Libraries in the Cloud

Dr. Rahul R. Dhuldhule[1]

[1]Librarian, Milind Mahavidyalya, Mulawa, Ta- Umrkhed, Dist Yavatmal, Maharashtra, India

ABSTRACT

Cloud computing is a paradigm shift of computing and information technology to a new phase ofplatform to cater the clients in more sophisticated manner and also in more cost effective manner from acommon pool of service providers platforms. Cloud computing technology continues to grow at a rapidrate with new applications and architecture. It is used to practice of storing, accessing and sharing data,applications and computing power in cyberspace. This technological development has brought adramatic change in every field and libraries are not exception to it. Libraries have also started adoptingthis technology as cost effective tool which involves delivering hosted service over the web. Budgetaryprovision for building collection development and procurement of computing resources and peripheralshave been reducing gradually, so cloud computing is the best option for the libraries to solve the abovementioned problem. This paper aims to demonstrate and elaborate the journey of library from actual to virtual, itsuses in the field of library and information centers. This paper also tries to give a clear idea that how cloudtechnology helps libraries to provide a better service to the user community.

I. INTRODUCTION

In this technological era, libraries are improved constantly by adopting many new ITtechnologies. The theories of conventional libraries have been changed now a days. Introduction of newand innovative technologies like cloud technology helps libraries to provide better services to the usercommunity. Though libraries have been using some of cloud computing services for over a decade likeonline databases, large union catalogues as cloud applications, the library community can further adoptthe concept of cloud computing to strengthen the power of collaboration or cooperation and to build a major, fused existence on the worldwide network.

II. WHAT IS CLOUD COMPUTING

Cloud computing is the delivery of computing services over the Internet. Cloud servicesallow us to use software and hardware that are managed by third parties at remote locations. Examples of cloud services include onlinefile storage, social networking sites, webmail, and online business applications. The cloud computing model allows access to information and computer resources from anywhere that a network

connection is available. Cloud computing provides a shared pool ofresources, including data storage space, networks, computer processing power, and specialized corporate and user applications.

U.S. National Institute of Standards and Technology (NIST) defines Cloud Computing as:

"Cloud computing is a model for enabling convenient, ondemand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essentialcharacteristics, three service models, and four deployment models."[1]

Definition by Wikipedia:

Cloud computing is the computing in which large groups of remote servers are networked to allow centralized data storage and online access to computer services or resources. Clouds can be classified as public, private or hybrid.[2]

Cloud computing is a term that describes the means of delivering any and all information technologyfrom computing power to computing infrastructure, applications, business processes, and personalcollaboration to an end user as a service whenever and wherever they require it. Cloud computing is anemerging style of computing where applications, data and resources are provided to the users as a serviceover the web. The services which are provided by the service provider may be available globally, alwayson, low in cost, on demand, massively scalable, pay-as-you-grow. Cloud computing is a technology thatallows user to access software applications, store information, develop and test new software, createvirtual services, drawn on disparate IT resources and more- all over the Internet or other network. Incloud computing, users only think about what the service does for them but don't think about how it isimplemented.

In other words, cloud computing refers to applications and services that run on a distributednetwork using virtualized resources and accessed by Internet protocols and networking standards. In thistechnology, the resources are virtual and limitless. Cloud computing takes the technology, services andapplications that are similar to those on the internet and turns them into a self-service utility. The use ofthe word "cloud" makes reference to the two essential concepts:

Abstraction: Cloud computing abstracts the details of system implementation from users anddevelopers applications run on physical systems that aren't specified, Data is stored in locations that areunknown.Administration of system is outsourced to others, and access by users is ubiquitous.

Virtualization: Cloud computing virtualizes systems by pooling and sharing resources. Systemsand storage can be provisioned as needed from a centralized infrastructure.Costs are accessed on ametered basis.Multi-tenancy is enabled and resources are scalable with agility.

