UTILIZATIONS OF CLOUD COMPUTING IN LIBRARY AND INFORMATION CENTERS: A THEORETICAL STUDY

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ABSTRACT

The "cloud computing" trend of replacing software traditionally installed on campus computers (and the computers themselves) with applications delivered via the internet is driven by aims of reducing universities' IT complexity and cost. This study examines the Utilizations of Cloud Computing in Library and Information Centers: a Theoretical Study. The present study demonstrates and elaborates the various aspects of uses of cloud computing in libraries, model of cloud computing, essential characteristics, pros and cons, benefits, how the trend of cloud computing will be impact libraries and drawback of cloud computing. Areas for further studies and conclusions of the theoretical study are given at the end of the article.

Keywords: *Cloud computing, Web services, Theoretical studies, Libraries.*

1. INTRODUCTION

Cloud computing, cloud, sometimes called electronic clouds concept and the term modern spread recently in the literature network technologies and information services. This concept refers to a new pattern to share electronic resources to produce and exchange information over the Internet, providing the tools to process data and save them on your network, and then return to it at any one of the websites that have arisen on this concept. Cloud computing is a computing model, not a technology. In this model "customers" plug into the "cloud" to access IT resources which are priced and provided "on-demand". Essentially, IT resources are rented and shared among multiple tenants much as office space, apartments, or storage spaces are used by tenants. Delivered over an Internet connection, the "cloud" replaces the company data center or server providing the same service.

Electronic cloud appeared as a practical solution and optimize after the infrastructure of the Internet in various parts of the world, and became the "connect" command does not constitute a barrier to contact with clouds, especially after the huge surge in the issuance of smart phones that carry with them always properties of your Internet connection and the possibility of dealing with various information and files on network mainly multimedia.

The definitions of the "Cloud Computing the practice of storing regularly used computer data on multiple servers that can be accessed through the Internet" (Merriam Webster Dictionary).An others way define "Cloud Computing is the paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, entertainment centers, table computers, notebooks, wall computers, handhelds, etc." (IEEE Computer Society).The *National Institute of Standards and Technology*, defines cloud computing as "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 (Mitchell,2010).

However, Cloud Computing is a completely new IT technology and it is known as the third revolution after PC and Internet in IT. To be more specific, Cloud Computing is the improvement of Distributed Computing, Parallel Computing, Grid Computing and Distributed Databases. And the basic principle of Cloud Computing is making tasks distributed in large numbers of distributed computers but not in local computers or remote servers. In other words, by collecting large quantities of information and resources stored in personal computers, mobile phones and other equipment, Cloud Computing is capable of integrating them and putting them on the public cloud for serving users (Sanchati and Kulkarni, 2011).

2. REVIEW OF LITERATURE

Literature plays a very important role in research activities, as it forms the very first step of a research pursuit. Review of literature happens to be an important segment of the concerned topic. The literature review should be conducted in a systematic way to achieve optimum results. In this study an attempt has been made to cover few works which have been undertaken in Saudi Arabia and abroad (Hussain, 2013).

Espades (2013) discussed as regards cloud computing advantages for offering on demand resources, there is still the need for certain automation when specific platforms are deployed and scaled over virtualized environments. This is the case of Software-as-a-Service (SaaS) platforms and their applications, where over and underutilization of resources occur due lower and higher workload pikes and because the number of virtual machine instances deployed for scaling applications are traditionally based on the maximum simultaneous users. In this matter, a tenant-based model is presented to tackle over and underutilization when SaaS platforms are deployed over cloud computing infrastructures.

Ghosh (2012) attempted to demystify the intricacies involved in cloud computing. Models of cloud computing and its effective implementation for mid-sized organization is emphasized. Lastly, it has been attempted to explore how cloud computing can extend Library services for better sustainability.

Padhy and Mahapatra (2012) focused cloud computing entails the reduction of in-house data centres and the delegation of a portion or all of the Information Technology infrastructure

capability to a third party. Universities and Colleges are the core of innovation through their advanced research and development.

Subsequently, Higher Institutions may benefit greatly by harnessing the power of cloud computing, including cost cutting as well as all the above types of cloud services. In this paper we discuss problems faced with digital library and development efforts to overcome that problem. Then it proposed to improve current user service model with Cloud Computing. This paper explores the application of cloud computing in academic library in Orissa.

