



CLLOUD COMPUTING IN EDUCATION

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Abstract *The development of our contemporary society, information and knowledge society depends on technology development that has long been based on the increasing performance of different devices concurrently with their miniaturization. The purpose of modern computing technology solutions miniaturized is the integration of its entire computing power in a single device and it must be an external source, which allowed the emergence of cloud computing. Abstract introduces the objective and intended contribution of the research. The technology involves a number of benefits to its users, evidenced by its adoption by firms that have succeeded to reduce their equipment costs and maintenance. The outsourcing all facilities that a computer can offer complement the idea of reducing costs and not accidentally is useful in education. The cloud solutions allow the teaching, research and development to be more efficient and sustainable which makes as the educational organizations to consider adopting these solutions.*

Key words:

Cloud computing,
web 2.0, cloud-
based e-learning,
platform,
virtualization

JEL Codes:

I25

1. Introduction

The cloud computing technology can be adopted in all areas of society and in terms of education the e-learning solutions based on the cloud promote a new era of learning, in which the lectures and labs are based on cloud platform through virtualization. A variety of knowledge can be made available to teachers and students through cloud-based services and these services can be accessed anytime, anywhere and on any device. On the other hand, providing educational services through cloud computing technology enables them to acquire the skills needed in the global information society. Many universities have begun to accede to this initiative and there is evidence of a significant decrease in costs as a result of implementing cloud solutions. (Manro *et al.*, 2012).

2. Web 2.0 and cloud computing

Regarding to define cloud services there have been confusions, even among teachers, who have supposed that cloud computing refers to all services provided by the Internet that are not hosted by their institution. On the other hand, there is a disagreement about what Web 2.0 means. Specific tools such as blogs, wikis and social bookmarking are considered Web 2.0 applications including used to interact. They can be hosted by an institution itself or accessed on the Internet and can be used from cloud.

Thus, Web 2.0 can be seen as a particular type of application while cloud computing is the method by

which applications and data are hosted in the cloud and delivered (Unesco IITE, 2010).

For education, the approach of cloud computing technology is based on the services they offer, their implementation and architecture. Thus, from the point of view of the services, can be mentioned:

- Platform as a service (PaaS) that provides a range of software for the development of programs;
- Software as a service (SaaS), so users access cloud software provided by cloud administrators who supervise them;
- Infrastructure as a Service (IaaS) that is the base model in Cloud Computing..

After the method of implementation, the cloud can be public, private or hybrid. Microsoft Company already works in the area of Cloud Computing using Windows Azure, which is made available to users as PaaS and IaaS This service is implemented as a Public Cloud.

From the point of view of learning technologies, web-based learning offers several advantages over the conventional classroom learning.

The biggest advantage is related to the low cost and use learning content anytime and anywhere. Learning material is easily maintained and updated; it may include multimedia content to facilitate understanding of concepts. Student-centered approach and the teacher creativity in making the learning material are encouraged (Jolliffe *et al.*, 2001).

3. Uses of cloud in education

Some schools use low-level cloud services for data storage but the use of cloud computing in education

offers a number of benefits such as (Unesco IITE, 2010):

- the economy of financial resources (to pay only what is used);
- elasticity of use, given the possibility of using initial the small services;
- increased availability, e.g. Google offers approximately 100% for educational applications and looks to exceed this target;
- end-user satisfaction because the applications that can be accessed in the cloud include the latest tools and features from innovative companies like Microsoft and Google; so the users can use free office applications without having to purchase, install and maintain these applications on their computers; there are enhanced collaboration possibilities; their data do not get lost, these are stored in the cloud for free use and accessible from any location or from a range of devices such as mobile phone.

Another use of cloud computing in education is for hosting learning management systems (LMS) such as Blackboard or Moodle.

Nowadays the e-learning is widely used to different levels of education: lifelong learning, training for companies, academic courses. There are various e-learning solutions from open source to commercial.

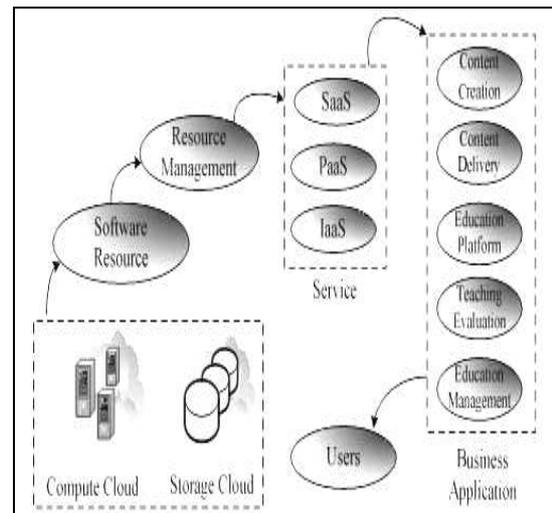
Since there are at least two entities involved in the e-learning system: students and trainers, the students can access courses, exams and can send online projects while trainers can accomplish content management, tests and can evaluate these tests, homework or projects for students and can communicate with them (Dong *et al.*, 2009).

