

# Impact of Cloud Computing Technology for Library Services

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## Abstract

*Technological developments have affected not only the format and sources of information, but also the reference services provided by the libraries. Libraries and their resources have partially moved to an E- World. As a result, library patrons can access our resources from outside the physical library through their computers. These technologies can be widely adopted but will have to endure through many alterations by means in which they are offered by the libraries. Adoption of cloud computing is not an easy task for libraries. The advantages/disadvantages, features and its implications have to be seriously considered before placing data on the cloud. The basic idea in this paper is to evaluate Cloud service for the library. This paper provides brief information on cloud computing and its application for library services with a special reference to the author's information centre.*

## 1. Introduction

Cloud computing is a technology that uses the web (Internet) and central remote servers to maintain data, software and application. Cloud computing allows users to use applications without installation in their local machine to access their personal and official files on any computer with internet access. This technology though not a new one but associated with the inception of web, allows users to access much more efficient computing by centralized storage, memory and processing. In the libraries, cloud computing is used to build a digital library and to automate housekeeping operations using third party services, both software and hardware. Cloud computing refers to both applications delivered as a package over the internet and the systems software in the data centers that provide services. In simple words the datacenters, hardware and

systems software is what we can call a 'cloud'. A simple example of cloud computing is Yahoo mail, Gmail etc. One does not need any software or server to store them. These services are free to all users to a certain limit, beyond any extra storage capacity and advanced services available at a cost.

The origin of the term *cloud computing* is ambiguous, but it appears to originate from the practice of using drawings of stylized clouds to denote networks in diagrams of computing and communications systems. The word *cloud* is used as a metaphor for the Internet, based on the standardized use of a cloud-like shape to denote a network on telephony schematics and later to depict the Internet in computer network diagrams as an abstraction of the underlying infrastructure it represents. The cloud symbol was used to represent the Internet as early as 1994. Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically 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. Cloud computing is a web based computing where shared resources, applications and information are provided to the set of computers and other devices on demand using web technology. Therefore, the process of cloud computing is being done through set of web enabled applications loaded on the server with proper access rights.

## **2. Components of Cloud computing**

Cloud computing consists of various components. Each of these components have to be optimized for a secured and well-functioning application for cloud computing.

### **2.1 Application**

The service is often thought as the application. Although it is partly correct given the fact that it provides the functions, the application is entirely different because it is through the application that the service is realized. This is where the software developers have to focus in terms of ensuring the application will work as expected. Optimization of the application is based

on the actual coding of developers. Through extensive testing on load handling, security and functionality, the application can work as expected.

## **2.2 Platform**

In regular websites or applications that do not deal with cloud computing, the application is directly connected to the server. In cloud computing, the application is still launched to another application called the Platform. The platform usually comes as the programming language such as Ajax (Asynchronous JavaScript and XML) or Ruby on Rails.

At this point, those who opt to seek cloud computing providers will have to follow the set programming languages that could be run in the platform. Although most programming languages could be launched in different platforms, a powerful application with real time updating capability is a must for cloud computing.

## **2.3 Storage**

Everything that the application knows and the functions that could be provided by the service are possible through storage. The storage holds pertinent data and information on how they will be implemented. Optimization on storage is based on how the storage facility is protected from different attacks and the availability of back-up. Cloud Computing is always about consistency and availability of service which will naturally require the storage to be available all the time.

## **2.4 Infrastructure**

Each function, service and the ability of storage to provide the needed data is only possible through optimized infrastructure. This could be considered as the platform behind the storage as the infrastructure helps the storage deal with load problems. The infrastructure is a platform wherein it weighs the ability of the storage against the number of requests. The infrastructure has the ability to make some changes by load balancing and smooth management.

## 3. Types of Cloud Computing

### 3.1 Public cloud

This type of cloud computing is the traditional model that everyone thinks of when they envision cloud computing. In this model, vendors dynamically allocate resources (hard drive space, RAM, and processor power) on a per-user basis through web applications.

- **Unlimited access-** As long as you have internet access and a compatible device such as a smart phone or laptop computer, you can access your data anywhere.
- **Unlimited data capacity-** Public cloud computing is flexible to meet your business' growing data storage and processing needs.

### 3.2 Hybrid cloud

This model combines business' hardware with cloud computing. Generally, one of the business applications such as Exchange Server 2007 or Microsoft Dynamics will interact with a vendor-hosted service. For example: *Cisco*, traditionally recognized for networking hardware, offers IronPort Email Security as their hybrid solution and *Google*, known for hosted solution, offers Postini email archiving.

- **Hardware:** Hybrid cloud computing requires that you have or purchase hardware to interact with the hosted solution.
- **Software:** In addition to hardware requirements, business will need to have or purchase the software to manipulate and store data.

