A New Era For Library: Cloud Computing

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Abstract

A well-equipped library is the heart of any educational institution and also helpful for the growth of a nation's economy by providing knowledge and information on time. A library should be equipped with the modern technology to store the digital information in a wide number which can be retrieved quickly by various users from anyplace. Better library services can be achieved on time in collaboration with the modern technology i.e. Cloud Computing. Cloud computing technology offers great opportunities for libraries with accessibility anywhere, anytime and on any device. Cloud computing allows libraries to avoid locally hosting multiple servers, equipment and constantly dealing with hardware failure, software installation, up-gradation, compatibility issues etc.

Keywords: Library, Cloud Computing, e-library, digital data.

Introduction

Library is the place where information is gathered and stored in collections of books, which can be retrieved by the patrons. Internet is one of the paramount technologies of this age; it revolves around advancements in ICT applications to provide information at earliest. Now-a-days information is accessible online and in digital format. Today many enterprises are implementing cloud computing as a new technology model for ICT infrastructures and services. The better library services can be achieved on time in collaboration with the modern technology i.e. Cloud Computing. Cloud computing has huge prospective for libraries also. (Nagalakshmi, 2013).

Cloud computing is a new technology and it can be acknowledged as 3rd mutiny after PC and Internet. It is an augmentation of distributed computing, parallel computing, grid computing and distributed databases. Cloud computing allows libraries to avoid locally hosting multiple servers, equipment and constantly dealing with hardware failure, software installation, up-gradation, compatibility issues. Libraries availing cloud computing services save time, money and offers simplified library access. ICT related burden of libraries get reduced by the introduction of this technology as library professionals many a times find it difficult to manage the technologies owing to skill levels, lack of support from IT departments or for not having IT facilities within the organisations. Now, cloud computing may help libraries to undertake modern ICT activities without worrying about technical side of it (Gosavi et al.,2012; Goyal and Jatav, 2012; Nagalakshmi, 2013; Dastagiri and Kumar, 2017).

Data storage could be a main function of libraries, particularly those with digital collections storing large files can stress local server infrastructures. These files need to be backed up, well-kept, and reproduced for patrons. This can strain the data integrity as well as monopolise bandwidth. Libraries associated with cloud computing can put much more content into the cloud. All historical and exceptional documents would be scanned into a comprehensive and would be available to any researcher. Already many libraries have online catalogues and share bibliographic data with OCLC (Online Computer Library Center). A number of frequent online catalogues are linked to consortium that share resources (Gosavi et al., 2012). Cloud computing or IT infrastructure that exists remotely frequently gives users increased capacity and less need for updates and maintenance, and has gained wider acceptance among librarians. However, with faster retrieval times for requests and local server space made it available over the web it could improve storage solutions for libraries (Ogbu and Lawa, 2013).

Cloud Computing offers following services:

1.Software as a Service (SaaS):

Software as a Service model of cloud computing provides services and applications over the Internet. These services can be accessed with internet facility without installing and maintaining software. Cloud service provider offers SaaS as a complete software solution on a **pay-as-you-go** basis. Furthermost SaaS applications can be run directly on our local computers without downloads or installations from a web browser. The SaaS applications are also identified as **on-demand software, Web-based software or hosted software.** The SaaS service model deals with the services to the consumer using standardized interfaces (Gong et al., 2010).

2. Platform as a Service (PaaS):

Platform as a Service model offers a platform and environment to developers to develop applications and services over the internet. It supports to create applications without managing the underlying infrastructure. A PaaS provider arrange for the hardware and software on its own infrastructure. In PaaS, an operating system, hardware, software and network are provided to the customers to install or develop their own software and applications supported by a cloud based infrastructure (Mell and Grance, 2011; Carlin and Curran, 2012).

3. Infrastructure as a Service (IaaS):

The IaaS service model makes available infrastructure resources as a service, such as raw data storage, processing power and network capacity. IaaS as a service arranges for infrastructure as outsourcing to enterprises such as networking equipment, devices, database and web servers. It is also recognized as **Hardware as a Service (HaaS).** This model of cloud computing provides storage, servers, networking, and virtualization. (Creeger, 2009).

Deployment Models of Cloud Computing

Cloud services can be deployed in various ways, on the basis of the organizational behaviour and the providing location. Four deployment models for cloud service usage are as follows:

1. **Private cloud:** The cloud infrastructure is managed solely for exclusive use by a single organization comprising multiple consumers (e.g., business units), where resources are not shared by other entities. (Bardin et al., 2009).

