Cloud Computing And Its Application In Libraries

Mahipal Dutt

Dy. Librarian, Chitkara University, Baddi -India

Abstract

Cloud computing is a new phenomena in the history of services which are offered over the internet., It has completely changed the way of use of the power of computers irrespective of any geographic location. The biggest benefit for organizations and businesses is that it offers services using hardware or software or platform of third party sources. It is very economical as it saves cost and maintenance . Cloud computing comes in several different forms. In order to minimize the cost and avoid duplication of resources, infrastructure, software, hardware, manpower use of emerging technologies like server virtualization and cloud computing in libraries are increasing.

In this paper, an attempt has been made to give an overview of how service, platform and infrastructure forms of cloud computing have been used to serve library needs.

This paper discusses about characteristics, types, advantages and disadvantages, role of cloud librarian, use of technology, initiatives of cloud computing. An attempt has also been made to overview the areas in libraries where this technology can be deployed to provide better library services and the productivity of library staff can be augmented.

Keywords: Cloud computing; Web 2.0; libraries; Cloud librarian.

1. Introduction

Till recently, and now too many organisations and individuals use computers to work alone, inside a business or home by investing on hardware, software and maintenance. It is the need of the day to adopt the latest technology in an organization. With the

help of technology, it can ensure quick and appropriate access of every information when needed.

Cloud computing is use of internet for computing needs. There are so many forms of using this technology. For example, use of software applications, storing data. Etc

Accessing computing power or platform to build applications is also the example of such services. From e-mail, to word processing or photo sharing or video sharing there are so many services one can choose from. These services can be accessed from any type of internet connection and are secure. These services are also backed up. The best live example of this is Gmail, which is increasingly used by organisations and individuals to run their e-mail services. Google Apps being free for educational institutions is widely used for running different applications, especially the email services, which was earlier run using their own computer servers. This has saved cost for the organisations as they pay per use for applications and services and time for the computer staff, which they can invest on running other services. Google takes care of the upgrading, backup and maintenance of servers.

Libraries are using computers for running services such as Integrated Library Management Software (ILMS), website or portal, digital library or institutional repository, etc. These are either maintained by parent organisation's computer staff or library staff. It involves investment on hardware, software, and staff to maintain these services and undertake backup and upgrade as and when new version of the software gets released.

"Now many university libraries are virtualizing servers and desktops, collaborating with other campus organizations and saving money and staff time" (Kelley, 2012).

Cloud based services provide a means for libraries to free resources on information technologies and focus on libraries' core competencies- manage, organize and disseminate information.

"Cloud based services are also bringing cutting-edge services to libraries that have less information technology expertise," according to Zhu (2012).

Library professionals in most cases not being trained in maintaining servers find it difficult to undertake some of these activities without the support of IT staff from within or outside the organisation. Now cloud computing has become a new buzzword in the field of libraries, which is blessing in disguise to run different ICT services without much of a problem as third-party services will manage servers and undertake upgrades and take backup of data. Even though there are some concerns in using cloud services such as privacy, security, etc., some of the libraries have already embraced this new technology to run some of their services.

Many libraries now adapting 3M cloud libraries applications.

2. What Is Cloud Computing

Cloud computing is a new phenomena. Many individuals and organizations are adopting this technology model for IT services. The benefit is that they are saved from hosting and operating multiple servers over their own network. It saves them

from the burden and risk of constantly hardware failure. They need worry to install softwares, upgrading or backup issues. It also saves the cost of the organization.

According to Wikipedia, cloud computing refers to "the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a metered service over a network, typically the internet".

"The idea of cloud computing has emerged for outsourcing of computing infrastructure, storage of client data and applications that are accessed via a remote server" (Hosch, 2009; Knorr and Gruman, 2008).

In cloud computing model, organizations need to buy or pay for only those services which are to be needed by the. In this pick and choose model, organsations are just to request the service providers to add or remove the services as per the needs.

The Christy & Carina of Gartner Group define 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'.

To simplify the concept, cloud computing can be defined as 'simply the sharing and use of applications and resources of a network environment to get work done without concern about ownership and management of the network's resources and applications' (M.-S. E Scale, 2009)

Cloud computing is a very flexible model. In it, users can also build or prepare their own application which can also be used by others through internet. Actually it provides a common computing platform.

