# E-Learning using Cloud Computing

**Utpal Jyoti Bora, Majidul Ahmed**

***Abstract- Cloud computing is becoming an adoptable technology for many of the organizations with its dynamic scalability and usage of virtualized resources as a service through the Internet. Cloud computing is growing rapidly, with applications in almost any area, including education. Now a day, e-learning is also becoming very popular and powerful trend, which is also broad. E-learning systems usually require many hardware and software resources. This paper presents the benefits of using cloud computing for e-learning. There are many educational institutions that cannot afford such investments, and cloud computing is the best solution, especially in the universities where the use of computers are more intensive and what can be done to increase the benefits of common applications for students and teachers.***

***Keywords- Cloud Computing, E-learning, ICT, SaaS, PaaS, IaaS.***

## I. INTRODUCTION

Education or Learning is an important component of life and No human beings are able to survive properly without education. Now a days, there are lots of paradigms for getting knowledge or learn something. One of the most promising paradigms for education is e-learning. E-learning is commonly referred to the intentional use of networked information and communications technology (ICT) in teaching and learning. Some other terms are also used to describe this mode of teaching and learning including online learning, virtual learning, distributed learning, network and web-based learning. The growth of e-learning is directly related to the increasing access to ICT, as well as its decreasing cost. The capacity of ICT to support multimedia resource-based learning and teaching is also relevant to the growing interest in e-learning. Poor or insufficient technology infrastructure can cause more damage than good to teachers, students and the learning experience. While the costs of the hardware and software are falling, often there are other costs that have not been factored into the deployment of e-learning ventures. The most important of these include the costs of infrastructure support and its maintenance and the appropriate training of staff to enable them to make the most of the technology.

Cloud Computing is a new paradigm that provides an appropriate pool of computing resources with its dynamic scalability and usage of virtualized resources as a service through the Internet. The resources can be network servers, applications, platforms, infrastructure segments and services.

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Cloud computing deliver services autonomously based on demand and provides sufficient network access, data resource environment and effectual flexibility. This technology is used for more efficient and cost effective computing by centralizing storage, memory, computing capacity of PC's and servers. With the tremendous advantages of cloud computing, we expect this technology to revolutionize the field of e-learning education. Cloud computing applications provide flexibility for all educational universities, schools and institutions. The cloud platform in institutions' campuses provides effective infrastructure and deployment model for their dynamic demands. The benefits of cloud computing can support education institutions to resolve some of the common challenges such as cost reduction, quick and effective communication, security, privacy, flexibility and accessibility. "Cloud computing" is the next accepted action in the evolution of on-demand information technology services and products. Cloud computing allows to move the processing effort from the local devices to the data center facilities. The software is seen as a service and the applications and data are stored on multiple servers that can be accessed from the Internet. However, in traditional web-based e-learning mode, system construction and maintenance are located in interior of educational institutions or enterprises, which results in a lot of problems existed. cloud computing has many advantages such as expected performance, reduced upfront investment (i.e., software, hardware, and professional staff to maintain servers and upgrade software), high availability, reduced launching time, infinite scalability, tremendous fault-tolerance capability, and accessibility, enhanced collaboration, and mobility, allow users to use any device, such as a mobile phone, personal computer (PC) etc. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited. This paper presents the impact of using cloud computing upon e-learning solutions development.

## II. E-LEARNING

E-learning includes all forms of electronically supported learning and teaching.
The information and communication systems, whether networked learning or not, serve as specific media to implement the learning process. This often involves both out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum. Abbreviations like CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning.

E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual education opportunities and digital collaboration. Content is delivered via the Internet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio It is commonly thought that new technologies can make a big difference in education.

In young ages especially, children can use the huge interactivity of new media, and develop their skills, knowledge, and perception of the world, under their parents' monitoring, of course. Many proponents of e-learning believe that everyone must be equipped with basic knowledge in technology, as well as use it as a medium to reach a particular goal. E-learning is widely used today on different educational levels: continuous education, company trainings, academic courses, etc. There are various e-learning solutions from open source to commercial. There are at least two entities involved in an e-learning system: the students and the trainers. Some benefits of e-learning are discussed below:

Time: One of the key benefits of online study is that one can learn or take a course through e-learning at any time as it is convenient for them. Podcasts and downloadable lectures mean that students are no longer constricted by a conventional timetable of lectures.

