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E-Learning Using Cloud Computing and IT

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Abstract: **Cloud computing brings wide ranges of computing power, innovations and shifts in paradigms of Information Technology. Cloud computing will have a significant impact on the educational and learning environment, enabling their own users (i.e., learners, instructors, and administrators) to perform their tasks effectively with less cost by utilizing the available cloud-based applications offered by the cloud service providers. This paper discusses the use of cloud computing in the educational and learning arena, to be called "Education and Learning as a Service" (ELaaS), emphasizing its possible benefits. This paper will probe whether the promise of cloud computing could be employed to enhance or mitigate the challenges poised to e learning implementation i.e. It focuses on the benefits of cloud computing for e-learning solutions.**

Keywords: **Cloud Computing, Information Technology, E-learning**

1. INTRODUCTION

In recent years e-learning has grown into a widely accepted way of learning, and the usage of the global network is inevitable in every education process. Ubiquitous learning integrates wireless, mobile and context awareness technologies in order to detect the situation of the learners and provide more seamless adaptive support beyond formal learning process (Shih, Chu, Hwang, & Kinshuk, 2011; Hwang, Chih-Hsiang, Tseng, & Huang, 2011, El-Bakry & Mastorakis, 2009;[2] Yang, 2006).[4] In order to support modern pedagogical approaches, as well as a variety of heterogenic learning resources within courses, ubiquitous learning environments need to be based on a powerful IT infrastructure. At the same time, in order to be efficient, ubiquitous learning environments need to be based on learning management systems (LMS) and integrated into an existing e-learning environment of educational institutions. [5]

LMSs are powerful integrated systems that support a number of activities performed by teachers and students during the e-learning process (Hauger & Kock, 2007; [3] Kahiigi, Ekenberg, Hansson, Tusubira, & Danielson, 2007) [6]. In most cases, LMS users belong to heterogeneous groups with different, sometimes even adverse, individual characteristics and needs. The adaptation of e-education systems to an individual or to a group based on their characteristics, expectations, knowledge, and preferences is nowadays inevitable (Paramythis & Loidl-Reisinger, 2004).[7] Since systems for adaptive e-learning are becoming more complex, educational institutions need new solutions for deploying scalable and reliable environments for adaptive e-learning (Aroyo, Dolog, Houben, Kravcik, Naeve 2006)[1]

2. RELATED WORK

Cloud computing (CC) is an abstract, scalable and controlled computer infrastructure that hosts applications for the end-users. Cloud Computing is an area of computing that refers to providing customers with highly scalable IT capacities as a service via the Internet (Sultan, 2010).[8] Services and data coexist in a shared and dynamically scaled set of resources (Srinivasa, Nageswara, & Kumari, 2009). [9]Virtualization is one of prerequisites for the realization of Cloud Computing (Dong, Zheng, Yang, Li, & Qiao, 2009).[10] It allows for an efficient usage of resources, because several virtual machines (hereinafter: VM) can operate on one physical machine (Jin, Liao, Wu, Shao, & Luo, 2008).[11] Cloud Computing is an infrastructure that can bring a new value to an e-learning system, as educational services can be delivered in a reliable and efficient way. It also provides a suitable environment for ubiquitous learning activities. As a result, efforts to introduce Cloud Computing in e-learning environment have been initiated over the last couple of years and are ongoing across the world. However, shifting from a traditional IT infrastructure to a cloud based infrastructure is a complex task for an educational institution (Reich, Hubner, & Kuijs, 2012)

3. INTEGRATION MODEL

The development of a typical system for e-learning includes: the implementation of LMS, the integration of Internet services in a network of educational institutions and a business information system. The integration of components of the system is realized using multiple layers:

- Human resource integration – students, teachers and other participants in the learning process can access the system and can communicate from any location.
- Information integration – the system enables gathering heterogeneous, unstructured data, while users can access structured data.
- Process integration – adaptive e-learning processes are integrated using web services.
- Application integration – the integration is realized at the application level on cloud computing infrastructure.

