# Sustainable Development: Proposing Cloud Computing Framework for Higher Education Ministry (HEM) in Iraq

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***Abstract*-- We believe that promoted people depends on their level of education which is largely depends on the gravity and evolution of the Higher Education Ministry (HEM). HEM will surely derive its scientific strength through the progress of the various types of sciences. The communications technology allows the HEM to cope with the outside world and the latest innovations. Information is the corner stone of HEM knowledge database. This knowledge can be used to manage information that has considerations in many faces: political, social, and economic. Building an efficient, commercially sustainable and dynamic HEM that effectively serving all the Universities, offering superior products and premium services. In deciding constructing cloud computing, it will present risks and challenges as deciding to use more traditional outsourcing arrangement. This research aims to introduce a general framework to build enterprise of cloud computing in higher education ministry in Iraq called Higher Education Ministry Cloud (HEMC). This enterprise will benefit from all the characteristics of Cloud to provide services in a modern way, low cost, flexible, mobile, and Business continuity.**

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***Keywords: Cloud Computing, Higher Education Ministry, Framework, and cloud characteristics.***

## I. INTRODUCTION

Cloud computing can be the ability to rent a server or a thousand servers and run a geophysical modeling application on the most powerful systems available anywhere. It can be the ability to rent a virtual server, load software on it, turn it on and off at will, or clone it ten times to meet a sudden workload demand. It can be storing and securing immense amounts of data that is accessible only by authorized applications and users.

Cloud is a set of multiple resources (hardware and software) available via the Internet and managed by the provider, the customer gets all or some of these resources according to system usage. Cloud computing is a way to increase the capacity of a network without investing in new infrastructure, training new personnel, or licensing new software.

Cloud computing is a model for enabling 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 [1,2]. The services offered by cloud computing

providers according to the three models of cloud computing.

1. Infrastructure as a service (IaaS), because providers of IaaS offer physical or virtual machines and resources. Within the cloud operational support-system can support large numbers of virtual machines and the ability to scale services up and down according to customers' varying requirements [4,5]. In this model, the cloud user patches and maintains the operating systems and the application software.
2. Platform as a service (PaaS). In the PaaS model, cloud providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.
3. Software as a service (SaaS). In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. The cloud users do not manage the cloud infrastructure and platform on which the application is running. This eliminates the need to install and run the application on the cloud user's own computers simplifying maintenance and support.

The types offered by cloud computing according to four models of cloud computing.

A. Public cloud, Public cloud applications, storage, and other resources are made available to the general public by a service provider via Internet. These services are free or offered on a pay-per-use model.
B. Community cloud, Community cloud shares infrastructure between several organizations from a specific community with common concerns, security, whether managed internally or by a third-party and hosted internally or externally.
C. Private cloud, Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. Private Cloud are built for the exclusive use of one client, this model gives companies high level of security, quality of service and control over how application or data are deployed on it.
D. Hybrid cloud, Hybrid cloud is a composition of two or more clouds (private, community and public) that remain unique entities but are bound together, offering the benefits of multiple deployment models. By utilizing "hybrid cloud" architecture, companies and individuals are able to obtain degrees of fault tolerance combined with locally immediate usability without dependency on internet connectivity.

## II. Proposing Cloud Computing for Higher Education Ministry Cloud (HEMC)

We think there are many faces and measures must be considered and adopted for constructing real,

dependable and reliable cloud computing framework for Higher Education Ministry Cloud in Iraq, which we call it HEMC, these steps are:

a. Determining the basic characteristics in constructing the cloud.
b. Determining the basic characteristics that must be demonstrated in constructing the cloud.
c. Constructing the Proposed HEMC.
d. Implementing HEMC.

