

Feasibility Study for Cloud Computing in Education Field: Sudanese Research and Education Network (SudREN)

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Abstract The cost of managing, acquiring and maintaining IT infrastructure is one of the main factors that facing Sudanese higher educational institutions in Sudan to adopt and implement eLearning. Recently, cloud computing has emerged as a new computing paradigm for delivering cost effective computing services that can be used to harness eLearning. However, the adoption of cloud computing in Sudanese higher educational institutions in Sudan is very low. Although there are many factors that may influence educational institutions to adopt cloud services, cost effectiveness is often a main factor. The objective of this paper is to declare feasibility study for cloud computing in education field, taking Sudanese research and education network SudREN case study, that with introduce their current resources use in Sudanese research and education network and there need additional resource require to implemented cloud computing in Sudanese higher educational institutions.

Keyword: Cloud computing, SaaS, PaaS, IaaS, Sudanese Research and Education Network (SudREN).

I. INTRODUCTION

Recently cloud computing has offered attractive solutions for academic and research institutions. The 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.

II. SERVICE MODELS OF CLOUD COMPUTING

The Service Models of cloud computing can classified of the following:

A. *Software as a Service (SaaS).*

B. *Platform as a Service (PaaS).*

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider.³ The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment. (Example such as AWS ElasticBeanstalk, CloudFoundry, Heroku, Force.com, EngineYard, Mendix, OpenShift).

C. *Infrastructure as a Service (IaaS).*

III. CLOUD COMPUTING IN HIGHER EDUCATION

Now many individuals, universities, companies and countries are currently benefiting from the Internet already, and through the development of education through the democratic transformation of the information sector, and to provide the possibility of economic growth through e-commerce, and accelerate business innovation by enabling greater collaboration. Although the use of colleges and universities for years for many applications based on cloud computing (such as e-mail), but it is clear that cloud computing is rapidly evolving into a large model for data storage and sharing. Company expects "Gartner "Gartner technological research that more than 50 % of global companies will go to store confidential data in public cloud by the end of 2016.

IV. SUDANESE RESEARCH AND EDUCATION NETWORK (SudREN)

The Sudanese Research and Education Network (SudREN) is a specialized Internet Service provider dedicated to supporting the needs of the research and education communities within Sudan. SudREN is a non-profit entity operating under the umbrella of the Association of Sudanese Universities. All research and education institutions of Sudan are eligible to become members of SudREN. Figure 1 shows Sudanese Network for scientific research and education layout.



A. THE OBJECTIVES OF THE SUDANESE NETWORK FOR SCIENTIFIC RESEARCH AND EDUCATION (SudREN)

1. Linking scientific research institutions and education in the high-speed network and efficiency.
2. The provision of high-capacity Internet service and the cost of potential for scientific research institutions, education Sudanese.
3. Support various electronic services for employees of educational and research institutions.
4. The establishment of partnerships with peer networks at home and abroad for the exchange of expertise and human resources development.

B. SERVICES OF SUDREN

The service provided by the Sudanese Network for scientific research and education as following:

1. Internet Service

SudREN is a specialized ISP in Sudan. It provides affordable high speed Internet service to its members. In Feb 2011 SudREN started obtaining a whole sale Internet bandwidth of 155 Mbps (STM-1) from Sudatel Company. In May 2012 an additional STM-1 was obtained. The Internet bandwidth is distributed to the 45 members according to the demand of the member institution. The monthly distributed bandwidth per institution ranges from 2 Mbps to 50Mbps per month, depending on the size of the institution network.

2. Connectivity

SudREN is one of the largest networks operating in Sudan with geographical coverage including all Sudanese states. The network connects 45 public and private research and



3. Capacity Building

During the past years SudREN carried out several capacity building programs for the technical staff and the librarians of its member institutions. The training covered areas of computer networks and website development. The programs also included library standards and library systems.

V. FEASIBILITY STUDY FOR CLOUD COMPUTING IN SUDANESE NETWORK FOR SCIENTIFIC RESEARCH AND EDUCATION.

A. Existing Resources

Table 1 shows the existing resource and its available in the Sudanese Research and Education Network (SudREN).

C. Operational Cost

The operational cost is contains Support and Maintenance Cost, Hosting Costs, Cooling and Power Consumption, table 3 shows these cost items.

Support and Maintenance Cost calculated based on the salaries of technical staff employed at the institution. At minimum, institutions need two technical staff to manage and maintain system. The government of Sudan salary scale for a graduate of computer science or related field is approximately 500 \$ per months. Therefore, for two staff in a period of 1 year, the institutions will incur a total of 6,000 \$.

Hosting Costs is the cost of hosting 3,000MB is 25 \$ per months at University Computing Center Therefore, for hosting a server of 800GB is estimated to be US \$60 per month. In other words, hosting server will cost the institutions a total of 2,160 \$ for 12 months.

Cooling and Power Consumption it's the cost of electricity consumption, computer hardware, and related devices for eLearning system at a given institution is estimated to be 100\$ per month. Therefore, for 12 months the institution will incur a total of 1,200 \$.



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