

iLearn: Implication and Complications

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Abstract— Cloud computing is an emerging field in educational service. The academic institutions as non-profit organizations attempt to enhance quality of service provided with the cost-effective way. Number of universities took the advantage of cloud-based applications offered by service providers and provided their instructors/students with remote access to handle their educational tasks. This paper discussed advantages, challenge and limitation of using cloud service in educational system. The authors conducted a case study to capture implications and perception of different participates toward moving to cloud service. The empirical findings highlight main issues and concern that should be taken into consideration prior merging cloud service into the learning process.

Keywords: *Cloud Computing, Learning system, Moodle learning system*

I. INTRODUCTION

Computers, information technology and internet have been replacing the labor-intensive business activities across the different industries. The current market supports the new generation of applications like mobile phones or PDAs, which allows storing data inside the cloud. (POCATILU et al., 2009)

Cloud computing is considered as the latest a new advanced technology that invades the innovation for the computer industry (Masud and Huang, 2012). It is growing rapidly, with applications in different sectors like financial, health, telecommunication and education sector. This new technology has the capability to run on a wide range of hardware devices, and storing data inside the cloud (Masud and Huang, 2012). It becomes an adoptable technology for many of the organizations due to its dynamic scalability and usage of virtualized resources as a service through the Internet.

In this paper, the authors discuss the cloud computing readiness in educational system in developing countries. According to (Tuncay, 2010), Cloud computing is one of the new technologies that have a significant impact on the education environment (Masud and Huang, 2012). This will allow the education be more in interactive among teachers and students and gains more benefits from usage of applications. As well as it allows colleges to run their information systems effectively with small budget for the computers and network devices. (POCATILU et al., 2010)

II. PROBLEM STATEMENT

The need for education is increasing and the need for improvement for e-learning solutions is essential (POCATILU et al., 2009). Traditional web-based e-learning mode, system construction and maintenance are located inside universities, therefore problems exist (Masud and Huang, 2012).

E-learning systems require many hardware and software resources. It must be adapted with the technology taking into consideration the implementation of cloud solution. So, the Blackboard and the Moodle considered as biggest players in e-learning software with versions of base applications that are cloud oriented (Masud and Huang, 2012), (POCATILU et al., 2009).

The main aim of cloud computing is to share data, calculations and services among users (Tuncay, 2010); (Masud and Huang, 2012). There are several cloud computing services providers that offer support for educational systems with certain architectures to support compute, storage and application service; for example: Amazon, Google, Yahoo, Microsoft etc. (POCATILU et al., 2009). Mallikharjuna et al. (2010) made a survey and found the following: 69% recognized cloud usage in business, 12% knew that it is used in education, 88% agree to implement the cloud for education sector, and 94% believe that the cloud technology can reduce the cost of high quality education system.

III. CLOUD COMPUTING OVERVIEW

Pocatilu et al. (2009), define Cloud computing as a term derived from the way the internet represented in the network diagrams where Masud, and Huang (2012) state that cloud computing is a model based on networks, based on internet whose task is to ensure that users can simply use computing resources on demand and pay money according to their usage.

In accordance to (Masud and Huang, 2012); (POCATILU et al., 2009); (Tuncay, 2010); (Mallikharjuna et al., 2010), the main characteristics of cloud computing are:

- High scalability for data storage;
- Feasibility to use resources on demand;
- Availability of virtualized resources to users in terms of fast connection, broad band internet, wireless

hotspots and virtualization, which have a significant impact on teaching and learning environment;

- Users communicate through internet with remote servers at same time and allows exchange of information between them;
- Users do not acquire special knowledge about cloud computing.

Additionally, Tuncay (2010); POCATILU et al. (2009); Mallikharjuna et al. (2010) discussed the advantage of cloud computing and stated the following:

- Allowance of the Provision of global platforms;
- Elimination of hardware and software capacities and licenses;
- Reduction of cost in hardware and software upgrades;
- Flexibility, which allows dynamic scalability as demand fluctuate;
- Adopting cloud network redundancy;
- Increased automation;
- Decrease of disaster recovery risks and its high costs, data is secured because it stored in cloud, so absence of data loss;
- Improve IT by using new applications and tools;
- Devices with minimum hardware requirement can use cloud successfully (e.g mobile phone);
- Dismissal of the responsibility for IT staff in maintenance.

