

The Cloud Systems Used in Education: Properties and Overview

Agah Tuğrul Korucu, Handan Atun

Abstract—Diversity and usefulness of information that used in education are have increased due to development of technology. Web technologies have made enormous contributions to the distance learning system especially. Mobile systems, one of the most widely used technology in distance education, made much easier to access web technologies. Not bounding by space and time, individuals have had the opportunity to access the information on web. In addition to this, the storage of educational information and resources and accessing these information and resources is crucial for both students and teachers. Because of this importance, development and dissemination of web technologies supply ease of access to information and resources are provided by web technologies. Dynamic web technologies introduced as new technologies that enable sharing and reuse of information, resource or applications via the Internet and bring websites into expandable platforms are commonly known as Web 2.0 technologies. Cloud systems are one of the dynamic web technologies that defined as a model provides approaching the demanded information independent from time and space in appropriate circumstances and developed by NIST. One of the most important advantages of cloud systems is meeting the requirements of users directly on the web regardless of hardware, software, and dealing with install. Hence, this study aims at using cloud services in education and investigating the services provided by the cloud computing. Survey method has been used as research method. In the findings of this research the fact that cloud systems are used such studies as resource sharing, collaborative work, assignment submission and feedback, developing project in the field of education, and also, it is revealed that cloud systems have plenty of significant advantages in terms of facilitating teaching activities and the interaction between teacher, student and environment.

Keywords—Cloud systems, cloud systems in education, distance learning, e-learning, integration of information technologies, online learning environment.

I. INTRODUCTION

IN 21st century, technology is dramatically growing and thus information is spreading everywhere easily, which forms a new field of technology: Information Technology (IT) [1]. IT is becoming a part of our lives in every aspect and its role in education cannot be ignored. Especially the internet affects education since it provides easy access to information and communication between learners and teachers [2]. Thanks to the internet, teachers and students do not have to print and carry lesson materials. Reaching knowledge, students and lecturers are no longer an important concern of teaching and learning [3]. The challenges on today's education can be classified as mobility, pace and social interaction aspects of learning.

Agah Tuğrul Korucu is with the Department of Computer Education and Instructional Technology, Ahmet Kelesoglu Faculty of Education, Necmettin Erbakan University, Konya, Turkey (e-mail: akorucu@konya.edu.tr).

Mobility is a requirement for both students and teachers in order to prepare or revise the lessons in different locations. In addition, the learning pace should be a concern because every learner can learn at his/her own pace and classroom lecture may not provide same benefits for every learner. Finally, due to lack of social interaction and responsibility, collaborative work cannot be applied properly [4].

These problems emerge the need for network, servers, storage, applications and services in education. In fact, Students expect to access the information on their PDAs, tablets and Mobile Phones. In this manner, Cloud Computing, which has removed the need for lecturing in the classroom, offers embedded learning into every place in which available internet [2]-[5]. Cloud computing, one of the web 2.0 technologies, is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computer resources [6]. This new technology trend can have a crucial effect on education [7].

The positive effects of cloud computing on education can be categorized as savings, upgrades guaranteed, flexibility, effectiveness and sharing. Cloud services reduce the cost for lesson materials, reaching students, technical staff, hardware and software. Also, these services follow the technologic change, which leads to appropriate and relevant software use for all time. Moreover, cloud services are flexible since users can adjust content and resources easily, they can run cloud on any hardware and software regardless of setup and they can access and change their files independence from time and space, which provides learning at every place. As cloud gives learners opportunity to take control of their own learning and ease the classroom management for teacher, a productive and effective learning occurs. Finally, social interaction between students and teachers and collaborative work can be improved because cloud allows sharing among users [4].

Cloud computing is not only used to enhance traditional learning at school, but also it is an essential way to create distance education platforms, and thus it promotes e-learning. E-learning systems suffer from inadequate technology infrastructure. Supplying sufficient network access, data resource environment and effectual flexibility, cloud services can be a solution for this issue [8]. Taking the responsibility of data security and managing network traffic without affecting user experience, cloud based applications can also facilitates mobile learning [9].

Spreading the scope of use, cloud computing for education

should be discussed in detailed way. This paper aimed to clarify the use of cloud computing systems in education.

