

Impact of Cloud Computing Applications in Academic Library and Library Services

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Abstract - *The Evaluation or Impact of information and communication technologies (ICTs) in growing academic libraries have today changes the way libraries services are carried out, Cloud computing is an evolving technological paradigm that facilitates conveniently, on-demand network access to a shared pool of configurable computing resources like network, servers, storage, applications and services etc that can be presented as a service and released with minimal management effort. Cloud computing is a new technique of computing that is extensively used in today's industry as well as society. It is a contemporary model and one of the latest computer industry buzzwords. Cloud computing brings the revolutionary changes in the world of Information Communication Technology because of its potential benefits such as reduced cost, accessible anywhere anytime as well as its elasticity and flexibility. This paper wills discoursing the cloud computing, definitions, historical background, characteristics, models and application of new generation libraries and digital or e-libraries of Academic library's.*

Keywords: Cloud Computing, E-library, Services, models, Adoption, Open Source

Introduction

Cloud computing can transform the way systems are built and services delivered, providing libraries with an opportunity to extend their imprecates. Cloud computing offers a new dimension in computing, it changes how we invent, develop, scale, update, maintain and pay for applications and the infrastructure on which they are run. In cloud computing data and services reside in massively scalable data centers in the cloud and can be accessed from a web browser. Cloud computing was away of providing various services on ritual machines allocated on tap of a large physical pool which reside in the cloud, in other words cloud computers is capable of collecting enlarge quantity of information and resources stormed in personal computers, mobile phones and other equipment and integrate them and put them on the cloud for serving users.

Cloud computing offers information retrieval systems, particularly digital libraries and search engines, a wide variety of options for growth and reduction of maintenance needs and encourages efficient resource use. These features are particularly attractive for digital libraries, repositories, and search engines such as CiteSeer^x The dynamic and elastic provisioning features of a cloud infrastructure allow rapid growth in collection size and

support a larger user base, while reducing management issues.

The pace of growth of information available on the Web and the challenge in finding relevant and authoritative sources of information make information retrieval systems such as CiteSeer^x very useful. CiteSeer^x is an application instance of a framework for building digital libraries, repositories and search engines. SeerSuite was developed as a result of extensive research and development with the goal of enabling efficient dissemination of scientific information and literature. The use of these application components have helped reduce feature and software development time and improve efficiency of maintenance and operations. As such, an examination of cloud computing infrastructure is particularly relevant for SeerSuite application instances as in CiteSeer^x

E-library allows users an improved access to library services at the comfort of their homes and offices. That is, users of library can read library books, conduct research at home and offices. E-library is therefore an integrated platform of hardware and software with developmental orientation. The popularization of E-library has grown very rapidly in recent years, but its growth and usage has been stifled by poor infrastructure, high cost of running e-library and software development. Cloud computing offers a solution to the above problems, it provide a cost effective way of running and managing E-library. It equally offers a better and much more efficient ways of collaborating between users of E-library within and outside This paper addresses the various aspects of cloud computing, internet computing and E-library, it also attempts to show how cloud computing can be applied in E-library to cut cost and improve services and increase the growth of E-library in the organization.

Cloud Computing

Cloud computing is a style of computing in which massively scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies. Cloud Computing is the improvement of Distributed Computing, Parallel Computing, Grid Computing and Distributed Databases. And the basic principle of Cloud Computing is making tasks distributed in large numbers of distributed computers but not in local computers or remote servers. Cloud computing can be defined as an emerging computer paradigm where data and services reside in massively scalable data centers in the cloud and can be accessed from any connected devices over the internet. Cloud computing is a way of providing various services on virtual machines allocated on top of a large physical machine pool which resides in the cloud. Cloud computing provides a way for businesses to increase capacity and quality without investing in new infrastructure, licensing new software or training personnel.

On-demand self-services: to enable consumers to use Cloud provisions as and when required by business demands.

Resource pooling: to allow dynamically assigned computing resources to serve multiple consumers through the use of virtualization technologies.

Rapid elasticity and scaling: to allow Cloud services, resources and infrastructures to be automatically provisioned as business requirements change.

Measured provision: to provide a metering capability to determine the on-demand usage for billing purposes.

Effective management: to provide and facilitate easy monitoring, controlling and reporting Cloud computing offers information retrieval systems, particularly in digital libraries and search engines, a wide variety of options for growth and reduction of maintenance needs and encourages efficient resource use. These features are particularly attractive for digital libraries, repositories, and search engines.

