

## CLOUD COMPUTING: EXPLORING POSSIBILITIES IN HIGHER EDUCATION

GEETIKA SHARMA

Department of Education, Lady Irwin College, Delhi, India

### ABSTRACT

This paper draws on the issue of the most recent technology of cloud computing by making the use of resources available virtually, a service through the internet which in turn will specifically and positively affect the present educational scenario. Undoubtedly, cloud computing is an exceptional alternative for educational institutions, especially the ones with low capital to invest in systems and network settings and devices. The higher education system can seek the benefits from cloud based applications largely offered by service providers so that their students can furnish their academic tasks with high proficiency. Cloud Computing (CC) is in vogue and is widely used, but we need to be vigilant to the risks and challenges it offers. Suggestions can be implied for more extensive and safe usage by higher education.

**KEYWORDS:** Cloud Computing, Educational Institutions

“Cloud is about how you do computing, not where you do computing”

-By Paul Maritz

"Necessity is the mother of invention" is an English-language proverb. It means, roughly, that the primary driving force for most new inventions is a need. The education sector has gone through a robust metamorphosis over a decade. Plethora of demands in the teaching - learning process has given birth to new technology or new strategy of technology, Cloud Computing (CC). People are avid in learning new things in a novel manner. Off late CC is magnifying universally, academia appeared to be lagging behind the ponderous evolution in this field. A set of turmoil in the education sector was precipitated by the emergence of CC technology, which took the worldwide classrooms by hail and restructured most of the strategy related to teaching, learning and administration. CC is the talk of the decade due to its capability to accord access to information, improves collaboration and restructuring traditional IT structures. Gartner defines “Cloud computing as a style of computing in which scalable and elastic IT-enabled capabilities is delivered as a service using Internet technologies”. According to Youseff et al. “Cloud computing can be considered a new computing paradigm that allows users to temporarily utilize computing infrastructure over the network, supplied as a service by the cloud-provider at possibly one or more levels of abstraction”. For Lawrence Cruz (2011), “Cloud computing is a collection of applications and technologies which can be accessed and manipulated by a large number of users in real time”. So, what are the benefits of cloud computing to the educational institutions which implement it?

According to Mircea and Andreescu (2011) here is a list of benefits provided by CC:

- “Cloud computing allows institutions to access real time information from anywhere in the world in a matter of seconds”. In the field of education, this is cardinal as it gives the teachers and the learners constantly upgrade their pile of information.

- “Cloud computing allows teachers and learners to access applications and other useful tools for free”. That makes it easily accessible and cost effective.
- “This technology is a particularly new one and, because of this, it is not only efficient, it is also environment-friendly”. That makes it safe to use and apply.
- “Cloud computing allows for interconnectivity, students are exposed to openness”. In other words, simulated teaching occurs. Hence, learning will be more decent and fruitful as it is facilitated by a pedagogue.

The US National Institute of Standards and Technology (NIST) has developed a working definition that covers the commonly agreed aspects of cloud computing. The NIST working definition summarizes cloud computing as: “A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., Networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”. This definition describes cloud computing as having five essential characteristics, three service models, and four deployment models.

### Idiosyncrasy of Cloud Computing

- **On-demand self-service-** CC can be used by consumers without any sort of human interaction at any point of time and anywhere. Computing resources include network storage, processing power, virtual machines, etc.
- **Ubiquitous network access-** Heterogeneous platforms like mobile phones, laptops, and PDAs can access the capabilities which are available over the widely spread network.
- **Location independent resource pools-** Resources like storage, processing, memory, network bandwidth, and virtual machines are pulled by cloud service providers and then multiple users share these resources (multi-tenancy) without having any control or knowledge over the exact location of the resource provided.
- **Rapid elasticity-** Infinite and flexible capabilities available for rent and can be purchased in any quantity at any time. Once the resources are no longer required they can be scaled down and as per the demand it can be rapidly and elastically supplied and provisioned to scale up.
- **Pay per use-** It is a measured service as usage of resources is metered using pertinent metrics such as monitoring, storage, bandwidth usage, CPU hours, etc.

