International Journal on Applications in Electrical and Electronics Engineering
Volume 1:Issue 6: June 2015. pp 17-20. www.aetsjournal.com ISSN (Online) : 2395-3527

Application of Cloud Computing in Libraries

M.Mahalakshmi , S.Maidhili

Abstract— The deployment of Computers in Library and Information centers has made a great transformation about the library from being just a custody of books to powerhouse of knowledge. This important fact is convincing many Libraries and Information centers to move towards digital resources, which are ground to be less expensive and more useful for easy access .The latest buzzword going around in the world of Information Technology is "Cloud Computing**"** and in the IT context, Cloud generally refer to the internet, thus cloud computing involves using the internet for all the computing needs which is usually user-oriented. The purpose of using cloud is that cloud is a large group of interconnected computers. These computers can be personal computers or network servers or they can be public or private. The application and data served by the cloud are available to wide group of users, cross-enterprise and cross-platform which can be accessed via the internet. Any authorized user can access these documents and different applications from any computer which has Internet connectivity. The paper presents an overview of cloud computing and the possible areas in libraries where cloud based services can be adopted.

Key words: Cloud computing, IaaS, PaaS, SaaS, Models of Cloud Computing

I. INTRODUCTION

In this epoch of digital revolution the word – " DIGITAL DATA" has become the slogan in this information based society. The world Internet population was 205 million in 2013 and is projected to grow above 300 million by 2015. It indicates the speed of the Digital momentum for the development of any nation. The libraries and knowledge centers are also running in this positive direction and are being converted as digital libraries for providing improved service to the users " . Digital Libraries are being created today almost in all libraries, irrespective of whether it is academic, public or special library.

Libraries and knowledge centers nowadays prefer digital collections for many reasons, such as: " digital journals can be linked from and to indexing and abstracting databases; can be accessed from the user's home, office whether or not the physical library is open; the library can obtain usage statistics that are not available for print collections; and digital collections save space and are comparatively comfortable to keep. When total processing and space costs are held into account, electronic collections may also result in some overall reductions in library costs "(Montgomery and King 2002).

M.Mahalakshmi , Research Scholar, Bharathiar University, Librarian. Stella Maris College, Chennai, India. (Email: smclibr@gmail.com)

S.Maidhili, Research Scholar, Bharathiar University, Librarian, Meenakshi College for Women, Chennai, India. (Email: maidhili11murai@yahoo.com)

Libraries and Information centers have seen a great metamorphosis in recent years, both in their collection development and in their service structure. Print medium is increasingly giving way to the electronic resources like e-books, e-journals, e-theses, e-databases, e-newspapers, web based Subject guides, online Indexes, online library catalogs and online reference sources and in most recent times offering library services utilizing cloud computing has become the need of the hour **.** Cloud computing can transform the way systems are built and services delivered, providing libraries with an opportunity to extend their impact for achieving economy in library functions . Online databases can be accessed as cloud applications and also large union catalogs can also be defined as cloud applications.

II. OBJECTIVES

1. To know different types of Cloud Computing
2. To trace the evolution of Cloud computing
3. To present the deployment models of Cloud computing
4. Identity the possible areas in libraries where cloud computing can be utilized

III. WHAT IS CLOUD COMPUTING?

Cloud computing is a computing term that evolved in the late 2000s, based on utility and of computer resources. Cloud computing involves deploying groups of remote servers and software networks that allow centralized data storage and online access to computer services or resources. Cloud computing technology has come as a blessing for libraries which can offer various openings and challenges for libraries to connect their services with clouds. Nowadays, cloud computing has emerged as one of the most popular virtual technology for libraries to deliver the services in an effective manner thereby reducing the cost.

The Gartner Group defines cloud computing as "a style of computing in which massively scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies."

IV. EVOLUTION OF CLOUD COMPUTING

The trend toward cloud computing started in the late 1980s with the concept of grid computing when, for the first time, a large number of systems were applied to a single problem, usually scientific in nature and requiring exceptionally high levels of parallel computation. Grid computing provided a virtual pool of computation resources but it's different than cloud computing. Grid computing specifically refers to leveraging several computers in parallel to solve a particular, individual problem, or to run a specific application. Cloud

computing, on the other hand, refers to leveraging multiple resources, including computing resources, to deliver a unified "service" to the end user.

In the 1990s, the concept of virtualization was expanded beyond virtual servers to higher levels of abstraction—first the virtual platform, including storage and network resources, and subsequently the virtual application, which has no specific underlying infrastructure. Utility computing offered clusters as virtual platforms for computing with a metered business model.

More recently software as a service (SaaS) has raised the level of virtualization to the application, with a business model of charging not by the resources consumed but by the value of the application to subscribers. The concept of cloud computing has evolved from the concepts of grid, utility and SaaS. It is an emerging model through which users can gain access to their applications from anywhere, at any time, through their connected devices. These applications reside in massively scalable data centers where compute resources can be dynamically provisioned and shared to achieve significant economies of scale.