## III. Basic Characteristics in Constructing HEMC

a. Client/server environment: we think client–server computing must be considered in cloud computing because it is the base stone to any distributed system.
b. Autonomic computing: self-management is important characteristics must computer systems be capable of it.
c. Mainframe computer: Leaders computers server large companies for various applications, such as huge data processing such as consumer statistics and financial transaction processing.
d. Cloud Push and Pop: push and pop is the on-demand characteristics, mean by that request the services by client and providing the services by servers.
e. Grid computing: distributed and parallel computing presented by the grid, since the last clustering the networks for increasing performance with huge tasks.
f. Utility computing: computation and storage are the effect parameters to services.
g. Peer-to-peer: sometimes there is no need for distributed architecture, so peer to peer model is also important characteristic in cloud computing.

## V. Demonstrate Basic Characteristics in Constructing HEMC

a. Cloud must exhibit scalability and elasticity via push and pop, supplying resources on a real time as possible as without congestions.
b. Cloud computing Performance is efficient by designing suitable system interfaces for the various services.
c. Cloud computing could be protected in high level due to centralization of data, but it have a distribution style so there is many of security problems, but also could be under control.
d. Cloud computing maintain applications easier, since the applications are resident on cloud servers not installed on user's computers.
e. Cloud computing make users architect and deploy services to their systems uniquely as they like, without complicated steps and without time consuming.
f. Cloud provides prompts infrastructure vendors to create cloud computing templates, which are obtained from cloud service catalogues.
g. Cloud improves quickness with users' ability to re-thrift resources.
h. Cloud computing support Application Programming Interface (API) accessibility to software enables computers to be included

with cloud software in the same way the user interface facilitates interaction between humans and computers.

i. Cloud computing reduce cost since there is no need to buying software applications, services, platforms and hardware.

j. Cloud computing make device and location independence so enable users to access systems using a web browser regardless of their location or what device they are using.

k. Cloud computing is the next step of virtualization, virtualization technology allows servers and storage devices to be shared and utilization be increased. Applications can be easily migrated from one physical server to another.

l. Cloud computing enables sharing of resources and costs across a large pool of users thus allowing for: Centralization, Peak-load capacity increases, Utilization and efficiency improvements for systems.

m. Cloud computing improve reliability if multiple redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery.

## IV. Constructing the Proposed HEC

The proposed Architecture for HEMC will be explained by sequential general steps as in Fig. 1. These steps are explaining the proposed infrastructure of HEMC as the following:

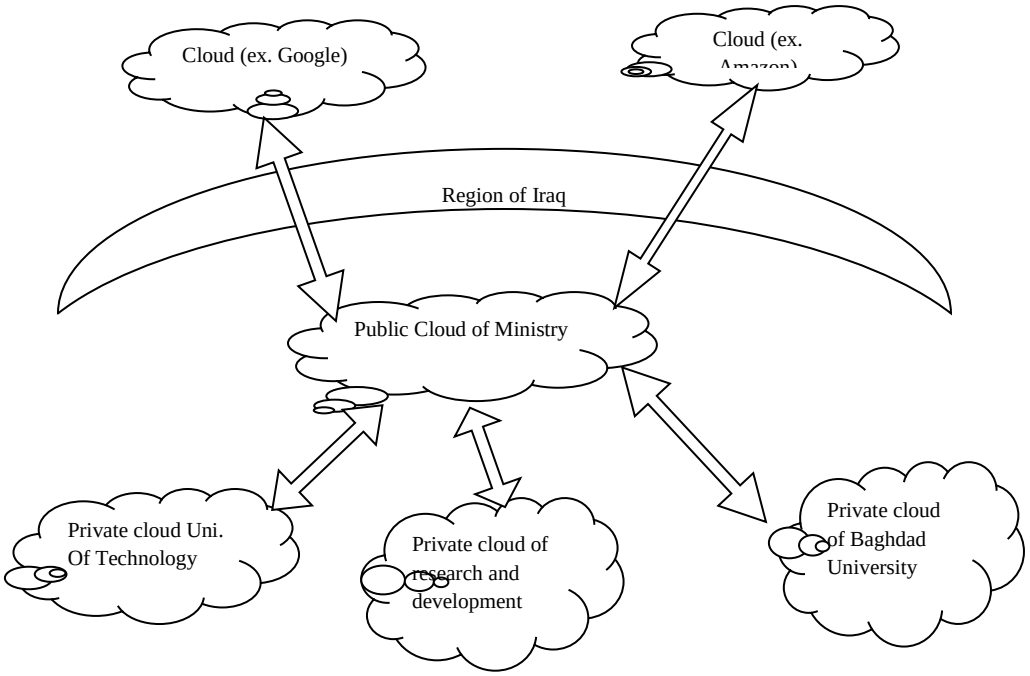


Fig. 1: The proposed architecture of HEMC.