### Service Models of Cloud Computing

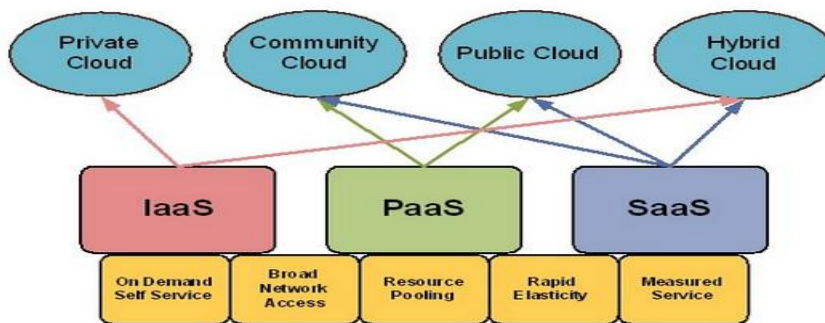
- **Software as a Service (SaaS)** - The consumer use the web browser (e.g., Web-based email), or a program interface to access software that has been developed by others and offered as a service over the web for usage. Herein, users do not dominate or command the underlying cloud infrastructure. Google docs are a popular example that uses the SaaS model of cloud computing.
- **Platform as a Service (PaaS)** - Google App Engine and Microsoft Azure are popular PaaS examples where applications are developed using programming languages and tools that are reinforced by the provider. Pass users are allowed to focus on developing their applications as providers give them a high level of abstraction for the same. Similar to SaaS model users do not dominate or command the underlying infrastructure.

- **Infrastructure as a Service (IaaS)** - IaaS consumers are able to establish and hasten their applications and operating system provided by IaaS provider by acquiring computing resources/services. It is flexible, but expensive and consumers are responsible for updating and mending the operating system at IaaS level. Unlike PaaS it is a low level of abstraction and gives freedom to consumers to access the underlying infrastructure using virtual machines. Amazon Web Services, Go Grid, 3 Tera, etc. Are a few examples.

**Deployment Models of Cloud Computing**

- **Private cloud**- The cloud infrastructure caters specifically to one organization. It may be possessed, commanded, and operated by the organization, a third party or a combination of both.
- **Public cloud**- Large corporations like Google, Microsoft and Amazon own this type of cloud as it involves a significant amount of capital and the general public is the user of the same.
- **Community cloud**- Organizations having shared concerns like mission, policy, safety and security, etc. Make use of this type of a cloud. It may be possessed, commanded, and operated by one or more of the organizations in the community, a third party, or a combination of both.
- **Hybrid cloud**- The cloud infrastructure which is established using an amalgamation of the above three deployment model types, that remain sole entities, but are bound together by systematize technology that enables portability of data and applications such as cloud bursting for load equilibrium between clouds.

Jerry Bishop, the Chief Information Officer at Chippewa Valley Technical College in Wisconsin, specified the interrelationships and necessary connections of the NIST cloud computing characteristics and models (Bishop, 2011). “This visual demonstrates that a cloud-based strategy can take on different configurations depending on the institution’s needs”.



**Figure 1**

Over the past few years, cloud computing has become one of the elucidating secular drift within technology and in no time the effects are just beginning to be felt across the industry.

“Education is not the filling a bucket, but the lighting of a fire.”

-By William Butler Yeats

According to Lazowska, et al., (2008) “Higher education is one of the pillars of society development through the partnerships between universities, government and industry, researchers and students have proven their contribution to the

transformation of society and the entire world economy”.

As per Mircea, 2010 and Bozzelli, (2009) “The tendency observed during the last few years within the higher education level, is the universities’ transition to research universities and ongoing update of the IT (Information Technology) infrastructure as the foundation for educational activities and Science research. With the evolution of technology, the number of services which migrate from traditional form to the online form grows as well”.

CC is a very practical approach for varied reasons in the field of education. Undoubtedly, CC will empower certain educational institutions to actually make use of the global internet resources for data storage and data analysis. Cloud and Cloud-Connected technologies are running the world. Simply, to work independently from this fact is to work with futility. Gone are the days when teachers used to carry around storage devices, as of late cloud is helpful in saving valuable files and also memorize to bring them together under one roof. CC will bring a revolution in the educational scenario by encouraging e-textbooks and discouraging expensive textbooks, updated and upgraded course based learning material, no expense on hardware installation as applications of cloud will run on internet browsers on mobile phones as well. Similarly, no expensive software is required, thanks to SaaS (which is one of the biggest advantages of cloud based technology. Students who are not aligned well with the traditional method of teaching can be benefitted with this technology. Hence, cloud computing is catering more to diversities.

Walter Bailey writes on CloudTweaks.com, “The entire educational system is suffering from a lack of resources: small classrooms, staffing cuts, a shortage of qualified teachers and constantly changing standards. But, Bailey points out, the cloud is a valuable tool that can be used to improve accessibility to quality education and to boost achievement by virtualizing the classroom environment”. Students can log in online and orchestrate classes outside of the classroom environment. According to John Omwamba “The cloud allows for information durability, which means information can be placed in cloud storage for as long as needed. He adds that the advent of online video has made the idea of cloud in education even more exciting, providing universal access to teaching videos and demonstrations on almost any topic”. It showcases the coherence and versatility of CC.

The challenges and risks that will contrive higher education’s acquisition of cloud computing relate to faith, conviction and guarantee. As Burton Group analyst Drue Reeves points out, “Building an IT organization’s confidence in a solution requires a combination of consistent performance, verifiable results, service guarantees, transparency, and plans for contingencies.” Most cloud services do not have the credential on which one can establish the necessary trust to shift prevailing services without either great contemplation or a very compelling welfare. Constituting these challenges, most IT organizations in higher education are not themselves highly dexterous in managing risk and service performance of third parties.

