MODELS OF CLOUD COMPUTING AND ITS APPLICATION IN LIBRARIES

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Abstract

The term "Cloud Computing" became very popular in recent couple of decades. It has completely changed the way of use of the power of computers irrespective of any geographic location. Cloud computing is a new technology model or new interpretation of web technologies. Cloud computing comes in different forms. It reduces the cost of service, save time and avoid duplication of resources, infrastructure, software, hardware, manpower use of emerging technologies like server, virtualization and cloud computing in libraries are increase.

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

This paper discuss about characteristics, models, merit and demerits, role of cloud librarian and enhancement of Library services of cloud computing. An attempt has also made to overview the areas in libraries where this technology can be deployed to provide better library services.

Key Words : Cloud Computing, Web, Libraries, Cloud Librarian, 3M Cloud Libraries

1. Introduction:

Cloud computing is a new technology model or new Interpretation of web technologies or new Infrastructure of Web technologies or new Infrastructure. Cloud computing seems to be a new phrase but looking into the concept, we all have using it from quite a long: e.g. email services of yahoo, Google, you tube , Google Docs, Social Networking sites, e-granthalaya, etc..

Cloud computing is use of internet for computing needs. Clod computing is the delivery of computing resources like servers, storage, databases, networking, software, analytics and more-over the Internet.

Cold Computing is kind of technology, which can ensure quick and appropriate access of every information when needed.

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 organization'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 vitalizing 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 organization. Now cloud computing has become a new buzzword in the field of libraries, which is blessing in disguise ti 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 adopting 3M Cloud libraries application.

2. What Is Cloud Computing

Cloud Computing is a new Phenomena, new technology model or new interpretation of web technologies.

- According to Wikipedia, cloud computing refers to "The delivery of computing as a service rather that 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, originations are just to request the service providers to add or remove the services as per the needs.
- 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.

1. Cloud Computing: Characteristics

The main characteristics of clouds computing are :

- 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 platform and can be accessed from different places.
- There are minimum chances of infrastructure failure, so servers are more reliable and highly available.
- User can access services by using Application Programming Interfaces (APIs) on the cloud and pay as per the usage.

2. Models of Cloud Computing:

Cloud computing Models generally two Categories- I) Services Models and II) Deployment Models

Service Models

* Service Models has three different types of services-.

* Infrastructure as a Service (Iaas).

* Platform as a service(Paas).

* Software as a service(Saas)

◆ Infrastructure as a service (IAAS)

Infrastructure as a Service is 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; rather he buys all these as a fully outsourced service. The cost the services is on computing basis, the user pay for bundle of services chosen. The example can taken from Amazon's web services. AWS provides simple storage services (S3) for data storage and elastic compute cloud (EC2) for computing resources.

◆ 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 application or software's and the user have the access simply via a web browser over the internet. Software's 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 application. The 'organizations need not to invest for the infrastructure they require for the building web and mobile applications. They have to simply rent the use platforms of vendors such as Windows Azure, Google App Engine, and Force.com.

◆ Software as a service (SAAS)

Software as a Service or Saas is a service in which software's 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 the this model, users provided the access

to the application through licenses or subscriptions. The software's are provided in a 'pay as-you-go' model, where the user has to pay only for the software's or applications which she going to use or at no charge. Example of such service's is Google Apps, Sales force, etc.

It is hosted centrally hosted and scope for customization or control of applications or software's 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 low initial costs, and access to (usually 24/7) support services.

Deployment Models are-

(I) Private Cloud

(II) Community Cloud

(III) Public Cloud

(IV) Hybrid Cloud

1) Private Cloud

- On-demand infrastructure owned by a single customer (organization) who controls the running of applications.
- Organization owns physical resources and provides access to users.
- Good option for companies dealing with data protection and service-level issues.
- Examples of private cloud :

- Eucalyptus
- Ubuntu Enterprise cloud – UEC (Powered by Eucalyptus)
- Amazon VPC (Virtual Private Cloud)

2) Community Cloud

- Cloud infrastructure is shared by several organizations
- May be managed by the organizations or a third party
- Cost is spread over more users compared to private cloud
- Examples of Community Cloud :

- Google Apps for Government
- Microsoft Government Community Cloud

3) Public Cloud

- Infrastructure made available to general public
- Owned by organization selling cloud services
- Services are free or "pay per use"
- lmost a synonym for 'Cloud Computing'
- Examples of public Cloud :

- Google App Engine

- Microsoft Windows Azure
- IBM Smart Cloud
- Amazon EC2

4) Hybrid Cloud

- Composition of two more clouds (Private, community, or public)
- Bound together by standardized or proprietary technology that enables data and application portability.
- Examples of Hybrid Cloud

- Windows Azure (capable of Hybrid Cloud)
- VMware v Cloud (Hybrid Cloud services)

5. Cloud Computing: Application in Libraries

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

- **OCLC's Web scale**

  OCLC is perfectly using cloud computing for libraries, 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 centralized data store. OCLC has implemented the plan of library management systems i.e. World share Management Services (WMS). This service has services for many areas like acquisitions, analytics, resource-sharing, and cataloguing and license management components. It offers the entire library collection management in a cloud based application. The main purposes of web scale are that libraries can share their resources, data, and innovation with ease.

- **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 for their users.

- **Duraspace's Dura Cloud**

  Dura space provides open source repository solutions by undertaking turnkey projects for organizations and libraries to enable them to share scholarly literature using D. Space and Fedora Commons. It is particularly devoted to improve and sustain Fedora and D. Space. These open source repository solutions are very famous for IR solutions. Its new service Dura Cloud provides digital preservation support services in the cloud, which is cost effective and simple for libraries.

- **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. OSS Labs offer hosting and maintenance services for Koha ILS and D Space IR. OSS Labs use Amazon's cloud services. Library operations have become very cost effective and the library staff needs not to worry about maintenance of software etc.

6. 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.

- **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, 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 examination 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, presentation and files on the cloud for user's orientation.
- **Social Interaction with the users:** Can be possible because of cloud computing.

7. 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 expect, 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 inter-library loan facility.

8. Merit And Demerits

Cloud computing also has its merit and demerits like other technology.

- ## Merits

Some of the merits 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 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 organizations 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 needs not to worry about 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 mare number of resources at one place.

- ## Demerits

Like any other technology, cloud computing also has some merits. 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 other 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.

- **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 equipments in the organization such as printers, USB drives, etc. So it is difficult to integrate and the integration is also an issue.

9. Conclusion:

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 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 actives.

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