

# Role and Service of Cloud Computing for Higher Education System

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**Abstract:** Higher education has vital role in the development of society and nation. Therefore education methodologies should adapt new technologies and IT infrastructures in education system. To implement new technical infrastructure in an educational institute impose a big cost of implementation and maintenance of infrastructure, this may be a limit for various institutions to adapt new IT infrastructure. For institutions, having financial limitations, cloud computing is a feasible solution. With cloud computing we can hire service and infrastructure on lease as per the need of institution. Institution does not develop as well as maintain the complete infrastructure by its own. Institute needs to invest as their requirement. In this paper, limitations / drawbacks of traditional education system and benefits of education with cloud computing are discussed. And also discuss about the cloud services which are useful for educational institutes for their students, teachers, researchers, and as well as for administration staff.

**Keywords:** Cloud Computing, Higher Education, SaaS, PaaS, IaaS.

## I. INTRODUCTION

Higher education institutes are key organizations for development of society and nation. In last few years universities are implementing high end IT infrastructure for their higher education and research activities. With the evolution of new technologies traditional education system is being migrated toward online education system [2]. These new trends in education system requires an educate infrastructure with proper technology that guaranty the access for large number of users with security. It is necessary to use IT infrastructure effectively in higher education to provide high quality education and research activity. Adaptation of new technology is very slow due to financial limitation of higher education institutes. In past few years cloud computing is an emerging solution for the challenges related to IT infrastructure cost. Cloud computing is a model for accessing a shared pool of configurable resources (for example servers, network devices, storage, applications, operating systems etc.) that can be dynamically allocated as per user requirement [1]. These all resources can be accessed from anywhere using any device having high speed network connectivity because the entire computational task is performed at remote server or cloud server. As all the computational task is performed at cloud server, user does not require a high configuration machine. This reduced the cost to

maintain IT infrastructure in organization [3][5]. Thus the cloud computing is a feasible solution for a higher education institute for transiting from a traditional education system to a online or digital education system. In these days, every student is familiar with computer and smart systems like smart phone, tablets etc., and they all are using cloud based technologies (Facebook, WhatsApp, Twitter, Instagram, Gmail etc.) and has connected to internet all the time. Thus it is not difficult to implement cloud based technologies in educational system. By implementing cloud technologies in education system make it is convenient for students. They can access any learning content from anywhere any time. It improves availability of education and also helps in evaluation of student performance [4].

## II. LIMITATION / DRAWBACKS OF TRADITIONAL EDUCATION SYSTEM

As traditional education system every student is treated as same regardless of their caliber of learning. Teachers lecture is generally like one size fit all. Each student has different pace of learning. Teacher does not consider the ability, likes and dislikes of student. Therefore traditional education system is very unfair at core [9, 10]. Traditional education system is like a spoon feeding process as it does not contain any additional contents like demonstrative videos or any other digital media which helps student in acquiring the subject contents easily. Teachers and students meet every day in classroom; teachers see every activity of students. Teachers show favoritism which destroys personality and moral dignity of student. They feel incompetent and worth less. Moreover; traditional education system is very costly as tuition fees, books, notebooks are very costly. For overcoming on these drawbacks of traditional education system cloud computing has very important role in higher education system [9, 10].

## III. CLOUD COMPUTING

Cloud computing provide various facility to user to store and process huge amount of data through internet or network access to a shared pool of configurable resources (e.g. servers, network devices, storage, applications, development tools, operating systems etc [1]. NIST cloud model specify five essential characteristics, three services models and four deployment models.

### 3.1. Five characteristics of cloud computing are as following [1] –

- ❖ On demand self-service.
- ❖ Broad network access.
- ❖ Resource pooling.
- ❖ Rapid.
- ❖ Measured.

### 3.2. Three service models of cloud computing are as following –

**Software as a Service (SaaS)** – applications are provided to user which is running on cloud server. Applications can be accessed from different devices through a client interface such as web browser or a program interface [1, 2].

**Platform as a Service (PaaS)** – the capability of cloud system provided to users to deploy their own applications on cloud. It provides support for programming, libraries services, network devices, servers, operating systems, development tools etc. [1, 2].