II. CLOUD COMPUTING

The cloud computing term can be defined as the software applications and other computing resources that can be accessed through the Internet, regardless of installing on users' personal computers [10].

Cloud computing has typically 3 different service models:

A. Infrastructure as a Service (IaaS)

This type of services provides users control not only the applications but also infrastructure resources (storage, networks, provision processing) [11]. Users can distribute and run on-demand software including operating systems. The only thing cannot be managed by users is Cloud infrastructure [6]. In order to accomplish a specific task, these services can be used to meet the infrastructure needs globally or locally with some technologic adjustment [12]. Examples for this type of services are: Amazon EC2 and Google Compute Engine [13].

B. Platform as a Service (PaaS)

This type of services provides operating systems and applications created by consumers or service providers for users which built upon IaaS [6], [11], [13]. Creating applications, customers (especially software developers) use programming languages and other services supported by provider. [6], [13]. Users do not have any control over other computing resources [6]. Examples for this type of services are: Google App Engine and Microsoft Windows [13].

C. Software as a Service (SaaS)

This type of services provides software running on cloud and enables it for public use which can be accessed through a client interface (web browser, e-mail application) [6], [11]. Offering applications by provider over network instead of running them on user's computer, these are the widely-known cloud services [13]. Consumer cannot control or manage infrastructural components and applications [6]. Examples: Google Docs, Salesforce, Dropbox [13]. Cloud computing has typically 4 different deployment models:

D. Private Cloud

This deployment model has an infrastructure that allows usage by a single organization with multiple consumers, which can be possessed, administrated and operated by an organization [6]. The main purpose of this cloud is to enable more control over resources and to resolve security and privacy issues [11].

E. Community Cloud

This deployment model's infrastructure is prepared for consumers from organizations that have shared concerns, which can be possessed, managed and operated by one or more organizations [6].

F. Public Cloud

This cloud infrastructure is arranged for general public use,

which allows open access. it can be owned, managed and operated by organizations while existing on cloud provider [6] although public cloud has security and privacy issues it can save more files than private cloud and the all the risks are under responsibility of cloud provider [11].

G. Hybrid Cloud

this cloud infrastructure is a combination of two or more different deployment models cloud infrastructures, where some of the resources are supplied by organizations and others by cloud provider. [6], [11].

III. CLOUD BASED LEARNING

A. E-Learning, M-Learning, U-Learning, Distance Education, and Cloud

The rapid shift in the technology, a transformation process has begun for education and traditional learning methods have left its place to technological learning methods [14] like e-learning, m-learning and u-learning. Newly introduced cloud systems have a close relationship with those concepts [15], which is discussed following in detail.

Beyond being an education system bounded by electronic networks to content, E-learning is using technology in teaching and learning process consists of digital tools, virtual classroom, web learning and computers [16]. As information technology develops and e-learning become more famous and virtual. Virtual education is a part of e-learning and it decreases spending time and money on accessing educational resources and it facilitates learning and teaching process [16]. Virtual education can be applied in provisioned virtual learning environments.

Virtual Learning Environment is a learning platform that arranged to improve students' learning experience with computers and the Internet in which student can access lecture tools such as content, grades and assessments via web [11]. VLEs are being used in many universities around the world and they provide favorable circumstances like in traditional learning environments without any human interaction [11]. In this scope, cloud services offer communication and interaction between student-student, student-teacher and teacher-teacher. Moreover, using virtual learning environments in education have some other advantages such as feeling secure, designing cost, flexibility allows on-demand changes and controlling the environment which may be impossible in reality [16]. These are all filling the gap between virtual learning environment and traditional ones.

Despite its benefits on education, e-learning is inadequate for some reasons, which leads to the integration of mobile technologies in education. These new dimensions have created a new concept which is called mobile learning (m-learning) and it has a supremacy over e-learning in terms of the independency from time and space [14]. In fact, m-learning is an expansion of e-learning and it is crucial for non-stop learning process with the integration of mobile cloud services. Although m-learning provides prevalent computing and mobility, it has deficiency in device and content resources, which can be resolved by cloud computing [17]. the opportunities given by cloud technologies

like storage, communication and planning with minimum resource usage and independent from time and space have resolved the issues in m-learning and convert into an efficient and effective learning concept [18].