3. Cloud Computing: Characteristics

Mentioned below are the main characteristics of clouds computing:

- Resources are shared among users. **It works very fast in the distributed computing environment**.
- It ensures **"on-demand" provision of resources**, without having engineers for peak loads.
- By sharing common infrastructure, it ensures to work efficiently with **multiple users and multiple applications. It reduces the cost of services.**
- It is the characteristic of Cloud computing that users can access it from any corner of the world simply through the internet connection because the **infrastructure is** provided by a third-party.
- These applications are easy to maintain as compared to individual applications, since they **are installed on a common platform and can be accessed from different places**.
- **There are minimum chances of infrastructure failure**, so servers are more reliable and highly available.
- As the company **need not to set its own infrastructure**, so there are cost reductions through pay-as-per usage of resources.

- User can access services by using Application Programming Interfaces **(APIs) on the cloud and pay as per the usage.**

4. Types Of Cloud Computing

Cloud computing IT model has wider meaning as it essentially has three different types of services viz. SaaS, PaaS and Iaas.

- **Software as a Service (SaaS)**

  Software as a Service or Saas is a service in which softwares or applications are provided to the users as a service. So we know it popularly as software on demand. The program can be accessed online via any suitable client such as a web browser. In this model, users are provided the access of the applications through licenses or subscriptions. The softwares are provided in a 'pay as-you-go' model, where the user has to pay only for the softwares or applications which s/he is going to use or at no charge. Example of such services is Google Apps, Salesforce, etc.

  It is hosted centrally hosted and scope for customization or control of applications or softwares is little.

  However, there are benefits like the user has no worry about hosting, installing, upgrading, or maintaining the software or applications. In addition, the user has low initial costs, and access to (usually 24/7) support services.

- **Platform as a Service (PaaS)**

  Platform as a Service is a category of service which provides platform or environment to allow the developers to build the required applications or softwares and the users have the access simply via a web browser over the internet. Softwares are deployed and configuration settings are done by users.

  All types of enterprises, irrespective of its size, are adopting this service as it is very hassle free, no worry about the maintenance of hardware of software infrastructure.

  In this model, the enterprises are helped in building, testing and deploying web based applications.The 'organisations need not to invest for the infrastructure they require for building web and mobile applications. They have to simply rent the use of platforms of vendors such as Windows Azure, Google AppEngine, and Force.com.

  However, there is a disadvantage that the applications or softwares which re built using these vendor's services, are usually locked into that one platform[6]. This service is like water and electricity facility, where the users have to simply 'tap in' and take what they need without worrying about the complexity. It is based on subscription model. Users only pay for what they use. Users can focus on innovation instead of complex infrastructure[7].

- **Infrastructure as a Service (IaaS)**

  Infrastructure as a Service ie Iaas is also called as Hardware as a Service or Haas. In this pay as you go service model, the user is offered both storage and computing power services. It includes virtual service space or a platform. It also includes storage, network connections, IP addresses and bandwidth. In

this model, user doesn't buy separately software, servers, network equipment or data-center space; rather he buys all these as a fully outsourced service. The cost of the services is on computing basis, the user pay for bundle of services chosen. The example can be taken from Amazon's web services. AWS provides Simple Storage Services (S3) for data storage and elastic compute cloud (EC2) for computing resources. Amazon's web services are being used by organizations for many purposes viz. to run high performance computing simulations, for content delivery etc. It is also being used to host or backup the organization's websites, to host their media collections and many other services.

5. Initiatives Of Cloud Computing

There are good number of cloud computing initiatives undertaken by Amazon, Google, Microsoft and others offering various types of cloud computing services for the organisations, businesses, and individuals. Some services offered by these initiatives are:

- **Amazon Web Services (AWS)**

  Amazon is a major player of cloud computing. It offers a wide range of prominent services, for example, simple storage service (S3), elastic compute cloud (EC2), simple DB and simple queuing service (SQS). AWS provides a scalable and reliable low-cost platform of infrastructure in the cloud that powers hundreds of thousands of businesses in countries around the world[8]. Some of the solutions offered by Amazon through cloud computing include application hosting, web hosting, backup and storage, enterprise IT, content delivery, and databases. To help new users, Amazon also offers a free service for a period of one year on all its cloud computing services to launch new applications, test existing applications in the cloud, or simply gain handson experience with AWS.

