

Cloud-based Services: Prospects for the University Libraries

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Abstract

University libraries are set to build and manage their own data centres. In this data-model libraries would gain more control over the software applications and data stores. Cloud-based technologies are here to make this possible. This paper, discusses meaning, definition, and characteristics of cloud-based computing. It emphasises on IT infrastructure and highlights the potentialities of libraries in implementation of these technologies. It also gives brief introduction to the challenges posed by cloud-based library services. The objective of this paper is to investigate and design reference architecture to digital library systems with scalability using cloud computing. This paper intend to explore the possibilities with 'cloud-based technologies' as 'must adoptable', feasible prospects for future of university library systems in building highly scalable and robust information systems.

Keywords: Cloud Computing, Library Cloud, Cloud Storage

1. Introduction

'Cloud computing' is the latest ICT buzzword! Globally, it is being fast adopted by many businesses, industries and organizations. Ever since, libraries being the front runners in adopting any new technology tool, have found cloud-based technologies as a hope for their every purpose. Cloud-based technologies help to avoid locally hosting multiple servers and equipment and constantly dealing with hardware failure, software installs, up gradations and compatibility issues. Cloud computing can enable simplified processes, achieve economy in terms of time and money. A cloud-based computing technology allows sharing of data, software and computing mechanism and facilitates seamless access from a shared, remote server. It is hugely beneficial to the institutions, libraries, and learners.

2. Understanding Cloud-based Computing

Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: 'infrastructure-as-a-service', 'platform-as-a-service' and 'software-as-a-service'. The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams.

National Institute of Standards and Technology (NIST) had provided a universally acceptable definition of 'cloud-computing, as "cloud computing is a model for enabling convenient, on-demand 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 essential characteristics, three service models, and four deployment models."

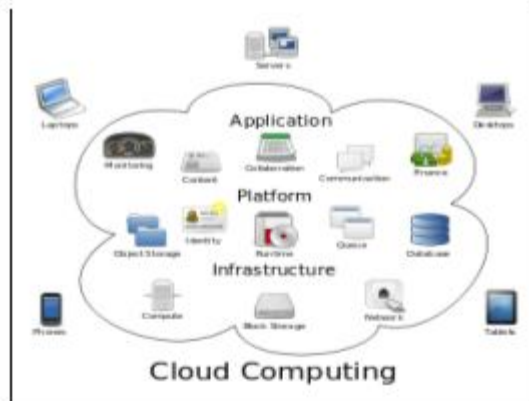


Figure 1: Cloud Computing

A cloud can be private or public. A public cloud sells services to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider.) A private cloud is a proprietary network or a data centre that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services.

3. NIST Prescribed Essential Characteristics

- a) On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- b) Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
- c) 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 (e.g., country, state, or datacentre). Examples of resources include storage, processing, memory, and network bandwidth.
- d) Rapid elasticity: Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
- e) Measured service: Cloud systems automatically control and optimize resource use by leveraging a metering capability¹ at some level of abstraction appropriate to the type of service (e.g., 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.

4. Potentiality of Library Services and Facilities

A) A library comprises of the following:

- a) Physical collection of books, journals, reports, proceedings, dissertation, thesis, video tapes, CD-ROM
- b) A virtual collection of e-books, e-journals, dissertations, online videos and other electronic resources
- c) Library automation and management software
 - i) With a circulation desk
 - ii) Bar Code Reader and creator
 - iii) Library server
 - iv) OPAC terminal
 - v) A server class machine to authenticate users for remote access hosting proxy facilities
 - vi) A server class machine to host the single gateway software to enable users access the resources seamlessly.
 - Vii) A Proxy server to access internet and all e-resources.
 - Viii) A Local Area Network and Library terminals.

B) The above facilities in the library provide the following services:

- a) Access to Content - all electronic and print resources.
- b) Library Management Services - access to OPAC and other modules of the library for circulation, acquisition, serials control, issue of books etc.
- c) Single gateway facility to subscribed resources through Journals discovery service and federated discovery service.
- d) Remote authentication to users outside the campus to all the resources of the library.