Ubiquitous learning (u-learning) term is arisen from ubiquitous computing which is defined the pervasive presence of computers in our lives. Apart from personal computers; mobile phones, televisions, music players, PDA s, video cameras, game consoles and so on are becoming like computers adding new technical features. Since they are becoming more portable, smaller and cheaper, they are presented in our lives pervasively, which causes ubiquitous computing [19]. Therefore, learning can occur everywhere. Not bounding by space and time, a surrounding context with right contents and services can create learning for students. [20] Cloud services can build u-learning applications such as ubiquitous campus offers efficiency, flexibility and value [21].

Evolving cloud computing has renewed and relieve distance education systems with many advantages in terms of staff, students and teachers. Integrating cloud computing into distance education system can increase the resource use, reduce educational costs and improve teaching and learning quality [22].

Cloud based distance education system supplies independent, quick and collaborative learning for students; and it provides building personalized teaching environment and improved teaching quality for teachers. Allowing synchronous teaching counseling, the requirement for inquiry learning and new curriculum standards coincides by cloud systems [23]. Moreover, installing distance education system on cloud infrastructure can reduce the dependence among different layers and mutual interference among developers [24]. That is, hardware and software requirement with high technical features and resource duplication removed by cloud technology [25].

B. Collaborative Learning and Cloud

Collaborative learning, a learning method allows students to share knowledge, learn together and gain responsibility in team work, is supported by cloud technologies as these technologies enable multiple users to reach and work on a same document.

In cloud, the documents can be shared creator with others to view and edit the document, which resulted in the interaction of several people in different locations simultaneously on a single document. The confusion which resulted from multiplying same document for each version is eliminated and the older versions of document can be retrieved easily when needed because the editing has done by several users have been saving on same document. [26].

In a study conducted by [27], it has found that collaborative cloud based learning can be more effective with the constructivism methods. The ease-of use, playfulness and immediacy characteristics of cloud computing lead to create efficient collaborative learning environment, and it improve lateral thinking and problem solving skills of students.

Another study from China has revealed that there is an enormous increasing rate in the number of e-learners compare to the teachers. Therefore, educational support for students

remains inadequate. Collaborative learning can be a solution for this problem, but current collaborative learning cannot meet the needs, where cloud computing takes place. Most of the students have positive attitudes toward collaborative cloud learning and they think there is no difference between learning from an instructor and collaborative cloud environment [28].

IV. CLOUD SERVICES EXAMPLES IN EDUCATION

Google Apps for Education and Microsoft Live @Edu are the most widely used cloud services in education because they are free of charge for educational institutions, they have no advertisements and they enable to use the institution's domain name [3].

Google Apps for Education involves adjustable web services such as Gmail, Google Docs and Spreadsheets, Google Sites, Calendar and Groups, Picasa and Google Reader. A teacher can prepare and share the learning contents and course syllabus through Google sites; can form dynamic groups through Google Groups in which students can interact with each other on an assignment; can arrange the tasks and meetings which announced through Google Calendar; can share the assessments grades through Google Spreadsheets; can create web albums through Picasa [27].

Although Google (Google spreadsheets and docs, Gmail, Youtube, hangout...) and Microsoft (Office 365, Outlook...) services are used for online productivity widely, there are other cloud service providers for education. Teachers or students can use Dropbox and SkyDrive to access their data from everywhere and share them with everyone. In higher education, for civil engineering AutoCAD WS, for maths and statistics Scilab and R and for professional programming GitHub and Sourceforge can be used. In order to create virtual learning environments Blackboard and Lesson LAMS can be used; to make up a virtual computing laboratory, NEEtLab+ can be used [13].

V. CONCLUSION

Using cloud systems in education is a requirement for 21st century learning concepts. They can improve new learning methods such as online learning, mobile learning video conferencing in new environments like VLEs. [12]. They have a positive impact on collaborative learning as it allows synchronous or asynchronous participation of many users to a shared file. Cloud services can expand the learning environments out of the classroom and provide easier communication and resource sharing for students. Using cloud services can help educational institutions in terms of reducing costs of installation, maintenance, hardware, software and IT staff [29].