Types and Characteristics Cloud Computing

A. Software as a Service (SaaS)

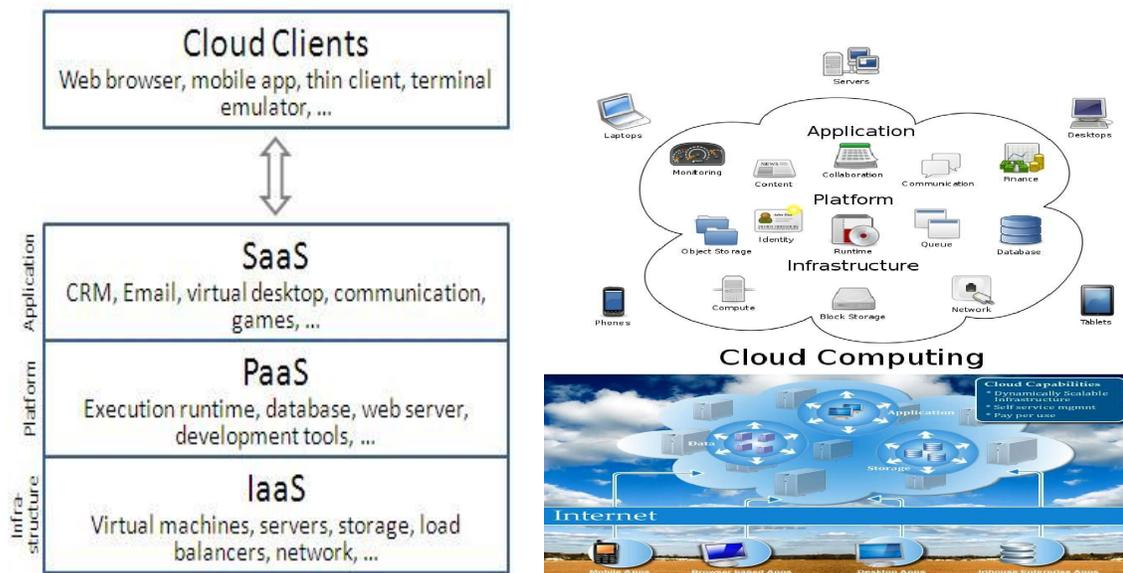
Software package such as CRM or CAD/CAM can be accessed under cloud computing scheme. Here a customer upon registration is allowed to use software accessible through net and use it for his or her business process. The related data and work may be stored on local machines or with the service providers. SaaS services may be available on rental basis or on per use basis.

B. Platform as a Service (PaaS)

Cloud vendors are companies that offer cloud computing services and products. One of the services that they provide is called PaaS. Under this a computing platform such as operating system is provided to a customer or end user on a monthly rental basis. Some of the major cloud computing vendor is Amazon, Microsoft, and Google etc.

C. Infrastructure as a Service (IaaS)

The cloud computing vendors offer infrastructure as a service. One may avail hardware services such as processors, memory, networks etc. on agreed basis for specific duration and price



The following are characteristics of cloud computing :

- Self-Healing
- Multi-tenancy
- Linearly Scalable
- Service-oriented
- SLA Driven
- Virtualized

- Flexible

Problems of Digital Library:

Digital library for our study presents a convenient, along with the growing potential phases; the requirement of digital library is also growing day-to-day, but because of uneven fiscal development in different regions reasons the digital library's assets to be relatively quick, to university digital library as an example. More than a few colleges and universities whilst are raising the respective teaching degree unceasingly, have established a digital library to purchase its own database resources, however considering the fact that of the teaching focal point And fiscal stipulations, library resources between university's has the differences, mean while regarded from the whole that the Digital library has precise flaw. Data resources between various universities are relatively independent, building redundant projects possibility was excessive, has created the manpower, the Financial resource and the assets waste, or some colleges and universities to make use of only part of data base resources, inadequate use of resources, and are not able to play resources maximum utilization. Digital library representative one kind of new infrastructure and the environment, via the cloud computing, it may use assets more robust, and can remedy the defects of digital library

Cloud Computing in E-Library

Cloud computing offers many possibilities that will help to reduce technology cost of installing and maintaining e-library and improve collaboration among users a good example is the universities in the country.

Fig. 1 shows universities in the country running e-library with huge servers, and licensed software packages which is actually very costly.

Fig. 2 shows when the universities adopted cloud computing. The adoption of cloud environment relieves the institutions of the need to acquire an actual costly server in order to install an e-library, one costly software applications needed for individual universities to run e-library can be placed in the cloud and all the universities in the country will have access to it as shown in the diagram. Every change in technology can be accommodated and updated in the cloud which all the universities would have access to.