Jinga,Zhijiang and Suping 2012) discussed the Community library has been an effective complement to the large public libraries. But a single community library is always facing some difficulties in management, costs and resource. Through establishing the community libraries alliance based on network, those problem can be solved effectively. In this article, the basic characteristics of cloud computing technology are described, and the component and principle of the community library alliance based on cloud computing and client-server model are analyzed in detail. As a relatively new network model, cloud computing has obvious advantage compared with the common client-server model.

Sultan (2010) conducted a study under the titled "cloud computing for education: a new dawn". Cloud computing is an emerging computing paradigm which promises to provide opportunities for delivering a variety of computing services in a way that has not been experienced before. It was demonstrated in this article how organizations (both small and large) are already taking advantage of the benefits which this technology is bringing, not only in terms of cost but also efficiency and the environment. This computing approach relies on a number of existing technologies, e.g., the Internet, virtualization, grid computing, Web services, etc. The provision of this service in a pay-as-you-go way through (largely) the popular medium of the Internet gives this service a new distinctiveness.

Buyya (2009) highlighted cloud computing is a new and promising paradigm delivering IT services as computing utilities. As Clouds are designed to provide services to external users, providers need to be compensated for sharing their resources and capabilities. In this paper, authors have proposed architecture for market-oriented allocation of resources within Clouds. They have also presented a vision for the creation of global Cloud exchange for trading services. They have discussed some representative platforms for Cloud computing covering the state-of-the-art. In particular, authors have presented various Cloud efforts in practice from the market oriented perspective to reveal its emerging potential for the creation of third-party services to enable the successful adoption of Cloud computing, such as meta-negotiation infrastructure for global Cloud exchanges and provide high performance content delivery via `Storage Clouds'.

3. OBJECTIVES OF THE STUDY

The main objectives of the study were: to explore the concept of cloud computing and what it in relation to library and information centers and its services in institutions of higher education with a main focus on academic libraries.

4. METHODOLOGY

The theoretical methods are used for data collections. In this paper represent few points for the utilizations of Cloud Computing in library and Information centers. The author have collect data and information from national as well as international esteemed research journal library and information science and various recognized websites. The time period of the study was from August to October 2013.

5. MODELS OF CLOUD COMPUTING

A. Cloud Service Models

There are three major types of cloud service models available:

(i)Software as a Service (SaaS): Applications or software is delivered as a service to the customer who can access the program from any online device. Some of these Web-based applications are free such as Hotmail, Google Apps, Skype, and many 2.0 applications, while most business-oriented SaaS, such as Sales Force, is leased on a subscription basis. There is usually little customization or control available with these applications. However, subscribers benefit from low initial costs, have access to (usually 24/7) support services, and needn't worry about hosting, installing, upgrading, or maintaining the software.

(ii)Platform as a Service (PaaS): With PaaS, a computing platform is provided which supplies tools and a development environment to help companies build, test, and deploy Web-based applications. Businesses don't need to invest in the infrastructure required for building Web and mobile applications but can rent the use of platforms such as Windows Azure, Google AppEngine, and Force.com. Applications which are built using these provider's services, however, are usually locked into that one platform.

(iii)Infrastructure as a Service (IaaS): This type of cloud computing is also sometimes referred to as HaaS or Hardware as a Service and it involves both storage services and computing power. Amazon's Web Services, one of the major players in this area, offers two main products including the Elastic Compute Cloud (EC2), which provides computing resources, and Simple Storage Service (S3) for data storage.

Companies are using Amazon's Web Services to host or backup their websites, for content delivery, to run high performance computing simulations, to host media collections, and much more. Most of these cloud services are available on a pay-per-usage basis, differing from the SaaS subscription model, enabling customers to scale up or down depending on their need at any given time and only pay for what they've used (Padhy and Mahapatra, 2012).

B. Cloud Deployment Models

Cloud Computing can be classified into 4 types of deployment model on the basis of location where the cloud is hosted, these are Public, Private, Hybrid and Community Cloud.

(i) Public Cloud: Computing infrastructure is hosted at the Vendor/Provider location. The Client/user has no visibility over the location of the cloud computing infrastructure. The computing infrastructure is shared between organizations.

(ii) Private Cloud: Computing architecture is dedicated to the Client/customer and is not shared with other organisations/clients. They are expensive but are more secure than Public Clouds. Private clouds may be externally hosted ones as well as in premise hosted clouds.