Location: Neither are students restricted by their physical location. With an Internet connection, they can attend live online tutorials, participate in dedicated discussion forums or download course material and notes regardless of where they are.

Communication: Another key advantage of online study is that it encourages and enables students to collaborate and communicate with their fellow students as well as their tutors.

**Improved training and material costs:** With e-learning, each time the course is accessed our return on investment improves because users are dividing the fixed production costs by number of uses. We also have savings through decreased travel, reduced material, and hopefully improved (and more efficient) performance.

**Increased productivity**: Because e-learning is not bound by geography or time, you can control training's impact on production by training people during down times. In addition, with the current economy, you're asking people to do more with less. So e-learning is a great way to give them the tools and skills needed to enhance their performance.

## III. CLOUD COMPUTING

Cloud Computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth.

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

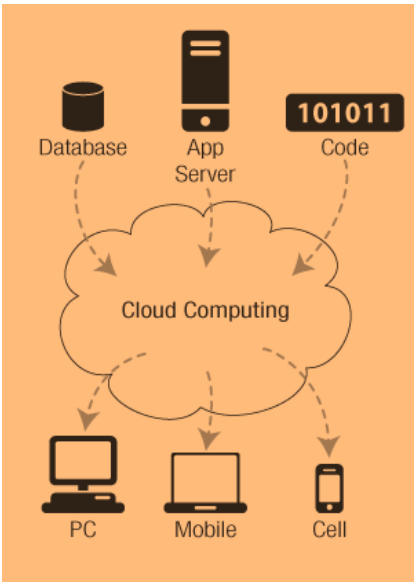


**Fig.1**

According to the official NIST (National Institute of Standards and Technology) definition, "cloud computing is a model for enabling ubiquitous, 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."

The NIST definition lists five essential characteristics of cloud computing: on-demand self-service, broad network access, resource pooling, rapid elasticity or expansion, and measured service. It also lists three "service models" (software, platform and infrastructure), and four "deployment models" (private, community, public and hybrid) that together categorize ways to deliver cloud services. The definition is intended to serve as a means for broad comparisons of cloud services and deployment strategies, and to provide a baseline for discussion from what is cloud computing to how to best use cloud computing.

Cloud computing employs a service driven business model. Cloud offers services that can be grouped into the following categories:

**A. Infrastructure as a service (IaaS):** Hardware resources (such as storage) and computing power (CPU and memory) are offered as services to customers. This enables businesses to rent these resources rather than spending money to buy dedicated servers and networking equipment.. As examples in this category, Amazon1 offers S3 for storage, EC2 for computing power, and SQS for network communication for small businesses and individual consumers.

**B.Software as a service (SaaS):** In this model, software applications are offered as services on the Internet rather than as software packages to be purchased by individual customers. One of the pioneering providers in this category is Salesforce.com offering its CRM application as a service. Other examples include Google web-based office applications (word processors, spreadsheets, etc.),

**C. Platform as a service (PaaS):** This refers to providing facilities to support the entire application development lifecycle including design, implementation, debugging, testing, deployment, operation and support of rich Web applications and services on the Internet. Most often Internet browsers are used as the development environment. Examples of platforms in this category are Microsoft Azure Services platform6, Google App Engine7, Salesforce.com Internet Application Development platform8 and Bungee Connect platform9. PaaS enables SaaS users to develop add-ons, and also develop standalone Web based applications, reuse other services and develop collaboratively in a team.

**Models of Cloud**

**A. Private Cloud:** The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

**B. Public Cloud:** Public cloud applications, storage, and other resources are made available to the general public by a service provider. These services are free or offered on a pay-per-use model. Generally, public cloud service providers like Amazon AWS, Microsoft and Google own and operate the infrastructure and offer access only via Internet (direct connectivity is not offered).

