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Improving the Availability of the Education Sector in Iraq over the Cloud Computing

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Abstract. Information and Communication Technology (ICT) start playing major rules in human life and specially in education sector. The education system is need to be redesign from the paper-based system to the digital-based system to fit the new era requirements. Cloud computing become an interesting technology according to their storages, distributions, web hosting, scalabilities and availabilities. The education system will take advantage from the cloud computing infrastructure to develop a flexible application to access and monitor the student's information records as well as their lecturers within their institute to get required services over the teaching period. Adopting the education system to the cloud, will reduce the cost of managing, upgrading the infrastructure services. The e-education resources generate a high amount of data, as the student's records need to be update during the study period by their lecturers regarding to their performance. The amount of data that are generated from each institute will be distributed according to their geographical location within the country to provide a close monitor to student's records by the authorities. The goal of this study is to identify the interaction relationship among students, lecturers and administration staff. The interaction will be within the institute and among them by distributing the education data records over the cloud servers and allow a full admirative control to monitor the information for whatever update have been done to each record.

Keywords. Information and Communication Technology (ICT), Cloud Computing, Deployment Models, E- Education, Interaction relationship, Student Record (SR).

1. Introduction

The time the networks infrastructure been implemented and the digital devices become available to everyone to seek information through different applications. Many sectors start use the availability of the networks to enhance their services. One of the most important service that are need to be enhanced is the education system. The traditional education system is not become suitable for requirements of social progress and educational development [1]. The Internet have changed the educational setting, in both traditional and distance learning. Therefore, there is a need to change the educational content in how it is been designed, developed and delivered to learners. This can be done by making the learning tools accessible, to allow the lecturers and students to communicate to obtain knowledge [2]. The web-based electronic learning method is been designed as a complement to a traditional learning system. The Internet technology will be used to support and enhance learning in education institutions, by allowing the teaching resources to be shared among the learners over the networks [3]. The educational institutions will be responsible for creating, upgrading and maintenance their own learning portal [1]. The use of the technology to implement the electronic education portal will increase the efficiency and the availabilities to the education system. The e-education system requires communication between lecturers and students through digital devices like; personal computer, laptops, smart phones, and tablets. The information and knowledge can be exchanged between participants either in synchronous or asynchronous way over the Internet [2,4,5]. The students can get all learning recourses like; instructions, timetables, forms and course materials, from the online portal that can be found on the institute webpage. The computer equipment's will be located within the institute and it is difficult to maintain, especially if each institute will be responsible for their local data. Therefore, there is a need for a distribution system, that could be more flexible with a scalability approach and to reduce the construction and maintenance cost [2]. Cloud computing is a plug and play model that been built based on the Internet. Cloud computing technology become an attractive due to its dynamic scalability and effective usage of the computer resources [1]. Cloud computing technology trends to have a significant impact on education environment, as it is introduced an efficient scale mechanism that can let the constructions of e-education system to change the way of the application development, process and access to the data. The data that are obtained from the e-education system whether they were students' information, teaching resources or grading would be saved and backup automatically within the cloud servers which greatly reduced the data management time and storage spaces [6]. In this work, a study on how the student's information with their learning resources will be distributed over the cloud. The data are distributed over several data center will create the load balancing. The interaction relation between the participants will defined the way that the students, lecturers, and management staff are communicating through the cloud.

2. Overview of Cloud Computing

Cloud computing is a technology that become widely interesting according to their flexibilities, scalabilities and availabilities to the computer resources at low cost over the Internet [7,8,9]. The users will be able to access the information over the cloud from different location and at different time. The cloud users can access and share the same resources simultaneously, by combine different computing resources and services with minimal management [10]. The services will be transferred to the service provider, where the service provider will be responsible for maintaining these services (applications, servers, and data storage). In this section the layers of cloud services and deployment models will be highlights.

