



DISSEMINATION OF INFORMATION THROUGH CLOUD COMPUTING SERVICES IN ACADEMIC LIBRARIES

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ABSTRACT

LIBRARY is not only a Knowledge Ocean, its main aim is to provide quality and satisfactory information services for all the users. In this Digital era, new IT technologies are emerging day by day. So to provide timely updated digital information services and to promote Research and Developments, the Library should improve itself by adopting new technologies. Cloud computing is one of the fastest emerging Digital Information and Communication Technologies, being applied and used by various Libraries and Companies at present. Cloud Computing is the use of outsourced Digital Information resources which can be accessed through networking or Internet. Dissemination of required and relevant information to the users of the Library can be provided easily and regularly through the cloud computing services. Since Cloud computing offers flexibility in usage and reduces cost, it is very much suitable and accessible for the present digital era. This research paper explains about what is Cloud Computing, its benefits, advantages, and services. How Cloud computing services can be adopted, various best companies of Cloud computing, kinds of services which can be provided through Cloud computing also have been discussed in this paper. What kind of Cloud computing services can be adopted and disseminated in Academic Libraries is also explained very particularly.

KEYWORDS: Information Technology, Cloud Computing, Digital Information Services, Cloud Computing Companies

INTRODUCTION

LIBRARY is not only a Knowledge Ocean, its main aim is to provide quality and satisfactory information services for all the users. In this Digital era, new IT technologies are emerging day by day. So to provide timely updated digital information services and to promote Research and Developments, the Library should improve itself by adopting new technologies. Cloud computing is one of the fastest emerging Digital Information and Communication Technologies, being applied and used by various Libraries and Companies at present. Cloud Computing is the use of outsourced Digital Information resources which can be accessed through networking or Internet. Dissemination of required and relevant information to the users of the Library can be provided easily and regularly through the cloud computing services. Since Cloud computing offers flexibility in usage and reduces cost, it is very much suitable and accessible for the present digital library services.

CLOUD COMPUTING- DEFINITION

Cloud Computing is a completely new IT technology and it is known as the third revolution in IT after PC and Internet. To be more specific, 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. In other words, by collecting large quantities of information and resources stored in personal computers, mobile phones and other equipment, Cloud Computing is capable of integrating them and putting them on the public cloud for accessing required information [Michael Miller]. [Figure (i)]

Rupesh Sancheti and Gaurav kulkarni defines “**Cloud computing** is one of the fastest emerging information technologies, being employed and used by various companies and Libraries today. To define cloud computing one can say that is the use of “outsourced” computing resources that can be employed or accessed through networking or the internet [Rupesh Sancheti].

The Gartner Group defines cloud computing as “A style of computing in which massively scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies (Gartner Group-OCLC INFORUM 2011). In simple cloud computing are Web-based applications with shared data and services.[Gartner Group]

Cloud computing is the use of computing resources of hardware and software that are delivered as a service over a network, typically like 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. Cloud computing entrusts remote services with a user's data, software and computation.[Wikipedia]

In short, Cloud computing is the delivery and consumption of Information services via the Internet. Without any installation, this technology allows businesses and individual users to access data or computer applications. **Cloud Computing** involves central remote servers where all subscriber data, applications or other information are stored and an Internet connection, using which subscribers can access their data or applications from any computer system.

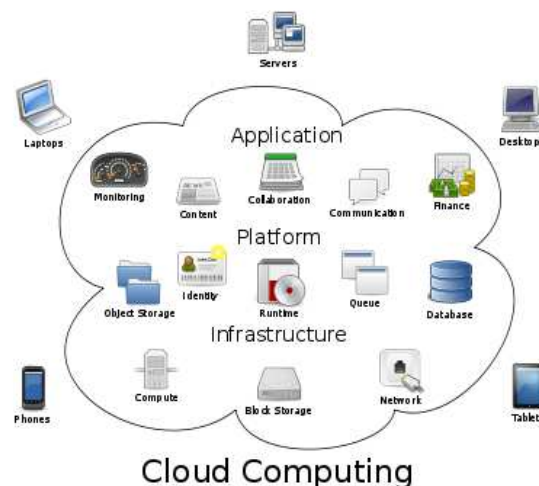


Figure 1: Cloud Computing

TYPES OF CLOUD COMPUTING SERVICES

Mainly three types of services are offered by cloud computing vendors:

