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A Proposed Cloud Computing Model For Supporting E-Learning

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ABSTRACT

Dependence on Information Technology (IT) in universities has become inevitable. They use IT for both admin works, academic activities in the form of e-Education and for training on various software packages.

In large universities, where they have thousands of students working on hundreds of computers, IT environment requires expensive infrastructure. Consequently, academic institutes tend to look for solutions to reduce the cost of computer services represented in computer process and hardware maintenance, software implementation, maintenance and upgrade cost. Cloud computers emerged as a possible solution, but the problem remained, "how to implement it?".

Indexing terms/Keywords

Cloud computing, e-learning, e-Education.

Academic Discipline And Sub-Disciplines

Computer Science; Education;

SUBJECT CLASSIFICATION

Cloud computing

TYPE (METHOD/APPROACH)

Practical Study

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INTRODUCTION

As many activities in life have been automated, teaching and lecturing as well have been automated. At several universities e-Education and

eLearning have established themselves to be the education standard norm that required expensive IT environment to support. [1][2]

E-learning is a tool which has the potential to enhance and support the traditional learning system and already it is becoming an integral part tools used by every educational organization. ELearning is: “the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance.”[3]

At the very beginning, there were mainframes, and then came servers and PCs. Despite being less expensive, as the cost of storage and the power consumed by computers and peripherals has decreased, spreading software over PCs led to several problems. The first is the large overhead represented by the number of licenses required to make an environment operating, environment maintenance and software upgrade. Additionally, storage space in data centers is no longer sufficient to meet their needs in terms of systems requirements and services to be offered. [4] [5]

Cloud computing, offers an easy to implement and manage solution, a less expensive environment, and more controlled tool to solve many IT environments' problems. Cloud computing, is a kind of computing which is highly scalable that uses virtualized resources which can be shared by many users. It offers an environment that is very similar to the Internet where users do not need to know where the services are offered from nor need any background knowledge of those services. In short, the cloud is a virtualization of resources that maintains and manages itself. [6] [7]. Similarly, students on the cloud can communicate with many servers at the same time and exchange information among them without the need to know anything about the environment [8] [9]. From that sense, Cloud computing is a technology that offers to both students and teachers an opportunity to quickly access various application platforms and resources through using web pages on demand [10]. Unfortunately, not all educational institutions often have an ability to take full advantages of this technology because they do not have an implementation model.

This paper presents a model of implementing cloud computers in educational institutes. The model was implemented and tested in Future Academy Higher Education Institutions (FAHEI) one of the largest educational institutes in Egypt. It shows how the proposed model can be used to measure cost reduction in terms of hardware cost reduction and software cost reduction; study the effect of the cloud on students learning cycle; study the effect of the cloud on lecturers teaching abilities. From the obtained results, the salient parameters of cloud computing implementation That model has the ability to show the difficulties and challenges facing cloud computing implementation. It also shows the effects of cloud computing implementation in universities and educational institutes.

Section two describes the implementation environment (FAHEI). Section three discusses cloud computing architectures and their definitions. Section four discusses the proposed model, their components and how the system work. Section five presents the conclusion and future work.

THE TEST ENVIRONMENTS–THE FUTURE ACADEMY HIGHER EDUCATION INSTITUTIONS (FAHEI)

The Academy was founded in 1975 and according to the law 52 of 1970, as the first Institute to support Computer science and IT education. It acquired a certificate (ISO 9001-2000), for the quality management system. Generally, it consists of four institutes; the numbers of students per institute are presented in Table 1:

Table 1. Institutes of (FAHEI)

Institute	Number of students
Management Information System (MIS)	5000
Tourism Studies (TS)	1000
Hotel Studies (HS)	1000
Tourism Guiding (TG).	1000

Additionally, there exists a certified Microsoft training center to give students international certificates in Microsoft courses, those are around 1000 students.

THE TEST ENVIRONMENTS–THE FUTURE ACADEMY HIGHER EDUCATION INSTITUTIONS (FAHEI)

A 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.[11] [12]

Most of the current clouds are built on top of modern data centers. It incorporates Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). The hierarchical view of cloud computing is presented in Fig 1 [13] [14].

