CLOUD COMPUTING AND ITS BENEFITS TO LIBRARIES

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Abstract

Cloud computing is a new concept of computer and information science especially in IT services industry which can be termed as third revolution after Personal Computers and Internet. In cloud, the information is stored on the internet and distributed via network at any large network environment. The main concern is data sending, receiving, storing and dissemination of data whenever required by the users. The hardware and software are integral parts of cloud computing, without these we can't imagine services provided by cloud environment. This paper discusses the characteristics, types, layers, merits and demerits of cloud computing, adopting cloud computing and impact of cloud computing in libraries and concludes that the cloud computing model will encourage libraries and their users to participate in a network and community of libraries by enabling them to reuse information and socialize around information. It can also create a powerful, unified presence for libraries on the Web and give users a local, group and global reach.

Keywords: Cloud Computing, IaaS, PaaS, SaaS, Internet, Information Communication Technology.

Introduction

The information landscape is rapidly changing due to modern technological innovations. Technological innovations play crucial roles in provision and delivery of services in library and information centres. The emerging trend of cloud computing is an innovation dramatically reshaping the information environment in the same way other technological developments have done in the past. "Cloud computing is a kind of computing technology which facilitates in sharing the resources and services over the internet rather than having these services and resources on local servers/nodes or personal devices" (Joshi, 2015). It provides a shared pool of resources, including data storage space, networks, computer processing power, and specialized corporate and user applications. In modern library and information centres, cloud computing provides effective and efficient utilization and sharing of information services. This model of computing is increasingly becoming attractive in libraries and information centres. Cloud computing has brought new innovative ways of empowering the creation, diffusion, utilization and sharing of information, knowledge and intellectual records in organizational libraries, while reducing management related issues (Makori, 2015).

In institutions of higher education and learning, academic libraries are fountains of knowledge that manage, preserve, organize, distribute and utilize information to support research, teaching, learning, scholarly communication and community services. Libraries exist for the sake of clients whose major interests are that desired information materials should be readily made available when needed, and in the appropriate format (Khan & Rubina, 2009). The modern library is a service industry or institution that acquires, processes, preserves, markets and

provides information services to the clients. In addition, the library extends beyond the physical walls of the building through technological and digital applications such as cloud computing, social computing, mobile phones and internet solutions.

Cloud computing model is displacing the client server architecture and reshaping delivery of information services to the customers in the 21st century. Of critical importance is the need for information professionals to play a leadership role in the implementation of cloud computing solutions. In library and information centres, cloud service cannot be ignored because of its crucial role in the management of information services due to hard economic situation and limited financial budgets facing organizations including institutions of higher education and learning. Cloud computing has brought new business ways to handle, support and manage information services. Libraries are "agents of change" should proactively be involved in the implementation of new and smart technological solutions so as to enhance and support delivery of services to clients (Hundu & Ezeala, 2014).

Cloud computing

The foundation of cloud computing is virtualization. Virtualization is the consolidation of servers and environment management. Cloud computing uses computing resources (hardware and software) that are delivered as a service over a searching information as well as in identifying users' needs should work hand in hand with software professionals in organizing the so-called 'anarchy' of the Internet network (typically the Internet). The name comes from the use of a cloud- shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams (Figure 1). Cloud computing entrusts remote services with a user's data, software and computation (NIST, 2012). The word *cloud* is used as a metaphor for the Internet, based on the standardized use of a cloud-like shape to denote a network on telephony schematics and later to depict the Internet in computer network diagrams as an abstraction of the underlying infra-structure it represents (Lewis, 2009). Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications; it allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing data storage, processing and bandwidth. A simple example of cloud computing is Yahoo mail, Gmail, or Hotmail etc. All you need is just an internet connection and you can start sending emails. The server and email management software is all on the cloud (internet) and is totally managed by the cloud service provider Yahoo, Google etc.