- **Google Apps**

  Google Apps cloud services, a multi-tenant, internetscale infrastructure, offers faster access to innovation, superior reliability, and security, and maximum economies of scale as compared to on-premises, hosted and software plus services technologies[9]. Google Apps is available free for individuals and organisations (limited up to 10 user accounts), educational institutions and US non-profitable organisations and for a price to businesses and organisations. Google apps offer Gmail which is now most preferred email service. It also provides Google Docs, Google Sites, Google video and other services. Google Apps helps organisations to move their e-mail services, web services and office applications. Google also has 'Google App Engine' service. With this service, organizations can build and host web apps on the same systems that power Google applications. It offers fast development and deployment; simple administration, with no need to worry about hardware, patches or backups; and effortless scalability[9].

- **Microsoft Windows Azure**
Microsoft Corporation has created its own cloud platform on 1st February 2010 which was named as Windows Azure before 25 March 2014. After this it is renamed as Microsoft Azure. Microsoft provides this service through its datacenters. In this platform, organisations can develop and run applications itself with unbounded scalability. User has to pay only for the services he chooses. Windows Azure allows developers to develop and run applications quickly, while leveraging current skills to develop applications with .NET, PHP, or Java[10]. Some of the scenarios offered by Windows Azure for businesses and organisations include SaaS, storage, computing, database management etc.

- **Rackspace Cloud**
This cloud platform offers three types of services for organisations and businesses viz. cloud servers, cloud files and load balancers. It offers free architecture assistance to its users with every account. Cloud servers are available to organisations in different sizes . It uses Akamai's content delivery network (CDN) to globally deliver the stored media and files. Its third service Cloud balancer helps organisations to enhance their server capacities and to balance the load factor and this service is extended only on-demand[11].

6. Cloud Computing: Application In Libraries

There are some organizations and business houses who functions as cloud computing vendors for library softwares, search engines and digital libraries etc and offer the use of cloud computing platform for these purposes. Some of these are:

- **OCLC's Webscale**
OCLC is perfectly using cloud computing for libraries and set an example for others. Years together OCLC has been functioning as a cloud computing vendor because they provide cataloguing tools over the internet and allow member institutions to draw on their centralised data store[13]. OCLC has implemented the plan of library management systems i.e. worldshare management services (WMS). This service has services for many areas like acquisitions, analytics, resource sharing, cataloguing and license management components. It offers the entire library collection management in a cloud-based application. The main purposes of webscale are that libraries can share their resources, data, and innovation with ease. To serve these purposes, it has some certain features that work together to provide its users better library services. In other words, this will generate cost benefits for libraries and efficiencies not possible when utilizing disparate, specialised systems[13]. The service promises to include privacy, security, scalability and technical support.

- **Ex-Libris Cloud**
Ex-Libris is a leading library software vendor from USA. It provides cloud based solutions to automate the library operations. It developed most products for locally implemented solutions and adapted them to a hosted environment later. Its website claims that over 5300 in more than 80 countries are

deploying Ex-Libris solutions for automation of their library resources. It allows libraries to enhance their efficiency and lower the cost of operations and extend their value through launching new services. It has changed the way to provide traditional management of library resources through its library based system, Alma. It besides ensuring considerable savings in total cost, involved in the implementation of software and the use of a centralized cloud service enables libraries to easily influence the collaborative efforts of the library community to provide effective services for their users[14]. To provide worldwide cloud-based services; it has opened data centers at various locations. The company promises to adhere to data security, updates, and standards in implementing cloud services to safeguard the interests of customers.

- **Duraspace's DuraCloud**
  Duraspace provides open source repository solutions by undertaking turnkey projects for organizations and libraries to enable them to share scholarly literature using DSpace and Fedora Commons. It is particularly devoted to improve and sustain Fedora and DSpace. These open source repository solutions are very famous for IR solutions. Its new service DuraCloud provides digital preservation support services in the cloud, which is cost effective and simple for libraries. DuraCloud helps libraries to move content to the cloud and store it with different service providers to eliminate the risk of data loss.
 The cloud solutions offered include online backup, preservation and archives, media access, online sharing, and cloud broker[16].

