aggregation and virtualization of computing resources. Cloud computing guarantees the global reach of information and services. Use a computing environment that offers on-demand scalability, performance assurance, minimal upfront investment, and ongoing cost savings. In short, the cloud provides educators with an architecture that provides pre-packaged educational services and solutions with the skills needed to operate and maintain them.

In this paper we will discuss about how cloud computing supports higher education? In section 1 we will see how cloud computing works. Section 2 will brief about how CC relates to higher education. Section 3 will talk about one of a case study of using CC in academic.

## II. Working of Cloud Computing

### A. SERVICE MODELS

Cloud computing generally refers to an Internet-based computing model that various PCs and servers are associated with internet, operating systems, software and database. These resources can be shared by multiple clients based upon their demands (Chi and Gao, 2011). Cloud computing do offer the computing resources *as a service*, meaning that the resources are owned and managed by the cloud provider rather than the end user. Those resources may include anything from browser-based software applications, third party data bases, or third-party servers used to support the computing infrastructure of a business, research, or personal project.

CC has three main service models which are based on the type of resource being offered. These are Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS).

#### i. SaaS

SaaS provides users access to various applications over a widerange of devices through a APIs or a thin clientsuch as web browser over the internet [1]. Users are able to access these applications at any time in any place and are able to continue from where ever they stopped the previous time[7]. Because of the possibility of accessing course content anytime and anywhere, knowledge sharing can be improved among users in HEIs [14]. In SaaS applications are delivered through the medium of the Internet as a service. It helps organizations with limited IT resources to deploy and maintain needed software in a timely manner while, at the same time, reducing energy consumption and expense. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management.

Examples of popular SaaS providers include:

- BigCommerce.
- Google Workspace, Salesforce.
- Dropbox.
- MailChimp.
- ZenDesk.
- DocuSign.
- Slack.
- Hubspot.

## ii. IaaS

IaaS provides users with access to computing resources; infrastructure such as storage, processing and networks over the internet [7]. IaaS allows users to be able to run applications on remote devices. Also users can save their data on the provided resources without having to worry about the management and maintenance [1].

Examples of popular IaaS providers include:

- AWS EC2.
- Rackspace.
- Google Compute Engine (GCE).
- Digital Ocean.
- Microsoft Azure.
- Magento 1 Enterprise Edition\*.

## iii. PaaS

PaaS allows users to deploy their own applications onto the cloud platforms and gives them control over their applications [7]. The service provider is left with the responsibility of managing and controlling the underlying infrastructure such as servers, networks, storage and operating systems [1]. PaaS is the operating environment in which applications run. PaaS is a way to rent hardware, operating systems, storage and network capacity over the Internet. It is an outgrowth of Software as a Service (SaaS), a software distribution model in which hosted software applications are made available to customers over the Internet (Rouse, 2010).

Examples of popular PaaS providers include:

- AWS Elastic Beanstalk.
- Heroku.
- Windows Azure (mainly used as PaaS).
- Force.com.
- Google App Engine.
- OpenShift.
- Apache Stratos.
- Adobe Magento Commerce Cloud.

Here are some examples of cloud Computing Operating Systems are:

1. Glide OS - Glide is a free suite of rights-based productivity and collaboration applications with 30GBs of storage.
2. Amoeba OS - is an advanced Online Operating System. Log in to your free account and join a cloud computing revolution that begins with great apps like Shutterborg, Exstream and Surf.
3. MyGOYA - is a free online operating system. Your own personal desktop can be accessed from any Internet PC in the world and includes e-mail, chat, filesharing, calendar and an instant messenger. Manage your contacts from anywhere in the world.
4. Kohive - is an online desktop where you can easily collaborate with others
5. ZimdeskOS - is your computer on the web – the entire functionality of a PC – online. There is nothing to install. A web browser and internet connection are all you need to access your desktop, files and favourite applications. You can access your data anytime from anywhere, from any PC.

## B. DEPLOYMENT MODELS of CC

Just as there are service models, CC also have deployment models. These are private cloud, community cloud, public cloud and hybrid cloud.

