Cloud Computing and its Impact on Library Practices and Services

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ABSTRACT - Nowadays, cloud computing is emerged as one of the most popular virtual technology for libraries to deliver the services in an effective manner. Cloud computing focuses on maximizing the effectiveness of shared resources. Cloud computing makes it possible to enterprises to get their applications run and run faster, with improved effectiveness and less maintenance, and enables IT to adjust resources to meet vacillating and irregular business need. Cloud computing puts up the tools & technologies to build data and calculate intensified parallel applications with much more low-cost prices compared to conventional parallel computing techniques. This paper describes the need of cloud computing in LIS and illustrates its features along with advantages and concerns with examples.


1. INTRODUCTION -
Today, libraries are using cloud computing technology for enhancing the services by adding more values, attracting the users and cost effectiveness for more and more improvement. The concept of cloud computing and libraries has generated a new model called cloud libraries. Though the usages of cloud computing may vary with the libraries nature, services and information needs but most common usages of cloud computing with in libraries can be development of digital libraries, corporate cataloging, acquisition, storages and sharing the resources on virtual environment on the web. Cloud computing suppliers offer their services as per fundamental models.

Cloud computing comes into concentration only when you think about what IT always demands: a way to gain capability on the fly without inducting new basic structure, training new people, or certifying new software. Cloud computing covers any agreement based or pay-per-use service that, in real time over the Internet. Cloud computing has been defined as an integrated package of computing services and application on web, offered as utility ensuring throughout abstraction (Yuvaraj & Singh, 2013). This apportioned IT infrastructure contains huge excavation of systems that are connected together. Often, virtualization techniques are used to make as big the power of cloud computing.

As (Wikipedia & Webopedia, 2014) mentions, in cloud computing, the word cloud is used as a metaphor for "the Internet," so the phrase cloud computing means “a type of Internet-based computing,” where different services that are delivered to an organization's devices via Internet. In cloud computing, small businesses can retrieve these resources and expand or decrease services as business scenarios change.

Table 1 – Cloud computing varying definitions
Today, with such cloud-based association not often in evidence with many isolated clouds of services which IT clients must add into individually. On the contrary, as virtualization and SOA diffuse the
organization, the concept of loosely coupled services running on an agile, scalable structure should eventually make every organization a node in the cloud. It’s a long-running trend with a far-out horizon. But among big meta-trends, cloud computing is the hardest one to argue with in the long term.

2. MODELS OF CLOUD COMPUTING -

Some types of cloud computing architecture are as follows - (Dhiman & Sharma, 2012)

2.1 Infrastructure as a Service (IaaS):

This is the basic cloud-service model of cloud computing. It provides the user with virtual infrastructure viz. servers and data storage space. Virtualization plays a major role in this mode, by allowing IaaS-cloud providers to render resources on demand extracting them from their large pools installed in data centers.

2.2 Platform as a Service (PaaS):

In this model, cloud suppliers hand over to the user development environment services. Here, the user can develop and run their own applications. The services might include a programming language execution environment, an operating system, web and database.

2.3 Software as a Service (SaaS):

In this model, the cloud gives the user with rights to developer applications that are running in the cloud. The cloud users and the clients do not manage the infrastructure where the application is stored.

2.4 Network as a Service (Naas):

The least common model, where the user is given with network connectivity services, such as bandwidth on demand and virtual private network etc.

3. DEPLOYMENT MODELS OF CLOUD
(Kaushik & Kumar, 2013)-

3.1 Private cloud

Private cloud is a cloud infrastructure run solely for a single company, whether managed in house or by a third party, which is hosted internally or externally. Attempting a private cloud project requires a decent level and degree of engagement to implement the business environment, and requires the organization to recalculate decisions about resources which are already present.

3.2 Public cloud

A cloud is called a "public cloud" when the services are depicted over a network that is exposed to the public. Public cloud services may be offered on a pay-per-usage theme or free also. Technically, there may be no gap between private and public cloud architecture, however, security condition may be considerably different for services such as storage, applications and other resources which are made usable by a service supplier for a public spectators and also when communication is affected on a non-trustworthy network.

3.3 Hybrid cloud

Hybrid cloud is a composition of two or more clouds in any of the combinations (private, community or public) that remain distinct entities but are held coupled, delivering the benefits of multiple models of cloud. Hybrid cloud can also mean the ability to connect apposition, managed and/or devoted services with cloud resources.

A company party only pays for extra resources when they are needed. Cloud bursting enables data centers to create an internal IT infrastructure that backs the average workloads, and use cloud resources from private or public clouds, during transient variation in processing demands.