**First step: Ministry Build its own Public Cloud:**

a. We prefer the higher education to have **Public cloud** computing so it delivering infrastructure, services, and software on demand through the network.
b. This Public cloud must be work on the three models Iaas, Paas, Saas.
c. Proposing Public Cloud that to reduce information and communications technology costs as possible as by concept of virtualizing principle property such as disk storage and processing cycles into a readily available, affordable operating expense.
d. But when we offer the public cloud as an optimal cloud for ministry must declare the risks will be created around security, privacy, interoperability, or performance.

**Second step: Ministry Build Private Clouds for each offices and colleges**

a. Universities, colleges and offices related with the ministry, all of them should consider **private** cloud deployment models to realize scale on demand, rapid platform deployment, and lower costs and carbon emissions while minimizing risk.
b. This Private cloud must be work with the public cloud of ministry in all the three models Iaas, Paas, Saas.
c. Cloud service providers, by using economies of scale and their capacity to manage computing assets more efficiently, can consume far less energy and other resources than traditional data center operators.
d. Building Public cloud computing of the ministry will deliver efficiency beyond the major universities. It may be even more pronounced in small colleges that have not yet achieved high levels of computerization, or do not have and have trouble fizzing people with adequate skills in new technology.
e. The small college can adopt applications and services, enabling the college to overshoot a whole generation of academic computing, thereby bypassing many of the costly and debilitating challenges.

**Third step: Challenges of HEMC Cloud**

We think for higher education, decisions to adopt cloud computing will be influenced by more than technical and cost considerations. Many challenges of cloud computing for higher education relate to its relative newness and the underdevelopment of the marketplace for cloud services. Most of these challenges are:

1. Security, users do not have control or knowledge where their data is being stored.
2. Interoperability, resulting in a significant risk of vendor lock-in.
3. Reliability, existing cloud infrastructures leverage commodity hardware that is known to fail unexpectedly
4. Access, amount of control that the user has over the cloud environment varies greatly.
5. Performance, access to the cloud is done via the internet, introducing latency into every communication between the user and the environment.

We can destroy many of challenges by building a private cloud with levels of confidence you have already established and tested in your own data center, or parsing out the pieces of the environment according to your level of confidence in any other deployment models of cloud.

**Fourth Step: Administrators of Higher Education**

1. Supply the proposed enterprise with deep understanding of how cloud computing is evolving, and the trends in its construction.
2. We don't see our proposal limited to just Saas because it is the much more easy for clouds model.
3. The creation of own private clouds for core applications, we prefer to be in partnership with other institutions of higher learning.
4. Higher education organizations must weigh the costs and benefits of each approach.
5. Detect the potential opportunities and benefits for switching from existing computing to cloud services.
6. Administrators must identify in-house infrastructure complements cloud-based services. Because the conversion to the cloud services is not new beginning nor simple modifications. Virtualization will be a critical piece of a compatible infrastructure.
7. Secure in-house competencies that will be required to manage effective construction of cloud services.
8. The networking environment must be ready for cloud computing.
9. Since cloud computing as a natural evolution of the Internet, so it is vital for higher education administrators to understand the cloud and the connection between cloud and user.
10. Network is the critical part of providing security and quality of service at scale

## V. Implementing the Proposal

Implementing of the enterprise HEMC is under control and success if the administrators understand the implementing process of cloud. We will introduce the basic steps related to the implementing Cloud construction.