As more enterprises add cloud computing the level of applications is migrating toward more mission critical and SaaS will become a mainstay of IT strategies. A number of companies, including Google, Microsoft, Amazon, and IBM, have built enormous datacenter-based computing capacity all over the world to support their Web service offerings (search, instant messaging, web-based retail).

V. CHARACTERISTICS OF CLOUD COMPUTING

The NIST (US National Institute of Standards and Technology) has identified five essential characteristics (Plummer et al., 2009) which are as follows:

1. On Demand Self-Service: Allows for provisioning of computing resources automatically as needed.
2. Broad Network Access: Access to cloud resources is over the network using standard mechanisms provided through thin or thick clients in a heterogeneous manner,for e.g. through Smartphone's, mobile phones and laptop computers. Moreover Cloud Computing provide the users with variety of services on the network with broader data spaces, multiple value added services, various new software, numerous advanced processing techniques and much more accessibility to a highly rich and capable network.
3. Resource Pooling: The vendors' resources are capable of being pooled to serve multiple clients using a multi-tenant model, with different physical and virtual resources in a active way. The pooling and assigning of resources is done based on the varying needs of users. Example of resources include; computation capabilities, storage and memory
4. Rapid Elasticity: Allows for rapid capability provisioning, for quick scaling out and scaling in of capabilities. The capability available for provisioning to the client seems to be unlimited and that it can be purchased as demanded.
5. Measured Service: It can be provided as much service as needed to the customer through usage of Cloud Computing technology thereby giving the specified number of user license for any type of the software. A definite data space and network bandwidth which is suitable to any demands allows monitoring, control and reporting of usage.

   It also allows transparency between the provider and the client. This characteristic makes this service very well defined and predictable cost.

VI. CLOUD COMPUTING SERVICES

The three service models widely used for delivering the different cloud based services are described below:

A. Software as a Service (SaaS)

The most widely known and used form of Cloud Computing, SaaS provides all the functions of a sophisticated traditional application, but through a Web browser, not a locally-installed application. SaaS decreases the worries about application servers, storage, application development and related updates, which are the common concerns of IT. Highest-profile examples are Salesforce.com, Google's Gmail and Apps, instant messaging from AOL, Yahoo and Google, and VoIP from Vonage and Skype.

B. Platform as a Service (PaaS)

The clients use a hosted environment for their own applications. The clients controls the applications that run in the environment (and possibly has some control over the hosting environment), but does not control the operating system, hardware or network infrastructure on which they are running. The platform is typically an application framework. E.g and Google App Engine is designed for distributed web applications and developers using Java, Python, PHP and Go.

C. Infrastructure as a Service (IaaS)

The client uses "fundamental computing resources" such as grids or clusters or virtualized servers, networks, storage and system software designed to augment or replace the functions of an entire data center. The highest-profile example is Amazon's Elastic Compute Cloud [EC2] and Simple Storage Service, but IBM and other traditional IT vendors are also offering services, as are telecom providers (e.g. Verizon).

VII. DEPLOYMENT MODELS

Currently, four types of cloud deployment models have been defined in the cloud community:

A. Private Cloud

A private cloud is owned and operated by a single company that controls the way virtualized resources and automated services are customized and used by various lines of business and constituent groups. Private clouds exist to take advantage of many of cloud's efficiencies, while providing more control of resources and steering clear of multi-tenancy.

B. Public cloud

Public clouds are owned and operated by companies that use them to offer rapid access to affordable computing resources to other organizations or individuals. With public cloud services, users don't need to purchase hardware, software or supporting infrastructure, which is owned and managed by providers. Some popular public cloud services include Amazon EC2, S3, Google App Engine and Force.com.

C. Hybrid cloud

A hybrid cloud uses a private cloud foundation combined with the strategic use of public cloud services. The reality is a private cloud can't exist in isolation from the rest of a company's IT resources and the public cloud. Most companies with private clouds will evolve to manage workloads across data centres, private clouds and public clouds—thereby creating hybrid clouds.

D. Community cloud

It is the fourth deployment model that can be used to deliver Cloud Computing services. In this model the cloud infrastructure is shared by multiple organizations or institutions that have a shared concern or interest such as compliance considerations, security requirements. This type of cloud may be managed by the organization or by a third party and may be located on-premises or off-premises. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the cost savings potential of Cloud Computing is realized.

VIII. Application of Cloud Computing In Libraries

The library community can apply the concept of cloud computing to improve the power of cooperation and to build a significant, unified presence on the Web. This approach to computing can help libraries save time and money while simplifying workflows, and libraries are also shifting their services with the attachment of cloud and networking with the facilities to access these services anywhere and anytime. In the libraries, the following possible areas were identified where cloud computing services and applications may be applied.

A. 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, it has become indispensable for all libraries to have a digital library by using any digital library software. In connection to cloud based digital library software, Duraspace is having two softwares 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.

B. Searching Bibliographical Data

OCLC is one of the best examples for making use of cloud computing for sharing libraries data for years together. For instance, OCLC World Cat service is one of the popular services for searching library data which is now available on the cloud. OCLC's various services pertain to circulation, cataloguing, acquisition and other library related services on cloud platform through the web share management system. Web share management 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.