### i. Private cloud

In a private cloud, the infrastructure is owned by some organization. Organization uses the cloud as good as they have physical system in their organization. In this case cloud infrastructure is dedicated for use by a single organization with different divisions such as a university with different faculties and departments. The university, institute or a service provider owns the infrastructure. The university can manage it

themselves or let the service provider manage it for them. The infrastructure can be either on premises or off premises. This deployment model gives the university more control of the infrastructure and data because it is owned and used exclusively by the university. In this case the data security is very high as all the servers are private to the university or institute.

ii. *Community cloud*

If there are two or more organizations with similar goals then they can share the cloud infrastructure is called as community cloud. [7]. For example, one or more universities or a service provider can own, manage and use the cloud infrastructure. The infrastructure can be in shared one or more of the universities that makes up the community. The infrastructure could also be at a service providers premises or some part of the infrastructure could be in one or more of the universities while the remaining part could be at the service providers' premises [1].

iii. *Public cloud*

In a public cloud, the cloud infrastructure is dedicated for use by the general public. It could be used by individuals, businesses, government organizations and any one from the general public. It is owned by the service provider who controls the infrastructure [1].

iv. *Hybrid cloud.*

Hybrid cloud is a combination of two or more deployment models. For example, a university could use private cloud for their sensitive data for a sake of security and use public cloud for their less sensitive data which can be handled by all users [1].

### III. Cloud benefits for Higher Education.

Cloud computing has a prominent role to play in the classrooms of tomorrow. Cloud computing can democratize education. For example, many schools suffer from low graduation rates directly attributable to insufficient infrastructure – shorthanded staff, tiny classrooms, lack of teachers [3]. Cloud computing solutions can solve many of these problems. Typically, the cloud computing infrastructure resides in a large data centre and is managed by a third party, who provides computing resources as if it were a utility such as electricity, accessible by anyone, anywhere with an Internet connection [4]. Some countries are already moving in this direction.

Out of the three services provided by CC, Software As A Service (SaaS) is used highly in Higher Education. SaaS offers many benefits for higher education institutions and it has the capability to improve the learning process in HEIs. Some of the benefits SaaS offer HEIs include:

1. *Access from any place at any time*

Due to CC as a SaaS, students, lecturers, administrative staff and other cloud users in the institution can access the cloud from any place at any time and continue their work without losing any data. This will help them in completing their tasks on time [2]. For example, students can now continue with their assignments at home or wherever they are provided they have internet access. As a result, everyone will be able to meet their deadlines.

2. *No installation is required by the institution*

As service provider provides all installation, the time needed for installation and upgrades of software and applications could be used for other important tasks. [5].

3. *Cost reduction*

HEI can save the money needed for purchasing and licensing of software and applications. The money needed for maintenance could also be saved and used for other important tasks [2].

4. *Ease of use*

The software provided by cloud service providers has very easy GUI that anyone can use it easily. This makes it easy for users to be able to understand and use cloud applications and software with little or no training [3].

5. *Increases collaboration and knowledge sharing among institutions*

Students, lecturers and other cloud users in institutions can share knowledge and ideas easily in a community cloud. This will assist them in keeping up to date with other institutions [3].

## 6. Scalability

The number of cloud users in an institution can be increased or reduced at any time depending on the institutions requirements. This helps the institutions to maximize the use of resources and only use and pay for resources that are utilized[7].

The potential of cloud computing for improving efficiency, cost and convenience for the educational sector is being recognized by a many institutions. Cloud benefits for education are obtained through Flexible services - Drive innovation with data services in the cloud that students, teachers, faculty, and staff can reuse. Offer your own data mash-ups on a portal.

Infrastructure - Get all the IT resources you need, only when you need them, managed securely and predictably. And pay for only what you use.

Applications and content - Rather than waiting in the software procurement line, get hosted software, datasets, and services so fast you'll have plenty of time to work on your mission.

Policies and regulations - Proceed carefully, but note how cloud computing can help you meet your institution's compliance requirements.

