A Revolutionary Change in Education Sector: Cloud Computing

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ABSTRACT: Education plays a vital role in constructing a student with robust knowledge and information that gradually grows over time which in turn helps the economic growth of that nation. Giving students theoretical knowledge and not emphasizing on the practical use of it can be a serious problem for the growth of the student as well as the education system. Current education system is lacking as students are unable to use the knowledge learnt in day-to-day life. A technological advancement that can be inculcated in the current educational system is cloud computing. Cloud Computing offers features such as self service, optimization, customization, elasticity and availability. These services are provided to the end user at minimal cost, making cloud computing center of attraction in the world of technology & digitization. This research paper focuses on the present scenarios of education system and how cloud computing will be beneficial in the future for enhancing the education system for better productivity and practical utilization.

KEYWORDS: Cloud Computing, Education system, e-Learning, SaaS, PaaS, IaaS.

I. INTRODUCTION

Cloud computing is a buzzword as it happens to appear in almost all IT magazines, blogs and websites. Cloud refers to a network in which resources are stored and accessed as per use. Computing of these resources for higher level services with easy management often over the internet is called as cloud computing. Cloud computing helps user to access, configure and use services offered by the cloud at anytime and anywhere. The National Institute of Standards and Technology characterizes cloud computing using these five essential characteristic as on-demand self-service,broader network access, resource pooling, rapid elasticity and measured service [9]. Cloud computing was made technological success and was made popular when Amazon released its Elastic Compute Cloud (EC2) which enabled renting of computers to required users to execute their applications.

The education system currently being used now is based on the traditional infrastructure. It consists of physical resources such as various personal computer which are connected to each other by a network using remote servers. The expenditure on the traditional infrastructure consists of buying physical pieces of hardware, setup and upgrading the hardware to meet the technological advancements happened over time. Efforts are made for crash recovery as hardware can cease to work due to any uncontrolled actions. In cloud computing, access methods and the cost changes as we introduce cloud in the infrastructure. Cloud computing can be considered as a virtual hosting platform. Instead of expending capital on physical resources, all the servers, software or networks can be hosted on cloud. To make the infrastructure less tedious, the cloud can be managed off premises by third party organizations. Cloud architecture consists of two vital components that are front end and back end which are connected to each other using communication medium such as internet. Front end component deals with the client infrastructure which using interfaces or applications to enable the user to access cloud computing services,such as web browser. The back end is the cloud itself consisting of all the resources as storage, virtual machines, servers, deployment models, cloud services, etc. Cloud computing cuts off expenditure that makes the economic growth of the organization stable. Security issues are managed by role based access which takes care of unauthorized access. Cloud computing promises quality of service to any user accessing the cloud from anywhere at anytime [9].

Education nowadays are not restricted in the classroom and in front of the teacher. By using a internet connection anyone can learn anything at anywhere. Inculcating cloud can help handicapped students, students wanting to complete their studies after taking a break or the students who stay miles away by accessing resources available on the cloud. Virtual universities and classrooms in which students attending lectures on their own place using personal computer having internet connection can be possible future to the educational system. The institution can opt for an cloud management service in which the service provider provides with all the softwares and development tools at a cost much lesser if compared to buying computers, installation and paying for individual software and their licenses which can be used in the institution, outside the institution or both. Traditional education system uses restricted applications such as library management or attendance manager and are limited to powerpoint presentation, videos and documentaries. Using the cloud services discussed above, a practical and much more interactive teaching can be given to the students making it easy and efficient.

II. CLOUD COMPUTING

There are many definitions already existing to define what is Cloud Computing. Based on the definition provided by Google, cloud computing refers to standards that are open service based, secure, accessible, accessible by internet, rapid network computing and data storage services. Cloud Computing can also be defined as the resources that can be accessed widely and can be used by different users over the web[1]. The National Institute of Standards and Technology (NIST) defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction"[5]. It is also known as the process of running an application or the program over several computers that are connected by the network. Despite the change in different definition it basically means a computing model that is internet based. Cloud computing permit the people to pay for the services that will be used by them which includes the processing time, memory and the bandwidth, hence making it cheaper. The quantity and the payment of the resources entirely depends on the amount of the resources that are utilized. The end users need not purchase any new equipment or hardware, or need to update the existing hardware or data sync techniques since the applications of cloud computing includes all the services that are required. The cloud is comprised of four deployment models and three service models. The deployment models are categorized into Public, Private, Public + Private and Community. Service Models composed of Software as a service (SaaS), Platform as a service (PaaS), Infrastructure as a service (IaaS) [9].

