International Journal Of Multi-Disciplinary Studies And Sport Research (IJMSRE)

Vol 5, No 2, December 2015

International Journal Of Multi-Disciplinary Studies And Sport Research (IJMSRE)

A Journal of Studies in the Humanities, Sports and Human Development

Published By:

International Center for Professional Advancement (ICPA)

At 25, Tonmead Road Northampton, Northamptonshire Nn3 8HX United Kingdom.

In Collaboration With

AFRICA SPORT RESEARCH NETWORK

Department of Health Physical Education Recreation & Sport
University of Education Winneba, Ghana.

International Journal of Multi-Disciplinary Studies and Sports Research (IJMSRE)
Vol 5, No 2, December 2015

EDITORIAL

International Journal of Multi – Disciplinary Studies and Sports Research (IJMSRE) is a multi-disciplinary bi-lingual journal that publishes peer review articles on issues of general concern to human development and sports research.

Well researched articles covering research reports, position papers policy impact assessment received from academics found publishable in the Journal are included in this edition of the Journal. In all, Forty (40) articles were received and only Twenty Seven (27) articles scaled the editorial hurdle in the Volume 5, Number 2, December 2015 Publication.

I acknowledge the work of Editors involved in the rigorous process of peer assessment of articles and congratulate contributors whose articles are published in this edition. Of concern is the growing number of articles failing peer reviews judging from the last edition. I use this opportunity to appeal to academics submitting articles to update their knowledge and understanding of research methodology and the process of article submission to this Journal. The guidelines for submission of manuscripts and general operations of the journal as approved are published in this edition. I enjoin all, to please follow the guidelines strictly as articles that fall short of expectation of the approved guidelines shall not be assessed.

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Submission of a manuscript to this journal represent a certification on the part of the author(s) that it is an original work, and that neither this manuscript nor a version of it has been published elsewhere nor is being considered for publication.

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Manuscript(s) should be submitted electronically as e-mail attachments in MS Word format. To facilitate the double-blind review process, author(s) are instructed to include titles of manuscript, their names, academic titles and degree, current affiliations, mailing address, contact information (telephone no and e-mail), and 100-word biographical sketches only on the cover page. The title of manuscript only should appear again on the first page of text. All manuscript must include an abstract containing a maximum number of 300 words. To facilitate the production of the annual subject index, a list of key words (not more than six) should be provided, under which the paper may be indexed.

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CLOUD COMPUTING ADOPTION AND IMPLEMENTATION IN UNIVERSITY LIBRARIES IN AFRICA: AN OVERVIEW.

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Abstract
This paper makes an exploit into how cloud computing can change the computational resource utilization and value in the African University Libraries (AULs) terrain. It takes a look at the economics of providing computational resources through cloud computing web services providers like Amazon, using the concepts of utility services providers like, in the case of electricity consumption, pre-paid meter which is operated on 'pay per use' basis. This approach is cost effective in terms of implementation in that since the server resides in the cloud, it follows that the required space for storing data will be used at a particular point in time, thereby the unused server space can be allocated to other customers using the same cloud service on request instead of allowing it to waste away. Personnel cost, with regards to technical staff, will be reduced to the barest minimum since the issue of baby-sitting server must have been eliminated at the point of requesting for cloud services. Given limited available financial support at the disposal of AULs, server space economy, disaster recovery, prudent infrastructural utilization, seamless resource sharing, a robust, sustainable and efficient backup plans, among others, will be the resultant benefits of cloud computing adoption and implementation to AULs for efficient, timely and effective service delivery. All these are exhaustively discussed in this paper. A model of adoption and implementation as well as a review of what same will translate to within the AUL systems are also presented. This article is an overview of the adoption and implementation of cloud computing services in AULs with an associated model which can be used as a benchmark for implementation strategies within the AUL systems. An exhaustive practical implementation plan is strongly recommended for future research which will incorporate result analysis as well as exhaustive discussion of findings.