Tuncay, (2010) and POCATILU et al., (2009) define a number of disadvantages related to cloud computing:

- The speed of the Internet connection may affect the overall performances;
- Data center subscription fee may be more expensive than buying the hardware;
- All cloud providers do not have the same capability for their technological levels
- Constraints with application offerings, service-level agreements and security issues still exist; since service quality is crucial and the need of the backups is critical for data security.

Regarding the required resources for cloud computing, Masud and Huang, (2012) identified the following as pre-requisite infrastructure:

- **Externally owned (public cloud):** this allows access to external users whose charged as a pay as you use
- **Internally owned (private cloud):** this can be accessed within the organization, and the users are not charged.

Cloud computing is consisted of three layers (POCATILU et al., 2009), (Masud and Huang, 2012), (V), (Tuncay, 2010): These layers are PaaS, IaaS and SaaS

1) **Platform as a service (PaaS):** refers to the foundational elements to develop new applications (e.g google application engine)

2) **Infrastructure as a service (IaaS):** provides computational and storage infrastructure in centralized, location-transparent service (e.g amazon)

3) **Software as a service (SaaS):** The services can be Web-based email, inventory control and database processing (Newton, 2009). There is no need for users to buy software, hardware, or even upgrade. The users are required to pay monthly fees. Since the service providers supply the required hardware and software and interact with the user through a web portal.

Masud and Huang (2012) stated that e-learning cloud consists of five layers: These layers are infrastructure layer, software resource layer, resource management layer, service layer and application layer.

- 1) **Infrastructure layer:** refers to the dynamic and scalable physical host pool. It composed of information infrastructure and teaching resources.
- 2) **Software resource layer:** presents a unified interface for e-learning developers. It composed by operating system and middleware.
- 3) **Resource management layer:** is achieved through loose coupling of software and hardware resources.
- 4) **Service layer:** consists of three levels of services (software as a service, platform as a service and infrastructure as a service),
- 5) **Application layer:** offers the content production, content delivery, virtual laboratory, collaborative learning, assessment features.

Since service quality is a vital factor for the success of cloud computing (POCATILU et al., 2009), (POCATILU et al., 2010). Juran (1988) introduced the concept of Company Wide Quality Management (CWQM). According to Pocatilu, et al. (2010) it can be applied for e-learning based on cloud computing. (CWQM) consists of *three pillars*:

1. **Quality planning:** focus on categorize customers with their needs that should be satisfied;
2. **Quality control:** follows the process of producing goods and services that meet the customers' needs, which identified in quality planning;
3. **Quality improvement** the efforts required to execute to improve the previous processes.

Emerging the cloud computing in the learning process is mandatory. Several studies indicated the advantage of using cloud computing in e-learning (Tuncay, 2010); (Mallikharjuna et al., 2010); (POCATILU et al., 2009):

- Decreases of Cost, since students and administrative personnel access various application platforms and resources through the web pages on-demand. Also there is no need to buy expensive software, since it is available for free;

- 24/7 for Students and teachers to access files and applications from any place become easier too;
- Reliability of data in cloud, in other word, improved improbableness as it is impossible for anyone to determine the location of important data like exams, results, etc.
- Centralized data storage.

IV. RESEARCH METHODOLOGY

The main research question tackled in this study " will the movement toward cloud computing provided the educational institution with economical and technological advantages?". In order to tackle such question, we have to tackle such questions:

- What are the main issues that face the educational institution in implementing and managing learning-based management system?
- What are the advantages/dis-advantages of moving to cloud computing for managing the educational resources remotely?