Cloud computing is an abstraction based on the notion of pooling physical resources andpresenting them as a virtual resource. It is a new model for provisioning resources, for stagingapplications, and for platform-independent user access to services. Cloud computing represents a realparadigm shift in the way in which systems are deployed.[3]
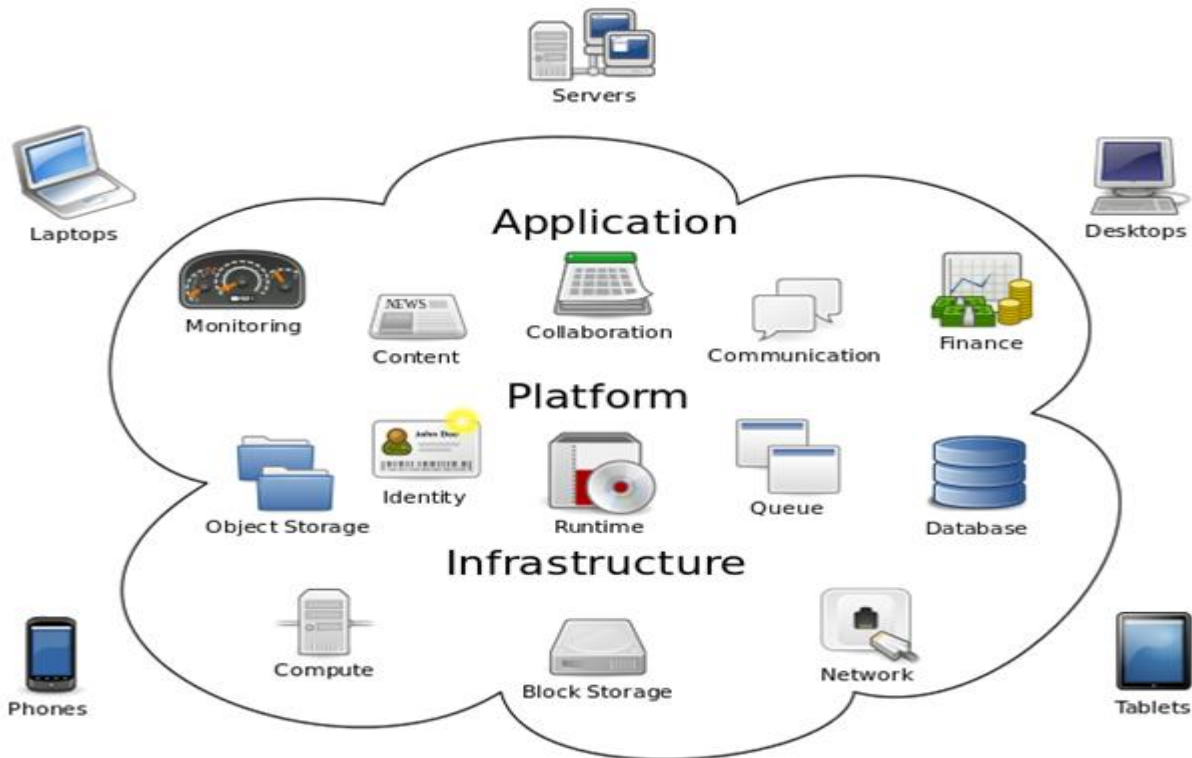
Fig : Cloud Computing[4]

III. CHARACTERISTICS OF CLOUD COMPUTING

1. Self Healing: Any application or any service running in a cloud computing environment has the property of self healing. In case of failure of the application, there isalways a hot backup of the application ready to take over without disruption.There are multiple copies of the same application - each copy updating itselfregularly so that at times of failure there is at least one copy of the applicationwhich can take over without even the slightest change in its running state.

2. Multi-tenancy: With cloud computing, any application supports multi-tenancy - that ismultiple tenants at the same instant of time. The system allows severalcustomers to share the infrastructure allotted to them without any of them beingaware of the sharing. This is done by virtualizing the servers on the availablemachine pool and then allotting the servers to multiple users. This is done insuch a way that the privacy of the users or the security of their data is notcompromised.

3. Linearly Scalable: Cloud computing services are linearly scalable. The system is able tobreak down the workloads into pieces and service it across the infrastructure.An exact idea of linear scalability can be obtained from the fact that if oneserver is able to process say 1000 transactions per second, then two servers canprocess 2000 transactions per second.

4. Service-oriented: Cloud computing systems are all service oriented - i.e. the systems aresuch that they are created out of other discrete services. Many such discreteservices which are independent of each other are combined together to form thisservice. This allows re-use of the different services that are available and thatare being created. Using the services that were just created, other such servicescan be created.

5. SLA Driven: Usually businesses have agreements on the amount of services.Scalability and availability issues cause clients to break these agreements. Butcloud computing services are SLA driven such that when the

systemexperiences peaks of load, it will automatically adjust itself so as to complywith the service-level agreements. The services will create additional instancesof the applications on more servers so that the load can be easily managed.

6. Virtualized: The applications in cloud computing are fully decoupled from theunderlying hardware. The cloud computing environment is a fully virtualizedenvironment.

7. Flexible: Another feature of the cloud computing services is that they are flexible.They can be used to serve a large variety of workload types - varying fromsmall loads of a small consumer application to very heavy loads of acommercial application

IV. TYPES OF CLOUD COMPUTING

1. Software as a service (SaaS): Software package such as CRM or CAD/CAM can be accessed undercloud computing scheme. Here a customer upon registration is allowed to usesoftware accessible through net and use it for his or his business process. Therelated data and work may be stored on local machines or with the service providers. SaaS services may be available on rental basis or on per use basis.