- **OSS Labs**
  OSS labs from India is using Amazon's elastic cloud computing platform owing to the various capabilities of Amazon such as high durability of data, ISO standards based strong information security and flexibility. It is expected that the OSS labs will be able to provide robust open based solutions to demanding customers[17]. OSS Labs offer hosting and maintenance services for Koha ILS and DSpace IR. OSS Labs use Amazon's cloud services. Library operations have become very cost effective and the library staff need not to worry about maintenance of software etc.

7. Enhancement Of Library Services By The Use Of Cloud Computing

- **E-books Lending Service**: Cloud platform is now becoming popular to lend the E-Books.
- **Union /Shared Catalogue/OPAC**: Network libraries can use same platform and give access to their collection on one platform. Through cloud computing creation of union catalogue becomes very easy.
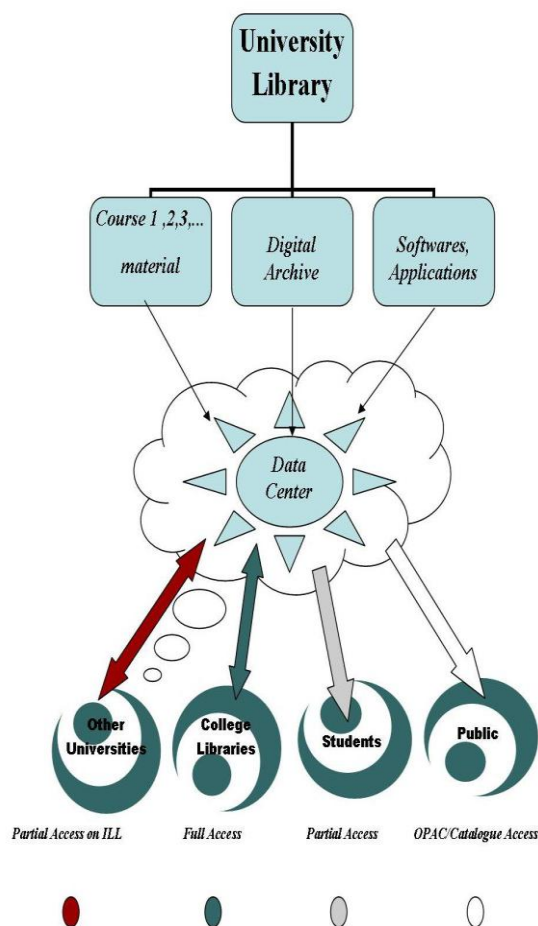
Figure 1. The model for Cloud University Library.

- **Document Download Service**: One can download documents easily if permit access in the network.
- **Digital preservation/Scanning Service**: Digitization and scanning work can be done centralized and so one can avoid duplication of such time consuming work. Libraries can preserve the collection is digital form in the form of archives.
- **Article Delivery Service**: Cloud computing can be used for article delivery service to the patrons by the libraries. Publishers are already using this technology for providing access to libraries.
- **Current Awareness Service**: To provide current awareness service to all patrons has become easy with cloud computing.
- **Document Sharing**: Document sharing has become easy with cloud computing.
- **Bulletin board service**: We can provide new services on bulletin board with this technology.

- **Information Common**: Information common like bibliographical data, content pages, cover pages, question papers, syllabus, and other reading material we can share on one platform. It helps in improving economy of library and avoids duplication of library purchase.
- **Collection Development**: Cloud computing is used for collection development. Duplications can be easily avoided and alternate resources can be located and made accessible to patrons.
- **File sharing**: To share various files in electronic form become easy with the cloud computing.
- **Information Discovery**: Cloud provides a platform to store all information that one can access anytime from anywhere; so information discovery and searching become easy and it is very useful for researchers.
- **E-Learning**: In the E-Learning environment too, cloud computing is boon. Study material can be kept on the cloud for reference purpose and online examinations also can be conducted. Discussions, revisions can be done at a time from different places.
- **Information Literacy/Orientation**: Libraries can conduct information literacy and orientation courses on the cloud. They can keep the tutorials, videos, presentations and files on the cloud for user's orientation.
- **Social Interactions with the users**: Can be possible because of cloud computing.