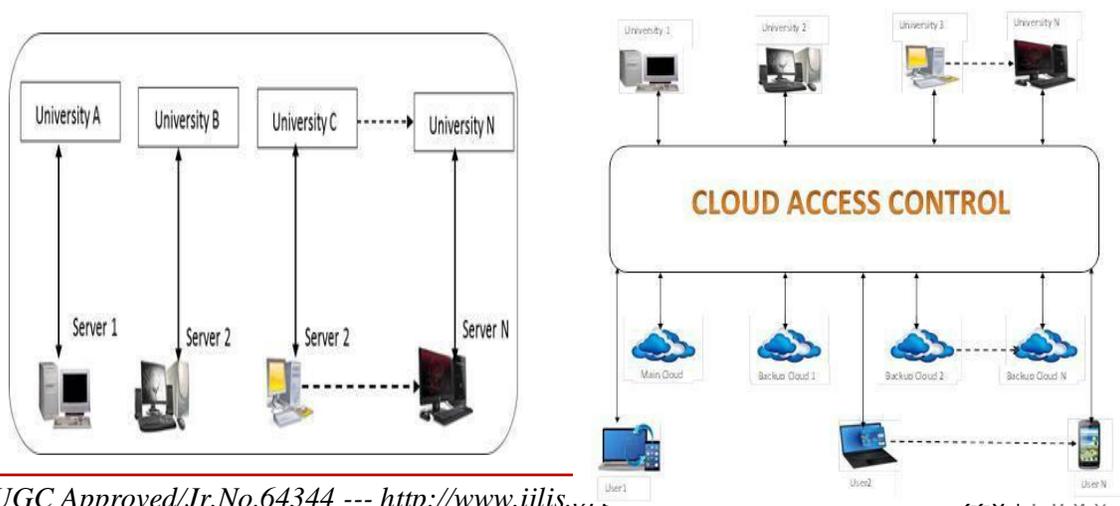


Fig. 1. Schematic diagram of universities running e-library services with huge servers, and licensed software packages.

Fig. 2. Schematic diagram of universities adopting cloud computing.

V Cloud Computing Architecture for e- Library

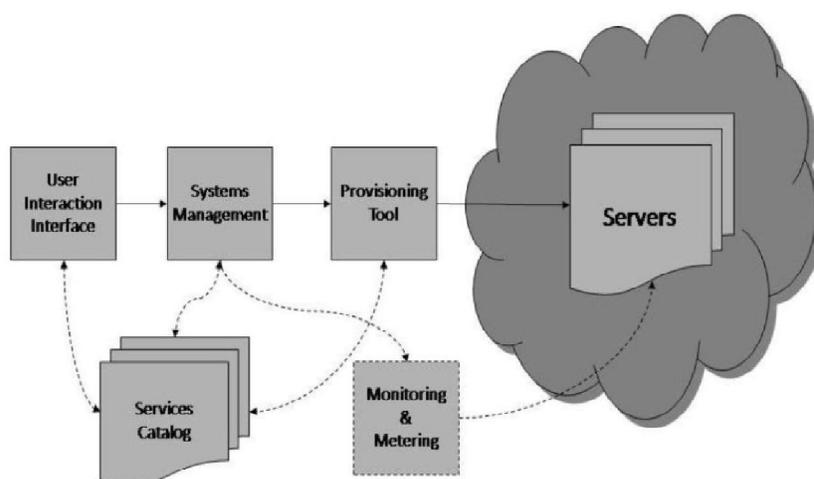


figure 3: Architecture of e- Library

The architecture behind cloud computing is a massive network of "cloud servers" interconnected as if in a grid running in parallel, sometimes using the technique of virtualization to maximize computing power per server. The following figure 3 represents the architecture of cloud computing in digital library. A front-end interface allows a user to select a service from a catalogue. This request gets passed to the system management which finds the correct resources, and then calls the provisioning services which carves out resources in the cloud. The provisioning service may deploy the requested stack or web application as well.

User interaction interface: This is how users of the cloud interface with the cloud to request services.

Services catalogue: This is the list of services that a user can request.

System management: This is the piece which manages the computer resources available.

Provisioning tool: This tool carves out the systems from the cloud to deliver on the requested service. It may also deploy the required images.

Monitoring and metering: This optional piece tracks the usage of the cloud so the resources used can be attributed to a certain user.

Servers: The servers are managed by the system management tool. They can be either virtual or real.