2.1. Cloud Services Layers

The cloud users and cloud service provider are the two main sides in the cloud computing environment. Cloud computing delivers infrastructure, platform, and software that can be scaled dynamically according to users' needs. Cloud computing provides different types of services layers [8,9,11,12], that are shown in Figure 1.

- Software as a Service (SaaS): The users do not know about the infrastructure and platforms. The users will use the digital devices to access the software applications without the concerns of installation and maintenance. The user interface is been design to support a particular or unique application. SaaS could deliver a single application through the browser to multiple users by using a multitenant architecture. SaaS is important due to scalability, compatibility, accessible worldwide, where the users do not need to do or worry about scaling, configuration, and updating.
- Platform as a Service (PaaS): The users do not know about the processing unit, memory, and storages, that are related to their applications. The service providers will be responsible for the platform that include software, hardware, operating system, servers, and development tools. PaaS provides a full of software lifecycle, since it's allowed the application developers to be directly implement on the cloud.
- Infrastructure as a Service (IaaS): It allows users to deploy and run both operating systems and applications. The users will not be responsible on deployment, administration, and maintenance. IaaS will provide virtualization environment service to the users that support their applications and the necessary computational resources, such as storage, processing unit, and bandwidth.

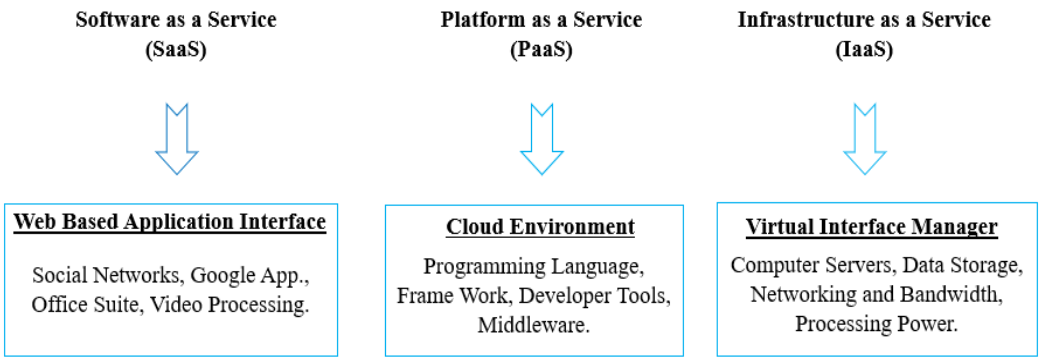

Figure 1. Cloud Computing Services Layers

2.2. Cloud Deployment Models

Cloud computing can be operated on different infrastructure over the Internet according to the deployment models that been proposed by NIST (National Institute of Standards and Technology). Cloud computing delivery model can operate and classified according to one or more of the following infrastructures [7,13,14]:

- Private Cloud: Private cloud infrastructure is provisioned for exclusive use by a single organization. It may be owned, managed, and operated fully by the organization or by a third party, or may be hosted or outsourced to a hosting company.
- Community Cloud: Community cloud infrastructure is provisioned for exclusive use by a specific community of users from organizations that have shared the same mission, policy, and security requirements, rather than serving a single organization as does on a private cloud.
- Public Cloud: Public cloud infrastructure will provide services to the public users and make the computing resources available to the users over the existing networks.
- Hybrid Cloud: Hybrid cloud infrastructure is a composition of two or more cloud infrastructures (private, community, or public) that remain unique entities, and they are bounded together by standardized or proprieties technology that enables the user's applications and their data portably.