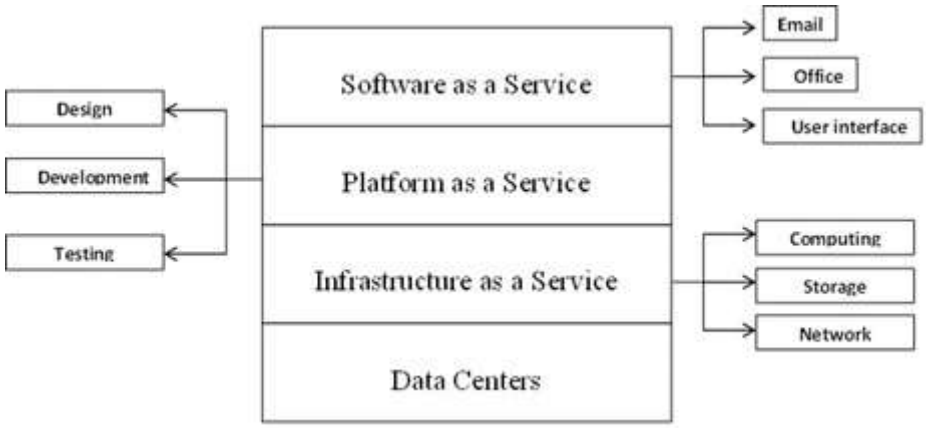

Fig 1: Hierarchical View of Cloud Computing

Parameters to compare between Cloud-Computing Solutions

In order to compare between different cloud computing solutions, researchers offered many parameters that can be used to do that. Some of those parameters are presented in table 2 [15]:

Table 2. Cloud Computing Comparison Parameters

Scheduled Backup	Auto Scaling
Elastic Load Balancing	Backup and Storage
Multiple Locations	Backup and disaster recovery
Elastic IP Addresses	High-Availability Environment
On-Demand Instances	API Access
Reserved Instances	Web-based Cloud Management
Spot Instances	Automated Backups
Content Delivery Network (CDN)	Server Cloning
Storage Gateway	Rapid deployment
Virtual Private Cloud (VPC)	High Performance Computing
Data Encryption	Monitoring
Access Control	Offers of Free Trial
Platforms	Operating System
Client Interfaces	Chat Support
Phone Support	+

Hypothesis of the proposed Model

The main objective of implementing this model is to give more flexibilities and dynamic resource utilization which solve scalability issues. The model proposes a Virtual University Services to be built on top of Cloud Computing layer. By applying this model, several limitations of the current IT service deployment scenario were solved.

Figure 2 shows the proposed Cloud Architecture. It shows that there are three interfaces: one for teachers, the second for internal students, and the third is for external students. Each of which has different security and capabilities features.

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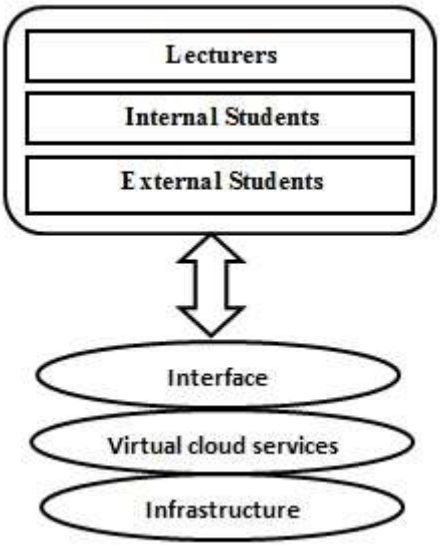

Fig 2: FAHEI Cloud Architecture

1) Lecturers: This Architecture allows lecturers to provide student with lecture notes and exams more easily and quickly regardless of the student numbers. It also allows training using virtual cloud services, task collaborations, manage students' assignments/quizzes and submit marks. Finally, the system allows archiving all teaching works in the storage media using cloud computing infrastructure.
2) Internal Students: This Architecture allows internal students to use virtual cloud services in order to run their applications from anywhere and any device in the university using internet connections. This requires students to sign-in to the cloud through the cloud interface. Once they are in, the cloud allows them to create, upload, manage and/or organize their shared files, and saves their work in the cloud infrastructure.
3) External Students: This Architecture allows external students from other universities to access the cloud.
4) Interfaces: allow internal students, internal teachers and external students to have access to the cloud and their work.
5) Virtual cloud services: contains all application and services.
6) Infrastructure: contain network connection and storage media.

THE PROPOSED MODEL

The proposed model is based on a type of clouds that is called "Hybrid Cloud". Hybrid Cloud is characterized be having a part of it as a private cloud where it can be accessed only by internal users and the other parts of it are public cloud that can be accessed by external users. Hybrid clouds basic design is presented in Figure 3.

The proposed Cloud Computing model, is designed to deliver different services such as e-learning environment, laboratory training, enterprise resource planning systems, researching.