**Infrastructures as a Service (IaaS)** – in this model various fundamental computing resources like processing, network and network devices, storage are provided on cloud system. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications [1, 2].

### 3.3. Four deployment model of cloud computing are as following –

**Private Cloud** – in this deployment model of cloud computing, cloud infrastructure is developed for exclusive use of a single organization. The cloud system is managed by the organization itself or may be by third party organization. Benefit of private cloud is that organization has better management and control over data. Private cloud is suitable when privacy and security of data is major concern [1, 2].

**Public Cloud** – in this model of cloud computing cloud services are hosted on a public cloud and are delivered to users over a shared network (Internet) which is open to public. From the technical point of view, there is no difference in public and private cloud regarding structural design except the privacy and security level provide the cloud’s vendor. The main advantage of public cloud is cost of uses. Private cloud is cheaper than private cloud [1, 2].

**Hybrid Cloud** – this cloud is mix of private cloud and public cloud. Some services are borrowed from public cloud and some services are hosted on private cloud. Workloads which are not critical hosted in public cloud managed by third party vendors and workloads which are

critical in privacy and security concern must be hosted on internal (private) cloud [1, 2].

**Community Cloud** – in this type of deployment model entire cloud infrastructure is shared among different organization related to same community i.e. banks and trading firms. A community cloud is appropriate for organizations and businesses that work on joint ventures, tenders or research that needs a centralized cloud computing [1, 2].

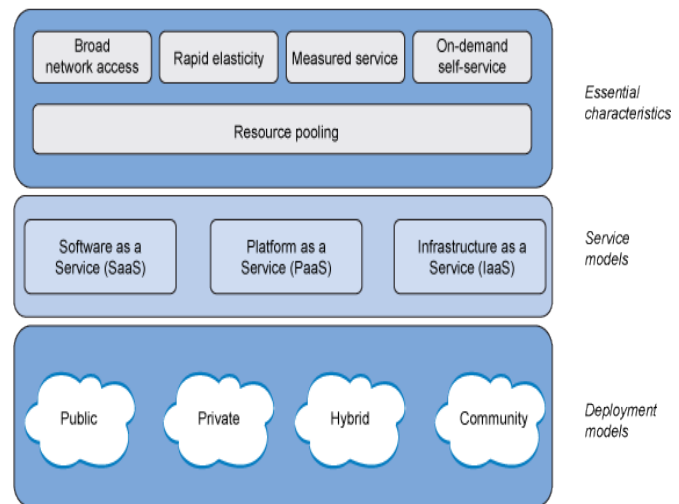


Figure 1 – Basic Cloud Model of NIST [1]

## IV. CLOUD COMPUTING IN HIGHER EDUCATION

Cloud computing is an emerging tool for education. It brings all new-resources, digital contents like cloud based text books, multimedia learning contents, virtual labs and administrative tools for educational institutions. It brings changes, progress, and opportunity for educational institute [7]. With the use of cloud computing workload of IT staff is reduced so that they can focus strategies to better and efficient use of IT infrastructure [2, 3]. Use of cloud computing enables students and teachers to access more resource and work in collaborative manner with institutes and they can communicates and share resource and ideas with other students and teachers of different institute at anytime and anywhere [1, 2]. All the educational institutes do not have same resources due some constraint like financial or any other constraint. They can access these resources on cloud by paying nominal charge for cloud providers. An higher educational institute can access resource from cloud as per their need like software’s, servers, computing , network devices, virtual labs, journals, textbooks, multimedia contents, and various other tools those helpful in their research work and learning. Thus cloud computing is beneficial for higher educational institutes for carrying out their research work and to improve learning of student as well as teaching and evaluation practice of teachers [7]. Cloud computing

reduced total IT infrastructure cost for institute because it is managed by cloud providers. Therefore cloud computing has many benefits for a higher educational institute regarding their research work, learning, teaching as well as cost of infrastructure. Some key benefits of cloud computing in higher education are [2, 3] -

- ❖ Expensive textbooks are not required, digital books are used which are accessible from anywhere and anytime.
- ❖ Learning material is latest and updates. Student does not require using an outdated learning material. All learning material is accessible from anywhere and anytime.
- ❖ Expensive hardware (servers, supercomputing etc.) does not require. Institute can get these from cloud as pay per use. Cloud based hardware's are accessible from anywhere and anytime.
- ❖ Expensive software (web server, MS office, operating systems, development tools, etc.) does not require. Cloud based software's are accessible from anywhere and anytime.
- ❖ More opportunities and resources are available on cloud which is beneficial for students as well as students.