Creative IT - Free your IT department from a keep-the-lights-on approach to foster some creative problem solving that can help teachers better engage their students.

## IV Conclusion

Today's companies are looking for innovative ways to grow and achieve their business goals. With the help of cloud computing, this business will continue to grow in the future. Powerful and scalable cloud computing continues to grow and offers many benefits in the future.

Cloud computing is very cost effective and enterprises can use it to grow. The future of cloud computing is bright and benefits both hosts and customers.

Education providers need to be familiar with the latest developments in cloud technology.

Hopefully that will increase the level of education quality offered by the faculty as well as the research work of students and academic staff. In future as more and more cloud services are adopted by HEIs, there should be standard SLA's that will help reduce the issues with SaaS adoption such as security and legal issues.

## References -

1. Paul T. Jaeger, Jimmy Lin & Justin M. Grimes (2008): Cloud Computing and Information Policy: Computing in a Policy Cloud?, *Journal of Information Technology & Politics*, 5:3, 269-283 <http://dx.doi.org/10.1080/19331680802425479>
2. Sultan N. (2010): Cloud computing for education: A new dawn?, *International Journal of Information Management*, Volume 30, Issue 2, April 2010, Pages 109–116.
3. Vouk M. (2008): Cloud Computing – Issues, Research and Implementations *Journal of Computing and Information Technology - CIT* 16, 2008, 4, 235–246 doi: 10.2498 /cit.1001391
4. Betonio D. (2011): 12 Excellent Cloud Computing Operating Systems <http://www.tripwiremagazine.com/2011/04/12-excellent-cloud-computing-operating-systems.html>
5. Cloud computing in education (2010): [www.microsoft.com/educloud](http://www.microsoft.com/educloud)
5. Fox, A. (2009). Cloud computing in education. Berkeley iNews, <https://inews.berkeley.edu/articles/Spring2009/cloud-computing> (accessed on: 29 July 2009).
6. Kowalenko K. (2012): Coming Soon: New Cloud Computing Services, 7 Юни 2012, <http://theinstitute.ieee.org/benefits/products-and-services/coming-soon-new-cloud-computing-services>
7. Larson L. (2012): Web 4.0: The Era of Online Customer Engagement, Published January 5, 2012, <http://www.business2community.com/online-marketing/web-4-0-the-era-of-online-customerengagement-0113733>

8. Rouse M. (2010): Platform as a Service (PaaS) <http://searchcloudcomputing.techtarget.com/definition/Platform-as-a-Service-PaaS>
9. Sourya B. (2011): How Can Cloud Computing Help In Education? <http://www.cloudtweaks.com/2011/02/how-can-cloud-computing-help-in-education/>
10. Teylor F. (2010): Cloud Computing, 10 Web Operating Systems, <http://www.admixweb.com/2010/07/23/cloud-computing-10-web-operating-systems/>
11. Uskov V. (2010): Transforming Web-Based Education: From Web2.0 to Web4.0, [http://www.ineer.org/Events/ICEE2010/presentations/Pres\\_1303\\_1425\\_USKOV.pd](http://www.ineer.org/Events/ICEE2010/presentations/Pres_1303_1425_USKOV.pd)
12. P. Mell and T. Grance, "The NIST Definition of Cloud Computing: Recommendations of the National Institute of Standards and Technology," September 2011. [Online]. Available: <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf>. [Accessed 18 July 2014].
13. K. Yadav, "Role of Cloud Computing in Education," International Journal of Innovative Research in Computer and communication Engineering, vol. 2, no. 2, pp. 3108 - 3112, 2014.
14. N. Deepa and R. Sathiyaseelan, "The Cloud and the Changing Shape of Education - Eaas (Education as a Service)," International Journal of Computer Applications, vol. 42, no. 5, pp. 4 - 8, 2012.
15. T. Rostami, M. K. Akbari and M. S. Javan, "Benefits, Weaknesses, Opportunities and Risks of SaaS adoption from Iranian organizations perspective," Advances in Computer Science: an International Journal, vol. 3, no. 1, pp. 82 - 89, 2014.