The development of e-learning solutions can't ignore cloud computing trends. Literature presents e-learning architecture based on the cloud (Figure 1) which is mainly divided into five levels called (Kumar and Chelikani, 2011):

- the hardware resources level : the lowest layer of cloud middleware service and most importantly for the total system infrastructure;
- the level of software resources: created by using operating systems and middleware technology, it enables software developers to realize more applications including the incorporating of e-learning applications in the cloud;
- resource management level: with an important role in poor coupling of hardware and software resources what enable a constant on demand software distribution for various hardware resources;
- the services level (IaaS, PaaS, SaaS), which allows customers use of different cloud resources such as software resources, hardware resources and infrastructure resources to achieve their applications;

- the business application level, that enables creation and content delivery, the platform for education, assessment and management education; this level differs from all other layers in the e-learning cloud-based architecture because it acts as business logic of e-learning and framework for extending components group for e-learning.

Figure 1. Architecture of e-learning cloud



Source: Laisheng and Zhengxia, 2011

According to Masud and Huang in (Masud and Huang, 2011) development of e-learning in cloud computing environment is characterized by the fact that:

- the services are accessed through the Web, which means ease of them accessing from anywhere and at any time;
- doesn't require software on client-side, which means lower costs to the institution concerning the installation, software maintenance, implementing server administration including IT staff costs;
- subscription pay for use, according to the model of education, provides access to complex applications;
- SaaS system can support several educational institutions;
- all user data are on the SaaS server and security is provided by the SaaS provider;
- the virtualization enables rapid replacement of a compromised server cloud without major costs or damages because it is easy to create a clone of a virtual machine so the idle times are reduced substantially;
- centralized data storage and fast possibility to connect a new customer;
- the monitoring of data access becomes easier, given that only one place it should be supervised, not thousands of computers spread over a large geographical area;

- security changes can be easily tested and implemented as cloud represents a single point of entry for all customers (Wheeler and Waggener, 2009).

4. Advantages of using e-learning in the cloud

Decision making e-learning systems implementation in cloud provides many benefits for the educational institutions dealing with this solution due to the following:

- the institutions cut the costs using the cloud applications on the computers, mobile phones, PC tablets, with the least configuration and Internet connection; equipments are not necessary and the payment is effected only for the necessary applications and for the data stocks (Al-Jumeily *et al.*, 2010);
- the performances are improved as the e-learning applications on cloud have most of the processes and applications in the cloud and the users' systems have no problem regarding the performance (Rao *et al.*, 2010);
- the software updates are accomplished on the spot and the users get the updates very quickly;
- the document frameworks compatibility is improved as the e-learning applications based on cloud open the cloud files;
- the cloud- based e-learning grant a lot of benefits for the students mainly concerning the online courses access, the exams and the online communication with the professors (Pocatilu *et al.*, 2009);
- the benefits for the professors concern the student's training for the online tests, the creation of more complete resources for the students through the management of contents, assessment and communication with the students using the online forums;
- in the e-learning cloud business model the supplier is responsible for the e-learning cloud organization and maintenance, providing technical support for e-learning cloud.

There are certain doubts regarding the way the institutions approach of the cloud technology about the following:

- the security for the data stocked in cloud, some of the users consider that the client data are safer when internally managed while others state that the cloud suppliers are strongly stimulated to keep up the trust and therefore leave a higher security level (Mills, 2009);
- the confidentiality, the cloud computing uses the virtual computing technology ,the users' personal data can be spread in many virtual data centers even beyond the national borders and therefore the private data protection will face the different juridical systems controversy (Jianchun and Weiping, 2010);

- the open standards are critical for the cloud computing development, most of the cloud services suppliers display API-s which are usually rich in documentary data and yet unusable.

Presently, the cloud computing platform characteristics are suitable for the cloud-based e-learning as a learning system because it enables the exploitation of the possibilities provided by the organisation of an efficient learning environment which offers a personalized content and its easy adjustment to the current learning pattern.

5. Conclusions

Specifically, the benefits of e-learning system integration in the cloud refers to better flexibility and scalability, possibility of access to complex applications and storing data in the cloud at a small cost. However, there are some disadvantages that must be approached before the full integration of e-learning in universities.

Optimizing resource requirements, storage, management and communication require the use a platform which satisfies the scalable and cost control requirements.

Nowadays, the e-learning systems have poor scalability in infrastructure. Many resources can be used and allocated only for specific tasks, for example when is a large volume of work, new resources and their configuring are necessary, making it very expensive the cost management and resources (Kwan *et al.*, 2008).

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