

## **Cloud Computing: An Effective Approach for Education Sector: A Summarized Review**

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**Abstract :** *Education Sector has no doubt have contributed crucially in the economic growth of the nation. Maintaining the educational infrastructure at regular intervals and spending huge amount on their establishment is at time very hectic and that too at the time of economic crisis. Since, education integrated with technology, teaching and learning are no longer confined to textbooks and classrooms. This integration turned out to be useful for various purposes. Today, learners are always connected- on or off the school grounds. Who could have ever imagined that student in one part of the world can pursue a course being taught miles away on just a click of button? One of the technologies that drive innovation for the education industry is **Cloud Computing**. Cloud Computing is a technology that has managed to shift the emphasis from physical resources to virtual ones. The scalability and elasticity nature of Cloud Computing has managed to win the hearts of various educational institutions. This paper deals with introduction on Cloud Computing and its contribution in Education Sector and how it managed to get this sector to next level.*

**Keywords:** *Cloud Computing, E-Learning, SaaS, PaaS, IaaS.*

### **1. INTRODUCTION**

In this modern world, technology is recognised as the most influential factor and a phenomenal contributor in all development areas. Talking about Cloud Computing, if you want to understand on its impact on education landscape, you need to know how it actually works.

#### **1.1 Definition**

PC Magazine, an American computer magazine shortened as PCMag describes “In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer’s hard drive. The cloud is just metaphor for Internet. The cloud is also not about having dedicated network attached storage (NAS) hardware or servers in residence.”

According to National Institute of Standards and Technology (NIST) of the US Department Commerce, Cloud Computing is defined as “ a model for enabling ubiquitous, convenient, on demand network access to shared pool of configurable computing resources (eg ., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”[2].

## 1.2 About Cloud Computing

Cloud Computing in layman terms refers to computing over internet. In other words, it provides a means for you to store/access your data and applications over internet. It delivers on-demand, self-sufficient Cloud Computing Services like: Virtualization, Storage, Network, Databases, Security, Operating Systems, Applications, Middleware through Wide Area Network. Users can utilize these services with no interaction with service provider. Types of Cloud Computing Service models include-Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS). Also, one of the trending cloud model in industry today is Containers as a Service (CaaS).

### 1.2.1 Software as A Service

SaaS provides clients with ability to use software applications over the internet via subscription basis. Clients can access applications from anywhere via web. These are the Anywhere anytime applications. Example-Google Applications.

### 1.2.2 Platform as A Service

PaaS provides a platform where the clients can deploy their own applications and host them. The client is free from hassles of setting up infrastructure, managing storage, servers, network etc. These are the operating environments in which application runs. Example-Amazon Web Services.

### 1.2.3 Infrastructure as A Service

The IaaS provides just the hardware and network, the clients should install and develop software and applications. Example-IBM, Google.

## 1.3 Real World Examples of Cloud Computing

In this developing world of technology, we have come across various real examples where Cloud Computing is implemented. One of them is Google's Gmail. Gmail users can access files and applications hosted by Google via internet from any device. Not only Gmail but we encounter various other examples which we use in our day to day lives like -Skype, WhatsApp, Google Docs, Google Apps and many more. These have become an essential part of our routine life and have managed to lessen our burden, that is by sitting in one part of the world, we can crack any business deal, communicate with our loved ones virtually, pursue an online course and what not? Cloud Computing is been implemented in various fields, say business, social, entertainment, medical, military etc. One such field where Cloud Computing has justified its essence to the fullest is **Education**.

## 2. RELATED WORK

The Internet Revolution has managed to bring us in such a position today that we cannot even imagine our lives without Internet for even a minute. Today we have come a long way with Internet. Similarly, after Cloud Computing was introduced in various sectors it has also managed to come hand in hand along with Internet to make the lives of people less burdensome. Its journey has been remarkable throughout.