5. Infrastructure for Providing Library Services

The following is the hardware required for providing the above services of library:

- a) LMS Server for hosting LMS Software.
- b) Proxy server for accessing content.

- c) Remote authentication server for users to log in from outside the campus.
- d) Discovery Server for hosting the discovery solution.
- e) OPAC terminals.
- f) Internet ready terminals to access all the above resources.

The library requires 5 servers with requisite OS and software to provide the above services. The cost of each server may vary from '2 Lacs to '3 Lacs. The cost of Operating System and other application software will be additional per server. This may also range from '2 Lacs to '3 Lacs. Initial infrastructure cost in all may range from '20 Lacs to '25 Lacs.

6. Advantages of Cloud-based Library Services

Cloud based computing model reshapes the technology suit into a service, which in fact a web-based application based on an external infrastructure. This 'software-as-a-service' mechanism can involve the libraries and their users sharing a single software platform! Indeed, this being highly scalable platform, enable libraries to upload its updates and enhancements Tec for once and for all their users. The individual user and/or a library can customize several applications, professional priorities, policies and procedures etc. according to their local needs.

Among several advantages of using the cloud-based technologies in a library is that, it would not have to maintain its own hardware, so that, it can cut down on technology costs and improve the quality of services. Cloud-based technology facilitates efficient access management, authorization of users, utilisation data and knowledge resources. Also it can handle many of the users' increasingly demanding information services. Cloud computing provides advantage to the institution to rent out server space and application space on third party infrastructure based on the usage of the application and space.

6.1 Cloud-based Library Services would mean

- a) Library automation software with all the library data hosted on a cloud server and accessible on web based.
- b) Access to all the e-resources through this proxy server on the cloud which is registered with the publisher.
- c) Remote authentication software loaded on this cloud-based based server for authenticating remote as well as local campus users by providing VPN/Ezproxy, Federated searchings.
- d) Discovery Service software is also installed on the cloud server providing a single interface to all the resources of the Library.

6.2 The cloud-based library service will also be able to provide the following benefits

- a) Address the security issues of content and data.

- b) Keep quality services of all the users and the services they access.
- c) Provide a single platform branding to your library.
- d) Provide all services of the library under one roof.
- e) Saving on investment of hardware and software infrastructure.
- f) The library or users need an internet connected PC/laptop or tablet to access the library resources.

6.3 Among the benefits of a Cloud Computing Approach

- a) Users' real-time participation on the web
- b) Increases visibility of knowledge resources and services
- c) Enhanced accessibility
- d) Reduces duplication
- e) Streamlines workflows
- f) Cooperative intelligence
- g) Improves service quality
- h) Aggregation of usage data
- i) Reduces carbon footprints
- j) Encourages libraries and their users participation in a network.

7. Financial Implications of the Cloud-based library Services

The cloud-based library services infrastructure would be available to all the users on.

The advantages for such services are:

- a) You pay as you use.
- b) The bandwidth and storage get flexible based on your usage pattern.
- c) They increase or decrease with users and access and resources.
- d) There is no maintenance issues related to infrastructure of servers etc.

These costs are in addition to the subscription of products in the library which include:

- a) Content - e-resources
- b) Services - LMS, Journal Discovery Services
- c) Technology - Remote authentication software and federated services

8. Challenges

With all these offerings, cloud based library services still poses the challenges such as security, privacy, standardisation, continued evolution/innovation, compliance etc. which needs to be addressed before planning process.

9. Conclusion

Cloud computing offers Information Retrieval services to university libraries, particularly digital libraries and search engines, a wider variety of options for growth and reduction of maintenance needs and encourages efficient resources use. The dynamic and elastic features of a cloud based infrastructure allow rapid growth in collection size and support a larger user base, while reduce management issues. With cloud-based computing technologies and tools shall take care of transparency for the library and user. The university libraries need to harness the power of the cloud-based technologies, which has assurance of performing computationally intense task at record speed and maintain the huge data. Although the cloud-based technologies are in the evolving stage, have many advantages, which for sure, to help the university libraries in managing their organisational as well as personal data, their information products and services, and enhancing user satisfaction and accomplishing their academic objectives.

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