(iii) Hybrid Cloud: Organizations host some critical, secure applications in private clouds and other not so critical applications are hosted in the public cloud. The combination is known as Hybrid Cloud. Another hybrid cloud is Cloud bursting. It is used to define a system where the organisation uses its own infrastructure for normal usage, but cloud is used for peak loads.

(iv) Community Cloud: The Cloud infrastructure is shared between the organizations of the same of community. For example, all the government agencies in a city can share the same cloud but not the non-government agencies. All libraries in a city or country sharing the same cloud.
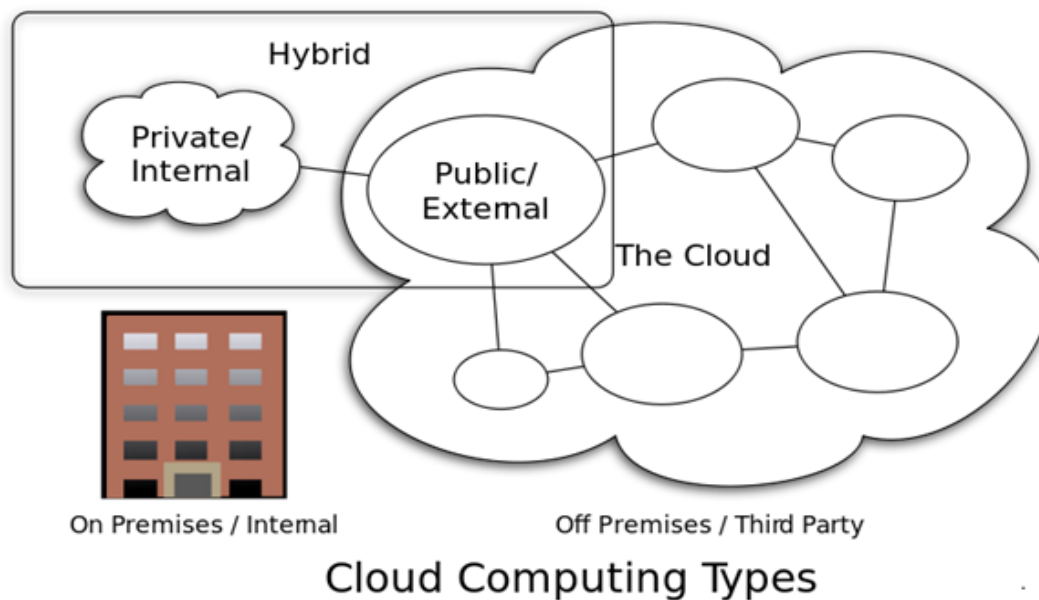

Fig.1 Types of Cloud Computing

6. ESSENTIAL CHARACTERISTICS OF CLOUD COMPUTING

The essential characteristics of cloud computing is On demand self-services-computer services such as email, applications, network or server service can be provided without requiring human interaction with each service provider. Cloud service providers providing on demand self services include Amazon Web Services (AWS), Microsoft, Google, IBM and Salesforce.com. New York Times and NASDAQ are examples of companies using AWS (NIST).

6.1 Broad network access: Cloud Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms such as mobile phones, laptops and PDAs.

6.2 Resource pooling: The provider's computing resources are pooled together to serve multiple consumers using multiple-tenant model, with   different physical and virtual resources dynamically assigned and reassigned according to consumer demand. The resources include among others storage, processing, memory, network bandwidth, virtual machines and email services. The pooling together of the resource builds economies scale.

6.3 Rapid elasticity: Cloud services can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

6.4 Measured service: Cloud computing resource usage can be measured, controlled, and reported providing transparency for both the provider and consumer of the utilised service. Cloud computing services use a metering capability which enables to control and optimize resource use. This implies that just like air time, electricity or municipality water IT services are charged per usage metrics – pay per use. The more you utilize the higher the bill. Just as utility companies sell power to subscribers, and telephone companies sell voice and data services, IT services such as network security management, data center hosting or even departmental billing can now be easily delivered as a contractual service.

6.5 Multi Tenacity: is the 6th characteristics of cloud computing advocated by the Cloud Security Alliance. It refers to the need for policy-driven enforcement, segmentation, isolation, governance, service levels, and chargeback/billing models for different consumer constituencies. Consumers might utilize a public cloud provider's service offerings or actually be from the same organization, such as different business units rather than distinct organizational entities, but would still share infrastructure.