- **Software as a Service (SaaS),**

- **Platform as a Service (PaaS)** and
- **Infrastructure as a Service (IaaS).**

SaaS is on demand software delivery mode. Here, clients are not required to install anything on their computers. They can obtain all the benefits of a software via Internet. PaaS is the delivery of a computing platform and solution stack. It provides all the facilities require to build and deliver a custom application or service. On the other hand, with IaaS, clients can avail the benefits of an entire computer infrastructure without buying any servers, software or networking equipments. [www.cloudcomputingworld.org]

- There are many types of public cloud computing:
- Infrastructure as a service (IaaS)
- Platform as a service (PaaS)
- Software as a service (SaaS)
- Storage as a service (STaaS)
- Security as a service (SECaaS)
- Data as a service (DaaS)
- Test environment as a service (TEaaS)
- Desktop as a service (DaaS)
- API as a service (APIaaS)
- IT as a service (ITaaS),

The business model of IT as a service (ITaaS), is used by in-house, enterprise IT organizations that offer any or all of the above services. Using software as a service, users also rent application software and databases. The cloud providers manage the infrastructure and platforms on which the applications run.

End users access cloud-based applications through a web browser or a light-weight desktop or mobile app while the business software and user's data are stored on servers at a remote location. Proponents claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables IT to more rapidly adjust resources to meet fluctuating and unpredictable business demand. [Gartner Group]

Cloud computing relies on sharing of resources to achieve coherence and economies of scale similar to a utility over a network. At the foundation of cloud computing is the broader concept of converged infrastructure and shared services. [Waters, John]

CLOUD COMPUTING MODELS

The umbrella of cloud computing is a big one. Some of the consistent top cloud computing models are,

The Internal Cloud

This is the most common type of cloud computing. The internal cloud occurs within a single organization, allowing them to implement virtualization for in-house services. The premise is that internal infrastructure including server, networks, storage and applications will be connected and virtualized, which in turn allows it to move things around in such a way as to maximize efficiency.

External Cloud Hosting

This type of cloud model uses an external service via a cloud provider, and its access by the organization via the Internet. This is probably the most cost-effective way to utilize the cloud. The big concerns with this model are security and Performance

The Hybrid Cloud

The Hybrid cloud model mixes both internal cloud computing and external cloud hosting. This is where most businesses shine. It allows a highly customized approach, and lets a business use the cloud when it makes sense and avoid it when it doesn't make sense.

Adoption Model

The Cloud Computing Adoption Model proposes five steps of Virtualization, Cloud Experimentation, Cloud foundations, Cloud Advancement and Cloud actualization. This model virtualizes infrastructure and applications, experiments cloud, lay foundations for scalable applications, achieve dynamic sharing of application workload by hyper cloud.

Software as a Service (SaaS)

It is a solution model in which users use a web browser to access software that resides, along with the programs and user data in the cloud. SaaS Solutions exist for a wide range of applications and provide customers with a cost effective way to get started.

Platform as a Service (PaaS)

This solution model provides a collection of hardware and software resources that developers use to build and deploy cloud-based applications. PaaS solutions run a Windows or a Linux based operating system and normally support a specific programming environment such as .Net or Java. Operating systems, database and other applications and programs will all be outsourced to a vendor thereby; all of these no longer needs to be locally managed.

Infrastructure as a Service (IaaS)

It makes all of the computing hardware resources available but leave the customer responsible for installing and managing the system for security needs and to manage all resources. IaaS cloud computing model allows consumers to use servers and storage provided by vendors. Storage, networking equipments and other infrastructure requirements that academic library may need at the present and in the future