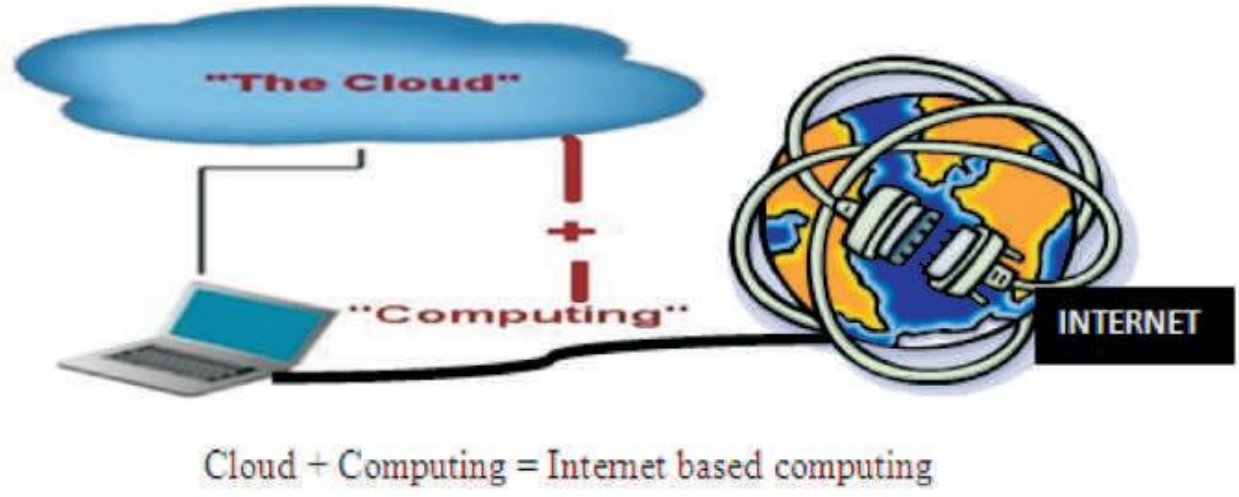

Figure 1: Conceptual Framework of Cloud Computing

Historical Background of Cloud Computing

The origin of the term cloud computing is obscure, but it appears to derive from the practice of using drawings of stylized clouds to denote networks in diagrams of computing and communications systems (Lewis, 2010). The word *cloud* is used as a metaphor for the Internet, based on the standardized use of a cloud-like shape to denote a network on telephony schematics and later to depict the Internet in computer network diagrams as an abstraction of the underlying infrastructure it represents. The cloud symbol was used to represent the Internet as early as 1994.

In the 1990s, telecommunications companies who previously offered primarily dedicated point-to-point data circuits began offering virtual private network (VPN) services with comparable quality of service but at a much lower cost. By switching traffic to balance utilization as they saw fit, they were able to utilize their overall network bandwidth more effectively. The cloud symbol was used to denote the demarcation point between that which was the responsibility of the provider and that which was the responsibility of the users. Cloud computing extends this boundary to cover servers as well as the network infrastructure. John McCarthy opined in the 1960s that "computation may someday be organized as a public utility"(Abidi & Abidi, 2012). Almost all the modern-day characteristics of cloud computing (elastic provision, provided as a utility, online, illusion of infinite supply), the comparison to the electricity industry and the use of public, private, government, and community forms, were thoroughly explored in Douglas Parkhill's 1966 book, *The Challenge of the Computer Utility*. Other scholars have shown that cloud computing roots go all the way back to the 1950s when scientist Herb Grosch (the author of Grosch's law) postulated that the entire world would operate on dumb terminals powered by about 15 large data centres (Goyal & Jatav, 2012). Due to the expense of these powerful computers, many corporations and other entities could avail themselves of computing capability through time sharing and several organizations, such as GE's GEISCO, IBM subsidiary The Service Bureau Corporation, Tymshare (founded in 1966), National CSS (founded in 1967 and bought by Dun & Bradstreet in 1979), Dial Data (bought by

Tymshare in 1968), and Bolt, Beranek and Newman marketed time sharing as a commercial venture (Goyal & Jatav, 2012).

Cloud Computing Architecture

Cloud computing architecture can be divided into two sections; the front end and the back end. They connect to each other through a network, usually the Internet. The front end is the part seen by the computer user or client. It consists of the client end hardware and software that helps to access the cloud network via a user interface such as a browser. Front end client software usually work as independent application. Back end, the 'not-seen' end of the network is essentially the group of machines that form the cloud. Back end of the cloud computing framework is made by hardware-like servers, processors and an array of software that provides the crux of the cloud service. A central server does bulk of administration work and take care of the traffic monitoring and resource allocation to satisfy the client demands and to ensure everything runs smoothly. It follows a set of rules called protocols and uses a special kind of software called middleware**.** Middleware allows networked computers to communicate with each other. Most of the time servers do not run at full capacity which leads to wastage of unused processing power. There is a hi-fi-term called server virtualization where in a physical server is divided into a number of virtual servers each running at maximum capacity. This technique reduces the need for more physical servers in the cloud computing framework. A user can access the cloud using a service on his mobile device, PC and tablet (Strickland, 2008). Customization and creation of a user-defined experience is the key element of Cloud Computing (Sovereign-Smith, 2013).