Controlled by service provider, Cloud computing prevents the update need for software installed on desktops [29]. Supplying cloud storage, requirement of server rooms and storage arrays is no longer a concern for libraries [29]. Especially in higher education, using powerful computer systems is a necessity due to some applications' setup prerequisites, which is overcome by use of cloud computing

[13]. Finally, cloud services are scalable, that is, they are convenient for any number of users at a large range [29].

Beyond these benefits, cloud computing brings several risks to educational systems. The most important one is the security and privacy issues of data. As data in cloud distributed over personal computers which use same cloud platform, stealing and exposing the private data by hackers facilitates [30]. Another issue is the divergence of cloud service providers which is called vendor lock-in. that is, once having integrated to a system, replacing it with another system administrated by different vendor is almost impossible without a lost [31], which is resulted from the distinction between cloud service provider's technical infrastructure [29]. Performance and reliability issues are another problem in cloud systems. In order to have learning experience at higher levels, institutions that use cloud services should have greater bandwidth and internet connection speed. [13], [29] the reliability can be defined as the lack of control over data security, server, costs etc., that is, every computing resources are depending on the cloud service provider [31], [32].

When comparing both benefits and risks of using cloud services in education, it can be inferred that the benefits predominated the risks. Moreover, the challenges in using cloud can be appeared in traditional computing systems, such as the loss of data in local hard drive, the performance and bandwidth need to reach resources over internet. Despite its proven advantages, cloud services are not being used frequently by students. [21] stated that the reasons for this fact can be the usability, socialability and learnability of cloud services. Socialability is found for the most crucial concern with regards to prefer to use cloud services, that is, students expect to socialize and interact with each other in cloud platforms. However, according to [10], the ease of use perception is the strongest predictor in terms of the intention to use cloud services. In other words, if it requires effort to learn cloud services, it is not adopted by students.

In conclusion, the cloud services should be integrated into educational systems from primary schools to higher education since they are cost effective, flexible and scalable. Moreover, they are an efficient tool to ensure the attendance of digital native students in lectures as they have a tendency to use technologies [3] and they better comprehend knowledge when using remarkable applications [33].