NEED FOR CLOUD COMPUTING SERVICES IN ACADEMIC LIBRARIES

- Advantages & benefits of Cloud computing services in academic libraries are
- The main use of cloud computing services by libraries is the advantage of freely available applications for internal use in the library and for social networking purposes in academic institutions.
- Considering the advantages of cloud computing for efficiency and collaboration, the present librarians have begun to provide efficient uninterrupted information services to their user community.
- Like other industries Cloud Computing services also expressing the same concerns, with data security and long-term stability of the service provider.
- The main advantage libraries can get from cloud-computing services is to work with system suppliers to change the way systems are built and how they open opportunities for technology sharing. [Goldner, M].
- The Web Technology has opened up a way for building new systems that can call shared services through cloud computing technology.
- The value of an open platform like cloud computing will allow innovation by anyone.
- With cloud-based computing services, work done in one place will echo through the rest of the system and will be available to all.
- Cloud computing is the platform the apps are shared on that makes it possible to succeed in sharing the innovation, no matter the original motivation of the developer.
- That illustrates one benefit of shared data and a cooperative platform. It encourages innovation and pools the creativity of many participants.
- Reliable and Unlimited information data can be stored and shared through cloud computing service platform.
- It secures the storages to high extent and the data can be managed easily.
- Independent and high level information service can be provided by the Academic digital libraries.
- Round the clock/24 hours service support can be possible through cloud computing.
- It reduces the cost of purchasing and maintaining e-resources in academic libraries.
- Virtualized, dynamic and relevant Information service can be provided for 24 hours through cloud computing
- Cloud computing subscribe to high quality services when / as long as needed.
- It chooses best value, not pieces of technology.
- Save costs on IT infrastructure & management of e-resources.
- Cloud computing services Improve visibility and accessibility of the service
- It focuses on core business, grow, innovate Collaborate, Aggregate & Share Data & Services

WHAT IS A CLOUD COMPUTING SERVICE PLATFORM?

The concept of cloud leads to a platform and apps concept for Library management services and to a collective innovation in academic libraries. Cloud computing platform is an infrastructure for developing and sharing applications.

For libraries, it is an “**App Gallery**”, through which libraries can easily develop their own custom applications for library management activities. Also libraries can expose and share those applications as web services on the platform for others to find and reuse.

For developers, a platform is a “toolbox” that allows building and sharing of apps, based on data and services exposed on the platform, including documentation and community support, extensibility and Interoperability with external data, services and applications.

MAIN PRINCIPLES OF CLOUD COMPUTING PLATFORM

- The main principles of Cloud computing services in academic libraries are
- Data richness: To Offer data pools and integrated workflows for all purchased, licensed and digital content
- Collaboration: Data and services can be shared with other libraries & partners in a controlled way
- Designed for the cloud: Suitable for public access, it is designed with Responsive, massive scalable, highly fault tolerant method.
- Openness: It Support interoperability between cloud based solutions, with library applications / services through APIs, incl. exit options
- Extensibility: Cloud computing Platform can be extended by applications, provided by supplier, libraries or partners

HOW CAN WE SUBSCRIBE CLOUD COMPUTING SERVICES?

Cloud Computing

Services are normally easy to implement and secure. At First, a monthly or annual subscription fees to be paid to the cloud computing service provider. Then access to service by using specific login ID and password will be enabled. There is no need to purchase any hardware or install any software. Cloud computing also offers flexibility in usage and reduces cost. Moreover, it can help improve productivity and services by collaboration.

Some Cloud Computing Companies

There are several **Cloud computing companies** around the globe which offer good packages for the Academic Library services [Figure 2]. We should able to know How would these products and services help for the growth of Academic Library? Most of the time, the institutions are doubtful in migrating their computing needs to the cloud, this is understandable since not everyone is ready to migrate computing to vendors whose hardware and equipment location is not within the country where the business is headquartered. So the Cloud Computing Companies have addressed this by making sure that client is aware where their data and information will be located and how it is being accessed and who can access it. To migrate from conventional computing to cloud computing, there are more factors need to be considered. With

the help of IT experts, all the factors like pricing, availability, support, service levels and other technical issues to be considered for choosing best cloud computing company.