This paper conducts a case study on one of private institutions in Egypt. The institution uses an open-source electronic learning system to support the learning process. A case study methodology - an exploratory method (Kanellis and Papadopoulos, 2008) – is employed. In accordance to this method, "The researcher can investigate a phenomenon in depth, getting close to the phenomenon, enabling a rich description and revealing its deep structure" (Cavaye, 1996, p.236).

The researcher conducted semi-structure and unstructured interviews with college management, ICT technical support, CMT faculty members, students to figure out their degree of satisfaction and reliability of the provided service from the adopted learning management systems. The interviews attempt to explore as well the experienced issues by learning management system users and technical support team. The researchers got details on the selection process of the adopted learning system and how the college tried to enhanced the service provided by getting highly configured HW to get speedy processing. The researcher did investigate the reason behind selecting open-source solution and it's competitive advantages over the licensed solutions for non-profit institutions. The users of learning management systems have been interviewed as well to report their satisfaction on the used systems and the reliability of such service. The researchers bring -out the new trends toward cloud computing and investigate the applicability of such solution to system users, management and technical team. The did interview the managerial decision makers of the college (20 decision makers), members of technical staff (5 technical staff) and choose random sample of system users (instructors, students) the sampling is stratified one to consider sample of freshly enrolled students to students near graduation. The instructor' sample did consider instructors from different department to consider different level of IT-

skills adequacy. The sample size for instructor and students is 30 users.

Methods triangulation is achieved through conducting semi-structured interviews and observing the use of learning system from different perspectives: instructors and students, the familiarity with use of electronic learning system, actual usage of learning system, IT skills of participant and cultural issues related to resistance of change, management commitment to new system implementation, willing to investment compared to priority of resources.

The empirical research attempted to cover all aspects that may face learners and instructors to deal with the automated learning process and address the issues related to the process automation. Besides issues that face technical support team for preserving a good service and handling maintenance and activities upgrade, the role of management in supporting the learning process and willingness to move to new technologies. In order to define interview procedure and questions, the authors referred to other studies conducted in the same region. Several interviews were conducted with learners, instructors, IT support service, network service department, management and decision makers of the academic institution.

V. CASE STUDY CONTEXT

The authors conducted the case study on college of management & technology, Arab Academy for Science. The Arab Academy for Science, Technology and Maritime Transport is an affiliate to the Arab League that was established in 1972. The Academy comprises four main colleges, which offer a wide variety of specializations: the College of Management and Technology, the College of Engineering and Technology, the College of Maritime Transport and Technology and our most recent addition, the School of Computing and Information Technology. Around 15,000 students are currently enrolled in these colleges.

In 1992, the College of Management and Technology was founded. Its establishment came in response to the Academy's desire to create a source of knowledge and skills for the business sector and professionals. Around 5000 students had graduated from the College of Management and Technology and over 500 students are currently enrolled.

VI. CASE STUDY FINDINGS

College of a management and technology is using Moodle as Web-based learning system. The Moodle application was hosted on-campus server. To ensure service reliability, the college invested 5000 USD in 2005 to get server with most updated configuration. The server processing is handled using four Intel processors (Xeon CPU 5160- speed 3.00GHz) and disk space of 150 GB. With the rapid technological changes, nowadays, such cost will enable the college to get one with

enhanced configuration but it is not possible to place another technological investment regarding recourse priorities.

The Moodle learning system is used by academic staff/students to upload/download material, download/upload assignments, post topics and participate in discussion. Users around 5,000 users are registered in the management system. Concurrent users may range from 100-150 users. Most of activities that are being handled by users on Moodle are related to upload/download files. Conducting a quiz online or any type of assessment test is not applicable due to occasional connectivity issue, limited IT skills for non-business information system students. That's why written exams are preferred by instructors as main way of assessment. Currently, the college of management considers moving to cloud computing service, which will take off the burden of HW purchase/upgrade and maintenance.

Accordingly, it will give more space for the technical team to support students/staff in practical sessions. There are number of issues that might be interfered to undertake such decision: cost of license that will be paid per user, max No of concurrent users and active sessions that can launched concurrently. Getting unlimited user access will be an expensive option for non-profit institution taking into consideration the increased rate of admitted students. On the other hand, managing the connectivity to a remote server and controlling the network traffic is another challenge that might face technical support team. Other issues related to total number of user allowed to use this service, Disk space allowed per user will impose constrains on file uploaded and may cause some difficulties for practical courses.