The method of integration of e-learning services with the cloud computing infrastructure is shown in the Figure 1.

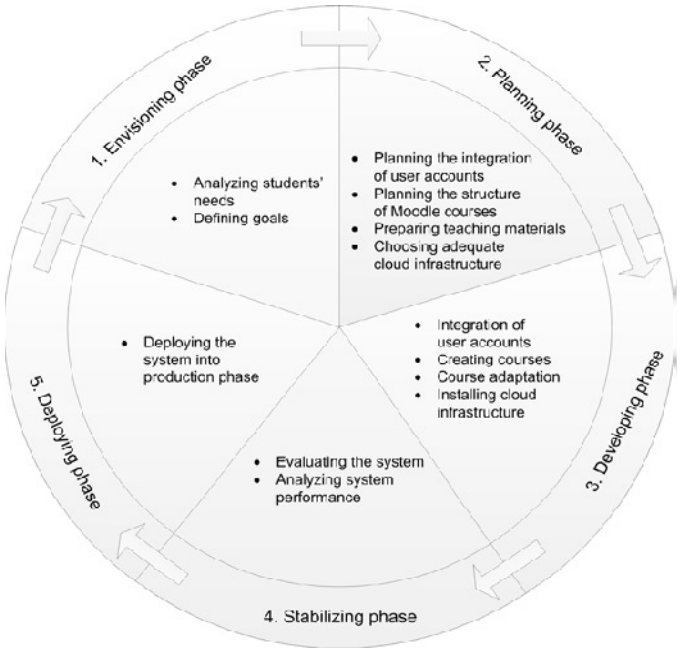

Figure 1. A method for integration of e-learning services with cloud computing

There are five phases in the proposed model. In the first phase, the user accounts are created. The user accounts are stored on LDAP server. The LDAP server is integrated with the user directory of the educational institution where the student accounts are located. In the second phase, the courses are created in the Moodle LMS. Teaching materials are prepared, the activities and the assignments are defined. The necessary software tools for teaching process realization are chosen. The course adaptation process is performed. In the third phase, the VMs with necessary operating systems and software are prepared. Each VM is adapted to students' learning styles and needs at a specific course. Afterwards, the prepared VMs are stored into the CC infrastructure. In the fourth phase, students use the ELAB Cloud application for VM reservation and its deployment. The application allows students to reserve any of the provided VMs for the Moodle course to which they are enrolled. Students can perform the reservation using a web application. In the fifth and the final phase, teachers and administrators of the system can view and analyze students' results and the performance of the system.

4. CLOUD-BASED EDUCATION SYSTEMS

As the adoption of cloud computing increases, many academic institutions are introducing cloud computing technologies into their education systems, promising and delivering more scalable and reliable education services. Many universities have acknowledged the potential benefits of leveraging cloud computing for economic reasons, as well as for more advanced teaching and data sharing [12]. A number of studies were conducted to investigate the benefits of using cloud computing for e-learning systems [8 - 10] and to suggest solutions for cloud computing-based e-learning systems [6, 10, 11]. Pocatilu *et al.*, [9] presented cloud computing advantages for e-learning as being low cost with higher data security, virtualization, centralized data storage, and the possibility of monitoring data access. They also specified cloud computing benefits for e-learning in terms of the characteristics of the three cloud service models: infrastructure (e-learning systems can be run on the provider's infrastructure), platform (e-learning systems can be implemented based on the provider's development interface), and service (e-learning systems can use provider-developed solutions). Bora and Ahmed [20] examined the benefits of adopting cloud computing for e-learning and found it is low cost, offers improved performance, provides instant software updates and improved document format compatibility and data security. Additionally, it provided many benefits for students and teachers, such as online courses, exams, assignments, projects, feedback, forums, and e-learning content and resource management.