8. Role of Cloud Librarian

- To track member information and transactions
- To provide Access Pin to students and define validity. (Pin can be auto generated; Validity can be set in the software)
- To communicate with the member libraries contributing their resources to cloud for resource sharing
- To communicate with the Ebooks, Journals publishers& distributors, consortia, database providers
- To discuss with faculty members and subject experts, librarians for preparing different packages for different faculties and classes.
- To update technological skills
- To give technological support to member libraries
- To conduct training and awareness programs for readers
- To provide interlibrary loan facility
- To track usage record of cloud resources
- To develop digital collection
- To keep record of physical resources too for providing referral service
- To deal with Cloud resource and players and select the best bargain.
- To maintain own virtual profile by creating his or her blog or social network profile to interact with the user. The same platform can be used for providing

reference services and educating the users on cloud resources or how to use the Cloud infrastructure.

- To use his or her strategic planning and decision making ability at different stages of developing a Cloud library.

9. Advantages And Disadvantages

Cloud computing also has its advantages and disadvantages like other technology.

Advantages
- Some of the advantages of cloud computing are:
- **Cost saving** – In cloud computing, the user has to pay only for those services which he chooses and thus technology enables the libraries or organizations to save on costs.
- **Easy on installation and maintenance** – *By using this technology, the organization has no worry about* server updates and other computing issues. IT staff of these organizations may concentrate on other tasks. There is no need to procure any hardware to run the servers.
- **Increased storage** - Cloud can hold more storage than a personal computer or the servers available in the libraries or organisations and it is possible to extend as per the need.
- **Automation** – With the help of cloud computing technology, every software update or maintenance is done automatically by the service provider and the IT or library staff need not to worry about all these things.
- **Flexible** – This technology is very flexible and the user is free to add or remove any of its facilities thus saving cost and time of the users. It facilitates the libraries to expand its services anytime.
- **Better mobility -** *The* users rather than having to remain present at their desks with a PC and Internet connection can access the library servers from wherever they are,.
- **Shared resources** – This is the main and important feature of cloud computing that participating organizations can share their resources. By sharing their resources, they can save on costs and more libraries can access more number of resources at one place.

Disadvantages
Like any other technology, cloud computing also has some disadvantages. Here are the mains:
- **Privacy and security of Data** - It is very big concern that there is a risk about the privacy and security of data. It can be accessed by others in cloud and it is more risky when the data is sensitive such as credit card information of customers. If the proper security model is not yet in place, then the data stored on the cloud is vulnerable to attacks from viruses, theft, etc. In addition, there is also the risk of data loss if there is system failure or improper backup. The

physical location of servers is difficult to find as these services are provided through internet. It is hard to undertake the audit of software and security.

- **Network connectivity and bandwidth** – It is also a big concern that this service is directly connected to internet connectivity. If there is connection failure, then the user cannot access because this service is provided through internet. Also more bandwidth is required, as it may not work on low-speed Internet connections[19].

- **Providers are supreme power** – As these services are provided by third party, the organizations have very little power to maintain or customize the services. It is very difficult to access the physical location of servers and the organizations have to depend on the service providers. Also the organizations are totally dependent on provider for backup, updates, restore and disaster recovery.

- **Flexibility is limited** – It has limited flexibility for the user as cloud computing is provided by third party. So there is little scope for customization as per specific requirements.

- **Cost** - Initially the cost of this service could be higher as there are some common services for all. The organizations can reduce by more usage of these services. However, cloud computing providers may increase the cost of their services in the future and organizations may end up paying higher charges.

- **Knowledge and integration** – It is very important requirement that the organizations have their own IT staff who have knowledge of cloud computing. Otherwise it is dependent on the service provider. Likewise, it is difficult to integrate equipment used in data centers are different from that of peripheral equipments in the organization such as printers, USB drives, etc. So it is difficult to integrate and the integration is also an issue.

