

E-Learning through Cloud Computing Services Provided by Academic Libraries for Promoting Research and Development

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Abstract

E-learning is a means of becoming literate, involving new mechanisms for communication, such as: computer networks, multimedia, content portals, search engines, electronic libraries, distance learning, and web-enabled classrooms. Different web based applications such as email, real-time conference, cloud computing, WebCam etc. are being used as important tools in the process of e-learning. Cloud Computing is a completely new Virtual Information and Communication Technology and it is known as the third revolution after PC and Internet in IT. To be more specific, Cloud Computing is the improvement of Distributed Computing, Parallel Computing, Grid Computing and Distributed Databases. The basic principle of Cloud Computing is making tasks distributed in large numbers of distributed computers. 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 providing required information to the users. 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, 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 promoting research and development. This research paper explains about what are Cloud Computing, its History, 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.

Keywords: Information Technology, Cloud Computing, Digital Information services, Cloud Computing Companies

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I. INTRODUCTION

E-learning is a means of becoming literate, involving new mechanisms for communication, such as: computer networks, multimedia, content portals, search engines, electronic libraries, distance learning, and web-enabled classrooms. 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 To enable E-Learning environment. 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 for developing research.

II. E-LEARNING & CLOUD COMPUTING- DEFINIT

E-Learning is a catch-all term that covers a wide range of instructional material that can be delivered on a CD-ROM or DVD, over a Local Area Network (LAN), or on the Internet. It includes Computer-Based Training (CBT), Web-Based Training (WBT), Electronic Performance Support Systems (EPSS), distance or online learning and online tutorials. The major advantage of e-learning to students is its easy access [3]. E-learning will enhance student learning opportunities by enabling them to take part in global level and to access a variety of digital information sources via a range of appropriate World Wide Web technology.

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 [4]. [Figure (i)]

Rupesh Sanchati 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 [5]. 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. In simple cloud computing are Web-based applications with shared data and services.[7]

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.[8]

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

III. HISTORY OF CLOUD COMPUTING

During sixteenth century, the idea of an "intergalactic computer network" was introduced by J.C.R. Licklider, who was responsible for enabling the development of ARPANET (Advanced Research Projects Agency Network) in 1969. His vision was for everyone on the globe to be interconnected and accessing programs and data at any site, from anywhere which is now we are calling as cloud computing.(Figure 2)

Other computer scientist John McCarthy had proposed the idea of computation being delivered as a public utility, similar to the service bureaus. Since the sixties, cloud computing has developed along a number of lines, with Web 2.0 being the most recent evolution. However, in 19th century, since the internet only started to offer significant bandwidth, cloud computing for the masses has been something of a late developer.

One of the first milestones in cloud computing history was the arrival of Salesforce.com in 1999, which pioneered the concept of delivering enterprise applications via a simple website. The services firm paved the way for both specialist and mainstream software firms to deliver applications over the internet.

The next development was Amazon Web Services in 2002, which provided a suite of cloud-based services including storage, computation and even human intelligence through the Amazon Mechanical Turk. In 2006, Amazon launched its Elastic Compute cloud (EC2) as a commercial web service that allows small companies and individuals to rent computers on which to run their own computer applications. “Amazon EC2/S3 was the first widely accessible cloud computing infrastructure service,” said Jeremy Allaire, CEO of Bright cove, which provides its SaaS online video platform to UK TV stations and newspapers. Another big milestone came in 2009, as Web 2.0 hit its stride, and Google and others started to offer browser-based enterprise applications, though services such as Google Apps.[16]

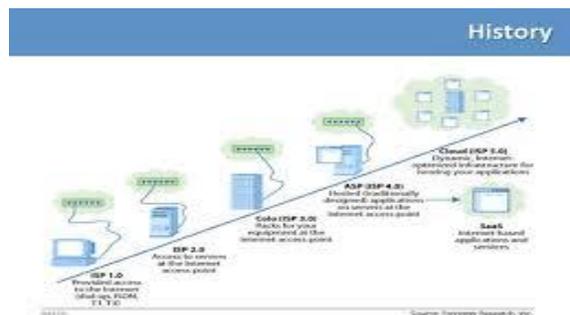


Figure 2: History of Cloud Computing

The following list briefly explains the evolution of cloud computing:

- Grid computing: Solving large problems with parallel computing
- Utility computing: Offering computing resources as a metered service
- SaaS: Network-based subscriptions to applications
- Cloud computing: Anytime, anywhere access to IT resources delivered dynamically as a service

Soft Layer is one of the largest global providers of cloud computing infrastructure.

IBM already has platforms in its portfolio that include private, public and hybrid cloud solutions. The purchase of SoftLayer guarantees an even more comprehensive infrastructure as a service (IaaS) solution. While many companies look to maintain some applications in data centers, many others are moving to public clouds.[16]

IV. TYPES OF CLOUD COMPUTING SERVICES

Mainly three types of services are offered by cloud computing vendors: (Figure 3)

- 1 Software as a Service (SaaS),
- 2 Platform as a Service (PaaS) and
- 3 Infrastructure as a Service (IaaS).