Application of Cloud Computing in Digital Library

Digital library is a development-oriented hardware and software integration platform, through technical and the product integration. Each kind of carrier digitization carries on the effective

deposit and the organization provides the network with effective service. Figure 4 illustrates application of cloud computing in digital library. Cloud computing offers real alternatives to Information Technology field for improved flexibility and lower cost. Digital Libraries[9] are developing for software applications, platforms, and infrastructure as a service to Information better and easier management of data security, since all the data is located on a central server, so main objective of cloud computing is to use a specific software through calculation and the data stored in a desired computer distribution which causes the enterprise to reduce cost and improve performance. Digital library represents one kind of new infrastructure and the environment; through cloud computing technology since it uses resources more effectively and can solve the

Constraint in digital library

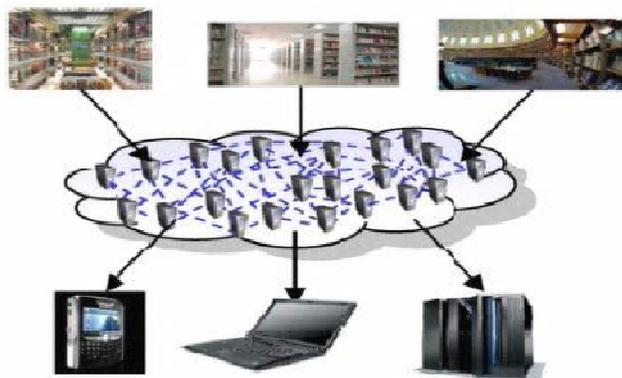


Figure4: Application of cloud computing in digital library
VI. ROLE OF CLOUD COMPUTING IN E-LIBRARIES

Cloud computing is completely a new technology and it is known as 3rd revolution after PC and Internet. Cloud computing is an enhancement of distributed computing, parallel computing, grid computing and distributed databases. Among these, grid and utility computing are known as predecessors of cloud computing. Cloud computing has large potential for libraries. Libraries may put more and more content into the cloud. 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. More frequent online catalogues are linked to consortium that share resources. Data storage could be a main function of e-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. A new technology and on the surface it is believed that library would have some control over this data or collections. However, 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

Advantages of Cloud Computing in E-Libraries

The advantages of cloud computing in e-libraries include the following:

- Cost saving
- Flexibility and innovation
- User centric
- Openness
- Transparency
- Interoperability
- Representation
- Availability anytime anywhere
- Connect and Converse
- Create and collaborate

Future Improvements in e- Library Using Cloud Computing Technology

In an era of shrinking budgets, it gets harder with each passing year to Justify the purchase and maintenance of servers that aren't in use all most all the time. Cloud computing offers price savings due to economies of scale and the fact that you are only paying for the resources you actually use Organizations of all sizes can take more risks when it comes to creative, innovative technology ideas when the new applications will run on sum one else infrastructure e-libraries do not have to decide between devoting their limited server resources to the OPAC overflow traffic and a new mobile application that one of your colleagues wants to develop. If they are both hosted in the cloud . The resources devoted to each will shrink and expand as traffic rises and drops. Furthermore, creating and configuring new virtual server instances is fast and easy in the cloud. e-libraries may soon be building and managing their own data centers.

In addition to all the hype and optimism surrounding cloud computing, there are still significant fears and doubts Industry Challenges points out. security, privacy and reliability. These concerns are leading some companies to build their own private or hybrid clouds. A hybrid cloud is primarily based in a privately-owned and operated data center, but it can shift some of its traffic and data processing requests to public cloud vendors such as Amazon or Rack space on an as needed basis. This hybrid model would let e- libraries maintain more control over the applications and data stores that contain sensitive, private information about patrons. Moreover, digital libraries can continually adjust and fine-tune the balance between the tight control of a private Information Technology infrastructure, and the flexibility and savings of cloud-hosted infrastructure. Just as digital libraries presently cooperate with one another to buy Information Technology equipment, bandwidth and the services of Information Technology professionals, Digital libraries may soon cooperate in the building and management of data centers. Alternately, if enough digital libraries express interest, a company such as Google, Amazon, Microsoft, or another cloud vendor might create a digital library Cloud similar google's Government Cloud. Or, a library vendor with deep Information Technology resources (e.g. OCLC or Sirsi Dynix) might build digital library-centric cloud services on top of cloud infrastructure leased from one of the more established

Conclusion

Cloud computing represents an exciting of opportunity to bring on-demand of applications to e-Library, in an environment of reduced risk and enhanced reliability. However, it is important to understand that existing applications cannot just be unleashed on the cloud services [18] as is. Careful attention to design will help ensure a successful deployment. Certainly cloud computing can bring about strategic, transformation and even revolutionary

benefits fundamental to digital libraries. For organizations providing digital libraries with significant investment in traditional software and hardware infrastructure, migration to the cloud will bring out considerable technology transition; for less-constrained organizations or those with infrastructure nearing end-of-life, adaptation of cloud computing technology may be more immediate.

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