2. **Community cloud:** The cloud infrastructure is managed for exclusive use by a specific community of customers from organizations that have mutual concerns (e.g., mission, security requirements, policy, and compliance considerations) (Rao et al., 2013).

3. **Public cloud:** The cloud infrastructure is managed for open use by the general public. The infrastructure is located on the premises of the cloud provider, who also owns and manages the cloud infrastructure. Public cloud users are known to be unreliable, as they are not part to the organization as employees and that the user has no contractual bond agreements with the provider.

4. **Hybrid cloud:** The cloud infrastructure is an amalgamation of two or more dissimilar cloud infrastructures (private, community, public) that persist exceptional entities, but they are assured togetherness by standardized technology that supports data and application portability.

Many organizations are concentrating on power of the cloud computing for reducing capital expenditure and controlling operational costs, business are getting progressive growth with cloud adoption. Libraries adopting Cloud computing offers following advantages:

• **Scalability**- Efficient control of expenditures due to "Pay as you go" feature of cloud computing.

• **Cost Saving**- No need to buy expensive hardware or software for library and it also reduce overhead of computer hardware maintenance.

• **Portability and accessibility**- The library services can be easily accessible anytime, anywhere through browser from any part of the world with cloud computing models.

• **Flexibility**- Immediate increase or decrease requirement of hardware or software can easily be achieved with offered cloud services.

• **Adaptable storage**- In the traditional system, the server needs to be replaced with the new one as per requirement of more storage space. With Cloud computing, the storage can be adjusted smoothly according to the necessities of the library, as the storage space is offered and controlled by the service provider.

• **Cloud OPAC (Online Public Access Catalogue)-** Most of the libraries are having the catalogue. If the catalogue of these libraries is made available on cloud, it will benefit to the users from worldwide, to search the availability of materials from libraries (Sahu, 2015).

Libraries shifting to the cloud and networking are enhancing the facilities of providing easy accessible library services with ease of place and time. In the libraries, the following possible areas are identified where cloud computing services and applications may be applied (Goyal and Jatav, 2012).

1. Building Digital Library/Repositories: In the present situation, every library needs a digital library to make their resources, information and services at an efficient level to ensure access via the network. Therefore, every library is shifting to digital library with the use of digital library software. In connection to cloud based digital library software, Duraspace is having two software"s namely Dspace and Fedora Commons but Dspace is widely used for building digital libraries/repositories relative to Fedora Commons. Dura cloud provides complete solutions for developing digital libraries/ repositories with standard interfaces and open source codes for the both software (Kaushik and Kumar, 2013).

2. Searching Library Data: OCLC is one of the best examples for making use of cloud computing for sharing libraries data for years together. For instance, OCLC WorldCat service is one of the popular service for searching library data now is available on the cloud. OCLC offers numerous services related to cataloguing, circulation, acquisition and other library related services on cloud platform.

Web share management (WSM) system facilitates to develop an open and collaborative platform in which each library can share their resources, services, ideas and problems with the library community on the clouds. On the other hand, the main aim of web- scale services is to provide cloud based platforms, resources and services with cost benefit and effectiveness to share the data and building. Cloud technology can be applied for backing up of media collections and storing and accessing of bibliographic data. Libraries can also store and maintain much of the same data hundreds and thousands of times (Jena and Das, 2013; Dutt, 2015).

e-libraries incorporating with cloud technology simplifying the use of library system to the user When the library systems are deployed as open cloud solutions then the library community itself can step up to create extensions to their core services and more importantly share them throughout the community using cloud computing (Bhattacharjee and Purkayastha, 2013). Website hosting is considered one of the primary adoptions of cloud computing as most of organizations including libraries wished to host their websites on third party service providers instead of hosting and maintaining their own servers, Google Sites 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 (Dhamdhere, 2014).

3. Searching Scholarly Content: Knimbus is known as Knowledge Cloud. It is cloud based research platform facilitator to discover and share the scholarly content to researchers and scholars. It was launched in 2010 to overcome the challenges faced by researchers in searching across and accessing manifold information sources. It is a collaborative platform for researchers and scholars to determine and share knowledge with peers. It facilitates to search and access millions of ebooks, journal articles and patents. It allows the users tagging, sharing and discussing of research contents with their peers. More than 600 academic institutions and R&D labs by scholars, researchers and scientists as well as over 50,000 researchers are currently using Knimbus. At present, Knimbus proposed a free offer to get registered to empower the libraries for dynamic searching and also for single point search interface, maximizes the usage of all e-resources, customized search across selected sources reduces noise and highlights relevant content and tools to support the complete research lifecycle (Rani and Bela, 2015). Currently, Information and Library Network (INFLIBNET) Centre (http://www. inflibnet.ac.in) has been incorporated Knimbus cloud service

into its UGC INFONET Digital Library Consortium in order to search and retrieve scholarly contents attached therein (Kaushik and Kumar, 2013).