2. Platform as a Service (PaaS): Cloud vendors are companies that offer cloud computing services andproducts. One of the services that they provide is called PaaS. Under this acomputing platform such as operating system is provided to a customer or enduser on a monthly rental basis. Some of the major cloud computing vendor isAmazon, Microsoft, and Google etc

3. Infrastructure as a service (IaaS): The cloud computing vendors offer infrastructure as a service. One mayavail hardware services such as processors, memory, networks etc on agreedbasis for specific duration and price.[5]

V. CLOUD COMPUTING FOR LIBRARIES

So turning to cloud computing and libraries, are their real problems that can be solved?The answer is yes. The library community can apply the concept of cloud computing toamplify the power of cooperation and to build a significant, unified presence on the Web.This approach to computing can help libraries save time and money while simplifyingworkflows.A brief list of potential areas of improvement could include:

1. Most library computer systems are built on pre-Web technology
2. Systems distributed across the Net using pre-Web technology are harder and morecostly to integrate
3. Libraries store and maintain much of the same data hundreds and thousands oftimes.
4. With library data scattered across distributed systems, the library's Web presence isweakened.
5. With libraries running independent systems, collaboration between libraries is madedifficult and expensive
6. Information seekers work in common Web environments and distributed systemsmake it difficult to get the library into their workflow.
7. Many systems are only used to 10% of their capacity. Combining systems into acloud environment reduces the carbon footprints, making libraries greener.

These improvements can be grouped into three basic areas: technology, data andcommunity. Each offers some general and some unique opportunities for libraries. Lookingfirst at the technology that most current library systems employ, several benefits of cloudcomputing solutions surface.[6]

VI. ROLE OF CLOUD COMPUTING IN LIBRARIES

Cloud computing is a completely new in technology and it is known as3rd revolution after PC and Internet. Cloud computing is an enhancement ofdistributed computing, parallel computing, grid computing and distributeddatabases. Among these, grid and utility computing are known as predecessorsof cloud computing.

Cloud computing has large potential for libraries. Libraries may put more and more content into the loud. Using cloud computing user would be able tobrowse a physical shelf of books, CDs or DVDs or choose to take out an item orscan a bar code into his mobile device. All historical and rare documents wouldbe scanned into a comprehensive, easily searchable database and would beaccessible to any researcher. Many libraries already have online catalogues andshare bibliographic data with OCLC. More frequent online catalogues arelinked to consortium that share resources.

Data storage cloud be a main function of libraries, particularly those withdigital collections storing large digital files can stress local serverinfrastructures. The files need to be backed up, maintained, and reproduced forpatrons. This can strain the data integrity as well as hog bandwidth. Movingdata to the cloud may be a leap of faith for some library professionals. It is anew technology and on the surface it is believed that library would have somecontrol over this data or collections. However, with faster retrieval times forrequests and local server space it could improve storage solutions forlibraries. Cloud computing or IT infrastructure that exists remotely, often givesusers increased capacity and less need for updates and maintenance, and hasgained wider acceptance among librarians.

VII.ADVANTAGES OF CLOUD COMPUTING IN LIBRARIES

- Innovative and productive library operations.
- Experience the efficiency and convenience of librarymanagement with the help of proven technology.
- Flexibility in choice of auto identificationtechnology, and seamless transition from barcode to Radio-Frequency Identification (RFID) technologies.
- Modular yet scalable deployment at preferred paceand schedule.
- Improved customer service provided to librarypatrons as a result of reducing time to borrow.
- Library materials, cutting down queue and queuingtime, and ease of identifying the library materialsrequired from the library.
- Provide quality service to library patrons by raisingthe librarian service standard to higher value addedand professional service provider in information andresource.
- Cuts down laborious tasks.
- Smoothens business workflow and upgrades thelibrary image to its library patrons

In short its advantages are Cost saving, Flexibility and innovation, User centric, Openness, Transparency, Interoperability, Representation, Availability anytime anywhere, Connect and Converse, Create and collaborate.[7]

Examples of Cloud libraries:

1. OCLC
2. Library of Congress (LC)

3. Exlibris
4. Polaris
5. Scribd
6. Discovery Service
7. Google Docs / Google Scholar
8. Worldcat
9. Encore

VIII. CONCLUSION

Cloud computing builds on decades of research in virtualization,distributed computing, utility computing, more recently networking, and websoftware services. It implies a service oriented architecture, reduced informationtechnology overhead forth end-user, great flexibility, reduced total cost ofownership, on demand services and many other things. In today's globalcompetitive market, companies must innovate and get the most from itsresources to succeed. Cloud computing infrastructures are next generationplatforms that can provide tremendous value to companies of any size. They canhelp companies achieve more efficient use of their IT hardware and softwareinvestments and provide a means to accelerate the adoption of innovations.

Cloud computing increases profitability by improving resourceutilization. Costs are driven down by delivering appropriate resources only forthe time those resources are needed. Cloud computing has enabled teams andorganizations to streamline lengthy procurement processes.Cloud computing enables innovation by alleviating the need ofinnovators to find resources to develop, test, and make their innovationsavailable to the user community. Innovators are free to focus on the innovationrather than the logistics of finding and managing resources that enable theinnovation.

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