The management paid consideration to most of interfering issues and reluctant to make the decision of moving forward to the cloud service. This is not the case of technical team, they are trying to convince the management with the value-added of the cloud service and it's economical advantage. From the participant perspective, both instructors and students are concerned with constrains that might restrict their disk space and their access to the learning system. To conclude, the management, student and instructor, technical team showed an interest to cope with the recent technological trend but need to get the most cost-effective cloud option that provide sufficient disk space and reliable service.

VII. DISCUSSION

Cloud computing is best defined as combination of applications can be delivered as services over the Internet using hardware and systems software hosted by data centers to provide those services.(Armbrust et al., 2010); (Armbrust et al., 2009). Since the cloud computing is emerging in several field (Kshetri, 2010), then the potential of using cloud service by academic institution should be investigated. Most of such

institutions have to deal with electronic learning management system and manage their lab capacities for practical sessions.

Consequently, the limitation of technological resource may interfere to provide enhanced learning services to both learners and instructors. Regardless of tight control and data security advantage of hosted on-campus HW/SW, Most of those institutions consider moving toward the cloud service provider to ensure quality of electronic service provided and provide economical advantages in term of resources. The institutions may decide on Platform-as-a-service (PaaS) or Software-as-a-service (SaaS) as service model. According to Platform-as-a-service (PaaS), the cloud provides platform, tools and database services in order to develop and manage own applications. On the other hand, Software-as-a-service (SaaS) enables the institution to access the application software and get connected to the databases. Consequently, the service provider is responsible to host the application software.

To maximize security and over control, institution may decide on hosting on Private clouds which will provide tight control on data and ensure its confidentially more over using public cloud systems. On the other hand, the public clouds will provide cost effective for such institution. For more cost effective alternative, the institution may choose billing and service usage metering which is called pay-as-you-go model. According to this model, users pay based on consumed resource.

When it comes to cloud computing advantage, service availability and accessibility from several devices (desktop, smart phones) 24x7 are main advantages. In Some cases, the third party hosting service can provide secured service than institution with limited resources can provide.

On the other hand, dealing with Data lock-in is critical risk institution may face. Data lock-in will prevent users from extract their data from the cloud. That is why Google started "takeout" options, which enable the user to export some data (calendar, email, contacts). Data Security is another issue. Using encryption does not mean that data is secured along the way. For instance, Drop-box provides secure data transfer over the internet but it does not mean that data are stored on drop-box in encrypted format. Sharing the same physical space with other customer might be cost-effective but it might impose limited size or less unsecured option.

Another challenge is related to latency and bandwidth-related issues. As long institution is accessing remote service with limited bandwidth, A transfer bottlenecks may occur especially for data-intensive applications (Grossman, 2009). To overcome such issue, extending institution bandwidth is essential prior moving to cloud service. Moreover, the academic institutions will have to deal with insider attacks. Such as a Denial of Service attacks. Here comes the role of cloud provider in securing their cloud from insider hackers.

Therefore, there are certain constraints on accessing the hardware and restricted access to the critical components of the infrastructure (Santos, 2009).

In case the institution is not convinced to host its data on third party, using ownCloud is an alternative to consider: OwnCloud is a cloud infrastructure that provides great functionality and can be installed on any webserver that runs MySQL and php5. According to this option, customer can define where to locate the server, which is not the case for other service providers.

VIII. CONCLUSION

The cloud computing is an emerging field that could enhance service provided by educational institutions. The educational institution faces many challenges to improve the service provided to enrolled students with the most cost-effective way. Coping with recent technologies and saving the huge investment in technological infrastructure are key drivers for such institution to use the cloud service in their learning system. The tradeoff between the internal hosted system and remotely accessed one should be based on reliable internet connectivity and sufficient bandwidth that can ensure providing reliable learning system to all participants.

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