III. SERVICE MODELS

Cloud computing offers different types of services. The different types of services are listed and discussed below:

A.   Software as a Service (SaaS) [10]

Education is believed to be benefited the most from this type of service.SaaS uses the web to deliver the applications that are addressed by the third party people and whose interface is accessed on the client's side. Most SaaS applications require some plugins but they run without any extra installation or downloads. This service allows the consumer to access all the application that are running on the cloud infrastructure. Based upon the need the customer can select the applications that are provided by the service provider. In this data along with the applications can be stored. Students as well as the staff members can access special software that are required to run experiments without putting any extra efforts and thus minimizing the burden on the institution. SaaS service providers include NetSuite, Google, Citrix.

B.   Platform as a Service (PaaS) [10]

It is an operating environment which helps the application to run. In a nutshell, it can be defined as with the help of PaaS the user can develop the application or the required services in the cloud that do not require any specific platform to run hence the need to buy and manage the associated hardware and software is eliminated and thus making it cost effective. It can widely be used and be available to the other users over the Internet. PaaS enables the customer to rent virtual servers, as well as other services required to operate the applications. Client can also deploy and control applications but they are not able to control the infrastructure,hardware ,and the operating systems. PaaS makes the

development, testing, and the deployment of the applications fast, simple, and the cost productive. Some of the characteristics include irregular software upgrades, optimized security, and easy deployment. The providers of PaaS include Google App Engine, Amazon's Relational Database, Salesforce.com, Microsoft Azure, as well as Rackspace Cloud Sites.

C.   Infrastructure as a Service (IaaS) [10]

It can be used to satisfy the needs of the students or the staff globally or locally with some specification that are used for the specific task. IaaS is used for executing the application and operating systems, maintaining and operating the various equipment. Here the basic resources like storage and the processor are available to the consumer on rent basis. They can rent the services and use them to run their own operating systems and application. Customers only pay for the resources that they use and the service provides all the capacity you need but the customer itself is responsible for managing the infrastructure. The biggest advantage of IaaS is that it offers a cloud-based data center without requiring the client to install new equipment in the system or to wait for the hardware procurement process. This service is a great boon for the educational institutions since they can have access to an particular resources without the need to install new hardware, hence providing cost effectiveness. IaaS example includes Amazon Elastic Cloud.
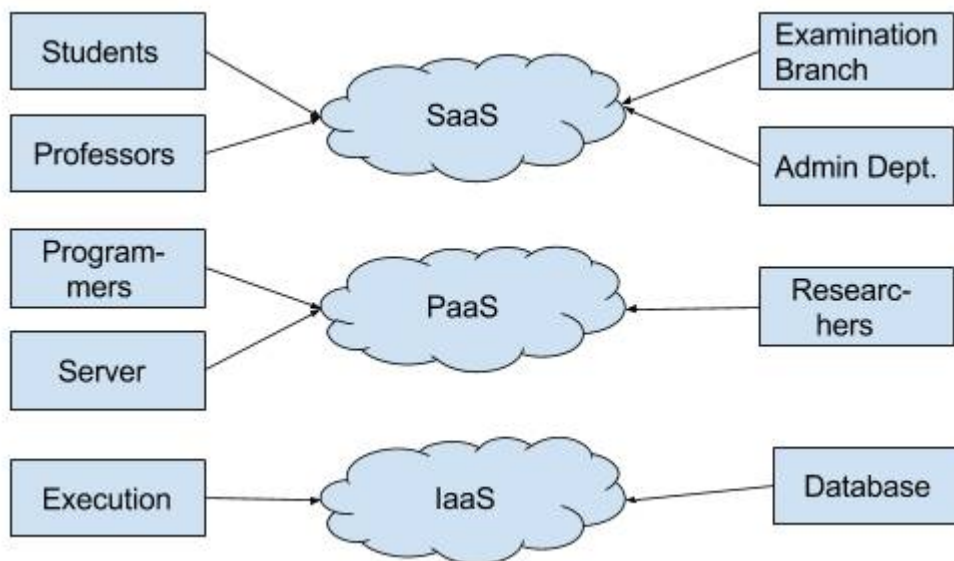

Fig 1. Users of Education Cloud Computing System

IV. CLOUD DEPLOYMENT MODELS

The Cloud Deployment Models are characterized by different sizes, access and proprietorships. There are four deployment models which are as discussed below:

A.   Public Cloud:

In this type of hosting the cloud services are provided through the network that can be accessible to the public.This cloud provides services and infrastructure to the wide range of the clients [2].
The main reasons of public cloud are as follows:
1.   Easy to Implement
2.   Levels Of Security
3.   Low Operational Cost

B. Private Cloud:

Private Cloud: It is also known as Internal Cloud.As the name suggests is solely owned by a particular organization, institution or an enterprise[10]. The environment on which the cloud computing platform depends upon is protected by a firewall that is under the information technology department which belongs to the particular organization and can only be used by the authorized clients only.[5]

The main reasons of private cloud are as follows:

1. Designed for institutions
2. Large Control over Cloud Infrastructure
3. User can access network and computational resources.