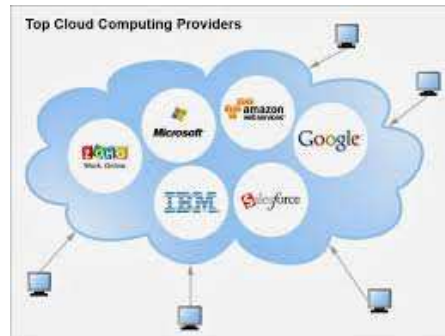


Figure 2: Cloud Computing Companies

Cloud computing is designed for computing scalability, to ensure that academic institution meet their requirements if computer use rises. Since these services are outsourced migration to cloud computing is fairly easy, everything will be done and will be provided by the vendor. Since cloud computing allows multiple users to use and access the valuable computer resources, this technology is one of the greenest and most effective way to provide academic library services. Also **Cloud computing companies** today competes with their pricing and technology, and hence consumers in turn gets the best price for the latest technology available in the market without sacrificing quality, efficiency and technology. **Cloud computing** also allows instant software updates; this makes sure that all the software a company uses are instantly updated on time on the servers without affecting the subscribers. [www.cloudcomputingworld.org]

Types of Cloud Computing Companies

Mainly there are four types of cloud computing companies which provide services relevant to academic libraries. [Figure 3]

- Public cloud computing
- Shared cloud computing
- Private cloud computing &
- Dedicated cloud computing companies

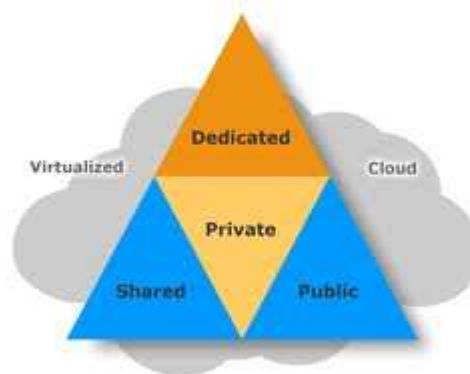


Figure 3: Types of Cloud Computing Companies

BEST CLOUD COMPUTING COMPANIES

There are several **cloud computing companies** which have the best and most advanced technology and the best business model that can effectively address all the cloud computing needs of their consumers and clients. Following are some of the top cloud computing companies worldwide today as observed by IT experts: [Jamsa, Kris]

Amazon Web Services

When Amazon started its business in 1995, they only sell books, books and books. From its humble beginning now we see Amazon.com is one of the top most and best cloud computing technology provider. It is one of the best in the Infrastructure as a service (IaaS) cloud computing model. Amazon offers two types of services under this model, the Elastic Compute Cloud (ECC) wherein a consumer can create his own servers through Amazon's cloud and load any program or data. Another type of service Amazon offers is Simple Storage Service where a client who tenants a storage system through Amazon can access the data anytime and anywhere.

Microsoft Windows Azure Service Platform

Microsoft the developer of one of the most used operating system today also has its value in cloud computing. Windows Azure is a Microsoft platform which provides operating system support for .Net applications and a cloud based SQL server with in which users can house their applications. Windows Azure maintains servers, operating systems, database software and other applications. It provides scalability, redundancy, cost benefits from resource pooling, outsourced server management and low cost entry.[Jasma, Kris]

The Apple Cloud Company

The apple company has the ability to introduce technology that changes institutions and industries and also the way people work and communicate. Apple's first entry in to the cloud was the iTunes virtual music store. Today iTunes laid a foundation for scalable e-commerce, high bandwidth download transactions and user device independence. Using Apple's iCloud, users can quickly exchange digital contents, and can customize the iCloud settings to make the file exchange seamless and automatic.

Google Cloud Computing Services

Today Google is not only a search engine but a giant most successful company with so many innovations. With regard to cloud computing, they are one of the best cloud computing vendors. Google offers two types of services and they are Software as a Service (SaaS) and Platform as a service (PaaS). Google makes bold moves but most of these turn into flops but with regard to cloud computing, they are one of the best and one of the safest choice amongst cloud computing company. Google offers collaboration and business email and it maintains the file in their very own servers for consumers. As a PaaS expert Google hosts software development through its very own platform.

Sales Force Cloud Computing

One of the first companies to launch a large scale of SaaS Cloud solution was salesforce.com. the company recognized that as much as three-fourths of salesperson's day was spent on non-sales tasks. Salesforce.com automated these sales tasks and put the underlying data storage in the cloud. Also the company released a customer service cloud which integrates common customer service operations. The software manages the process of responding to customer calls,

e-mails, facebook updates, live chats and more.