### 3. LITERATURE REVIEW

#### 3.1. Drawbacks of Education System Before Adapting Cloud Computing

Before adapting Cloud Computing in Education sector, though the educational institutions managed to deliver quality education but there were various, but had to deal with various issues as well like-

- lack of good faculty,
- lack of lab facilities,
- lack of latest book (hard copy) and
- lack of infrastructure.

Hence, the educational institutions have been under immense pressure to deliver a quality teaching to students using minimal resources.

#### 3.2 How Cloud Computing Contributed in bringing Education System to next level?

##### 3.2.1 E-Learning

Cloud Computing brought education to the next level with the help of **E-Learning**. E-Learning stands for electronic learning. E-Learning is an electronic based learning process. Various online courses conducted by esteemed universities allow students to pursue any course sitting at home or in any part of the world. Today E learning has become a key trend in this sector. Few online course providers include COURSEERA which was started by Stanford Computer Science Professors Andrew Ng and Daphne Koller in April 2012. COURSEERA provides about 532+courses and around 5+million students are a part of this course. Some other course providers include EDX, Udacity and many more. This is such an amazing evolution in the education sector, giving student an opportunity to learn courses from esteemed professors with a minimal expenditure.

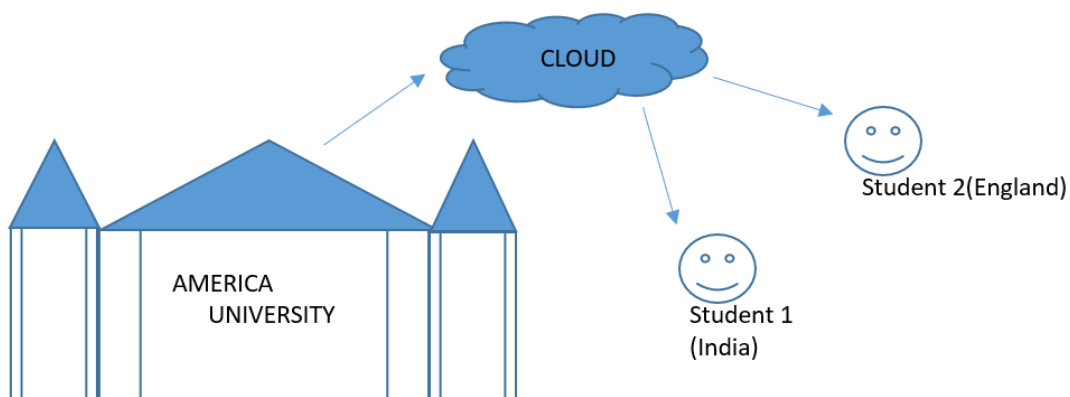


Diagram 1.1 depicts how students accommodated in different countries are still able to pursue same course being taught in different country at the same time using Virtual Classrooms (E Learning)

Cloud Computing is incorporated in education with the help of three service models which we will discuss in terms of Educational context.

SaaS- This model of cloud computing empowers educational organizations to utilize applications and programming through a cloud platform. These subscription-based e learning arrangements are

accessible in various variations, giving one the adaptability to scale tasks according to their necessities.

**PaaS**–It enables the educators to design self-created or acquired applications through tools that the cloud platform offers. Consider creating a virtual lab for students.

**IaaS**–The service providers enable the educator to deploy and run the software, including applications and operating systems.

According to survey conducted by Technavio, the global cloud computing market in education sector is projected to reach \$20.59 billion by 2021.

### ***3.2.2 Scalable and Flexible Infrastructures***

With the adaptation of Cloud Computing, the problem of constant maintenance of institutions got resolved. The amount of efforts to spend on establishment of schools and colleges, and spending on miscellaneous expenses were reduced to half that is cost effectivity. Just by promoting virtual classrooms via social media and consuming student intake for the same and delivering quality education seemed to be very less burdensome. Because of its elasticity and scalability Cloud Computing is been adapted by various institutions. One of the examples is **AWS** that is **Amazon Web Services**. Amazon Web Services is a subsidiary of Amazon that provides on demand Cloud Computing platforms and APIs to individuals, companies and governments on a metered pay-as-you-go-basis.[4]. AWS has come up with an idea of **AWS Educate**. AWS Educate is used in more than 200 countries and territories. It connects 2,400 institutions, over 10,000 educators, and hundreds of thousands of students. Through AWS Educate, students and educators have access to content and programs developed to skill up for cloud careers in growing fields. AWS Educate also connects companies hiring for cloud skills to qualified student job seekers with the AWS Educate Job Board.[5].