C. Hybrid Cloud:

This is an integrated model. As the name suggests it contains all the types of cloud services i.e public, private, and community[2]. It may contain two or more servers which can be any type of cloud services that are connected to each other but remains as a separate entity but are bound together by standardised technology that allows data and application portability[11]. Many business have already adopted this approach because it allows the Bring Your Own Device Policy (BYOD) mechanism, that enables the user can access business critical applications and information to improve their services and promotes a more personalized approach[5].

D. Community Cloud:

This involves cloud hosting that is mutually shared among several organizations and it supports the specific community that has shared concerns (eg mission, security , policy etc)[2]. It can be managed by the organisations or a third party and may exist on or off premises. For example, a state government may set-up a community cloud infrastructure for all its separate organisations to access all the resources[10].

V. PRESENT EDUCATION SYSTEM

The most important thing fundamental to human progress is Education. It plays a prominent role in all round development of individual as well as society. Education plays an important role in creating patriotic, disciplined and productive manpower. Through the use of internet technologies everything that can be improved has been made easier. The requirements of most of the educational institutes is highly dependent on information technology. Web browsers are used by students and faculties to access the information they obtain using various internet technologies. We are therefore facing a future where the majority of educational services will be hosted in the cloud and institutes no longer host their own data centers. This policy has therefore brought some of the emerging benefits and challenges of cloud computing for the educational sector. Though the Internet Technologies are used widely in educational sector, but still in most of the institutes, the work is done manually like taking attendance, classroom teaching, taking examination, maintaining logs which creates lots of trouble for the faculties to handle. By introducing Cloud Computing technologies in educational sector, the manual work can be eliminated and the stress level of faculties can be reduced.

VI. CLOUD COMPUTING IN EDUCATION SECTOR

Cloud computing technology can provide solution to all the traditional approach that is used before in the education systems [8]. The advent of cloud computing has gained interest from different educational systems due to its features. As we have seen in cloud computing all the consumers can access the data anywhere and at any point of time. Cloud providers nowadays are offering education at a higher level and the opportunity to customize or edit user data in the cloud for various institutions with existing data centers, servers and application replacing these traditional campus machines to the newer and effective approach thus transforming the learning experience in educational systems. Moreover, cloud computing provides a rich learning environment, a global collaboration, flexibility among academics and students, and allows shared learning technique[9]. The cloud computing applications that are related to education will form the basis of future IT infrastructure in education to ensure the growth and the development of hardware and software environment. Thus, with the tremendous advantages of cloud computing, this technology is expected to revolutionize the field of education, especially the higher education sector[11].

Cloud computing has a considerable status in the HEIs globally and locally. According to the statistics in 2009, 70% of HEIs in North America has moved to the cloud, and 50% have adopted cloud computing collaborative system to enhance information sharing within the campus. Developing a cloud architecture for the education system can vary according to the purpose and infrastructure of the particular institution[4]. The task of developing the cloud for an institution can be challenging as the universities has to follow certain strict rules and regulations of the state since many countries are very strict in cross border transfer of information. Service Level Agreement (SLA) is an agreement that should be provided in which the university establishes where their data will reside and gives the measure of data security. It is an document that ensure educational cloud users regarding the services provided by the cloud. It also ensures privacy , consistency and integrity of the system.