REFERENCES

- [1] Jalali, M., Bouyer, A., Arasteh, B., & Moloudi, M. (2013). The effect of cloud computing technology in personalization and education improvements and its challenges. *Procedia-Social and Behavioral Sciences*, 83, 655-658.
- [2] Saadatdoost, R., Sim, A. T. H., Jafarkarimi, H., & Saadatdoost, L. (2015). A cloud-based teaching framework: an introduction. *International Journal of Management in Education*, 9(2), 235-253.
- [3] Stevenson, M., & Hedberg, J. G. (2011). Head in the clouds: a review of current and future potential for cloud-enabled pedagogies. *Educational Media International*, 48(4), 321-333.
- [4] IBM Global Technology Services. (2012). Applying the cloud in education: An innovative approach to IT, retrieved from http://www-935.ibm.com/services/be/en/cloud-computing/cloud_edu_en.pdf
- [5] Lakshminarayanan, R., Kumar, B., & Raju, M. (2013). Cloud computing benefits for educational institutions. *Second International Conference of the Omani Society for Educational Technology*, eprint arXiv:1305.2616.
- [6] Mell, P., & Grance, T. (2011). The NIST definition of cloud computing.
- [7] Ercan, T. (2010). Effective use of cloud computing in educational institutions. *Procedia-Social and Behavioral Sciences*, 2(2), 938-942.
- [8] Alshwaier, A., Youssef, A., & Emam, A. (2012). A new Trend for E-learning in KSA using educational clouds. *Advanced Computing; An International Journal*, 3(1), 81.
- [9] Rao, N. M., Sasidhar, C., & Kumar, V. S. (2012). Cloud computing through mobile-learning. *International Journal of Advanced Computer Science and Applications*, eprint arXiv:1204.1594
- [10] Behrend, T. S., Wiebe, E. N., London, J. E., & Johnson, E. C. (2011). Cloud computing adoption and usage in community colleges. *Behaviour & Information Technology*, 30(2), 231-240.
- [11] Hegazy, A. F., Khedr, A. E., & Al Geddawy, Y. (2015). An Adaptive Framework for Applying Cloud Computing in Virtual Learning Environment at Education a Case Study of "AASTMT". *Procedia Computer Science*, 65, 450-458.
- [12] Pardeshi, V. H. (2014). Cloud computing for higher education institutes: architecture, strategy and recommendations for effective adaptation. *Procedia Economics and Finance*, 11, 589-599.
- [13] González-Martínez, J. A., Bote-Lorenzo, M. L., Gómez-Sánchez, E., & Cano-Parra, R. (2015). Cloud computing and education: A state-of-the-art survey. *Computers & Education*, 80, 132-151.
- [14] Korucu, A. T., & Alkan, A. (2011). Differences between m-learning (mobile learning) and e-learning, basic terminology and usage of m-learning in education. *Procedia-Social and Behavioral Sciences*, 15, 1925-1930.
- [15] Bai, Y., Shen, S., Chen, L., & Zhuo, Y. (2011, July). Cloud learning: A new learning style. In *2011 International Conference on Multimedia Technology*.
- [16] Bouyer, A., & Arasteh, B. (2014). The Necessity Of Using Cloud Computing In Educational System. *Procedia-Social and Behavioral Sciences*, 143, 581-585.
- [17] Butoi, A., Tomai, N., & Mocean, L. (2013). Cloud-based mobile learning. *Informatica Economică*, 17(2), 27.
- [18] Sarıtaş, M. T., & Üner, N. (2013). Eğitimdeki Yenilikçi Teknolojiler: Bulut Teknolojisi. *Eğitim ve Öğretim Araştırmaları Dergisi*, 2(3).
- [19] Cope, B., & Kalantzis, M. (2008). Ubiquitous learning: An agenda for educational transformation. *Proceedings of the 6th Networked Learning, Greece*.
- [20] Sung, J. S. (2009). U-learning model design based on ubiquitous environment. *International Journal of Advanced Science and Technology*, 13, 77-88.
- [21] Shin, D. H. (2015). User value design for cloud courseware system. *Behaviour & Information Technology*, 34(5), 506-519.
- [22] Wei, C. M. (2014, July). Research on the Network Education Platform of Universities Based on Cloud Computing. In *Advanced Materials Research (Vol. 926, pp. 4594-4597)*.
- [23] Zhao, H. Y., Zhang, P., Zhang, H., & Zhang, X. Y. (2014, May). Building Distance Education System Based on Cloud Computing. In *Applied Mechanics and Materials (Vol. 513, pp. 510-513)*.
- [24] Yu, H., Wan, F., He, X., & Xia, J. (2013). Research of Distance Education System based on Cloud Computing. *Journal of Convergence Information Technology*, 8(8).
- [25] Wang, Y. (2014, November). The Study of Distance Education System Based on Cloud Computing and Resource Integration. In *Applied Mechanics and Materials (Vol. 687, pp. 2841-2844)*. Trans Tech Publications.
- [26] Siegle, D. (2010). Cloud Computing: A Free Technology Option to Promote Collaborative Learning. *Gifted Child Today*, 33(4), 41-45.
- [27] Schneckenberg, D. (2014). Easy, collaborative and engaging—the use of cloud computing in the design of management classrooms. *Educational Research*, 56(4), 412-435.
- [28] Liao, J., Wang, M., Ran, W., & Yang, S. J. (2014). Collaborative cloud: a new model for e-learning. *Innovations in Education and Teaching International*, 51(3), 338-351.
- [29] Prince, J. D. (2011). Introduction to cloud computing. *Journal of Electronic Resources in Medical Libraries*, 8(4), 449-458.
- [30] Kasi Viswanath, M. D., Kusuma, S., & Gupta, S. K. (2012). Cloud computing issues and benefits modern education. *Global Journal of Computer Science and Technology*, 12(10-B).
- [31] Augustsson, K., & Fredriksson, J. (2011). Cloud service analysis-choosing between an on-premise resource and a cloud computing service.

- [32] A Vouk, M. (2008). Cloud computing—issues, research and implementations.CIT. Journal of Computing and Information Technology, 16(4), 235-246.
- [33] Kongchan, C. (2013). How Edmodo and Google Docs can change traditional classrooms. In The European Conference on Language Learning.