**C. Community Cloud:** Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party and hosted internally or externally. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the cost savings potential of cloud computing are realized**.**

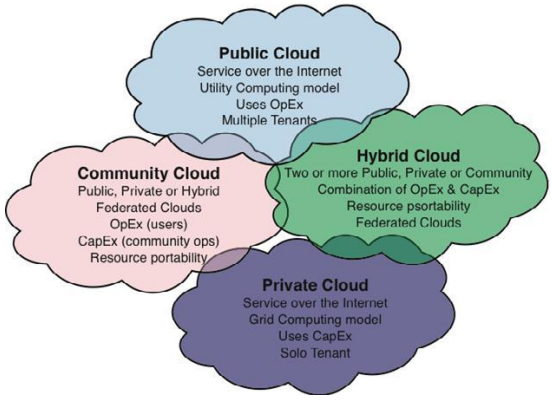


**Fig.2: Cloud Model**

**D. Hybrid cloud:** Hybrid cloud is a composition of two or more clouds (private, community or public) that remain unique entities but are bound together, offering the benefits of multiple deployment models.

## IV. BENEFITS OF USING CLOUD COMPUTING IN E-LEARNING

One of the most interesting applications of cloud computing is educational cloud. The educational cloud computing can focus the power of thousands of computers on one problem, allowing researchers search and find models and make discoveries faster than ever. The universities can also open their technology infrastructures to private, public sectors for research advancements. The efficiencies of cloud computing can help universities keep pace with ever-growing resource requirements and energy costs. Students expect their personal mobile devices to connect to campus services for education. Faculty members are asking for efficient access and flexibility when integrating technology into their classes. Researchers want instant access to high performance computing services, without them responsibility of managing a large server and storage farm. The role of cloud computing at university education should not be underestimated as it can provide important gains in offering direct access to a wide range of different academic resources, research applications and educational tools.

Usually, E-learning systems are developed as distributed applications, but not limited to. The architecture of an e-learning system, developed as a distributed application, includes a client application, an application server and a database server (see Figure 3), beside the hardware to support it (client computer, communication infrastructure and servers).

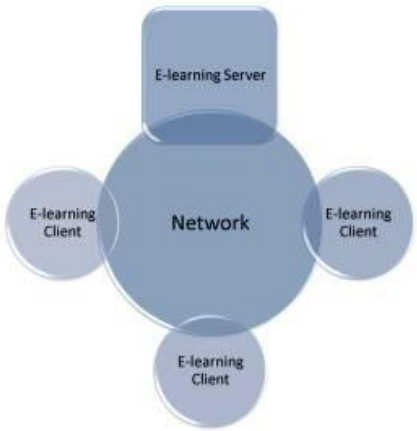


**Figure 3— E-learning system**

E-learning systems can use benefit from cloud computing using:

A. Infrastructure: use an e-learning solution on the provider's infrastructure
B. Platform: use and develop an e-learning solution based on the provider's development interface
C. Services: use the e-learning solution given by the provider.

**Key Benefits of Cloud Based E-Learning**

There are numerous advantages when the e-learning is implemented with the cloud computing technology, they are:

**A. Low cost**: E-Learning users need not have high end configured computers to run the e-learning applications. They can run the applications from cloud through their PC, mobile phones, tablet PC having minimum configuration with internet connectivity. Since the data is created and accessed in the cloud, the user need not spend more money for large memory for data storage in local machines. Organizations also need to pay per use, so it's cheaper and need to pay only for the space they need.

**B. Improved performance:** Since the cloud based e-learning applications have most of the applications and processes in cloud, client machines do not create problems on performance when they are working.

**C. Instant software updates:** Since the cloud based application for e-learning runs with the cloud power, the software's are automatically updated in cloud source. So, always e-learners get updates instantly.

**D. Improved document format compatibility:** Since some file formats and fonts do not open properly in some PCs/mobile phones, the cloud powered e-learning applications do not have to worry about those kinds of problems. As the cloud based e-learning applications open the file from cloud.

**E. Benefits for students:** Students get more advantages through cloud based e-learning. They can take online courses, attend the online exams, get feedback about the courses from instructors, and send their projects and assignments through online to their teachers.

**F. Benefits for teachers:** Teachers also get numerous benefits over cloud based e-learning. Teachers are able to prepare online tests for students, deal and create better content resources for students through content management, assess the tests, homework, projects taken by students, send the feedback and communicate with students through online forums.

**G. Data security:** A very big concern is related to the data security because both the software and the data are located on remote servers that can crash or disappear without any additional warnings. Even if it seems not very reasonable, the cloud computing provides some major security benefits for individuals and companies that are using/developing e-learning solutions.