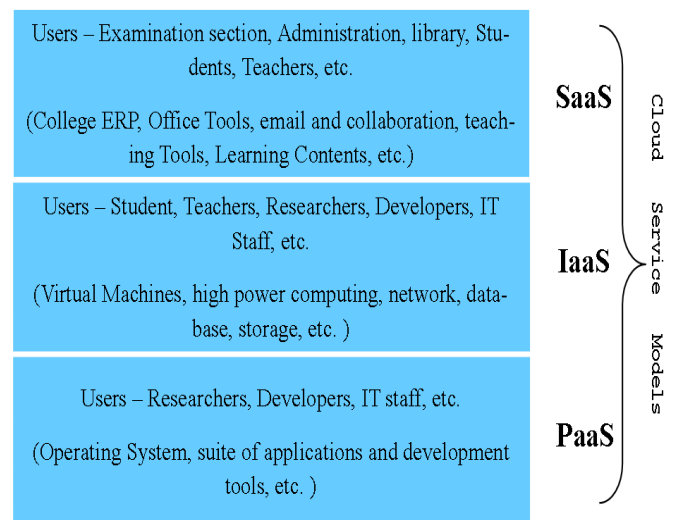


Figure 2:- of classification of cloud services related to Educational Institute [7]

### V. SOME COMMERCIAL CLOUD VENDOR

There are various vendors in market which provide cloud services commercially. A higher education institute can use these services on pay per use basis. These available cloud services are very useful for improvement in learning and teaching. Some of commercial vendor's services are described below in table (source: - vendors website) with respect to users of a higher education institute.

Table 1 - commercial vendor's services with respect to users of a higher education institute

Cloud Service Model	Google Platform	Cloud	Amazon Services	Web	Microsoft Azure	User's Level		
						Admini stratio n	Teachers & Researchers	Studen ts
IaaS	Google Engine	Compute	Amazon EC2		Azure Virtual Machines		Yes	Yes
	Google Bigtable	Cloud	Amazon DynamoDB				Yes	Yes
	Google Datastore	Cloud	Amazon DynamoDB		Cosmos DB		Yes	Yes
	Google Storage		Amazon S3		Azure Blob Storage	Yes	Yes	Yes
PaaS	Google App Engine		AWS Elastic Beanstalk		Azure Cloud Services		Yes	Yes
SaaS	Google BigQuery		Amazon Redshift		Microsoft Azure SQL Database		Yes	Yes
	Gmail				Hotmail	Yes	Yes	Yes
	Calendar				Calendar, Task	Yes	Yes	Yes
	Google Docs				Office 360	Yes	Yes	Yes
	Google Drive				One Drive	Yes	Yes	Yes
	YouTube						Yes	Yes
	Hangout					Yes	Yes	Yes
Classroom					OneNote		Yes	Yes

## VI. CONCLUSION

Traditional education system has some drawbacks related to methodologies of teaching; teacher's teaching methods are not related to student's caliber and adaptation capacity. It does not include additional contents which may be helpful learning for students in their learning and evaluation process. Students needs to purchases costly books, notebooks and other learning accessories by own. Traditional education system can be opted only in classrooms. Thus traditional education system imposes some limitation in learning and evaluation of students and teachers. To overcome limitations of traditional education system cloud computing solutions are very useful for educational institutions especially for higher education institutes. With the involvement of cloud computing in education system student can get access to various resources (i.e. – text books, journals video lectures, demonstrative videos and lab infrastructure etc.) which are not possible in traditional education system. Teachers can evaluate students in better way; researchers can get all the facilities and infrastructures related to their research field. Not only teachers and students as well as administrators can opt for good tools for administration purpose. In overall cloud computing has various services which may be included in traditional education system.

## VII. REFERENCES

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