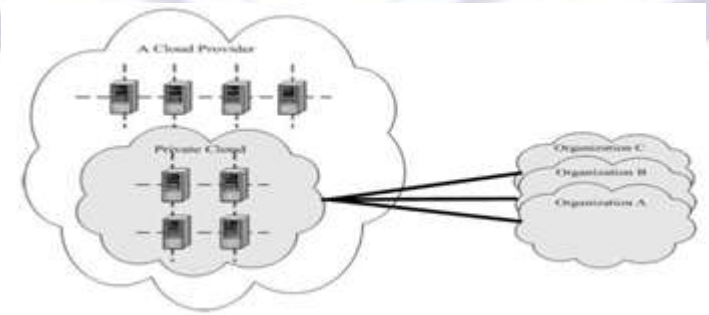

Fig 3: Hybrid Cloud

The proposed Model will use the existing infrastructure for institutions which would adapt the proposed Model In such a situation, the proposed Model deploy a hybrid Cloud model which combines the local infrastructure as a private Cloud with selected public Clouds . This process combines multiple services from different vendors to serve students and other users from different universities to enhance the teaching-learning and laboratories.

Hybrid Cloud provides the ability to access and use third-party (vendors) resources from multiple vendors and secure the institution's critical application and data by hosting them on the private Cloud without having to expose them to a third-party. With a hybrid Cloud model, the institution has more control of their system since part of the infrastructure is under

their control. by this model students can use ,create and share documents such as, Word, Excel spread sheets, PowerPoint presentations, PDF files. There is no need to send their work as attachments by emails or pass flash drives back. Also, they no longer have to install any software. Additionally, own cloud provides its users with a text editor which enables students, on group projects, to simultaneously write, edit, and share their code using the PHP programming language. Students can take assignments, answer it, and easily upload it. Professors could make assignments to specific groups, check students' answers and grade them.

Components of the proposed Model

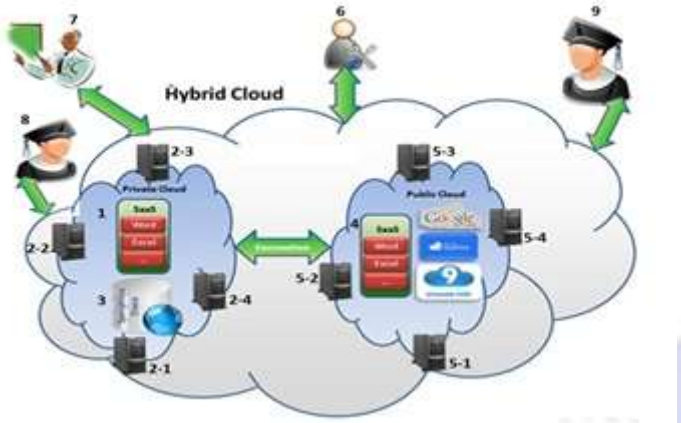

Fig 4: Components of the proposed Model

The main components of the system are described in figure 4, on the above graph, the numbers represent the following objects:

(1) SAAS: Excel, Word.

(2-1, 2-2, 2-3, 2-4) IAAS: Servers, Pcs in Labs, Internal Users.

(3) Database: MySQL.

(4) Services from Public cloud.

(5-1, 5-2, 5-3, 5-4) external IAAS: Servers, Pcs in Labs, External Users.

(6) Admin.

(7) Teachers.

(8) Internal Students.

(9) External Students.

The way the system work

The system works using the following steps:

1) The student sends a request using the own cloud interface
2) Then verification of the authorization will be checked the student profile in the private Cloud.
3) If the student is unauthorized to request such services, the system will refused the student request.
4) else , the request will be sent to the virtual infrastructure manager of Own Cloud to redirect the request to allocate for either public clouds or private Cloud.
5) Then the system will connection between the requested service from the Cloud and the student.
6) If the student is finished and not needs the requested resource, then system will end the connection between the requested service from the Cloud and the student.

CONCLUSION AND FUTURE WORK

This paper presented a proposed cloud computing model to be used in universities. The model was implemented and tested in the (FAHEI), one of the largest education institutes in Egypt. The proposed cloud model showed several advantages, some of them are:

1) Saving H/W cost.

2) Saving S/W cost.
3) Saving maintenance time and effort.
4) Having more control on the environment.
5) Protect the privacy of sensitive data by save it in private cloud.
6) Allow students to use multiple services which in the public cloud.

Future work could be summarized in adding the following features to the system:

1) Applying a methodology of measuring the application of the proposed model effectiveness by having different students. One group of students use the cloud services and the other group without using the cloud for their work.
2) Compare the proposed model to several other models to extract the salient characteristics of the optimal model implementation.

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