### ***3.2.3 Limited Editions of textbooks.***

Unavailability of educational text books at the time of exams is a very troublesome situation for a student in his studies. But cloud computing enables a student to download a text book online on just a click of a button without facing any hindrance in his/her routine studies. Sharing notes has also become very easier via various applications that run using Cloud Service. Also, the textbook file is located at a specific place as it is on cloud, hence chances of books getting misplaced are nil. Not only education but Cloud Computing also manages to promotes education to “Go Green” that is, it saves the cost spent on paper as well. Nowadays most of the educational institutions recommend the same to their students.

### ***3.2.4 Low vulnerability to Disaster.***

At the time of pandemics or any disaster-prone situation, higher education institutions foster a culture of collaboration amongst their team members, say students, faculties, administrative staff even at the time of geographically dispersed campuses or a phase where the institution people cannot show their presence physically. Today, nearly 70% of North American institutions of higher education have moved, or are in the process of moving, their admin systems to the cloud, and about 50% have adopted cloud-based collab systems to enhance the information sharing across campus. IaaS and SaaS are a perfect fit for addressing trends and challenges in higher education.

### **3.2.5 Data Storage.**

Educational textbooks for higher education have a huge file size. Finding a space for storing a file of huge size like 10GB or more than that in a local storage is at times quite problematic, as there are high chances of storage capacity in the system being consumed to its maximum level, hence causing students to delete few files from the system to accommodate the file. Cloud Services provide the solution of storing the big size file on Cloud without compromising with the threat of file getting misplaced somewhere. A student can just access the file as many times as he/she wants to access.

## **4. CONCERNS OF CLOUD COMPUTING IN EDUCATION SYSTEM.**

- **Data Security**-Data security is one challenge faced by various educational institutions. Though cloud computing manages to provide various benefits to the institutions, similarly it has some cons too. If some sensitive data regarding institution is stored on cloud and consider if the system is hacked, then it is a huge threat for the organization.
- **High Speed Internet** – In order to enjoy benefits of Cloud Computing, the one very important requirement is to have a high-speed internet in their systems. If one does not fulfil this requirement then it can be a tedious task for the user to access the benefits of Cloud service.
- **Reliability**-The occurrence of system failure can be a very risky for an institution which is entirely dependent on Cloud services. For instance, in February 2008, Amazon's S3 and EC2 experienced a major blackout for 3 hours. In mid-2009, Gmail suffered a delay of 3 hours in their service provision hence, millions of users were not able to access their mails and documents stored on Google Docs.

## **5. FUTURE SCOPE**

Cloud Computing has a wide scope in the future. There will be various upcoming services incorporated with cloud within and that is because with the increase in demand of internet, there are various schemes being launched by various internet service providers and provided to users at cheap rates. Hence people using internet facility will be a huge number. So, in order to be accessible and connected to a huge crowd of students in lesser amount of time, incorporation of cloud services in educational institutions will be given higher preferences than infrastructural education systems.

## **6. CONCLUSION**

Cloud Computing will always increase the exposure of students to newer technologies. It has given the students the power and independence to choose their course on their own and learn as many numbers of course they want without even considering the challenge of travelling from one place to another. It has given students the ability to think for their career and improve their knowledge. Overall, it is a very viable solution especially for institutions with insufficient funds to cope with the cost of adopting and maintaining expensive IT infrastructure and quality faculties. Though there is a threat of security, but with advancements in cryptography algorithms surely will provide a helping hand to the role of cloud computing in Education.

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