Netsuite Cloud Computing

It is a cloud computing provider of both SaaS and PaaS. On the SaaS side, NetSuite offers turnkey enterprise resource planning, customer relationship management and accounting solutions. It reduces total cost and duplication of data entry. On the PaaS side, NetSuite provides a development environment by which users can quickly build and deploy required solutions.

Rackspace Cloud Computing

It is one of the largest Infrastructure as a Service (IaaS) cloud computing company which offers a set of solutions that include hosting, managed hosting and hybrid solutions that combine the cloud and managed services. Rackspace offers pay-as-you-go scalability, with on-demand storage and load balancing. Also it provides solutions for e-mail, exchange hosting, file sharing, backups and collaboration.

IBM Cloud Computing Company

IBM cloud computing is using for a set of cloud computing services for business offered by the information technology company IBM. All offerings used to be marketed under the name **IBM SmartCloud**. IBM Cloud offers open cloud infrastructure services for IT operations. The IBM SmartCloud brand includes infrastructure as a service, software as a service and platform as a service offered through public, private and hybrid cloud delivery models. IBM places these offerings under three umbrellas: SmartCloud Foundation, SmartCloud Services and SmartCloud Solutions. It secures at every level with the latest technologies and protections.

CLOUD COMPUTING SOLUTIONS FOR LIBRARIES

Libraries are doing more than ever. Libraries are changing rapidly, Cost & time requirements are exploding. Cloud based library services could bring the power of library cooperation to core library management and the academic Libraries will be freed to focus on innovation. The library community can apply the concept of cloud computing to amplify 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 simplifying workflows. (Goldner)

The potential areas of improvements can be grouped into three basic areas: technology, data and community. Each offers some general and some unique opportunities for libraries. Today the main focus of the academic libraries which are moving in to Cloud computing services are providing Discovery services and to disclose their vast collections on the Web. Library OPACs are to be uploaded in to a common Union Catalogue pools for providing integrated information services to the users.

IMPACT AND ADVANTAGES OF CLOUD COMPUTING IN ACADEMIC LIBRARIES

To change the Library Management system in to Cloud computing environment, open service oriented architecture should be provided and libraries should not depend on a vendor other third party to start and provide new technology oriented services. When library systems are deployed as open cloud solutions then the library community itself can step up to create community using cloud solutions. This makes it possible to integrate two services once and re-use it across the community. Secondly libraries can get out of the business of technology and focus on collection building, patron

services and innovation. Instead technical skills can be re-deployed for extending cloud services into their environment and their environment into other cloud services.

If the data of Library is stored in the cloud it offers several advantages as follows

- Common data can now be easily shared among libraries and users.
- The need for local storage, maintenance and backups is removed.
- Agreements can be forged to share data that normally would be considered private to a single business or organization.
- Libraries can achieve Web scale when they massively aggregate data and users, in the cloud environment.
- It is easy to recognize the same data being stored hundreds and thousands of times across libraries.
- It is possible to know how many copies of the cataloguing data are available for serial publications.
- Changes in the uploaded data are very easy to perform.
- The opportunity for library collaboration and co-operative intelligence is possible
- Libraries can easily share the data for co-operative collection building, preservation and co-operative sharing of materials etc.
- Based on the usage data, new services can be created.

CHALLENGES CONNECTED WITH CLOUD COMPUTING

Following are some of the challenges met by the academic libraries when moving in to cloud computing services

- Data Security and Privacy problems
- Data ownership and exit options
- Scalability of cloud data services
- Reliability and performance of the cloud based service
- Inter operability with external services
- Compliance with legal standards and
- Lack of appropriate standards in cloud computing.
- When considering a cloud application two aspects of security and privacy must be examined, in technical and legal point of view.

CONCLUSIONS

To achieve the ultimate aim of providing satisfactory services for all the people, library should improve itself constantly by adopting many new IT technologies. Although study of Cloud Computing is still in the initial stage now, impacts brought by Cloud Computing are obvious. With the introduction of Cloud Computing to Academic library,

Services provided by libraries will become more user-centric, more professional and more effective. 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. Hence Librarians of academic Institutions should learn more about Cloud computing solutions for Library services, which will create the new workflows needed by librarians because it offers the opportunity for a cooperative platform for libraries to build on.

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