Keywords: *Cloud computing, university libraries, resource networking, data sharing, Africa.*

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Introduction

Cloud computing is a broad term in which various definitions are given by different schools of thought based on the variations in the understanding of the concept. The concept, in a nutshell, connotes renting a certain amount of server resources to the perceived users of the cloud. The server runs inside a virtual container which can be moved from one physical server to another without interruption of service. Such a container is also capable of spanning multiple physical machines, giving it potentially limitless resources (Galen, 2009). A web server typically has three tiers to it, viz: the physical infrastructure, operating system platform, and web application software being run. Choosing an appropriate cloud provider is often a matter of selecting which layers you wish to control yourself and which should be the responsibility of the hosting provider. This new technology option promises cost effectiveness, flexibility and massive scalability on demand remote services (Krissi, 2008). In essence, the whole idea is that computations are organized for public utilization without wasting computing power. Cloud computing refers to the provision of computational resources on demand via a network. It can be compared to the supply of electricity and gas, or the provision of telephone, television and postal services. All of these services are presented to the users in a simple way that is easy to understand without the users needing to know how the services are provided. This is a simplified view known as abstraction. Similarly, cloud computing offers computer application developers and users an abstract view of services that simplifies and ignores much of the details and inner workings. A provider's offering of abstracted Internet services is called 'The Cloud'. In this paper, efforts are made to present an overview of cloud computing otherwise known as utility computing, particularly when it is adopted and implemented in the University Libraries in Africa.

Background information on cloud computing

The trend in proper adoption and implementation of cloud computing, talking in general terms, had been slow until year 2007 when it began to receive the necessary attention it deserves. In the past, precious times were spent by organizations in the process of building infrastructures in which its resultant effect led to competition among them. Oftentimes, this approach is characterized by negative implications; such as:

- Space wastage in respect of unused computing capacity in big data centers.
- Servers' administrators will be required to baby-sit the server in order to carry out its administration before turning it out to end-users on daily basis.
- Alternative energy back-up plan must be provided in order to guarantee uninterrupted power supply which enhances rendering effective service (Galen, 2009)

With cloud computing, excess computing space can be put to use or sold to consumers who may need it instead of allowing it to waste away. This transformation of computing and information technology (IT) infrastructure into a facility for utility, which is accessible to all, places the users at comfortable level. In essence, one is privileged to rent the available infrastructure from the vendor that offers the best price and service based on need as against excessive wastage of storage space. Amazon is found to be one of such producers of web cloud computing services with outstanding record of performance.

Cloud computing uses scalable computing resources provided as a service from outside one environment on a pay-per-use basis. In essence, the rationale behind cloud computing is to use only what you need and pay for only what you use. The resources that reside in the cloud can be accessed at any time and from anywhere across the Internet without apprehension about the low level details on how the underlining infrastructures are being maintained behind the scenes in the cloud, that is, viewing it from the back end. In other words, backend details are shielded from users of the available resources (Kyriasis, 2010). The cloud is responsible for being highly available and responsive to the needs of users' applications. Resources constantly needed for applications and information technology (IT) systems (to meet growing demands for storage, computing resources, messaging systems, and databases) are essentially commoditized. Infrastructures can be rented from the vendor that provides the best price and service. In cloud computing, there is reduction in respect of redundancy to the minimum since unused space can be sold to other consumers of the cloud thereby enhancing profitability (Rochwerger, ... *[et al]*, 2009) .

Properties and components of cloud computing

In successfully implementing cloud computing in a typical organizational set-up, transparency, scalability, intelligent monitoring and security are identified characteristics that must be kept in proper perspective. The two most significant components of cloud computing architecture are known as the front end and the back end. The front end is the part seen by the client, that is, the computer user. This includes the client's network (or computer) and the applications used to access the cloud via a user interface such as a web browser. The back end of the cloud computing architecture is the *cloud* itself, comprising various computers, servers and data storage devices (Rochwerger, ... *[et al]*, 2009).

Cloud computing layers and deployment models

The ideal layers of cloud computing include the client, the application, the platform, the infrastructure and the Server. Once an Internet Protocol connection is established among several computers, it is possible to share services within any one of the layers (Gordon, 2009).

The identified models for deploying cloud computing are:

- Public cloud
- Community cloud
- Private cloud
- Hybrid

These models are hereby briefly explained.