3. The E-Education System

Education is an important sector in the society; therefore, it is necessary to consider the update technology to enhance the learning outcome. Combing education with Information and Communication Technologies (ICT's), will enhance the efficiency of education system that will have a positive impact on the learning performance. The combination will also provide a full monitoring to the data that will be managed and controlled by the institute or by the local ministry of education or by the federal ministry of education. E-education will provide a learning system over distance, where lecturer and their students do not have direct physical interaction, and does not transpire at a predetermined time and location [15]. E-education system is not been set in Iraq to support their education system rather than they just using an existing digital form that are available in the Internet either by payment or without. Unfortunately, the communications between students and their lectures, and the communication between institutes and the ministries either the local or the federal is not been set based on the digital system technology. The mechanism for providing the information regarding the student's performance and achievements is still been done in paper-based system. The paper work still been used in the administration process like; students payment fees, accessing and updating student's and lecturer's records, either internally within the institute or between the institutes and the local or federal ministry. The education sector will benefit from the cloud computing technology by making all the education resources available. Cloud computing will also improve the communication between all participate in the education sector (students, lecturers, staff, principles, head of the departments, etc.). This can be done, by identifying the interaction relation among all the related institutes or ministries that would have a full management and control to the education rescores without any paper involvement rather than the use of computer-based technology.

3.1. Data Distribution

Data is considered as a set of values that can be in a form of numbers, letters and symbols, that are increased on a daily based [16]. The data can be store, update and process according to the user's needs [17]. The education data are generated from two different sources like; personal information records (students, lecturers, and administration staff) and the other sources from the teaching materials (lecture notes, time tables, e-mails, sounds, videos, and student's performances). The education system can benefit from the computer resources in the networks. The computer resources are distributed over the networks and it will be invisible to the end users [18]. The institutes and their data are distributed according to their location or region. The data can cross many devices that are separated by large distances within the country. The e-education system will be viewed as a single system over the cloud to the authorities.

3.2. The Cloud Model for E-Education

Cloud computing will play an important role for communication, and collaboration between the education units. The staff and student's records are distributed according to their institute that are managed by a local ministry. The local ministries will update the record's information and share these records with other ministries that are fully managed and controlled by the federal ministry. Enabling communication and exchanging information between different institutes, local ministries and federal ministry is a key outcome of e-education system over the hybrid cloud. Hybrid cloud is the composition of community and private cloud that are going to be considered in this study to serve the purpose of the education sector in Iraq;

- Community Cloud: The community cloud will allow the lecturers and students to communicate to their local institute webpage to upload and access the information. The lecturers will upload all the teaching materials to the education portal for online access and also will update the student's performance in their records. The student's records (SR) will be updated over the study period from their lecturers to be monitored by their local institute 's manager.
- Private cloud: The communication among institutes and ministries should be in a private way as it sharing professional information. The private cloud will allow the institutes to communicate among

them and with the local ministry. The local ministries will update the records (students, lecturers, and staff) and share it with federal ministry.

The communication layers [19] that are shown in Figure 2, are used to update, access and storing the records in the education environment;

1. Front end layer: It is the window interface layer that allows the lectures and students to communicated through and it will be managed by the administration staff. It is the cloud users that are consists of computer hardware and software, that are relies on cloud computing for updating and accessing the data that been designed to deliver the cloud services.
2. Interaction layer: This layer will be responsible for user's interaction and integration to different devices where the data are moving across many middleware's to establish a communication between the students, lecturers and management staff.
3. Back end layer: This layer will provide a specific designed to the users information to deliver the cloud services, that include multi-core processors, storage, operating systems and combined offerings.