Essential Characteristics of Cloud Computing

National Institute of Standards and Technology's (2012) definition of Cloud Computing recognize five essential characteristics as follows:

On-demand self-service

A consumer can unilaterally provide computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

Broad network access

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (examples, mobile phones, tablets, laptops and workstations).

Resource pooling

The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (examples, country, state, or datacenter). Examples of resources include storage, processing, memory and network bandwidth.

Rapid elasticity

Capabilities can be elastically provided and released; in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provision often appear to be unlimited and can be appropriated in any quantity at any time.

Measured service

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of

abstraction appropriate to the type of service (examples, storage, processing, bandwidth and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for both the provider and consumer of the utilized service.

Cloud Computing Models

Cloud computing entrust remote services with the user's data, software and computation. According to NIST (2012), cloud computing is divided into two distinct sets of models: deployment models and service models.

Deployment Models: There are four types of deployment model: Private, Community, Public and Hybrid. These four types of deployment models refer to location and management of cloud's infrastructure.

Private cloud - The cloud infrastructure is operated for exclusive use by a single organization comprising multiple consumers. It may be present either on or off premises and owned, managed, and operated by the organization, or a third party, or some combination of them.

Community cloud - Community clouds are stipulated for exclusive use by a particular community of consumers from organizations that have shared concerns.

Public cloud - An academic, government, or business organization, or a combination of them can own and operate a public cloud. It exists on the premises of the cloud provider and is opened for the use of general public.

Hybrid cloud - A hybrid cloud is a combination of public, community or private cloud. It is also known as combined cloud. In hybrid cloud, private and public clouds retain their unique identities but are bound together by standardized or proprietary technology that enables data and application portability. An example of hybrid cloud is Google Apps.

Service Models: There are three types of service model: SAAS, PAAS and IAAS; the three different service models taken together are known as SPI Models of cloud computing. These consist of the particular types of services that can be accessed on a cloud computing platform.

Software as a Service (SaaS) - Saas is popularly known as software on demand. In Saas, software is delivered as a service to the end user, who can access the program online using a web browser or any other suitable client. In this service model, the service provider licenses an application to customers either as a service on demand, or through a subscription in a 'pay-as-you-go' model, or at no charge. It allows activities to be managed from central locations in a one-to-many model, including architecture, pricing, partnering, and management characteristics (Microsoft). Some of the examples of SaaS cloud service providers are Google Apps, SalesForce.com, Twitter, skype, Microsoft 365 and Oracle on Demand. There is usually little customisation or control available with these applications. However, subscribers benefit from low initial costs, have access to (usually 24/7) support services, and needn't worry about hosting, installing, upgrading, or maintaining the software (Kroski, 2009).

Platform as a Service (PaaS) - PaaS provides virtual machines, operating systems, applications, services, development frame works transactions and control structures. The client can deploy its applications on the cloud infrastructure or use applications that were programmed using languages and tools that are supported by the PaaS service provider. While client is responsible for installing and managing the application that it is deploying; the service provider manages the cloud infrastructure, the operating systems and the enabling software (Sosinsky, 2011). PaaS saves costs

by reducing upfront software licensing and infrastructure costs, and by reducing ongoing operational cost for development, test and hosting environment. An example of PaaS service is that SalesForce.com opened an API called the Force API that allowed developers to create applications based on the SalesForce.com technologies. Other important examples of PaaS are Google App Engine, Windows Azure cloud services, Openshift, Force.com.

Infrastructure as a Service (IaaS) - In this type of service the consumer is provided with processing capabilities, storage, networks and other fundamental computing resources. In this service model, rather than purchase servers, software, data-center space or network equipment, clients instead buy those resources as a fully outsourced service. Suppliers typically bill such services on a utility computing basis; the amount of resources consumed (and therefore the cost) will typically reflect the level of activity (Pettey & Forsling, 2009). The best example of this service is Amazon's web services viz. Simple Storage Services (S3) for data storage and elastic compute cloud (EC2) for computing resources. Organisations are using Amazon's web services to host or backup their websites, for content delivery, to run high performance computing simulations, to host media collections and many other services. IaaS is priced on a pay-as-you-go model enabling clients to scale up or down the operations depending on their needs at any given time and pay only for what they use (Kroski, 2009).