### 3.3 Private cloud

Also known as "internal cloud computing", Private cloud computing is the next generation of virtualization. While similar to virtualization at the server, workstation and application levels, private cloud computing has enhanced features that appeal to many businesses. Two examples of private cloud solutions are VMware vCloud and Citrix VDI.

- **Increased data security**-The business' are in control of security since data never leaves the network.
- **Simple compliance enforcement**- Depending upon the vertical market, government regulations may prohibit business' from using traditional or hybrid cloud computing. Private cloud computing permits to take advantage of cloud computing features while keeping all regulated data onsite and secure.
- **Customized IT network control**- By keeping the cloud private, they are free to customize their network to meet their specific business needs.

#### **4. Cloud computing in the context of Libraries**

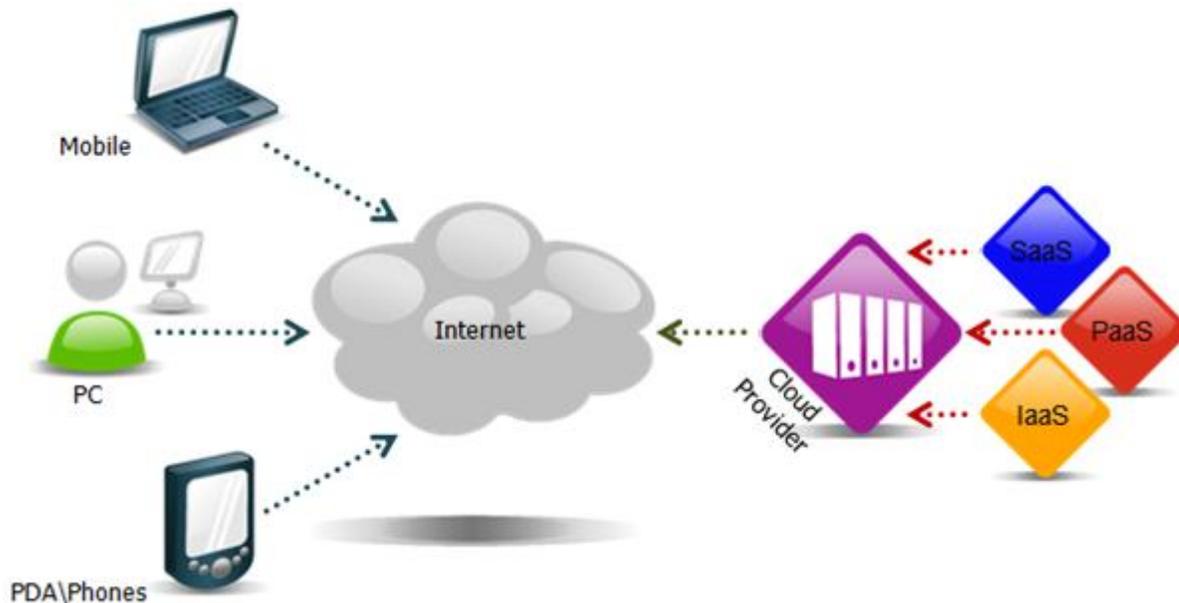
Libraries are moving towards cloud and trying to provide network based services. Moving to cloud-based services means, the library housekeeping operations, digital libraries etc., are hosted on cloud-based network. In the modern era, many libraries are using Google web technology knowingly or unknowingly to provide services. Earlier, if a person wants to create a document or spreadsheet he was using Microsoft's Office package, nowadays many libraries are processing documents, using Google web technology (Google Docs) on day-to-day basis. Use of Google apps and other similar tools in the libraries shows a radical shift from traditional to advanced technologies. Nowadays, libraries are providing good number of services to their users to access various resources and computer applications from a single platform. This is an advantage of cloud computing.

The concept of cloud computing is not much accepted in public libraries. The reason behind this is the lack of good service provider in the field of library management using advanced technology. Many libraries are thinking to adopt cloud computing but they are facing problems in relation to standardized software, administrative procedures, budget constraints, connectivity problem etc. These days, some foreign companies are providing cloud based services.

Therefore the main benefit in moving to a cloud computing environment for a library is the ability to try out new software without having to buy the hardware as well as being able to scale the computing power to meet the demand of users. A library's IT department can be more

flexible in raising the amount of cloud computing they require by contacting their vendor instead of physically having to acquire new hardware, software and manpower to meet increased demands. This method will save the library money and staff resources.

## 5. How it works



Cloud computing involves multiple cloud components that communicate with each other with the help of application interfaces, mostly web services. UNIX operating system follows the same theoretical techniques for its tasks. The task complexity is divided into all the components making balanced and manageable results.