The University of California (UC) at Berkeley is operating its courses on a cloud supported by Amazon Web Services, based on the SaaS service model [7]. The University of Washington is adopting cloud computing to provide state-of-the-art productivity and collaboration tools to staff and students, supported by Microsoft (Windows Live including Email and Calendaring, Messenger, SkyDrive, Spaces, and Photos) and Google (Google Apps including Google Email, Calendar, Docs, Sites, and Talk) [13]. The University of Texas at Austin and the North Carolina State University achieved a substantial decrease in IT-related expenditures [14]. Universities are leveraging cloud computing for economic reasons as well as for more advanced teaching, instruction, and data sharing.

Several companies including are accelerating delivery of cloud-based education systems to educational institutes as a way of generating future business, and several learning management systems are also now supporting cloud-based educational services [8]. Although much work has been done to date with regard to adopting cloud computing for educational systems, further studies need to be conducted to develop more diverse forms of cloud-based education systems, in more innovative and efficient ways. Meanwhile, most of the current cloud-based education systems are concentrating on delivering and sharing learning materials and teaching activities, rather than constructing and supporting an integrated, total cloud-based educational environment.

5. BENEFITS OF CLOUD COMPUTING

Generally, the benefits of cloud computing in e-learning can be divided into four groups [11]:

- reducing the costs of using resources
- flexibility in the use of infrastructure
- increased availability
- the client is the end user

As the Electronic Learning, better known as E-Learning [13], is defined as an Internet enabled learning. Components of e-Learning can include content of multiple formats, management of the learning experience, and an online community of learners, content developers and experts. The study summarized the main advantages, which include flexibility, convenience, easy accessibility, consistency and its repeatability. With Information Technologies (IT), there is a growing trend regarding the research and exploitation of this kind of e-Learning platforms. There exist several

initiatives at different educative levels, from which some examples are the Khan Academy1, the Virtual Learning Center of Granada University (CEVUG-UGR), the Open University of Catalonia, the MIT Open CourseWare, or the "Free Online Course" of the Standford University. The virtual courses that are supported by the e-Learning approach favors the achievement of a higher impact for the educative framework than those of the classical attendance group. As an example, in the first edition of the "Machine Learning" course of Stanford2 more than 160,000 worldwide students were registered. These dimensions affects different issues; on the one hand, the infrastructure provisions that are necessary to give a concurrent service for that amount of students clearly exceed the capabilities of a conventional web server. Furthermore, the demand of the teaching resources usually vary in a dynamic and very quick way, and presents high peaks of activity.

To attend requests during these periods of time without other system services to be resented, it will be necessary to prepare a quite superior infrastructure than that required for the regular working of the learning institution. An alternative would be to provide those services depending on the demand and only paying for the resources that are actually used. The answer to these necessities is the Cloud Computing environment. Cloud Computing [17] is a computation paradigm in which the resources of an IT system are offered as services, available to the users through net connections, frequently the Internet. It is a model of provision of IT services offered through a catalog that answers to the necessities of the user in a flexible and adaptive way, only billing for the actual usage that is made.

Therefore, two of the distinctive features of this paradigm are, on the one hand, the use of resources under demand and, on the other hand, the transparent scalability in such a way that the computational resources are assigned in a dynamical and accurate manner when they are strictly necessary, without the requirement of a detailed understanding of the infrastructure from the user's point of view. With these characteristics, the Cloud platforms arise as accurate alternatives to traditional computer centers. They represent a significative alternative versus the acquisition and maintenance of the computer centers. Additionally, the e-learning platforms of the large dimensions which we mentioned above generate extensive registers of interaction among students-platform teachers. These data bases contain significative information not defined in a precise way. Data Mining techniques must be applied to extract this information [15]. Therefore "Educational Data Mining" comes up, being this a discipline whose object of interest is the development of new methodologies to explore the data that aregenerated in the activity of the educational systems (mainly those with a technological base) and the application of such methods to achieve a better understanding of the behaviour of the students, and how to design procedures and material that ease the learning process.