7. PROS AND CONS OF CLOUD COMPUTING
(I)The Pros
1. Cost reduction - Cloud computing reduces paperwork, lowers transaction costs, and minimizes the invest in hardware (and the resources to manage it). Moving your business to 'the cloud' also reduces the need for an IT staff.

2. Its scalable - Like electricity and water, some cloud computing services allow businesses to only pay for what they use. And as your business grows, you can accommodate by adding more server space.

3. Levels the playing field - Cloud computing providers offers small and mid-size businesses access to more sophisticated technology at lower prices. Sharing IT resources with other companies reduces the cost of licensing software and buying servers.

4. Easier collaboration - Since services in the cloud can be accessed anytime from any computer, it's easy to collaborate with employees in distant locations.

(II)The Cons

1. Availability - Will your cloud service go down unexpectedly, leaving you without important information for hours or more?

2. Data mobility and ownership - Once you decide to stop the cloud service, can you get all your data back? How can you be certain that the service provider will destroy your data once you've canceled the service?

3. Privacy - How much data are cloud companies collecting and how might that information be used?

8. BENEFITS OF CLOUD COMPUTING IN GENERAL

a. Scalability: Scalability refers to real time adjustment of resources. Cloud computing enables to scale up or down IT requirements of organizations quickly and efficiently, without hampering productivity. It cuts down the time involved in buying & setting up additional hardware, software & other necessary resources every time a new service is required.

b. Reduced Infrastructure Cost: As said earlier that resources can be adjusted dynamically, a lot of cost related affairs like administration, maintenance and be reduced. It also helps cut down unnecessary capital expenditure as one has to pay only for the duration of use the service for.

c. Effective Utilization: As in cloud computing the total IT infrastructure is as a pool of resources, it reduces wastage of resources to a great extent and improves utilization.

9. CLOUD COMPUTING @ LIBRARIES

The above benefits are mostly applicable to libraries and other small-to-mid-sized organizations. Effective planning and decision regarding implementation is the most important factors for its success.

9.1. Financial Barriers vs. Cost Savings: Each library is facing acute shrinkage in budget. Varieties of resources, in all forms (printed and digital) broadened the issue. Purchasing infrastructural facilities recurrently and updating /up gradation of software and hardware is becoming a bothering issue. Cloud computing offers price savings due to economies of scale and the fact that you're only paying for the resources you actually use.

9.2. Rigidness vs. Flexibility and Innovation: Risks can be taken for creative and innovative ideas as the new application will run on provider's infrastructure. Libraries don't have to decide about the bandwidth, traffic etc. Creation and configuration of virtual server for storing digital resources would be easier as the script would be run under providers own machine. As Whitfield Diffie points out that in the long run the cloud might be more restricted and rule-bound than traditional IT. He compares the cloud to public transportation providers such as airlines which rely more on rules and fixed schedules than privately-owned planes.

9.3. Cloud OPAC and Cloud ILS: As of now the libraries are providing Union catalogue services through consortia approach, is still in its infancy. As now more and more LMS vendors are offering cloud-hosted versions of their tools, it is strongly expected that OCLC's cloud based ILS tools that complement their existing cataloging tools (e.g. WorldCat and FirstSearch). Unified search engine and catalogue retrieving tools may help global user to access more information in real time, satisfying the fourth law of LIS.

9.4. Cloud types and LIS: There are too much hype and optimism surrounding cloud computing. Lots of gray areas are still there which needs to be addressed promptly for implementation of cloud computing in LIS. Concerns about security, privacy and reliability are the most important among them. To mitigate the fears above the libraries choose to go for hybrid cloud model. This hybrid model would let libraries maintain more control over the applications and data stores that contain sensitive, private information about patrons. Fine tuning and adjustment of resources can also be done quickly (Ghosh,2012).

10. HOW THE TREND OF CLOUD COMPUTING WILL IMPACT LIBRARIES?

Beyond the basic components like hosted email services that have a strong consumer base, cloud computing can be utilized to address needs which are specific to libraries? This can be broken down into the three types of cloud services, replacing a library's onsite technology environment with an online version, and then situations where a library can create its own cloud infrastructure. These areas offer "benefits to information professionals: outsourced infrastructure, greater flexibility, reduced barriers to innovation, and lower start up investments".