The two most important components are the back end and the front end. The front end is the interface or the main screen that is visible to the customers and the users through which they can interact with the system. This interface can be browsed with the help of web browsers and all the applications can be used with this interface. Usually this interface is based on Graphics User Interface (GUI).

The back end involves all the components and the complete architecture and programming technique of cloud computing, that totally remains hidden from the users. Only

system knows what is going on at the back of very user request. The back end device includes Cloud server, Assistant computers, Data storage media and many connectors.

## 6. Implementation of Cloud Computing @ CSIR-NAL, Information Centre for Aerospace Science & Technology (ICAST)

In keeping up with the latest advanced technology, the Information Centre @ CSIR-NAL (ICAST) has adopted in their day to day activities, the concept of cloud computing being one of them. There are many areas adopted at the center has been ‘computed’ on the cloud.

### 6.1 Institutional Repository

NAL’s Institutional Repository is the digital archive of the research output of our scientists. This knowledge base covers journal articles, conference papers, technical reports, presentation/lectures, preprints, Thesis, images etc. One can browse the documents by author, division, subject, date and document type. Both simple and advanced search facilities have been provided. NAL scientists are welcome to submit their publications on their own by registering in NAL IR. The registered members can access and upload their publications form anywhere outside the campus using the interface installed at ICAST. IR server is hosted at NAL Campus and access is provided to their desktop/laptops. This service can be named as Private cloud computing.

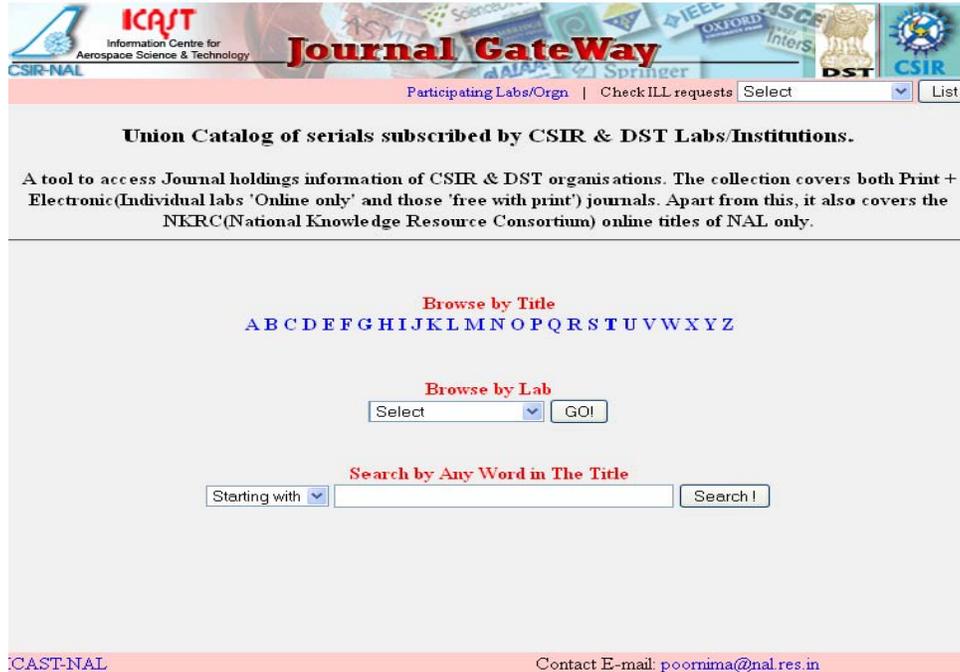
The screenshot displays the Institutional Repository @ NAL website. At the top, there is a navigation menu with links: Home, About, Browse by Year, Browse by Type, Browse by Subject, Browse by Department, Browse by Author, and Latest. Below the menu, a search bar is visible with the text "Search IR@NAL: Simple | Advanced" and a "Search" button. The main content area shows a list of recent submissions, including:

- Challappa, KR (1992) *LTA wing structure - Option 1*, Project Report. National Aerospace Laboratories, Bangalore.
- Chakravarathy, R and Anupama, - (1992) *Pilot static system*, Project Report. National Aerospace Laboratories, Bangalore.
- Madhava Rao, C and Raj Mahindra, - and Nagaraja Rao, TG (1992) *Economic study of an integrated civil aircraft development, production and overhaul programme*, Project Report. National Aerospace Laboratories, Bangalore.
- Singh, Manish K and Ramesh, V and Balakrishnan, N (2012) *An implicit scheme for a meshless Euler solver*, In: 26th National Convention of Aerospace Engineers: Expanding frontiers in aerospace technologies-challenges and opportunities, 24-25 November 2012, Hyderabad.
- Chattopadhyay, Lalitha (2012) *Analytical determination of buckling load of a delaminated plate subjected to axial compression*, International Journal of Applied Mathematics and Mechanics, 8 (16), pp. 39-51. ISSN 0973-0184
- Chidananda, MS and Jagannatha Rao, B and Venkatesh, S and Krishna Kumar, VS (1992) *Calibration of Orifice meter for the Ground AIR supply unit of STBE*, Project Report. National Aerospace Laboratories, Bangalore.
- Chattopadhyay, Lalitha and Sivarajani, T (2012) *Cohesive zone model for debond failure in plated beam using transverse shear deformation theory*, International Journal of Applied Mathematics and Mechanics, 8 (6), pp. 22-33. ISSN 0973-0184
- Khatir, AK and Sinha, NK (2011) *Aircraft Manoeuvring Design using Education Analysis and Nonlinear Control Techniques*, In: 49th AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, 4-7 January, 2011, Orlando, Florida.

At the bottom of the page, there are two footnotes: "A service from ICAST" and "IR@NAL is powered by EPrints 3".

## 6.2 Union Catalogue of Serials – CSIR & DST labs

This is a tool to access Journals holdings information of CSIR & DST organizations for the purpose of resource sharing. The collection covers both print Electronic (Individual labs ‘Online only and those free with print’) journals, Apart from this it also covers the NKRC (National Knowledge Resource Consortium) online titles of NAL only.



The screenshot shows the 'Journal Gateway' website. At the top, there are logos for ICAST (Information Centre for Aerospace Science & Technology), CSIR-NAL, and the Government of India. The main heading is 'Journal Gateway'. Below this, there is a navigation bar with 'Participating Labs/Orgn' and 'Check ILL requests' (with a 'Select' dropdown and a 'List' button). The main content area has the title 'Union Catalog of serials subscribed by CSIR & DST Labs/Institutions.' followed by a descriptive paragraph: 'A tool to access Journal holdings information of CSIR & DST organisations. The collection covers both Print + Electronic (Individual labs 'Online only' and those 'free with print') journals. Apart from this, it also covers the NKRC (National Knowledge Resource Consortium) online titles of NAL only.' Below the text, there are three search options: 'Browse by Title' with an alphabetical list 'A B C D E F G H I J K L M N O P Q R S T U V W X Y Z'; 'Browse by Lab' with a 'Select' dropdown and a 'GO!' button; and 'Search by Any Word in The Title' with a 'Starting with' dropdown, a search input field, and a 'Search!' button. The footer contains 'ICAST-NAL' and 'Contact E-mail: poornima@nal.res.in'.

## 6.3 EZproxy

This is a tool for accessing the held e-resources at the center to authenticated users from outside NAL-ICAST. This allows library patrons outside the 3 campus of NAL from any corner in the world. This tool allows to download the required documents like journals articles, conference papers, e-books, standards, patents, presentations, publications etc

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**Welcome to Information Centre for Aerospace Science and Technology**

Off-Campus access to e-Resources.

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Please enter your username:   
Please enter your password:

## 6. Conclusion

Libraries face mounting challenges in managing the assets of their collection and maintaining or improving service levels to patrons. For the past two decades, libraries have reached out their services to its patrons, initially offering physical forms to adding multimedia items at an advanced level through electronic media. In recent years, impact of cloud computing technology has been tremendous on the library and information centers and the developments are for all to witness. Libraries have been one of the first institutions to be affected by the Information and Communication Technology (ICT) developments and these developments have been exploited effectively to render various information services. Right from the days of designing databases to entering and retrieving records from the database, it has been exciting times for all library professionals. Just when it was time to rejoice the fruits of creating and using local databases on desktops, the communication revolution made its arrival.

The cloud computing is lately emerging technology. The basic principle of cloud computing entails the reduction of in-house data centers and the delegation of a portion or all of the Information Technology infrastructure capability to a third party. Universities and Colleges are the core of innovation through their advanced research and development. Subsequently, Higher Institutions may benefit greatly by harnessing the power of cloud computing, including cost cutting as well as all the above types of cloud services. The libraries which do not have sufficient budget to acquire high-end technology with proper hardware and software can choose cloud. To cope up with the new technological innovation in the field one needs to know and explore cloud computing. In future, the advantages of this technology may increase its usability, which will relieve libraries and its professionals from the hardships in maintaining the servers, software and manpower.

## 7. Reference

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2. Cloud computing strategies by Chorafas, Dimitris N, CRC Press, London, 2011.
3. ICAST handout
4. Wikipedia. Cloud Computing <http://en.wikipedia.org/wiki/cloud-computing>
5. Google App Engine. <http://code.google.com/appengine>.