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The Cloud Library: a Gift to LIS Community

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ABSTRACTS: With the help of Information and Communication Technology (ICT) the libraries have changed their environment and with the introduction of cloud computing the libraries now represents a new field and provides new opportunities to the Library and Information Science (LIS) Community . This paper discusses the concepts of cloud computing and its application in the libraries. This paper also aims to describe the cloud computing model, the required service providers for libraries and also how the cloud computing fulfils the desire of the libraries as well as the library users.

KEYWORDS: Cloud Computing, Cloud Library, Distributed Computing, Digital Library, Grid Computing, Library Automation, LIS Community.

I. INTRODUCTION

Necessity is the mother of all invention- which indicates, when people really need to do something, they figure out a way to do it and also lead a continuous development in the field of Information and Communication Technology (ICT). In the early days the ancient Chinese Dynasties created the abacus when they felt their need. With the development of human society as well as technologies, men created the modern computer step by step to satisfy their need. It simply says that the development of the modern computer is the result of the advancement of technologies as well as the need of human society. Now a days in the field of Information and Communication Technology the cloud computing is a new flavor and it is the third revolution after the Personal Computer (PC) and the Internet. Cloud computing is a web based technology and central remote server that maintains data, software, hardware and application which allows the users to use the computing resources (i.e. data, software, hardware) without installing in their local machine to access their required data on any computer over the network (Typically Internet). In the field of Library and Information Science (LIS) cloud computing is used to build a digital library and to automate housekeeping operations using third party services, software and hardware.

II. CONCEPT OF CLOUD COMPUTING

The origin of the term cloud computing is little known. In the Cloud Computing the term cloud is used as a metaphor to denote "the internet", so the cloud computing also called "internet based computing". The cloud symbol being used from as early as 1994 to represent the internet. Cloud computing contains set of software and hardware resources which are available on the internet and its services are managed by third-party. The term cloud computing refers to the delivery of scalable IT resources over the Internet. Simply Cloud computing is the use of computing resources (i.e. hardware software and other application without installation in their own machine) that are delivered as a service over a network or through Internet. To be more specific, Cloud computing shares characteristics with: Autonomic computing, Parallel Computing, Mainframe computer, Utility computing, Grid Computing, Client-server model, Distributed Computing and Distributed Databases.

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III. ATTRIBUTES OF CLOUD COMPUTING

Cloud computing exhibits the following key attributes:

- ❖ **Agility:** The cloud computing improves the users' ability to get the required IT resources through network.
- ❖ **Security:** Cloud computing consists a set of policies, technologies, and control mechanism, where IT experts are always responsible to protect the cloud resources from loss of data or system crash.
- ❖ **Management of Cloud Activities:** The cloud manager works within a distributed wide area network (WAN) infrastructure and manage it globally so that all the users can access cloud based resources very easily from different parts of the world.
- ❖ **Multitenancy:** Cloud computing environment is Multitenancy, where multiple users can access and share their resources at the same time over the networks throughout the worlds.
- ❖ **Reliability and resiliency:** In the cloud computing environment multiple sites are available for the same services, so any one can use one after another sites for their satisfaction.
- ❖ **Elasticity and scalability:** The cloud elastic means that the resource allocation of the cloud infrastructure can get bigger or smaller depending on demand.
- ❖ **Standardized interfaces:** Cloud computing services should have standardized APIs (Application programming interface), which facilitates the accessibility to software that enables machines to interact with cloud software and also facilitates interaction between humans and computers. Cloud computing systems typically use REST-based APIs
- ❖ **Self Service Model:** It is very much acceptable due to its self service model where users can upload files, build programs, manage resources, and generate reports etc.

IV. TYPES OF CLOUD COMPUTING

There are four types of Cloud Computing which are as follows:

- ❖ **Public cloud:** *Public cloud* or *external cloud* refers to the cloud computing where the IT resources are made available to the public by a service provider through internet. These services are free or offered on a pay-per-use model. Some of the Public Cloud service providers are Amazon Web Services, Microsoft Azure and Google Apps etc.
- ❖ **Community Cloud:** Community Cloud involves sharing of computing resources between several organizations with similar interests and requirements from a specific community. This may help limit the capital expenditure costs for its establishment as the costs are shared among the organizations. The operation may be in-house or with a third party on the premises.
- ❖ **Private cloud:** Private cloud (also called internal cloud or corporate cloud): *Private cloud* or *internal cloud* is cloud infrastructure operated solely for a single organization or deployed with in a corporate firewall. So it is available only for the members of the concerned organization.
- ❖ **Hybrid cloud:** A hybrid cloud is made up of the combination of at least one private cloud and at least one public cloud. Hybrid clouds offer the cost and scale benefits of public clouds while also offering the security and control of private clouds.

V. CLOUD COMPUTING SERVICE MODELS

There are three service models which are as follows:

- ❖ **Software-as-a-Service (SaaS):** referred to as "on-demand software" is a software delivery model. It provides access to the software and associated data which are centrally hosted on the cloud. SaaS provides a subscription based software service which may be subscribed with monthly or yearly fees. Generally the initial setup cost for SaaS is lower than the other enterprise software. Some SaaS provides are Salesforce.com (CRM), Google (GOOG) and NetSuite (N).
- ❖ **Platform as a service (PaaS):** provides a computing platform and a solution stack on which users can build applications usually linked to a particular vendor. The PaaS provider provides the networks, servers, storage and

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other services. Platform Service providers are: IBM - Lotus Live, Google(GOOG) - Apps Engine, Microsoft - Windows Azure.