Public cloud:

The following are its features:

- Infrastructure made available to general public
- Owned by organizations selling cloud services
- Services are free or 'pay per-use'
- Almost a synonym for 'cloud computing'

Examples of public cloud include:

- Google App Engine

- Microsoft Windows Azure
- IBM Smart Cloud
- Amazon EC2

Community cloud:
The following are the identified features of community cloud:

- Cloud infrastructure is shared by several organizations
- May be managed by the organizations or a third party
- Cost is spread over more users compared to private cloud

Examples of community cloud include:

- Google apps for government
- Microsoft government community cloud

Private cloud:
This is owned by an individual. The adoption and implementation are the sole responsibility of the affected person. The features of private cloud are as stated below:

- On-demand infrastructure owned by a single customer (organisation) who controls the running of applications
- Organization owns physical resources and provides access to users
- Good option for companies dealing with data protection and service-level issues

Examples of Private Cloud are:

- Eucalyptus
- Ubuntu Enterprise Cloud - UEC (powered by Eucalyptus)
- Amazon VPC (Virtual Private Cloud), etc (John, 2010)

Hybrid cloud:
Hybrid cloud combines both the characteristics and requirements of two or more previously mentioned computing clouds to form a unified whole. This has the following as its features:

- Composition of two or more clouds (private, community, or public)
- Bound together by standardized or proprietary technology that enables data and application portability

Examples of Hybrid Cloud:

- Windows Azure (capable of Hybrid Cloud)
- VMware VCloud (Hybrid Cloud Services)

(Source: *NIST definition of cloud computing)*

Categorization of the model services of cloud computing
Cloud computing is a general term for anything that involves delivering hosted services over the Internet. The model services are broadly divided into three categories; namely:

Infrastructure-as-a-Service (IaaS):

- Most basic cloud service model
- Providers offer computers, as physical or virtual machines, block storage, firewalls, load balancers like switches and routers, and networks

- Users install OS and application software
- Users responsible for patching and maintaining the operating systems and application software (Kyriazis, 2010).

Example:

- Amazon Web Services
- Joyent

Platform-as-a-Service (PaaS):

- Offers operating system, programming language execution environment, database and web server
- Provides for every phase of software development and testing
- No need to buy and manage the underlying hardware and software layers by the customer
- Can be specialized around a particular area like content management (Schofield, 2008).

Example: Google App Engine.

Software as a Service (SaaS):

- Delivery model in which software and associated data are centrally hosted on the cloud
- Cloud infrastructure and platform on which the application is running is managed by a service provider
- Based on multi-tenancy architecture
- Cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients

Example:

- Google mail, SalesForce.com (Krangel, 2009).

Cloud storage

Cloud storage is a model of networked computer data storage where data is stored on multiple virtual servers, generally hosted by third parties, rather than being hosted on dedicated servers. Hosting companies operate large data centers; and people who require their data to be hosted buy or lease storage capacity from them and use it for their storage needs. The data center operator, in the background, virtualizes the resources according to the requirements of the customers and expose them as virtual servers, which the customers can themselves manage. Physically, the resource may span across multiple servers. The service provider may pool the processing power of multiple remote computers in 'the cloud' to achieve the task, such as backing up of large amounts of data, word processing, or computationally intensive work. These tasks would normally be difficult, time consuming, or expensive for an individual user or a small company to accomplish, especially with limited computing resources and funds. With *cloud computing*, clients require only a simple computer, such as net-books, which were created with cloud computing in mind, or even a smart-phone, with a connection to the Internet, or a company network, in order to make requests to and receive data from the cloud, hence the term "software as a service" (SaaS). Computation and storage is divided among the remote

computers in order to handle large volumes of both. Thus, the client needs not purchase expensive hardware or software to handle the task. The outcome of the processing task is returned to the client over the network, depending on the speed of the Internet connection. Prominent among these networked computer data storage is Amazon Web Services (AWS) (Jim, 2009).

Amazon Web Services - The available services are:

- S3 – Simple Storage Service
- EC2 – Elastic Compute Cloud
- Simple Queue Service (SQS), etc (Needle, 2011).

Some issues of major concern in cloud computing: Despite the growing list of benefits that cloud computing offers, there are some issues of major concern that need to be addressed in this paper. These will be highlighted and explained here.

Privacy: The cloud model has been criticized by privacy advocates for the greater ease in which the companies hosting the cloud services control, and thus, can monitor at will, lawfully or unlawfully, the communication and data stored between the user and the host company.

Security: The relative security of cloud computing services is an issue of major concern which may be delaying its adoption. This has to do with external management of security based services. (Elinor, 2009)

Availability and performance: The availability and performance of applications that are hosted in the cloud is also an issue of concern that must not be lost sight of. There are also concerns about a cloud provider shutting down for financial or legal reasons.