The three main types of cloud services are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) (Kroski, 2009). First, cloud computing offers the ability of libraries to use online software to handle a task like video chat through either Gmail video chat or through Skype. Both of these are free services though there is "little customization or control available with these applications" (Kroski, 2009). In other words, services you offer through a SaaS' interface will look like that of your competitors which will not distinguish you from them. On the other hand, since the services and application interfaces are often familiar with users, there would be a decrease in the learning curve for library staff and users.

Second, libraries can create applications in an online environment. These environments allow a library to "build, test, and deploy Web-based applications" (Kroski, 2009). PaaS gives

the library the freedom to explore development options without having to purchase and maintain the required infrastructure. This way, if a particular program turns out to not be popular or a best fit for a library, they are not stuck with unwanted hardware and software which they could not recoup the costs from.

Third, a library no longer has to purchase their own servers to host their content. By using IaaS, a library can purchase server space and computing power. One of the major players in this arena is Amazon which offers the "Elastic Compute Cloud (EC2), which provides computing resources and Simple Storage Services (S3) for data storage" (Kroski, 2009). A library does not need to purchase a server which is underutilized but costs the same to purchase and maintain as if it were using all of its resources at all times. By using an IaaS, a library gains the benefit of only paying for the "resources you actually use".

Therefore the main benefit for moving to a cloud computing environment for a library is the ability to both try out new software without having to buy the hardware as well as being able to scale the computing power to meet the demand of users. A library's IT department can be more flexible in raising the amount of cloud computing they require by contacting their vendor instead of physically having to acquire new hardware to meet increased demands. This method will save the library money and staff resources.

11. DRAWBACKS OF CLOUD COMPUTING

The drawbacks are actually the same as those encountered by institutions that have information hosted outside of the entity. Whereas, in the case of hard-copy document files and at the enterprise level, this fear disappeared years ago given the benefits of cost reduction in infrastructure management and security, in the case of digital data there is still a huge fear of putting our information in the hands of third parties. This fear arises due to issues such as confidentiality, theft, loss etc. Yet people are increasingly more likely to do so now that the use of web 2.0 and social networks has become so widespread. There is nothing more sensitive than banking or personal data, yet this data is stored in servers over which we have no domain or ownership.

An institution might take the decision to progressively move towards Cloud Computing by uploading applications which are not very sensitive such as: messaging, the booking of rooms, meeting management, the liquidation of costs, and holiday management. This learning process more valuable information involving the corpus of the institution, i.e. "Business intelligence" might be uploaded to the cloud. In the case of library's and information centers, this information would include management funds and network transactions (Romero, 2012).

12. AREAS FOR FURTHER STUDIES

The present study is carried out the help of several variables i.e. the growth of cloud computing in information society and its impact of higher educational institutions/organizations, business world, administrations etc. The study covers utilizations of Cloud Computing in Library

and Information Centers. Still certain areas are there where further study can be carried out. They are as follows:

The study can conduct to find growth, development and use cloud computing of different libraries in one country as well as other countries.

1. The study can extend to whole of the countries.
2. The same study can also be extended to the University libraries.
3. To carry out research on the same specialized libraries and information centers/institutions in one country as well as other countries.

13. CONCLUSION

Cloud computing is an emerging computing paradigm which promises to provide opportunities for delivering a variety of computing services in a way that has not been experienced before Cloud computing which is applied in digital libraries, analyzes current situation and existing problems of the cloud computing in digital library .On this basis, on the combination of cloud computing, SaaS, web2.0, SOA and other technologies, this paper proposes a CALIS-based cloud service strategy and the corresponding cloud library services platform (i.e. Nebula platform) model. The model is suitable for constructing large-scale distributed network of public digital library services. All library resources and service distributed on the Internet can be integrated as a whole, which forms a new type of adaptive control service system supporting interlibrary collaboration and service access, as well sharing resources from different libraries. But in practice, the cloud computing is facing the large number of technical problems and engineering problems.

Therefore, it is necessary to encrypt data and make that the data obtained illegally cannot be deciphered. Cloud computing technology is still relatively young in terms of maturity and adoption. The expectation is that it will undergo several changes in the future, in terms of resources, issues, risks, and ultimately best practices and standards. However, there are some sought of greet advantages it can potentially provide value for institutions of higher education.

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