The main users of a typical higher education cloud include students, examination branch, faculty, administrative staff and admission branch. Through cloud all the users of the institution are connected to each other. All the users are provided separate login for their respective work[11]. Virtual classrooms can be made possible as students need their personal computers with internet access and they can remain at their homes to access live lectures or even use study materials later for referencing . All the teaching materials, tutorials, assignments will be uploaded by teachers can be accessed by students via internet on premises, off premises or both as per requirement and hence ensuring efficient collaboration and effective data exchange[4]. By analyzing student's study records, teachers can identify problem areas in which students tend to make mistakes. By doing so, teacher will also get to know what can be improved i.e. teaching materials or methods or both. Students having problems coming to the institution can use these materials at home for reviewing lessons. Institutions can opt for public cloud to store resources which is managed by third party cloud service provider. This public cloud can store information related to the institutions, admission guidelines for outside users and study materials. This makes the work burden of the institutions lessen. Private clouds can be used particularly for staff members as sensitive information could not be accessed by students or leaked into the institution. In the traditional approach of education,capital is invested in buying and setting up physical hardware and also paying for different licenses of the softwares. Deployment tools, development kits and softwares in cloud can be consumed over the Internet in cloud which in turn reduces the expenditure of the institution and can be either as fully functional applications (SaaS), development platforms (PaaS) or raw computing resources (IaaS). [6,9,11]
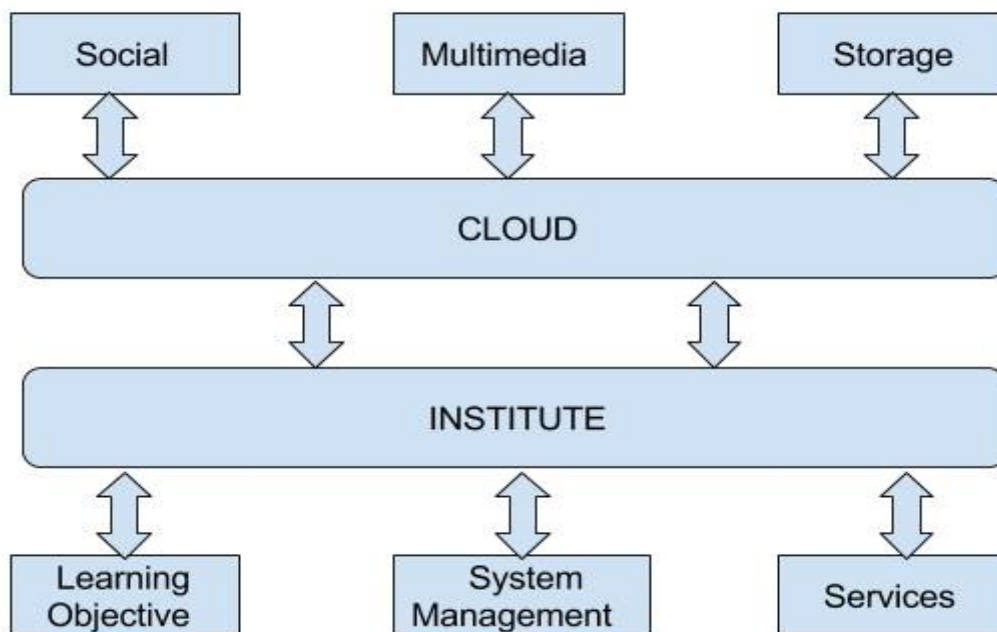

Fig 2. Cloud Architecture for Educational Sector

VII. BENEFITS OF CLOUD COMPUTING

1. Accessibility - Data stored in the cloud can easily be accessed from anywhere anytime.Lesson plans, grades,notes, Powerpoint slides, labs that is used in teaching is easily uploaded and accessed anytime. 24X7 is the availability.[13]

2. Collaborations - As cloud allows multiple users to work on and edit documents at same time hence students and teachers can collaborate on projects, studies, assignments in the cloud.[14]

3. Cost and time saving - Goal is making more facilities available to students and making the environment global in spite of wasting time on worrying about the buildings, labs, teachers. Cost savings in terms of buying, maintaining photocopies, printers, ink cartridges, paper etc. The cloud will allow teachers to post assignments online. The students will be able to access these assignments and complete them and save them. This could mean no wasting of time turning in papers during class time. This time can be better used on more educationally directed activities that impact student learning.It also provides the facility of Pay per use for some applications.[8]

4. Personalized Learning - Cloud computing affords opportunities for student choice in learning. A wide array of resources and software tools can be accessed by students that suit their learning styles and interests.[8]

5. Backup and Storage - Cloud automatically saves content and therefore it is not possible to lose content.Even if computer crashes, all documents will remain safe,saved and accessible in the cloud.Cloud allows its users to store almost all types of content and data. It is also possible to share information of attendance,assignments,students information.

6. Resource Availability - The biggest advantage of cloud computing is that the provider is able to pool the resources, which includes storage, bandwidth , memory, network, to serve multiple consumers with different virtual resources and dynamically assigning them the services according to the consumer demand and needs. [3]

7. Recovery - This the core feature of cloud computing. It mitigates the needs of the recovery plans for the infrastructure and ensures faster recovery and information available in multiple sites and hence make it efficient and effective.

8. Computing Power - Several computers are brought together to constitute a super server in cloud computing,and hence providing users with a powerful data processing and computing capacity.[3]

VIII. CONCLUSION

Cloud computing technology is an emerging technology in today's world of technologies. Cloud computing technology is extremely beneficial in terms of cost. To access a file or an application like word processor or spreadsheet program in cloud we do not need any specific machine. A universal platform with simplified scalability is created by using cloud. The shift towards cloud computing is necessary so that people can save money and take benefit of the developing technology. As every coin has two sides, cloud computing also has some limitations, but it's advantages are so many that many universities, educational institutions, etc are adopting this developing technology. The main objective of the paper was to identify how cloud computing can be considered as a new dawn in educational sector and how cloud technology can make a 'revolution' in the field of education.

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