

Implementation of Cloud Computing in Education - A Revolution

Saju Mathew

Abstract— Innovation is necessary to ride the inevitable tide of change and one such hot recent area of research in Information Technology (IT) is cloud computing. Cloud computing is a distributed computing technology offering required software and hardware through Internet. It also provides storage, computational platform and infrastructure which are demanded by the user according to their requirement. Due to the growing need of infrastructure educational institutes, organizations have to spend a large amount on their infrastructure to fulfill the needs and demands of the users. Cloud computing is a next generation platform that allows institutions and organizations with a dynamic pools of resource and to reduce cost through improved utilization.

In the present scenario, many education institutions are facing the problems with the growing need of IT and infrastructure. Cloud computing which is an emerging technology and which relies on existing technology such as Internet, virtualization, grid computing etc. can be a solution to such problems by providing required infrastructure, software and storage.

In this paper a basic research has been carried out to show how cloud computing can be introduced in the education to improve teaching, agility and have a cost-effective infrastructure which can bring a revolution in the field of education. It also tries to bring out its benefits and limitations.

Index Terms—Information technology, cloud computing, educational institutes, infrastructure, teaching, revolution.

I. INTRODUCTION

The concept of cloud computing dates back to 1960, when John McCarthy opined that “computation may someday be organized as a public utility”. The term ‘cloud computing’ is confusion to many people as the term can be used to mean almost anything. ‘Cloud’ is used as a metaphor for Internet and its main objective is customization and user defined experience. In other words cloud computing provides shared resources, software and information through Internet as a PAYGO (Pay-as-you-go) basis.

In the recent years, where educational institutes, universities, industries are giving their full contribution in transforming the society and entire world economy. Various researches are carried out to update the present IT infrastructure especially in the area of education. Cloud computing can be a welcomed optioned in the universities and educational institutes for higher studies. It gives a better choice and flexibility to the IT departments by building multipurpose computational infrastructure once and then

uses it for several purposes for several times. Amazon, Google have already started providing their facilities for large business group. With the help of cloud computing the platform and application the user uses can be on-campus or off-campus or combination of both depending on the institutions need. Due to the evolution of cloud computing number of services have migrated from the traditional system to the online form.

At present, as many universities are trying to update their IT infrastructure and data, but they are facing few challenges which can be solved by cloud computing. The challenges are; [1]

- 1) **Cost:** choose the subscription or PAYGO plan.
- 2) **Flexibility:** cloud computing allows to dynamically scale the investment in infrastructures as demand fluctuate.
- 3) **Accessibility:** making the data and services available publicly without losing the sensitive information

II. SERVICES OF CLOUD

With an aim of reducing the expenditure of the universities for IT infrastructure and the complexity faced by universities and institutions, the traditional installed software on the campus computers are now replaced by cloud computing. With the power of cloud, today higher education can gain significant flexibility and agility and can migrate the sensitive data into remote and world wide data center ‘the cloud’ itself.

To use the cloud services the universities and the institutions has to first define their requirements and has to take a special attention for the privacy and critical issues.

There are several cloud services as follows; [2]

- 1) **Infrastructure as a Service (IaaS):** can be used to satisfy the infrastructure needs of the students, faculties or researcher globally or locally with some specific hardware configuration for a specific task.
- 2) **Platform as a Service (PaaS):** certain providers are opening up application platforms to permit customers to build their own application without the cost and complexity of buying and managing the underlying hardware and software layers.
- 3) **Software as a Service (SaaS):** the application service provider is hosting the application which runs and **interacts** through web browser, hosted desktop or remote client. It eliminates the need to install and run the application on customer own computer and simplifying maintenance and support.
- 4) **Computing as a Service (CaaS):** providers offer access

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Saju Mathew is with the Department of Information Technology, Troy University USA, Sharjah Campus, Sharjah, U. A. E (e-mail: sms2saju@gmail.com).

to raw computing power on virtual server such as Amazons, EC2 service.

Following figure shows the university using the services of cloud computing. [3]

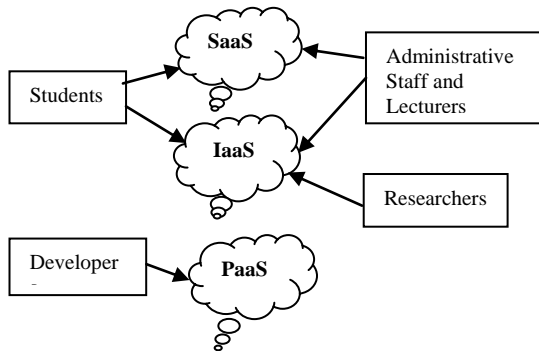


Fig. 1. University using the services of cloud computing

III. CLOUD ARCHITECTURE FOR EDUCATION

Due to the higher accessibility, availability and efficiency of cloud services many universities, businesses are trying to make use of these services. Today's cloud computing providers are offering higher education, the opportunity to substitute their data and information in the 'cloud' for universities with existing data centers, servers and application replacing these traditional campus machines.

Developing a cloud architecture for education can be distinct according to the purpose and infrastructure of the institution and can be challenging. The universities has to follow all the rules and regulation of the state and country for developing a cloud for education as many countries are very strict in cross broader transfer of information. Once the university establishes where their data will reside and gives the measure of data security an agreement called SLA (Service Level Agreement) can be made with the cloud service provider. The SLA is a document which can ensure educational cloud users regarding the services provided by the cloud. It tries to identify the users need and simplifies complex issues and creates a relationship between the user and the service provider. It helps to specify the privacy, consistency and integrity. [4]

Privacy is one of the important factors which have to be taken care for cloud computing, as the service provider may require some personal information which is related to the data on what the user is trying to store in the cloud. So the universities should be very careful before disclosing the data and it should not lose the integrity of educational data. There are many solutions that can ensure the security and protection of sensitive data in the cloud. These are;

- 1) Mask or de-identify of the data
- 2) Firewalls
- 3) Encryption and decryption
- 4) Authorization identity management.