❖ **Infrastructure as a Service (IaaS):** offers the capability of processing, storage, networks, and it also includes operating systems and applications. The most important advantages of this model is that all the users can expand and control whenever as needed such as at the time of high demand users can expand the servers to satisfy the increased demand on the other hand users can go back to the normal position when demand is normal. Examples of **IaaS** providers are Amazon, IBM, Rackspace and Verizon.

VI. CLOUD SERVICE PROVIDER FOR LIBRARIES

The cloud service providers for libraries are as follows:

- ❖ **Ex Libris:** Ex Libris is a USA based cloud service provider. They provide cloud solution for all types of libraries with software and hardware support to provide the needed services to the library users. Ex Libris is available for all type of libraries and also for the consortia
- ❖ **Polaris Library Systems:** Polaris Library System is a cloud based library automation system which provides standard acquisition and processing system. The system uses number of well know standards like MARC 21 for bibliographic data, XML, Z39.50 for information retrieval, Unicode etc.
- ❖ **Dura Cloud:** DuraCloud is a hosted service and open technology developed by DuraSpace which provides cloud solution for digital library it also provides services that enable digital preservation, data access, transformation, and data sharing.

VII. APPLICATIONS OF CLOUD COMPUTING IN LIBRARIES

In the age of Information and Communication Technology to fulfil the increasing demand Libraries are providing cloud based library services with the facilities to access from anywhere and anytime. In the libraries, the following possible areas are identified where cloud computing services may be applied:

- ❖ **Building Digital Library/Repositories:** Cloud based digital library is highly essential to ensure the right information at the right time in the right way as well as make sure the resource sharing in the proper way in the web environment. Dura Cloud (sister concern of the Duraspace) is providing complete cloud solution for digital library services with standard software (OSS) and hardware requirement. Dura Cloud is a collaboration of the Dspace digital library software and Fedora Commons. It also provides services that enable digital preservation, data access, transformation, and data sharing.
- ❖ **Searching and sharing of bibliographic and authority data:** is one of the important services for library professional as well as for the users also. There are so many tools for snatching the bibliographic and authority data (e.g. Name Authority Cooperative Cataloguing (NACO), Subject Authority Cooperative Cataloguing (SACO), Virtual International Authority File (VIAF), World Cat of OCLC, Z39.50 server etc.) that use in the cloud environment. OCLC is offering various services pertain to circulation, cataloguing, acquisition and other library related services on cloud platform through the web share management system. Integrated Library Management Software (ILMS) koha also use Z39.50 server to snatch the bibliographic data from different reputed libraries worldwide using cloud environment.
- ❖ **Website Hosting:** The fast, reliable and flexible website of libraries acts as a single window to represent the libraries throughout the world. Website hosting is one of the earliest adoptions of cloud computing, so if the libraries operate their website by using cloud infrastructure that can deliver all these qualities without the overload involved in maintaining a local server in the library. Amazon S3 provide cloud based website hosting facilities and Google Sites also serves as an example of a service for hosting websites outside of the library's servers and allowing for multiple editors to access the site from varied locations.
- ❖ **Searching Scholarly Content:** Researchers need to access to the scholarly content/ materials and tools from multiple sources for their research purpose. The cloud offers more efficient delivery mechanisms that make it possible to provide multiple points of access without necessarily requiring multiple client or apps installations which presents a scalable foundation for ubiquitous access and scholarly sharing. Knimbus (Knowledge Cloud

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which is dedicated to knowledge discovery and collaborative space for researchers and scholar) is the best example for cloud based research platform that facilitate to discover and share the scholarly content.

- ❖ **File Storage:** In the age of information explosion the growing need for digital libraries to manage large amounts of data and therefore requires such a storage infrastructure that libraries can deploy quickly and economically. Cloud computing is a new model that allows to store and access any files on the internet in a simplest way. In the Cloud environment there are some of the file storage services such as Flickr, Dropbox, Jungle Disk, Google Doc, Sky Drive and so on. These services virtually allow to store and share the files on the web and provide access from anywhere and anytime without any instillation of special software and hardware. Therefore, libraries can get advantages of such cloud based services for various purposes.
- ❖ **LIS Community power:** Cloud computing facilitate a somewhat unique opportunity for libraries to create an online information community network among LIS professionals, teachers, students, Research scholar and information seekers by using social networking tools like Facebook or Twitter etc. This kind of community power provide efficiency, bring wider recognition, provide cooperative intelligence for better decision-making, and provide the platform on which libraries can innovate.
- ❖ **Cloud Based Library Automation:** Library automation is the generic term that denotes application of Information and Communication Technology (ICT) for performing manual operations in libraries. Libraries can take advantages of cloud computing for the purpose of automation. In the cloud based library automation, libraries do not have to care about the physical management of hardware, software, user interface, data backup, hardware capability etc. For library automation in the cloud environment, Polaris provides variant cloud based services such as acquisitions, cataloguing, circulation, process system etc. and also support various standards such as MARC21, XML, Z39.50 and Unicode which is directly related to library automation. Nowadays some of the cloud service providers such as Ex-Libris, OSS Labs, LibLime, N-LARN (Project in India), Amazon EC2, Amazon S3 etc. are also offering cloud platform and service for library automation.

VIII. CONCLUSION

The ultimate goal of the library is to provide the right information at the right time to the right persons in the right way. To fulfil this goal of the library the cloud computing can play a vital role as a pathfinder. In the modern age to fulfil the increasing user demand the library adopted new Information and communication technology (ICT) and with the introduction of cloud computing library has come at one's finger ends. With the help of cloud computing the library services have become more easy, user-centric and more effective. So for the future generation the cloud computing is a highly demandable and indispensable technology for the development of the libraries as well as our society.

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