Probable are the nine major limitations of using CC in education:

- All the applications cannot run in the cloud.
- There is a gigantic risk related to security, data protection and management of accounts.
- Support of organization or the department
- Broadcasting politics, patent

- Certainty and shielding of susceptible date
- Ripeness of solutions
- Lack of fortitude
- Adherence to standards
- Speed availability of internet can affect work methods

University World News reports that by 2025, “The global demand for higher education will double to approximately 200 million students per year, mostly from emerging economies.” Dwindling budgets, aging facilities and striding costs present substantial challenges which have enabled the emergence of cloud computing as a viable solution for a convenient, elastic and economical usage of services. There can be possibly five areas where cloud can help.

- Modernizing operations
- Enhancing student participation, efficiency and conferencing
- Encompassing the range of higher education
- Amplifying and ascending delivery of course material
- Customizing education and upgrading learning outcomes

## CONCLUSIONS

It has been clearly stated by EDUCAUSE President and CEO Diana Oblinger, “Higher education has always been about more than information, no matter how quickly that information can be disseminated or how much of that information can be stored. Our institutions have always been communities driven by connections-connections among faculty, students, research, education, disciplines, communities, and the institution is, where the student is, or where the faculty member is. What matters is the value that comes from the connection.... In the connected age, data, collaboration tools, and communities can come together in ways never before possible.... Technology makes the connected age possible.” CC is one of the most promising technological innovations of the classroom’s process. It has the ability to cut down the cost of IT and simultaneously creates a conducive environment, all the higher educational institutions can imagine. As it relies on a number of existing technologies, i.e., Internet, Virtualization, Grid computing, Web Services, etc. However, since CC is still a budding technology, it is highly recommended to have a close contact with NIST in order to have a hassle free transition. The hybrid deployment model can be used as it can be a perfect concoction of desired requirements. It’s Pay-Per-Use characteristic makes it distinct in every possible term. Injecting inventive technologies and streamlining learning processes pushes students to develop the desired skills and the knowledge in achieving their goals both academic and professional. Undoubtedly, CC contributes in equipping future generations with exceptional skills and expertise necessary for global career advancements in spite of having certain challenges.

“Computing is not about computers anymore. It is about living”

-By Nicholas Negroponte

## REFERENCES

1. Gartner. (2009). Gartner highlights five attributes of cloud computing. Stamford. Press Release.
2. Youseff L., et al., (2008). Toward a unified ontology of cloud computing. Grid Computing Environments Workshop, GCE'08 (pp. 1–10).
3. Cruz, L. (2011). Education: Why Cloud Computing? CloudTweaks News Site [online] Available at <http://cloudtweaks.com/2012/02/education-why-cloud-computing/>
4. Mircea, et al., (2011). Using Cloud Computing in Higher Education: A Strategy to Improve Agility in the Current Financial Crisis. Communications of the IBIMA; Norristown.
5. Lazowska, E., et al., (2008). “Infrastructure for Esience and Elearning in Higher Education,” Computing Community Consortium. [Online], [Retrieved October 5, 2010], <http://www.cra.org/ccc/docs/init/Infrastructure.pdf>
6. Bozzelli, T. (2009). “Will the Public Sector Cloud Deliver Value? Powering the Cloud Infrastructure,” CISCO. [Online], [Retrieved October 5, 2010], [http://www.cisco.com/web/strategy/docs/gov/2009\\_cloud\\_public\\_sector\\_tbozelli.pdf](http://www.cisco.com/web/strategy/docs/gov/2009_cloud_public_sector_tbozelli.pdf)
7. NIST, (2009). “Presentation on Effectively and Securely Using the Cloud Computing Paradigm v25,” [Online], [Retrieved August 29, 2009], <http://csrc.nist.gov/groups/SNS/cloudcomputing/cloud-computing-v25.ppt>
8. Katz, R., et al., (2010). “Cloud Computing in Higher Education,” EDUCAUSE. [Online], [Retrieved October 5, 2010], [http://net.educause.edu/section\\_params/conf/CCW10/highered.pdf](http://net.educause.edu/section_params/conf/CCW10/highered.pdf)
9. Reeves, Drue, et al., (2009). Cloud computing: Transforming IT, Burton Group Advisory Program.
10. Omwamba J. (2012). Cloud Computing: A Quiet Game Changer in Education. CloudTweaks News Site [Online] Available at <http://cloudtweaks.com/2012/09/cloud-computing-a-quiet-game-changer-in-education/>
11. Katz et al. (Sep 22, 2009). “Demystifying Cloud Computing for Higher Education.” ECAR Research Bulletin. Web.