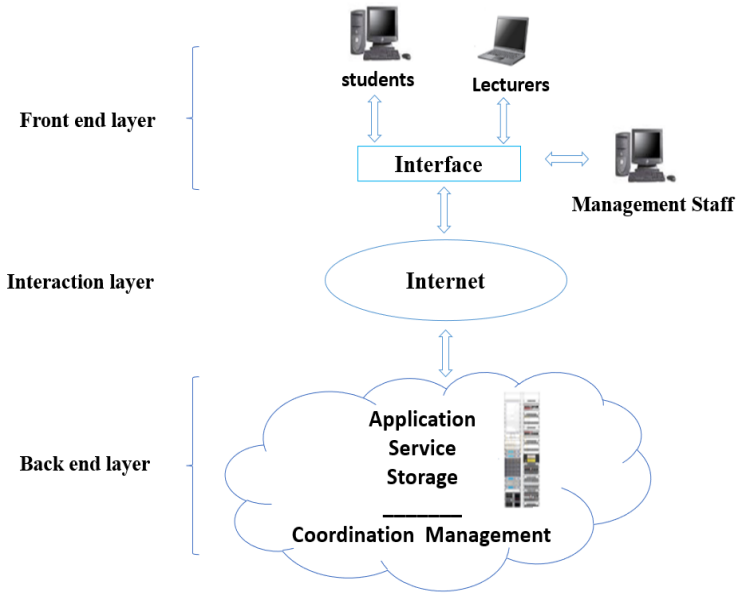

Figure 2. Overview of the Communication Layers

3.3. Categories of E- Learning

The student's records and teaching materials are distributed according to the location of their institutes. The communication mechanism will be set based on the type of interactions relationship. Identifying the type of interaction will improve the learning transaction process that will have a positive impact on students, lecturers, and administration staff. In this section, the inter-relation will be defined to identify the types of interaction among different user's level in the e-education process. The e-education system will be categories into four interaction relationship:

- Students - to - Lecturers (S2L) Interaction: It is an interaction between students and their lecturers. The aim of the lectures is to set the virtual classroom and upload all the teaching materials according to e-learning environment. The students will allow to access the virtual classroom, teaching materials and performing all the necessary tasks.

- Lecturers - to - Principal (L2P) Interaction: It is an interaction between lectures and the principal of the institute or the head of the department. The principal or the head of the department will monitor and manage the lecturers and their student's performance.
- Principal - to - Local Ministry of Education (P2LM) Interaction: It is an interaction between the principals of institutes that are located with the same region that are monitor by their local ministry of education (or the interaction between the head of the departments with the university or college management). The aim is to manage the institutes and their staff activities and performance.
- Local Ministry - to - Federal Ministry of Education (LM2FM) Interaction: It is an interaction between the local ministries with the federal ministry of education. The local ministries will report the lecturers and students' performance to the federal ministry. The federal ministry will be responsible for collecting all the details information.

3.4. Accessing the Information Records

The students can access the teaching materials after been uploaded to the institute's webpage. The lectures will grade the students and upload their performances during the teaching period until they are graduated. The students record (SR) will be saved in the cloud server that belongs to their local network. The update copy from the SR can be stored or accessed or processed by the main server in federal ministry, as shown in Figure 3. In this case, the e-education system will provide the availability, accessibility, and flexibility to update and process the students record (SR) as well as the lecturers record (LR) through the cloud infrastructure within the country.

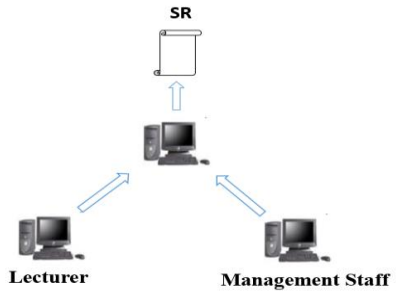

Figure 3. Accessing the Record

4. Conclusions

The education system in Iraq still uses the paper-based system for writing down all the information that are related to each student. The student's records will be uploaded according to the student's tasks and performance. The education system will generate a lot of data during the study period, which will not be easy to control and manage. The web-based technology will allow the education portal to store, access and process the student record and make it available. Cloud computing will be a suitable technique for providing services to the participants to access their applications. The participants can access their online applications through the web interface, where the data are stored in the cloud servers. The servers are distributed around the country where each server will be responsible for holding the local data in each region. Cloud computing will play an important role in the educational institutes for maintaining the huge amount of data with limited resources. Hybrid cloud are considered in this study, by allowing the interaction relation between lectures and management staff to access the students records for monitoring and updating information. The student's information will be viewed or retrieved or shared by different authorities over the cloud. The study shows the way to enhance the education system by merging the cloud computing technologies with the education sector to provide a reliable and available access to all the records in the education environment.

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