## V. CONCLUSION

Cloud computing as an exciting development is a significant alternative today's educational perspective. Students and administrative personnel have the opportunity to quickly and economically access various application platforms and resources through the web pages on-demand. This automatically reduces the cost of organizational expenses and offers more powerful functional capabilities. There will be an online survey to collect the required data for the use of cloud computing in the universities and other governmental or private institutions in the region. This will help us review the current status and probable considerations to adopt the cloud technology. Beginning with the outsourcing of email service seems attractive. The gradually removal of software license costs, hardware costs and maintenance costs respectively provides great flexibility to the university/corporate management. In this paper we discuss a cloud computing based e-learning . Describe its definition and some benefits. Cloud based education will help the students, staff, Trainers, Institutions and also the learners to a very high extent and mainly students from rural parts of the world will get an opportunity to get the knowledge shared by the professor on other part of the world. Even governments can take initiatives to implement this system in schools and colleges in future and we believe that this will happen soon.

## BIBLIOGRAPHY


1. **"A NEW TREND FOR E-LEARNING IN KSA USING EDUCATIONAL CLOUDS",** Abdullah Alshwaier, Ahmed Youssef and Ahmed Emam, Advanced Computing: An International Journal ( ACIJ ), Vol.3, No.1, January 2012
2. **"Effective use of cloud computing in educational institutions",** Tuncay Ercana, WCES-2010
3. **"THE UTILITY OF CLOUD COMPUTING AS A NEW PRICING – AND CONSUMPTION - MODEL FOR INFORMATION TECHNOLOGY",** David C. Wyld, Department of Management, Southeastern Louisiana University, Hammond, LA USA, International Journal of Database Management Systems (IJDMS), Vol.1, No.1, November 2009
4. **"Cloud Computing-Future Framework for e-management of NGO's",** 1. Harjit Singh Lamba, 2.Gurdev Singh, International Journal of Advancements in Technology http://ijict.org/ ISSN 0976-4860, Vol 2, No 3 (July 2011)
5. **"E-learning based on Cloud Computing", Deepanshu Madan,** *Scholar's; Computer science & Engg. Deptt. Dehradun institute of technology Dehradun,* **Ashish Pant,** *Assistant Professor; Computer Sc. & Engg dept. Dehradun Institute of Technology Dehradun*
6. **Suneet Kumar,** *Assistant Professor; Computer Sc. & Engg dept. Dehradun Institute of technology Dehradun, India,* **Arjun Arora,** *Assistant Professor; Computer Sc. & Engg dept. Dehradun Institute of Technology,* ***Dehradun, India.*** , International Journal of Advanced Research in Computer Science and Software Engineering
7. **"Using Cloud Computing for E-learning Systems",** PAUL POCATILU, FELICIAN ALECU, MARIUS VETRICI, Economic Informatics Department, Academy of Economic Studies Piata Romana, Secot 1, Bucharest, ROMANIA
8. **"E-Learning on the Cloud ",** Mohammed Al-Zoube, Princess Sumaya University for Technology, Jordan.
9. **"APPLIANCE OF CLOUD COMPUTING ON E-LEARNING",** Bhruthari G. Pund, Prajakta P. Deshmukh, *Prof. Ram Meghe Institute Of Technology, Badnera, Amravati, Maharashtra.*
10. **"Cloud Computing Benefits for E-learning Solutions",** Paul POCATILU, PhD, Associate Professor, Department of Economic Informatics, Academy of Economic Studies, Bucharest.
11. **"An E-learning System Architecture based on Cloud Computing",** Md. Anwar Hossain Masud, Xiaodi Huang, World Academy of Science, Engineering and Technology 62 2012
12. **Cloud Computing Issues and Benefits Modern Education,** By D.Kasi Viswanath, S.Kusuma & Saroj Kumar Gupta, *Madanapalle Institute of Technology and Science Madanapalle, Chittoor*
13. **Website url:**
14. http://www.articulate.com/rapid-elearning/ why-e-learning-is-so-effective/
15. http://hiberniacollege.com/study-with-hibernia/benefits-of-e-learning/
16. http://en.wikipedia.org/wiki/Cloud_computing
17. http://www.wikinvest.com/concept/Cloud_Computing
18. http://en.wikipedia.org/wiki/E-learning

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