a. In Cloud the templates contain predefined configurations used by consumers to set up cloud services. The templates or blueprints provide the technical information necessary to build ready-to-use clouds.
b. Each template includes specific configuration details for different cloud infrastructures, with information about servers for specific tasks such as hosting applications, databases and websites.
c. The templates also include predefined Web service, the operating system, the database, security configurations and load balancing.
d. Cloud consumers use cloud templates to move applications between clouds through a self-service portal.
e. The predefined blueprints define all that an application requires to run in different environments. For example, a template could define how the same application could be deployed in cloud platforms based on Amazon Web Service, VMware or Red Hat.

f. The user organization benefits from cloud templates because the technical aspects of cloud configurations reside in the templates, letting users to deploy cloud services with a push of a button. Cloud templates can also be used by developers to create a catalog of cloud services.

g. Open standards, most cloud providers expose APIs that are typically well-documented (often under a Creative Commons license) but also unique to their implementation and thus not interoperable.

h. Sustainability, citing the servers' affects on the environmental effects of cloud computing, in areas where climate favors natural cooling and renewable electricity is readily available, the environmental effects will be more moderate.

i. The case of distributed clouds over data centers with different source of energies including renewable source of energies, a small compromise on energy consumption reduction could result in high carbon footprint reduction.

## VI. CONCLUSION

It is possible to drew the following conclusions from this proposed HEMC:

a. Cloud computing has a potential for cost savings to the enterprises but the security risk are also enormous.

b. The strength of cloud computing in information risk management is the ability to manage risk more effectively from a centralize point.

c. Enterprise should verify and understand cloud security, carefully analyze the security issues involved and plan for ways to resolve it before implementing the technology.

d. Cloud Computing is likely to have the same impact on software that foundries have had on the hardware industry. Developers would be wise to design their next generation of systems to be deployed into Cloud Computing.

e. Cloud fears largely stem from the perceived loss of control of sensitive data. Current control measures do not adequately address cloud computing third-party data storage and processing needs.

f. Many applications are not suitable for hosting in external clouds at present. Good candidates may be applications that have low security exposure and are not mission-critical or competitive differentiators for the corporation.

g. Composite Applications, Ultimately, our cloud computing integration architecture will need to support composite applications built from multiple services, external suppliers, and internal IT sources.

h. For the foreseeable future, there will be multiple clouds. As a result, standards will be needed to enable these clouds to work as a single entity. Without common specifications for interfaces, protocols, and service announcements, each cloud service will have its own peculiarities of identification and access. For enterprises, this also introduces

the risk of getting locked in to specific clouds through the use of proprietary Application Programming Interfaces (APIs).

i. Clouds must be able to report significant errors, especially faults that affect SLAs or legal obligations. They must be able to report their health through industry-standard interfaces.

## REFERENCES

[1]. B. Rajani. The Rising Cloud Storage Market Opportunity Strengthens Vendors. InfoTECH, August 24, 2011". It.tmcnet.com. 2011-08-24. http://it.tmcnet.com/channels/cloudstorage/ articles/211183-rising-cloud-storage-market-opportunitystrengthens-vendors.htm. Accessed on Sept. 2014.

[2]. O. Ken. Converged Infrastructure. CTO Forum, November 15, 2010. Thectoforum.com.15-11-2010. http://www.thectoforum.com/content/converged-infrastructure-0. Accessed on Sept. 2014

[3]. K. Z. Yankee. Migrating to the cloud is dependent infrastructure. Tech Target". Convergedinfrastructure.com. http://www.convergedinfrastructure.com/Path-to-the-Cloud/. Accessed on Oct. 2014

[4]. Z. Dimitrios; Lekkas. Addressing cloud computing security issues. http://www.sciencedirect.com/science/article/pii/S0167739X1000255, (2010).

[5]. W. Vic. Securing the Cloud: Cloud Computer Security Techniques and Tactics. Waltham, MA USA: Syngress. 2011, P. 187-189.

[6]. B. Andreas. Energy-Efficient Cloud Computing, The Computer Journal, (2010).

[7]. F. M. Fereydoun. Low Carbon Virtual Private Clouds. IEEE Cloud (2011).