6. CLOUD COMPUTING FOR E-LEARNING TASKS

As with the huge growth of the number of students, education contents, services that can be offered and resources made available, e-Learning system dimensions grow at an exponential rate. The challenges regarding this topic about optimizing resource computation, storage and communication requirements, and dealing with dynamic concurrency requests highlight the necessity of the use of a platform that meets scalable demands and cost control. This environment is Cloud Computing. The main advantages and drawbacks to be addressed for e-Learning systems in (Subsection 6.1). Then, the significance of selecting Cloud Computing for this kind of tools will be discussed in (Subsection 6.2).

6.1 Current Challenges of E-Learning Systems

Among the learning technologies, web-based learning offers several benefits over conventional classroom-based learning. Its biggest advantages are the reduced costs since a physical environment is no longer required and therefore it can be used at any time and place for the convenience of the student. Additionally, the learning material is easy to keep updated and the teacher may also incorporate multimedia content to provide a friendly framework and to ease the understanding of the concepts. Finally, it can be viewed as a learner-centered approach which can address the differences among teachers, so that all of them may check the confidence of their material to evaluate and re-utilize common areas of knowledge [18].

However, there are some disadvantages that must be addressed prior to the full integration of e-Learning into the academic framework. Currently, e-Learning systems are still weak on scalability at the infrastructure level. Several resources can be deployed and assigned just for specific tasks so that when receiving high workloads, the system need to add and configure new resources of the same type, making the cost and resource management very expensive.

This key issue is also related to the efficient utilization of these resources. For example, in a typical university scenario, PC labs and servers are under-utilized during the night and semester breaks. In addition, these resources are on high demands mainly towards the end of a semester, following a dynamic rule of use. The physical machines are hold even when they are idle, wasting its full potential. Finally, we must understand that there is a cost related to the computer (and building) maintenance, but that the educational center must pay for the site licensing, installation and technical support for the individual software packages [19].

6.2 On the Suitability of Cloud Computing for E-Learning

E-Learning in the Cloud can be viewed as Education Software-as-a-Service. Its deployment can be performed very quickly since the hardware requirements of the user are very low. Furthermore, as we stated previously, it lessens the burden of maintenance and support from the educational institution to the vendor, allowing them to focus on their core business, also obtaining the latest updates of the system without charges and sharing key resources using Web 2.0 technology.

In what follows, we summarize the consequences and implications regarding the development of e-Learning services within the Cloud Computing environment, as pointed out by Masud and Huang in [21]:

- **Accessed via Web:** It implies an ease of access since anywhere, any time and any one can access the application, greater demand for Web Development skills.
- **No client-side software needed:** Therefore, it has reduced costs for subscriber, as no installation, software maintenance, deployment and server administration costs, and a lower total cost of ownership, reduced time-to-value, fewer IT staff is needed by the institution.
- **Pay by subscription based on usage:** Which is suitable for Software Model Education market, and can gain access to more sophisticated applications.
- **SaaS server may support many educational institutions:** Since the application is running on a server farm, the scalability in inherent to the system. As student usage grows, the software performance will not degrade.
- **All subscriber data held on SaaS server:** Very high level of security is needed by SaaS provider in order to gain trust of subscribers and sophisticated multitenanted software architecture. The subscriber data is distributed between many providers and it must be integrated in order to gain overview of business, higher demand for system and data integrators.
- Finally, several potential values of Cloud Computing for education as stressed by Ouf et al. in [23] include the following:
- No need for backing up everything to a thumb drive and transferring it from one device to another. It also means students can create a repository of information that stays with them and keeps growing as long as he wants them.
- Crash recovery is nearly unneeded. If the client computer crashes, there are almost no data lost because everything is stored in the cloud [16].
- Allow students to work from multiple Places (home, work, library ... etc), find their files and edit them through the cloud and browser-based applications can also be accessed through various devices (mobile, laptop and desk top computers, provided internet access is available) [25].
- Flexibility: Scale infrastructure to maximize investments. Cloud computing allows user to dynamically scale as demands fluctuate [26].
- Improved improbability : it is almost impossible for any interested person (thief) to determine where is located the machine that stores some wanted data (tests, exam questions, results) or to find out which is the physical component he needs to steal in order to get a digital asset [24].
- Virtualization: makes possible the rapid replacement of a compromised cloud located server without major costs or damages. It is very easy to create a clone of a virtual machine so the cloud downtime is expected to be reduced substantially.
- Centralized data storage: losing a cloud client is no longer a major incident while the main part of the applications and data is stored into the cloud so a new client can be connected very fast. Imagine what is happening today if a laptop that stores the examination questions is stolen.
- Monitoring of data access becomes easier in view of the fact that only one place should be supervised, not thousands of computers scattered over an extensive geographical area, for example. Also, the security changes can be easily tested and implemented since the cloud represents a unique entry point for all the clients [27].