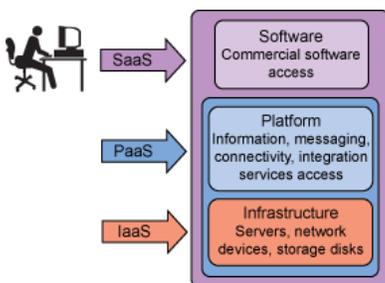


Figure 3: Types of cloud computing services

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. [9]

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. [7]

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. [6]

V. CLOUD COMPUTING MODELS

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

1. 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.
2. 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
3. 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.

4. 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.

5. 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.

6. 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 need to be locally managed.

7. Infrastructure as a Service (IaaS): It makes all of the computing hardware resources available but leaves 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.

VI. ADVANTAGES OF CLOUD COMPUTING SERVICES IN ACADEMIC LIBRARIES

Advantages & benefits of Cloud computing services in academic libraries are

- ❖ E-learning using Cloud computing services will enhance student learning opportunities by enabling them to take part in global level and to access a variety of digital information sources via a range of appropriate World Wide Web technology round the clock from anywhere.

- ❖ 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. [1].

- ❖ 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 for promoting research.

- ❖ 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 for promoting research and developments through E-learning.

VII. HOW CAN WE SUBSCRIBE & ACCESS CLOUD COMPUTING SERVICES?

For facilitating E-learning environment, by 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.

A. 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 be able to know how these products would and services help for the growth of Academic Library for enabling E-learning environment to the users. 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. [9]

B. Types of Cloud Computing Companies:

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

1. Public cloud computing
2. Shared cloud computing
3. Private cloud computing &
4. Dedicated cloud computing companies

VIII. 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:

A. 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.

B. 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.[2]

C. 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.

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

IX. E-LEARNING BY CLOUD COMPUTING SOLUTIONS FOR LIBRARIES

Libraries are doing more than ever. Libraries are changing rapidly, Cost & time requirements are exploding. The emergence of web based e-learning systems through Internet facilities has great impact on every facet of Library activities and information services. 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 in research activities. 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.

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 facilitating E-learning environment oriented Discovery services and to disclose their vast collections on the Web.

8. IDEAS FOR CLOUD BASED E-LEARNING LIBRARY SERVICES IN THE FUTURE

Some of the ideas that might work for libraries by facilitating E-learning environment in the cloud computing world for disseminating information for promoting research and developments are as follows:

A. Universal World Catalog Service:

Library OPACs are to be uploaded in to a common Union Catalogue pools for providing integrated information services to the users. The World catalog service allows users to register an account and personalize the service. This includes creating personal book lists, setting preferred libraries, and setting preferred locations. Zotero and Worldcat.org are few examples for personalized catalogues available on cloud.

B. Unified authentication for open access:

Libraries can develop a unified authentication that will allow library users to access their library resources at anytime, anywhere, from any service. This could change the way we handle patron access. This unified authentication account would hold all the information about users access to library services.

C. Relevant information based on a specified location:

The Cloud computing technology pulls contextually relevant data to the mobile applications that work with video and location aware mobile devices.

X. CONCLUSION

To achieve the ultimate aim of providing satisfactory E-learning 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 to promote their research activities. 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.

REFERENCES

- 1 Goldner, m. (2010). Libraries and Cloud Computing. OCLC, 2010
- 2 Jamsa, Kris (2013): Cloud Computing, Jones & Barlett Learning, New Delhi, 2013
- 3 Judith Hurwitz, et al.(2009). Cloud Computing For Dummies. Wiley Publishing, 2009
- 4 Kurtus, Ron (2004). What is e-learning.
- 5 Michael Miller. (2008). Cloud computing: Web-based Applications That Change the Way You Work and Collaborate Online. Que Publishing, 2008.
- 6 Liu Jinling, Ye Yanming, Song Xun. The Development of University Library Service Mode. Library and Information Service, 12, 2007.
- 7 Pace, Andrew. (2009). 21st Century Library Systems. Journal of Library Administration, 49, 641-650, 2009.
- 8 Rupesh Sanchati and Gaurav kulkarni. (2011). Cloud Computing in Digital and University Libraries. Global Journal of Computer Science and Technology, 11(12), 2011
- 9 Waters, John: Up, Up and Away. T.H.E. Journal, 37:1, 22-4, 26-7, 2010.
- 10 Bezos, Jeff: : <http://www.slideshare.net/goodfriday/amazon-web-services-building-a-webscale-computingarchitecture>
- 11 BSI Paper Cloud Computing: <http://bit.ly/cywMMH>, summary in en: <http://bit.ly/cUNjSD>
- 12 Gartner Group: <http://www.gartner.com/it/page.jsp?id=1035013>,
- 13 Moore, Geoffrey: Core Content and the Cloud. <http://www.youtube.com/>
- 14 Wikipedia: http://en.wikipedia.org/wiki/Cloud_computing
- 15 www.cloudcomputingworld.org
- 16 IBM CLOUD COMPUTING NEWS / March 3, 2014 | Written By: Turgut Aslan