4. File Storage: Cloud computing offers number of services such as Google Doc, Flicker, Dropbox, Jungle Disk, Sky Drive etc. to access any files on the internet. These services virtually offer to share the files on the web which can be accessed on anyplace and anytime without any specific software and hardware requirement. Libraries benefit with such cloud based services for various purposes. For instance, LOCKSS (Lots of Copies Keeps Stuff Safe), CLOCKSS (Controlled LOCKSS) and Portico tools are extensively used for digital preservation purpose by libraries and other organizations (Kaushik and Kumar, 2013).

5. Building Community Power: Cloud computing technology offers great opportunities for libraries to build networks among the library and information science professionals as well as other information seeker people with use of social networking tools. The most famous social networking services viz. Social Networking sites like Facebook and Twitter play a significant role in constructing community power. This cooperative effort of libraries provide facility of time saving, aptitude for better decision- making, platform for innovation and sharing the intellectual conversations, ideas and knowledge (Rani and Bala, 2015).

6. Library Automation: For library automation purpose, Polaris provides variant cloud based services such as cataloguing, acquisitions, process system, digital contents and provision for inclusion of cutting edge technologies used in libraries and also supports numerous standards such as Unicode MARC21, Z39.50, XML, and so on related to library and information science area. Moreover these days many other software dealers like Ex-Libris, OSS Labs are also offering this service on the cloud and third party services offering hosting of this service (SaaS approach) on the cloud to save libraries from investing in hardware for this purpose. Besides cost-benefit, the libraries will be free from taking maintenance viz. software updates, backup and so on (Kaushik and Kumar, 2013).

7. Amazon and Google: These are among the leading enterprises also providing solutions for libraries by having partnerships between library automation vendors. Amazon with web services architecture provides hosting services for data which are priced at gigabytes-month and CPU hour rates on basis of pay what someone actually uses. Google for years is working for the dissemination of information also taking interest in library solutions, going to implement "APP Engine", which provides a hosted service for application within their server farms on enormous and highly redundant storage system. IBM is showing curiosity in the world and has begun developing an infrastructure known by the name "Blue Cloud" (Khan et al. 2011).

8. Library Thing: Library Thing is one of the sites that consortium aspects of social networking and Cloud computing. It deals in services like social networking site, approves people for suggestion and to contribute information about books and permits them to connect globally to share interests. This site also contributes web services for libraries after paying a nominal fee it allows libraries to draw on the vast database of recommendation and other users available in Library Thing (Shaw, 2013).

9. Reed Elsevier: Reed Elsevier is a service provider for scientific information working with hospitals to provide in-time information to medical technicians as and when they require. It allows placing monographic and article content or technical manuals to facilitate technician and other medical personnel to get assistance exactly as per need. This utilizes the cloud computing model in the way that computers and other devices

used in the medical profession can be tied into the data and application provided by Elsevier from anywhere (Fox, 2009).

10. Kindle and Mobile Me services: In the electronic book arena Amazon is providing some reading services with "Kindle". If one have wireless connection, can purchase and read a rapidly growing list of books and periodicals from the Kindle no matter for the location. With this service largest text can be downloaded in seconds. "Mobile Me" is another like service provided by Apple computing. The concept is distributed calendaring and messaging with distinct devices. Modifications made on one device are immediately revealed on all of the devices and computers that are knotted into "Mobile Me". This has many applications in the library world for e.g. with the library acting as the gatekeepers, institutions could provide a list of articles from a vendors cloud to their students on mobile/laptop/PC with proper password. The same cloud works for preprint archives, data archives and digital object repositories (Goyal and Jatav, 2012).

11. DuraSpace: A hosted service and open technology to help organizations and end users effectively utilize public cloud services. Built upon existing cloud services. The service can work on Amazon, Atmos, Sun, Rackspace, and other cloud services (Shaw, 2013).

Conclusion

Library is a basic requirement of any educational institution. In this technological era, libraries are adopting many new ICT technologies and improving constantly. Introduction of new and innovative technologies like cloud technology reduces the high expenses for purchase and maintenance of hardware and software in libraries. It encourages libraries and their users to participate in a network and community of libraries by enabling them to socialize and exchange information with easy and fast access to library services. In conclusion, libraries with Cloud Computing services can concurrently simplify workflow of library and permit the libraries to make available improved end user customer services resulting in a highly developed online library through a large network of collaborating various libraries globally.

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