Why recommend adoption and implementation of cloud computing to the university libraries in Africa?

The reasons for recommending the adoption and implementation of cloud computing to the university libraries in Africa are not farfetched. Some of the perceived benefits of adopting and implementing cloud computing in the academic communities, particularly in the University systems in Africa are:

- Cost effectiveness in terms of implementation: It is cost effective in terms of acquisition and management of information technology (IT) infrastructure since all that is needed to enjoy the available facilities in the cloud is simply, a laptop and Internet access.
- Flexibility and innovation: Cloud computing brings about flexibility and innovations in terms of how information services are delivered to the library patrons. This has potentials of attracting more patrons to the library because without new innovations, the patrons may not patronize the library. In essence, academic libraries are free to focus on innovations, rather than technology.
- Restriction free storage space: Alternative storage space that is available in the cloud which is known as cloud storage can be used as a backup for what is

available locally. When this is achieved, restrictions in respect of storage space can be eliminated.

- Achieving cloud OPAC as well as inter-operability of library information systems: Through the adoption and successful implementation of cloud computing in the academic library, online public access catalogue of the library can reside in the cloud which will serve as a pivot for achieving inter-operability of information system (resource sharing). Academic libraries should be the vanguard in respect to building cloud computing in the areas of cataloguing, resource sharing, online reference, etc.
- Stress-free Servers' administration: This is achieved through cloud computing since the responsibility of Servers' administration will be handled by the web service provider. The maintenance and other related activities must be handled by the provider as well.
- There is mobility in the choice of web service providers because of the associated privileges of choosing a provider with best practices and services.
- Subscription to quality services when the need arises: This will attract patrons to the library as a result of availability of robust services.