7. CONCLUSION

We have discussed the main components of e-Learning, focusing on the flexibility, convenience, easy accessibility, consistency and repeatability of this kind of systems. In this manner, an E-learning system is facing challenges of optimising large-scale resource management and provisioning, according to the huge growth of users, services, education contents and media resources. The features of the Cloud Computing platform are quite appropriate for the migration of this learning system, so that we can fully exploit the possibilities offered by the creation of an efficient learning environment that offers personalized contents and easy

adaptation to the current education model. Specifically, the benefits considering the integration of an e-Learning system into the cloud can be highlighted as good flexibility and scalability for the resources, including storage, computational requirements and network access; together with a lower cost considering the paper-use billing format and then save in new hardware and machines and software licences for educational programs. There are several approaches that have been already proposed for addressing e-Learning on Cloud Computing, describing these models and how they take advantage of this environment to enhance the features of the educational system. However, we must stress that these are just initial steps towards an open line for research and exploitation of e-learning and cloud computing platforms.

REFERENCES

[1] Aroyo, L., Dolog, P., Houben, G-J., Kravcik, M., Naeve, A., Nilsson, M., Wild, F. (2006). Interoperability in personalized adaptive learning. Journal of Educational

[2] El-Bakry, H. M., & Mastorakis, N. (2009). Activation of informal learning with e-learning technology. In S. C. Misra, R. Revetria, L. M. Sztandera, M. Iliescu, A. Zaharim & H. Parsiani (Eds.), Proceedings of the 8th WSEAS International Conference on Education and Education Technology (pp. 245-247). Athens, Greece: World Scientific and Engineering Academy and Society.

[3] Hauger, D., & Kock, M. (2007). State of the art of adaptivity in e-learning platforms. In A. Hinneburg (Ed.), LWA 2007: Lernen - Wissen – Adaption, Halle, Workshop Proceedings (pp. 355-360). Halle, Germany: Martin-Luther-University Halle-Wittenberg.

[4] Dong, B., Zheng, Q., Qiao, M., Shu, J., Yang, J.: BlueSky Cloud Framework: An ELearning Framework Embracing Cloud Computing. In: Jaatun, M.G., Zhao, G., Rong, C. (eds.) Cloud Computing. LNCS, vol. 5931, pp. 577–582. Springer, Heidelberg (2009)

[5] Despotović-Zrakić, M., Simić, K., Labus, A., Milić, A., & Jovanić, B. (2013). Scaffolding Environment for Adaptive E-learning through Cloud Computing. Educational Technology & Society, 16 (3), 301–314.

[6] M. A. H. Masud and X. Huang, "An E-learning System Architecture based on Cloud Computing", World Academy of Science, Engineering and Technology, vol. 62, (2012), pp. 74-78.