Following figure shows the cloud architecture for education; [1], [5], [6]

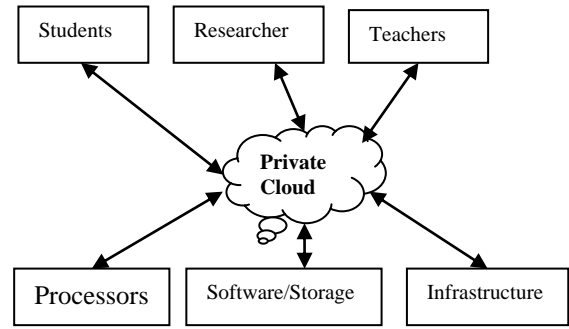


Fig. 2. (a) Private cloud architecture for education

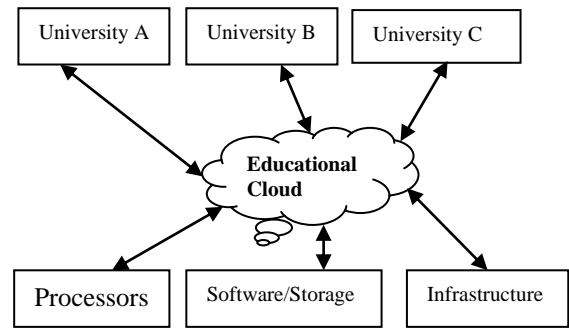


Fig. 2. (b) Educational cloud architecture

Fig. 2. (a) and (b) shows the private and educational cloud architecture for education. Institutes can develop their own cloud called as 'private cloud' by making use of their existing resources or multiple universities can come together and can develop a hybrid cloud called as 'educational cloud', in which they can share all the resources from the various universities. Private cloud makes use of the local network whereas the educational cloud makes use of public network to access the services provided by the cloud. Both private and educational cloud which is developed for education has to specify the services provided by them.

Following table shows the differences between private and educational cloud. [7]

TABLE I: DIFFERENCES BETWEEN PRIVATE AND EDUCATIONAL CLOUD

| Cloud Feature | Private Cloud | Educational Cloud |
|---------------------------|--|--------------------------------------|
| Owned and managed by | Single university | Service Provider (many universities) |
| Access | Limited to employees and students of single university | By subscription |
| Control and customization | Yes (By university) | None |

IV. BENEFITS AND LIMITATIONS OF CLOUD COMPUTING

Due to the recent development in IT technologies, infrastructure and continuous upgrades in software and hardware has put a great deal of pressure on the budgets and expenses of universities and educational institutes. Cloud computing development provides many universities with an opportunity to take advantage of new IT technologies at an affordable cost. Following are the benefits;

A. Cloud Computing To Prepare Lecture

With the development of private and educational cloud, new web applications such as LectureTools, Slideshare etc

allows the lecturer to get their work done in their web browsers rather storing and carrying it on the hard drive. Its gives the benefits such as; [8][9][10]

- 1) Access the files from anywhere
- 2) Create a backup of your data
- 3) Stop worrying about additional software licenses
- 4) Share content more easily
- 5) Get things done without software hassles

B. Other Benefits Are

- 1) Access to applications from anywhere
- 2) Support for teaching and learning
- 3) Software free or PAYGO
- 4) 24 X 7 access to infrastructure and content
- 5) Opening to various universities and advanced researches
- 6) Protection of environment by using green technologies
- 7) Increased exposure of new IT technologies to students
- 8) Increased functional capabilities
- 9) Offline usage with further synchronization opportunities

C. Limitations

Cloud computing has the potential for improving the efficiency, cost and convenience for the universities and educational sectors, but it has few limitations such as; [11]

- 1) Not all application run on cloud
- 2) Risk related to data protection and security and its integrity
- 3) Organizational support
- 4) Dissemination politics, intellectual property
- 5) Security and protection of sensitive data
- 6) Maturity of solutions
- 7) Lack of confidence
- 8) Standard adherence
- 9) Speed and lack of Internet can affect work methods

V. CONCLUSION

Cloud computing is an emerging computing paradigm and next generation platform that can provide tremendous value of information of any size. The shift towards cloud computing would enable the universities and educational institutions to save money and take benefit of the developing technology. Both private and educational cloud can provide the necessary computational facility on demand of the user without any expense and can create a common platform for sharing the various resources from the various institutions. In spite, of limitations of cloud computing and keeping in mind the present scenario of economic crisis many universities, educational intuitions, organizations etc are trying to adopt cloud computing as a solution to the developing technologies and try to reduce their expenses.

The main objective of the paper was to identify the

essentials of cloud computing which can be considered as a new dawn to the higher education and has the full potential to make a 'revolution' in the field of education.

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Saju Mathew is born and brought up in Nagpur, Maharashtra, which is the central part of India. He received his Bachelor of Science (B.Sc) and Master of Science (M.Sc) in computer science for Nagpur University, Nagpur during the year 1997 and 1999. He has received his M.Phil in computer science from Alagappa University, Karikuddi, Tamil Nadu, India during the year 2008. Currently pursuing Ph. D degree from CMJ University, Meghalaya, India. Presently he is working in Troy University USA, Sharjah Campus, Sharjah, U. A. E in the department of Information Technology. He is having total 11 years of teaching experience. His area of interests is cloud computing, data mining and data warehousing, database, software engineering. He has published and presented papers in journals, international and national level conferences.