Others include Community cloud, Distributed cloud, Intercloud, Multicloud

4. NEED OF CLOUD COMPUTING IN DIGITAL LIBRARIES -

Digital library, as a most important academic and scientific research base, charges for supplying the informative services for its users. In the past, almost all libraries asserted that their service is based on their own library resources. So, librarians barely considered users' concerns. However, today, digital libraries have altered this point of view. Librarians usually need to collect more and more information as per the users' requirements. Then they will dig out the information and evaluate out them. Finally, they will render them for users in some specific technical methodologies (Reddy, 2012). However, services in digital libraries will increasingly focus on users' requirements in near future. And the sole aim of digital library is to offer precise, broader and multi-layered services for its users. With the introduction of Cloud Computing to digital library, services of libraries will definitely have a new jump in the future. Services offered by digital libraries will become more user-focused, more professional and more effectual, etc. And we all trust that digital libraries will produce more knowledge advantage for our country with the help of Cloud Computing.

Cloud Computing can be used in Libraries for serving the following purposes –

1. Data Storage (Gosavi, Shinde & Dhakulkar, 2012)
2. Webmail
3. Media Streaming
4. OPAC
5. CLOUD COMPUTING INITIATIVES FOR LIBRARIES -
Like all purpose cloud initiatives undertaken by giants, there are sizable number of initiatives relevant to libraries initiated by organizations and business houses, which are in the business of integrated library software, digital libraries, search engines, etc. Few major ones are: (Dhiman & Sharma, 2012) and (Srivastava, 2012)

5.1 OCLC’s Webscale
Online Computer Library Centre has been functioning as a cloud company vendor for quite some time now. It has set an example for making use of cloud computing for libraries. 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 centralized data store. The centralized database allows the sharing of catalogue records between libraries and reduces the time for cataloguing.

5.2 Ex-Libris Cloud
Ex-Libris is a well-known cloud vendor for library software from USA, who initially developed most of the current products as locally implemented solutions and at a later stage, adjusted them to a hosted surround. It also provides software and hardware support needed to provide services to the users. It saves in total cost, involved in the implementation of software and the use of a centralized cloud service enables libraries to easily influence the cooperative efforts of the library group to provide effective services for their users. Ex-Libris is built on various standards and contains number of features like compatibility with Unicode font, flexibility, migration of data, customization etc. The company promises to adhere to data security, updates, and standards in implementing cloud services to safeguard the interests of customers.

5.3 Duraspace’s DuraCloud
Duraspace provides open source repository solutions for organizations. It is a sister concern of Duraspace which is a combination of the DSpace Digital Library Software and variants of Fedora. It is dedicated in sustaining and improving Fedora and DSpace, two of the most dominant open source repository solutions. Fedora commons is a framework for digital repository, which offers complete solution for digital library. 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. Even if it a open source, if you want to use Dura cloud Storage and software, you have to subscribe Dura Cloud services with a nominal cost.

5.4 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, strong information security based on ISO standards, scalability, and flexibility. It is expected that the OSS labs will be able to provide robust open based solutions to demanding customers. Using Amazon’s cloud services, it is offering Koha ILS and DSpace institutional repository hosting and software maintenance subscription services for libraries. This has enabled cost-saving for libraries and also helping library professionals to be free from worrying about software updates and maintenance.

5.5 Polaris Library System
It is one of the cloud based library automations system available in the market. The company also provides standard acquisition and processing system. Also, with a Polaris ILS client license, the library can integrate various PC and print management systems at no extra cost. The systems use number of well knows standards like MARC-21 for bibliographic data, XML, Z39.50 for information retrieval, Unicode etc.

6. ADVANTAGES OF CLOUD COMPUTING
Cloud computing offers many advantages to end users and businesses of all variants. They are as listed below (Kamila, 2013).

6.1 Cost Effectiveness
This is the primary and the biggest advantage of cloud computing which accomplished by eliminating the investment in single software or servers. By taking advantage of cloud’s capabilities, organizations can save on licensing costs and at the same time remove overhead.
charges such as the expenses of data storage, software management and updates etc.

6.2 Continuous availability and the Convenience
Wherever the end user may be located, public clouds offer services. This approach gives easy access to information and suits the user needs in different time zones and physical locations.

6.3 Backup and Recovery methods
The process of backup and recovery of data is made easier since those now don’t reside on a physical device but on the cloud. The various cloud providers bid reliable and conciliatory backup and recovery resolutions. In some cases, the cloud itself is used only for the backup repository of the data residing in local computer systems.