[7] N. Sultan, "Cloud computing for education: A new dawn?", International Journal of Information Management, vol. 30, (2010), pp. 109-116.

[8] P. Pocatilu, "Cloud Computing Benefits for E-learning Solutions", Oeconomics of Knowledge, vol. 2, no. 1, (2010), pp. 9-14.

[9] U. J. Bora and M. Ahmed, "E-Learning using Cloud Computing", International Journal of Science and Mod-ern Engineering, vol. 1, no. 2, (2013), pp. 9-12.

[10] M. Al-Zoube, S. A. El-Seoud and M. F. Wyne, "Cloud Computing Based E-Learning System", International Journal of Distance Education Technologies, vol. 8, no. 2, (2010), pp. 58-71.

[11] N. M. Rao, et al., "Cloud computing through mobile-learning," arXiv preprint arXiv:1204.1594, 2012.

[12] M. Mircea and A. I. Andreescu, "Using Cloud Computing in Higher Education: A Strategy to Improve Agili-ty in the Current Financial Crisis", Communications of the IBIMA, vol. 2011, Article ID 875547, (2011), pp. 1-15.

[13] University of Washington, "IT Connect: Cloud Services Frequently Asked Questions", http://www.washington.edu/itconnect/teamwork/cloudfaq.html#cloud (accessed on May 2013).

[14] Cisco, "Cloud Computing 101: Universities are Migrating to the Cloud for Functionality and Savings", http://www.cisco.com/en/US/services/collateral/ps10658/ps11785/cloud_101_higher_education_wp.pdf (ac-cessed on May 2013).

[15] Ji-Seong Jeong1, Mihye Kim2 and Kwan-Hee Yoo , A Content Oriented Smart Education System based on Cloud Computing

[16] International Journal of Multimedia and Ubiquitous Engineering Vol.8, No.6 (2013) pp.313-328

[17] Al-Zoube, M., El-Seoud, S.A., Wyne, M.F.: Cloud computing based e-learning system. Intl. Arab Journal of e-Technology 8(2), 58–71 (2010)

[18] Buyya, R., Broberg, J., Goscinsky, A.: Cloud Computing: Principles and Paradigms. John Wiley and Sons (2011)

[19] Ercan, T.: Effective use of cloud computing in educational institutions. Procedia – Social and Behavioral Sciences 2(2), 938–942 (2010)

[20] Jolliffe, A., Ritter, J., Stevens, D.: The online learning handbook: Developing and using Web-based learning. Kogan Page, London (2001)

[21] Kwan, R., Fox, R., Chan, F., Tsang, P.: Enhancing Learning Through Technology: Research on Emerging Technologies and Pedagogies. World Scientific (2008)

[22] Masud, A.H., Huang, X.: ESaaS: A New Education Software Model in E-learning Systems. In: Zhu, M. (ed.) ICCIC 2011, Part V. CCIS, vol. 235, pp. 468–475. Springer, Heidelberg (2011)

[23] Mayer, R., Clark, R.: E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, 3rd edn. Pfeiffer (2011)

[24] Ouf, S., Nasr, M.: Business intelligence in the cloud. In: IEEE 3rd International Conference on Communication Software and Networks (ICCSN 2011), pp. 650–655 (2011)

[25] Pocatilu, P., Alecu, F., Vetrici, M.: Measuring the efficiency of cloud computing for elearning systems. W. Trans. on Comp. 9, 42–51 (2010)

[26] Romero, C., Ventura, S.: Educational data mining: A review of the state of the art. IEEE Transactions on Systems, Man, and Cybernetics–Part C: Applications and Reviews 40(6), 601–618 (2010)

[27] Sosinksy, B.: Cloud Computing Bible. John Wiley and Sons (2011)

[28] Wheeler, B., Waggener, S.: Above-campus services: Shaping the promise of cloud computing for higher education. EDUCAUSE Review 44(6), 52–67 (2009)