C. Website Hosting

Website hosting is one of the earliest adoptions of cloud computing as many organizations including libraries preferred to host their websites on third party service providers rather than 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 clients to access the site from varied locations

Hosted cloud solutions offer a way to deal with the lack of technical expertise or a less experienced staff. The vendor can take care of hardware, operating system upgrades, and software upgrades . As a result, in many cases cloud computing may be less expensive than traditional computing methods. For non library-specific activities such as email, cloud-based solutions like Google's Gmail may be available for low or no cost.

D. Online Storage

To access any files on the internet, cloud computing present number of services such as Flicker, Dropbox, Jungle Disk, Google Doc, Sky Drive and so on. These services virtually share the files on the web and provide access to anywhere and anytime without any special software and hardware. Therefore, libraries can get advantages of 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.

E. Building Library Networks

Cloud computing technology offers great prospects for libraries to build networks among the Library and Information science professionals as well as other concerned people and information seekers by using social networking tools. Twitter and Face book play a key role in building community power. This cooperative effort of libraries will save time, improve efficiency and has wide recognition, for better decision making and provides the platform for improvement and sharing the intellectual conversations, ideas and knowledge.

F. Library Computerization

For the purpose of library automation, Polaris provides variant cloud based services such as acquisitions, cataloguing,

process system, digital contents and provision for inclusion of cutting edge technologies used in libraries and also supports various standards such as MARC21, XML, Z39.50, Unicode and so on which are directly related to Library and Information centers . Apart from this, nowadays many of the software vendors such as 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 can be free from taking maintenance viz. software updates, backup and so on.

G. Reference service

Knimbus is a cloud based research platform that facilitates the discovery and sharing of scholarly content. Knimbus stands for knowledge cloud which is dedicated to knowledge discovery which provides collaborative space for researchers. Knimbus is one stop knowledge hub for creators and users of scientific, technical and medical knowledge providing access to cutting edge scholarly content to help you keep up with the recent developments in any field and tools to share knowledge with peers globally. Single search window and knowledge sharing tools save time and boost research productivity. At present, Information and Library Network (INFLIBNET) Centre has incorporated Knimbus cloud service into its UGC INFONET Digital Library Consortium in order to search and retrieve scholarly contents.

There are a variety of cloud-based services in the library world. The most obvious is cloud-based to access library's book and Audio Visual collections through the online catalog (OPAC) that is part of the library's integrated library system (ILS). OPACs can be overlaid with cloud-based front ends or recommender systems to make them more user-friendly. Bibliocommons is an example of a cloud-based front end for public libraries that works in tandem with a variety of ILSs.

Electronic resources can also be made available through external repositories. Google Scholar incorporates metadata from journal indexes, article repositories, and other sources to offer web-scale access to scholarship that can be accessed at a patron's library of choice. OverDrive, the most popular library ebook vendor, works with public and academic libraries and is making strides to integrate flawlessly with online library systems.

IX. CONCLUSION

The future looks very promising for libraries and Information centres as many libraries have started to embrace Cloud applications, platforms, and services in their workflow. Many librarians have started to move their data to the cloud but are concerned about security and privacy as this is a real issue, and librarians need to be more careful before moving data—especially user's data—to the cloud, but most cloud computing providers go to great lengths to ensure security. It is also time to look at how library staff can benefit from moving the routine tasks required for acquisition of all types of material, whether physical or electronic, circulation functions and analysis of collections to cloud-based solutions. It can be demonstrated that this will save libraries money and free up staff involved with maintaining systems that perform routine functions to work on innovative services to meet local needs.

Patrons will also benefit from such a move. By placing routine library functions on the same platforms as discovery and delivery services, integration between services becomes simpler to accomplish. This means patrons have less frustration moving between systems to find and access physical, electronic and digital collections of libraries.

Thus it can be said adoption of Cloud Computing for their services is the next step to move for the libraries to move forward which would enhance the 21st Century learning.

REFERENCES

[1] http://www.fastcloud.org
[2] http://www.ibm.com/cloud-computing
[3] http://www.gartner.com
[4] Breeding, M. (2012). Cloud Computing for Libraries. Neal-Schuman.
[5] Yan, H. (2010). On the Clouds: A New Way of Computing. Information Technology Libraries,29(2), 87-92
[6] Goldner, M.R. (2010).Wind of change: Libraries and cloud computing. Bibliothek Forschung und Praxis, 34(3), 270- 275
[7] Sasikala, P. (2011).Cloud computing: Present status and future implications. International Journal Cloud Computing, 1(1), 23-36
[8] Kaushik, A. & Kumar, A. (2013). Application of cloud computing in libraries. International Journal of Information Dissemination and Technology, 3(4), 270-273
[9] Plummer, Daryl C., Thomas J. Bittman, Tom Austin, et al. 2008. Cloud computing: Defining and describing an emerging phenomenon. In Research, edited by Gartner