There are many service models described in literature such as Network as a Service (NaaS), Storage as a Service (SaaS), Backup as a Service (BaaS) etc. All of the models take the form as IaaS or "<something> as a service" Anyway SPI services cover all the other possibilities i.e. everything as a Service (EaaS). Companies such as Google, HP and Microsoft have frequently been associated with the EaaS concept (Sovereign-Smith, 2013).

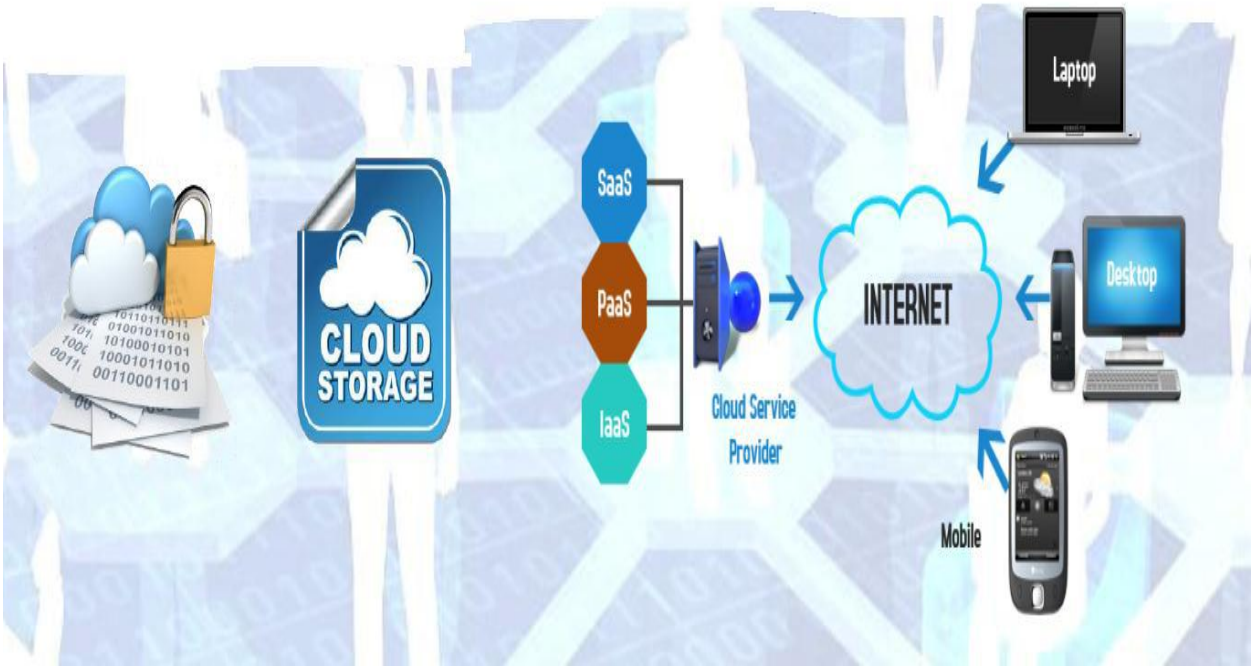

Figure 2: Application of Cloud Computing

CLOUD COMPUTING ARCHITECTURE

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Integration of Cloud Computing in Libraries

Libraries are finding it difficult to keep pace with the ever growing need of enhanced and better forms of information. Every year thousands of books are bought by libraries in order to keep track with the latest available literature on different subjects. Obviously, with their fixed budgets, not all books (or eBooks) can be purchased. Every library tends to have certain data which may be present in some other libraries too which leads to a lot of duplication of data. However, if the libraries integrate their data, there would be no more duplication since the libraries would be sharing the common data. The implementation of this technique, though, may not be as simple as it may seem to be. It is here that cloud computing can play its part.

Cloud computing can help libraries collaborate with each other in a facile manner. Every library has its own electronic data resources. If all the electronic data resources are put together in a single place which may be accessed by a group of libraries, the whole electronic data base will become huge. This space which contains all the electronic data can be some cloud, say, a library cloud. This library cloud will contain the digitized data of different libraries and hence will help libraries integrate their data. The need for maintaining and backing up the data will be no more the responsibility of the libraries since all the data will be stored in the cloud which shall be managed by some cloud provider.