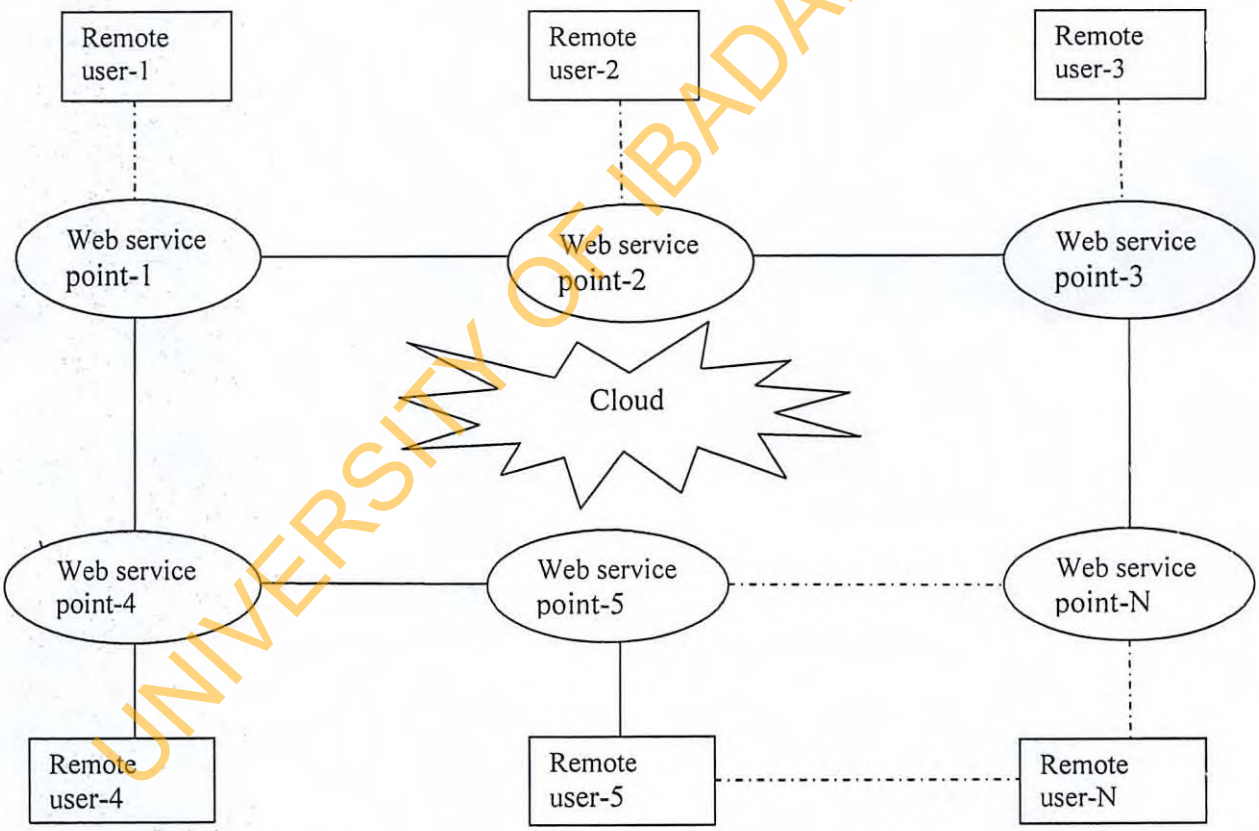

FIG. I: Suggested model for cloud computing adoption and implementation in the university libraries in Africa.

As can be seen from the above Fig.1, requests are made by the users remotely through the identified service points, in this case, the service points represent web service providers;

such as Amazon, Yahoo, Zoho, Google, etc. The web service providers act as an interface or go-between between the users and the cloud where services are provided on demand basis. The implication of this is that wastages are reduced to the minimum in terms of available space because it is 'pay for what you use' scenario. A remote user can represent an academic library in a particular university, that is, what constitutes a remote user has peculiarity in terms of definition. Again, a remote user is at liberty to choose a web service provider who offers the best services as well as an affordable price.

Implications of cloud computing adoption and implementation in academic libraries in Africa:

The implications of adopting and implementing cloud computing in a typical library are quite enormous and university libraries in Africa should be prepared to tackle them, some of these implications are hereby highlighted:

- Data security: People are usually apprehensive about the security of data stored in the cloud.
- Inter-operability with remote users: This may pose a lot of challenges in respect of cooperation, particularly in the process of sharing data.
- Additional responsibility: Users of the cloud have to be trained over and over again until stability level is reached. Training the trainers' workshop will also be observed.
- New innovations are introduced into the library: It means that the librarians, working in the academic library setting must be up and doing in terms of keeping pace with what the technology is dictating in order to stay relevant in terms of job performance.

Service providers of cloud computing for libraries

Two of the identified service providers of cloud computing for libraries identified globally are as presented below with the specific functions they perform:

Polaris library systems:

This provides services such as: Library automation system, standard acquisition and processing system, provision of well known standards like MARC 21 for bibliographic data, Z39.50 for information retrieval, Unicode etc.

Dura cloud:

Services such as: Digital library services, Dura space which is a collaboration of the D-space digital library software and Fedora Commons being used as content management system software, particularly for handling institutional repository (IR) in respect of the universities' intellectual output. This will pave room for wider visibility, accessibility, multiple access and preservation. It is also available for consortia. It offers complete solution for digital library with standard software and hardware solution. It also provides open source code and the code needs to be installed on machines (Elinor, 2009).

Cloud computing: a driving wheel in academic libraries

Fox (2009), stated that, cloud computing has been found to be the driving wheel for the generations to come. The under-listed which is the growing list of benefits that can be derived from the adoption and implementation of cloud computing as a propelling force that will effectively address needs within African academic library environment from now on are:

- Conformability in terms of use
- Reduction in software maintenance
- Security
- Backup
- Scalability
- Cost effectiveness in terms of drastic reduction
- Efficient Storage
- Accessibility
- Efficient use of computer resources
- Access in global terms without restriction

Cloud computing is, in the actual sense, according to Iiyoshi and Vijay (2008), the solution to getting all updated applications software with low cost without scattering documents.

Conclusion

The concept of cloud computing, in essence, leads to a platform and applications concept for library management services and to collective innovation. Cloud computing is a general term for anything that involves delivering hosted services over the Internet on 'pay as use' basis. The term cloud computing is being synonymously used as utility computing (Krissi, 2008). The understanding is that organizations pay for what they use only in terms of storage space. The services provided through cloud computing, are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). Proper explanations of these services were addressed in the paper. The principle behind the cloud is that any computer connected to the Internet is connected to the same pool of computing power, applications, and files. Users can store and access personal files such as music, pictures, videos or play games or do word processing on a remote server rather than physically carrying around a storage medium such as a DVD. Presented are general concepts of cloud computing and its adoption in the academic library settings, particularly, universities in Africa, given benefits accruable in terms of space preservation, low cost and funds management, and resource sharing capabilities and consortia.

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