10. Conclusions

Cloud computing is a new phenomena in the computer systems technology. It emerged due to the developments in internet and associated technologies. This phenomenon is in developing stage and will be very helpful for the organizations, if the services are being used with care. However, this technology is very helpful for organizations like libraries in automating and managing their services. This technology has certain advantages. With the help of this technology, library staff will be free from managing the servers. It is commonly seen that it is difficult for library professionals to manage the technologies. The reasons may be their skill levels; there may be lack of support from IT section or absence of IT facilities in the organizations. In these circumstances, the library staff hinders in undertaking automation of library activities or developing digital library services, etc. This technology can be of immense importance in helping libraries to undertake modern ICT activities. The library professionals need not to worry technical side of ICT activities. They only have to add content of resources. Libraries in the west countries have already been using the cloud computing technology for their resources. Slowly the awareness about this technology is spreading in other parts of the world and with the use of ICT and

internet; library professionals are sharing their library resources with others on the platform. Thus this technology will be of immense use to libraries, if handled with utmost care and awareness about its disadvantages.

11. References

[1]   Wikipedia. Cloud computing. http://en.wikipedia.org/wiki/Cloud_computing (accessed on 20 August, 2014).

[2]   D. A. Kumar, and S. mandal, "Development of cloud computing in integrated library management and retrieval system." International Journal of Library and Information Science. 2013. 5(10). 394-400

[3]   Christy, Pettey & Forsling, Carina. Gartner highlights five attributes of cloud computing. 2009. http://www.gartner.com/newsroom/id/1035013 (accessed on 19/08/2014).

[4]   S.Y.Bansode, and S.M. Pujar, "Cloud Computing and Libraries." DESIDOC Journal of Library & Information Technology, Vol. 32, No. 6, November 2012, pp. 506-512

[5]   Mark Shane E. Scale, "Cloud computing and collaboration", Library Hi Tech News, Vol. 26 Iss: 9, pp.10 – 13 http://www.libraryjournal.com/article/

[6]   CA6695772.html (accessed on 22/08/2014)

[7]   S. Dhamdhere, and R. Lihikar, "Information common and emerging cloud library technologies." International Journal of Library and Information Science. 2013. 5(10). 410-416

[8]   About AWS. 2014. http://aws.amazon.com/what-isaws/ (accessed on 4 July 2014).

[9]   Google.com.   Google   App   Engine.   2014. https://developers.google.com/appengine/?csw=1   (accessed on 02 August 2014).

[10]   Microsft.com. Cloud Platform. 2014. http://www.microsoft.com/enterprise/it-trends/cloud-computing/default.aspx#fbid=gB0X9apRw93   (accessed on 05 Aug 2014).

[11]   Rackspace.com.   The   Rackspace   Cloud.   2012. http://www.rackspace.com/cloud/ (accessed on 01 Aug 2014).

[12]   Robert Fox, "Library in the Clouds," OCLC Systems & Services, v. 25, 3 (2009): 156-61.

[13]   OCLC.   OCLC   Worldshare   management   services.2012. http://www.oclc.org/worldshare-management-services.en.html   (accessed on 26 July 2014).

[14]   Kozokin, Sarit. Ex-Libris cloud: Open for business. 2011.

[15]   http://www.exlibrisgroup.com/?catid={BC76D337-FEFA-4603-B827-28AB9F818BDB} (accessedon 28 June 2014).

[16]   Duracloud.org. Duracloud. 2012. http://www.duracloud.org   (accessed on 18 July 2014).

[17] OSS Labs. OSS Labs to host its solutions on Amazon's cloud computing platform. 2014, http://www.osslabs.biz/news/oss-labs-host-its-solutionsamazons-cloud-computing-platform (accessed on 13 Aug 2014).

[18] Mitchell, Erik. "Using cloud services for library IT infrastructure." *Code4Lib Journal*, 2010.9. http://journal.code4lib.org/articles/2510 (accessed on 21 July 2014).

[19] Webhostingreport. The advantages of cloud computing. 2014. http://www.webhostingreport.com/learn/advantages-of-cloud-computing.html (accessed on 11 July 2014).

[20] Miller, Michael. Cloud computing pros and cons for end users. 2009. http://www.informit.com/articles/article.aspx?p=1324280&seqNum=2 (accessed on 20 July 2014)

[21] Javaprint.com. Javaprint. 2014 http://www.javatpoint.com/what-is-cloud-computing (accessed on 18 Aug 2014)

[22] Getcloudservices.com. PaaS – Platform As A Service http://www.getcloudservices.com/blog/paas-platform-as-a-service

[23] Hayes, B. "Cloud computing." *Communications of ACM,* 2008, **51**(7), 9-11.