Cloud computing will also help libraries in scaling up or down their data capacity whenever required. This scaling up or down is purely a function of need. Hence, libraries would be consuming exactly the required space. As a result, libraries will not have to predict their future needs and buy space and infrastructure beforehand. This co adjuvant effort of the libraries will not only increase the overall efficiency (since the data will be shared) but also open doors for innovation and make libraries a lot more scalable and help save money as well. HathiTrust is a great example which shows what cloud

computing holds in store for libraries. HaithiTrust is a repository for keeping huge amount of digitized data being shared among its members. It was founded in 2008 and already has over sixty partners mostly including university libraries all around the world (Goldner 2011).

Libraries can utilize cloud computing services such as SaaS, PaaS, and IaaS in a number of areas such as library automation, website hosting, digital library services, search services, Storage, Integrated Library System (ILS), Inter Library Loan system, etc.

Automation

At present, automation in most of the libraries are carried out on local servers by using different types of commercial or open source integrated library management software and managed by internal IT / library staff. Now many software vendors (e.g. Ex-Libris) offer this on the cloud (SaaS model) which makes the library free from investing on hardware and undertaking maintenance, software updating and backup.

Website hosting

Libraries can host their own websites with the help of cloud technologies. Many of the libraries prefer to host their websites with third party service providers rather than hosting and maintaining their own servers due to dearth of required technical manpower to maintain the servers. Google Sites serves for hosting library websites. The District of Columbia Public
Library is using Amazon's EC2 service to host their website and provides rapid scalability and redundancy to libraries (Kroski, 2009).

Storage

Libraries nowadays store and access electronic documents, bibliographic records, tutorials, etc using personal desktops or servers which are locally hosted; but cloud computing has brought new services, which even offer space at no cost to store files and documents. For example, cloud storage services such as Dropbox, Google Drive, Microsoft OneDrive, Box, Apple iCloud, and other initiatives offer storage space on the cloud to enable organizations and individuals to store and share their documents**,** sync across multiple devices, and enabled to work collaboratively on the web irrespective of their geographical location. While Microsoft OneDrive and Google Drive offer 15 GB each, Box offer 10 GB, Apple iCloud and Amazon Cloud Drive offer 5 GB each and Dropbox and Spideroak offer 2 GB each free space to store and share documents, photos and videos online. Libraries may take advantage of this offer in order to undertake collaborative activities with other libraries. CLOCKSS (Controlled Lots of Copies Keeps Stuff Safe) and PORTICO offers libraries a permanent "dark archive solution" of e-journals, e-books, and digital collections, providing protection against the potential loss of access to e-literature integral to a library's collection (Kadli & Hanchinal, 2013).

Digital Library Services

Presently, the digital library services are being offered by libraries mostly using locally hosted open source software such as DSpace, Greenstone, EPrints, and Fedora Commons for providing open access to scholarly resources. Now vendors such as Duraspace offer digital library services on the cloud using SaaS approach which relieves libraries from maintaining separate servers and tedious work of taking backups and updating of new versions of software.

CLOUD COMPUTING INITIATIVES FOR LIBRARIES

OCLC WorldShare Management Services (WMS) – This is an integrated suite of cloud-based library management applications by OCLC which offer libraries cost savings, workflow efficiencies and the

ability to deliver new value to users by sharing data and work across many member libraries. Traditional ILS systems often require costs to maintain servers and software and these costs are eliminated with WMS. WMS subscription includes serials management, course reserves, openURL resolver, A- Z list services, and WorldCat Discovery Services with available options for group views, remote database search and custom reporting. WMS integrates all electronic and print resource management workflows including selection, acquisitions and maintenance within the same Web-based WorldShare interface. WorldCat Discovery can provide a library more visibility on the Web and better information about other systems. A report authoring tool which provides user-specified, peer comparisons based on OCLC cooperative data is also available at an additional cost (OCLC, 2012).