6.4 Environmentally friendliness
The cloud is more efficient than the typical IT infrastructure in general consideration. It takes fewer resources to evaluate, thus preserve energy. For example, when servers are not in use, the infrastructure frees up resources and hence, consumes lesser power.

6.5 Redundancy and Resiliency
A cloud deployment is usually constructed on a sturdy architecture thus provides redundancy resiliency to its users. The cloud offers automatic provision on failover conditions between hardware platforms if any disaster occurs.

6.6 Performance and Redundancy
Cloud deployments inherently have scalability feature. Cloud instances are deployed automatically only when needed in critical situations. As a result, you pay only for the data storage & applications you need. The systems utilize distributed architectures which offer excellent speed of computations.

6.7 Ease of integration and Quick deployment
A cloud system can be made up and running in function in a very short period which is a key benefit. On the same aspect, eliminating waiting periods, the introduction of a new user in the system happens instantaneously.

Furthermore, software integration occurs organically and automatically while installations in clouds. There is minimum effort in customizing and integrating these applications, a business is allowed to choose the services and applications that suit the best to their preferences.

6.8 Limitless Storage Capacity
The cloud can adapt and store a lot more data in comparison with a personal computer and in a way provides almost limitless storing capacity. It removes worries about running out of storage space and at the same time it refrains businesses from upgrading their computer hardware, hence reducing the overall IT expenses on that.

6.9 Device Diversity and Location Independence
Cloud computing services can be accessed via a profusion of electronic devices that are able to access the internet. These devices include all the variety of digital media devices: from the traditional PCs to the latest smart phones, tablets etc. There is no limitation of place and medium. We can access our applications and data anywhere in the world, making this method very attractive to people.

7. LIMITATIONS/CONCERNS OF CLOUD COMPUTING

It can be concluded from the above descriptions, cloud computing is a tool that offers tremendous benefits to its successors. However, as a tool, it also has its set of concerns and inefficiencies. Following are the most substantial ones.

7.1 Security and privacy in the Cloud
The biggest concern is the security when it comes to cloud computing. By adapting a remote cloud based infrastructure, an organization gives its private information data, things that might be very sensitive and secretive. It is then up to the cloud service provider to protect, manage and hold them, thus the provider’s dependability is critically very important. On the same point, privacy in the cloud is another huge issue. Companies and users have to trust their cloud service providers that they will secure their data from fake users (Kamila, 2013). The various stories of data loss and password leakage in the media do not help in most of the cases.

7.2 Dependency on particular vendor
It is difficult, and sometimes not possible, to shift from a service provider once you have rolled with him since all the data related changes have to revert back which is again leads to a lot of cost investment.

7.3 Technical Difficulties and Downtime
Breakdown and downtime due to malfunction is possible even to the best cloud service providers, as the past has shown it already.

7.4 Limited control and flexibility
Since the applications and services run on a third party, remote, virtual environments, companies and users have limited assurance on the function and performance of the software and hardware.

8. ROLE OF CLOUD COMPUTING IN LIBRARIES

Cloud computing is known as 3rd revolution after PC and Internet is an enhancement of distributed computing, parallel computing, grid computing and distributed databases. Cloud computing has large
potential for libraries. Libraries may put more and more content into the cloud. According to, using cloud computing user would be able to browse a physical shelf of books, CDs or DVDs or choose to take out an item or scan a bar code into his mobile device. All historical and rare documents would be scanned into a comprehensive, easily searchable database and would be accessible to any researcher. Many libraries already have online catalogues and share bibliographic data with OCLC. More frequent online catalogues are linked to pool that share resources. Data storage cloud can be a main function of libraries, particularly those with digital collections storing large digital files can stress local server infrastructures. The files need to be backed up, maintained, and reproduced for patrons. This can strain the data integrity as well as hog bandwidth. Moving data to the cloud may be a leap of faith for some library professionals. With faster retrieval times for requests and local server space it could improve storage solutions for libraries. Cloud computing or IT infrastructure that exists remotely, often gives users increased capacity and less need for updates and maintenance, and has gained wider acceptance among librarians.

9. CONCLUSION -

In spite of its concerns and the fact that it is still not in globally, fully functional age, cloud computing remains firm and has a great potential for the future libraries. Its user base is growing constantly and more big vendors/users/organizations are pulled towards it, giving better and fine tuned solutions and services. We can only hope that the advantages will further gain and the disadvantages will be reduced more and more, since cloud computing seems to have made IT easier from the library point of view (Romero, 2012).

REFERENCES –