Ex Libris - Ex Libris Group is a leading provider of library automation solutions, offering comprehensive product suite for the discovery, management and distribution of all materials: print, electronic, and digital. Ex Libris caters to libraries of all type and size and to large consortia. It is built on open architecture and are flexible, customizable, easy to maintain and manage, and Unicode-compliant, with full multilingual capabilities. It can be implemented as stand-alone solutions or integrated with existing environments. Ex Libris has developed the Alma, the cloud-based library resource management system to consolidate, optimize and extend the range of library services. It consolidates and extends library's operations with a unified, SaaS platform for electronic, print and digital resources. It supports the entire suite of library operations -selection, acquisition, metadata management, digitization, and fulfillment-for the full spectrum of library materials, regardless of format or location. They claim that using web-based, open interfaces, it can be integrated effortlessly with other systems including external campus systems, and libraries can develop adapters and plugins to meet their institutions' unique needs (ExLibris).

Dura Cloud - DuraCloud is an open source platform developed by DuraSpace which was released broadly as a service in 2011. It provides on-demand storage and services for digital content in the cloud for academic libraries, academic research centers, and other cultural heritage organizations. DuraCloud enables digital preservation, data access, transformation and data sharing. It helps to move copies of content of any shape or size into the cloud and store them with several different providers and offers compute services. The DuraCloud easy-to-use dashboard allow scholars to easily upload and download content and permits to add tags and metadata to content through their interface. DuraCloud is also integrated with the DSpace and

Fedora repository platforms and offer "elastic capacity" coupled with a "pay as you go" approach (DuraCloud).

LibLime - LibLime was founded in 2005 by Progressive Technology Federal Systems, Inc.

PTFS from 2010 became a commercial entity providing implementation and development services around the open source Integrated library system, Koha, which is generally considered to be the earliest. It is one of the most innovative technology platforms which bring new realities of open access, interoperability, rapid and flexible development. It is used by all types of libraries and consortia with confidence as it couples the concept of open source with the security of outstanding customer service and relieves libraries from the need to have expensive technical resources on staff.

Polaris Integrated Library System - The Polaris ILS provides a robust and scalable software solution with powerful staff tools and an intuitive experience for patrons. The Polaris ILS built on a Microsoft SQL server database platform with documented APIs is open to connections with third-party vendors, with patrons and their social media, and with resources beyond the walls. Its integrated expanded functionality enables direct access to e-content, shared collections, and outside systems. One can integrate the system with seamless patron access to resources by utilizing INN-Reach or a consortium network; direct patron access to 3MCloud Library, OverDrive, and Axis 360 eContent; and APIs that power direct connections to outside systems. The Polaris ILS offers a fully-documented Microsoft SQL database schema, facilitating construction of powerful searches and reports. Tools such as search alerts, fine estimators, and reading history, patrons can easily manage their accounts and maintain their connection with the library. Polaris ILS 5.0 includes several new features such as Family Holds Pickup, floating collections with optional load balancing, the ability to automatically renew items, a Carousel Toolkit, the ability to automatically close purchase orders, and the ability to automatically flip bibliographic display in the PAC. Polaris Leap is the new web client for Polaris ILS that performs public services workflows, such as registering new patrons and checking out items and works on devices such as tablets and laptops, enabling library staff to serve their patrons even outside library walls. Both Polaris Leap and Polaris ILS 5.0 will be officially launched into general release in October 2014 (Polaris).

CLOUD COMPUTING IMPACT ON LIBRARIES

Beyond the basic components like hosted email services that have a strong consumer base, cloud computing can be utilized to address needs which are specific to libraries. This can be broken down into the three types of cloud services, replacing a library's onsite technology environment with an online version, and then situations where a library can create its own cloud infrastructure. These areas offer "benefits to information professionals: outsourced infrastructure, greater flexibility, reduced barriers to innovation, and lower start up investments".

First, cloud computing help libraries to use online software to handle tasks like video chat through either Gmail video chat or through Skype. Both of these are free services though there is "little customization or control available with these applications" (Kroski, 2009). In other words, services you offer through a SaaS' interface will look like that of your competitors which will not distinguish you from them. On the other hand, since the services and application interfaces are often familiar with users, there would be a decrease in the learning curve for library staff and users.

Second, libraries can create applications in an online environment. These environments allow a library to "build, test, and deploy Web-based applications" (Kroski, 2009). PaaS gives the library the freedom to explore development options without having to purchase and maintain the required infrastructure. In this way, if a particular program turns out to not be popular or a best fit for a library, they are not stuck with unwanted hardware and software which they could not recoup the costs from.

Third, a library no longer has to purchase their own servers to host their content. By

using IaaS, a library can purchase server space and computing power. One of the major players in this arena is Amazon which offers the "Elastic Compute Cloud (EC2), which provides computing resources and Simple Storage Services (S3) for data storage" (Kroski, 2009). A library does not need to purchase a server which is underutilized but costs the same to purchase and maintain as if it were using all of its resources at all times. By using an IaaS, a library gains the benefit of only paying for the "resources you actually use".

It is evident that cloud computing is essential and can ensure that libraries become competitive and provide an environment for innovation. Consequently, cloud computing provides an opportunity for IT departments in libraries to assist users to leverage on new products and services available on the cloud (Kumutai & Muli 2015).

ADVANTAGES AND DISADVANTAGES

Cloud computing like any other technology also has its strength and weaknesses which needs to be taken into consideration before implementing this new technology.

Advantages

1. Cost effective: The Cost is reduced in terms of manpower, material, running costs.
2. Reduces storage space: You are no longer restricted by your computer's limited storage space. You can simply save your data in the cloud and log in to view and edit it as needed.
3. Reduces hardware and maintenance cost: There is no need for the user to invest in high end software and hardware or be tied to constant upgrade cycles as cloud based services utilize hardware and software on the cloud. Usually only system capable of running a web browser is required at the user end.
4. More computing power: Computing is done on cloud, and hence large scale computations can be managed by better machines.
5. Round the clock access from anywhere: Major benefit of Cloud application is around the clock availability; all you need is an Internet connection with right authentication details and you can access whenever without any geographical location i.e. remotely from home, or on the move. Cloud Services also allow you to synchronize data across multiple devices.
6. Infinitely scalable: Users can access the resources they need in line with their changing requirements. Usage based pricing models ensure that they only pay for the services actually used by them and this cost transparency gives a reliable basis for planning.
7. Automatic and secure data backup: Estimate suggests that about 80,0000 laptops are lost every year at airports alone. Data backup ensures that you do not lose just more than your laptop. Further no need of worries about mislaid USB sticks or the inconvenience associated with sending and opening email attachments. You are no longer restricted by your computer's limited storage space, simply save your data in the cloud and log in to view and edit it as needed.
8. Increased collaboration, faster provisioning of systems and applications. Cloud solutions also allow exchanging enormous data and documents more easily and efficiently than ever before. Because

of easier action employees can share information and work on documents and shared applications simultaneously, eg. Google apps and Zimbra.

Disadvantages of cloud based services

Need for Constant connectivity: One of the major drawbacks of every cloud service is the need for constant connectivity with Internet. Varying bandwidth at the end might cause errors to creep in and this limits the use of cloud services.

Complexity: While cloud services enhance and ease library performance they are initially complex to understand. Hence employees and users have to be trained for better utilization of cloud based services.

Latency: Latency, an obvious issue is the time taken for the user system to interact with machines in the cloud. Cloud based apps will have higher latency than the native apps installed on a user's system since there will be an added time of user end communicating with the cloud.

Further, higher traffic and un-favourable geographical location can aggravate the problem.

Easy on installation and maintenance: No longer having to worry about constant server updates and other computing issues, organisations will be free to concentrate on innovation and the IT staff may concentrate on other tasks. There is no need to procure any hardware to run the servers.

Security: Cloud computing is completely Internet based and all cloud based computing uses and stores data using the same network which makes it vulnerable to attack by hackers. Porting to the cloud can actually be more secure for smaller companies as companies offering cloud services use the latest and most sophisticated security methods.

Privacy: Privacy loss is a big concern when we talk about cloud-based services. Data stored or shared on the cloud by large social networking sites are usually protected and can be accessed by only authorized people, but there is always a chance of accidental data leakage, mismatch and other failures.

CONCLUSION

Libraries have the opportunity to improve their services and relevance in today's information society. Cloud computing is one avenue for this move into the future. It can bring several benefits for libraries and give them a different future. Cloud computing can help the integration of libraries in a painless easy manner. With cloud computing, libraries will be able to share their electronic data resources which could lead to reduction of duplicate data resulting in cutting down the overall budget of libraries. The dependency of libraries on external agencies for matters pertaining to information technology is also expected to reduce considerably. Capital expenditure on hardware resources will be converted to operational expenditure. Scalability of cloud computing will also help in saving money. The cooperative effect of libraries using the same, shared hardware, services and data—rather than hosting hardware and software on behalf of individual libraries—can result in lowering the total costs of managing library collections and enhancing the both library user's experience and library staff workflows.

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