

DOES CLOUD COMPUTING SOLVE THE PROBLEMS OF THE LIBRARY AND INFORMATION CENTRES?

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ABSTRACT

The expected outcome of this article is to enable the System Planners, System Analysts, Managers, Technologists and Librarians to identify the advantages and disadvantages of cloud-based solutions for their libraries. This article explains in detail about the Concept of Cloud Computing and the areas where we can use the Cloud Computing in the Library and Information Centres. The services, deployment models and strategies, the method of deployment, service delivery are explained here. This article strives to represent to promote the current progress and future trends of cloud computing and its impact on Libraries and Information Centres by providing a reference for further research.

Keywords: 1. Cloud Computing in Libraries, 2. Cloud Computing in Information Centres, 3. Cloud Computing Services, 4. Advantages and Disadvantages with Cloud computing, 5. New trends in cloud computing.

1. INTRODUCTION

The growth of business applications has led to the creation of large quantity of information/data. All of the IT Tools and Resources which are available have been developed based on certain assumptions or in connection with specific business and these cannot be reconfigured for best possible usage in other functions.

The new initiatives and actual demands could not be met in many of the organisations due to allocation of substantive or in fact lion share of budget towards the maintenance and operations, resulting to the rising costs. Such organisations included the Library and Information Centres, which are not flexible and dynamic, led to the decrease in their productivity.

This problem can be addressed by pooling and sharing of resources i.e., converged infrastructure. This converged infrastructure is a pool of virtualized servers, storage places and networking capacity, which will be shared by different applications from different locations either local or

remote. The Library and Information Centres should thus focus on the potential of cloud computing technology which is capable of providing optimal design and plan in providing the best information services.

2. CONVERGED INFRASTRUCTURE

Converged Infrastructure packages include various and multiple components of information technology (IT) into a single optimized computing solution. Various Components of a converged infrastructure solution includes servers, data storage devices, networking equipment and software for IT infrastructure management, automation and orchestration.

Converged infrastructure is specifically used to centralize the management of IT resources, consolidate systems, increase resource utilization rates, and maintain lower costs. These objectives are achieved by the creation of pools of computers, storage devices and networking resources. These resources are made available to multiple applications and are managed in a collective way using certain policies and procedures. Converged infrastructure is also sometimes referred as unified computing, fabric-based computing, and dynamic infrastructure.

Some of the examples of vendors providing Converged Infrastructure are:

- (i) VCE (formed by Cisco, EMC, VMware and Intel) builds converged infrastructure platforms which are made primarily of components from the parent companies
- (ii) HP and IBM offer converged infrastructure solutions comprised primarily from their own proprietary components,
- (iii) Dell's converged infrastructure solution is providing support for heterogeneous compute environments.
- (iv) NetApp and Cisco offers a joint converged infrastructure solution based on published designs called FlexPod.

2.1 Benefits of Converged Infrastructure

Converged infrastructure provides both technical and business efficiencies. The converged infrastructures, combining server, storage, and networks into a single framework, will help the Library and Information Centres (LICs) to achieve economy, transform them to build new infrastructures and to enable them to become "cloud-ready". The storage and computer put together into a single entity is known as Converged Storage.

The pre-integrated hardware reduces the complexity in its use, its virtualization and automation management tools of a converged infrastructure which makes an important value proposition for the LICs.

The two long-term advantages of a unified data center infrastructure are:

- (i) Lower costs as the result of the following:
 - a) lower capital expenses resulting from higher utilization, less cabling, and fewer network connections

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- b) lower operating costs resulting from reduced labor via automated data center management and a consolidating storage and network management infrastructure teams

(ii) Increased IT agility by:

- a) Virtualizing IP and Fibre Channel storage networking
- b) Allowing for single console management

The Capital and space constraints are making the LICs to rethink on their strategies. The only solution to this is the converged infrastructure.

3. CLOUD COMPUTING

The advancement of technologies in the area of virtualization, distributed computing and access to high speed Internet facility has led to the emergence of concept of “Cloud Computing”.

Cloud computing is a marketing term used by third party technological providers to describe a utility package that delivers computing as a service rather than as a product. Shared resources, software applications, data access/retrieval and information storage, etc., are provided to networked computers without the user knowing the location or architecture of the computing infrastructure. Users may pay for a standardized set of technologies common to all business users or pay for more capabilities.

Recent problems within the global economy have further encouraged companies to look for more efficient ways to manage their organizations. They have signed up for pay-as-you-go models to access Information services via the Cloud.

Services provided through the cloud not only help companies to have access to technologies that they are unable to maintain by themselves, but also they may have a strategic advantage by under-cutting sunk costs of companies tied to existing architectures and older technologies. By using cloud computing, organizations share costs with other participants in the network.

Cloud computing offers an affordable solution to Library and Information Centres. The cloud technology blurs organizational boundaries. The future of cloud computing grows while the prices of iPhones and mobile devices continue to drop.

And at the same time, mobile devices have become more powerful, have more storage and graphics possibilities. In a study published by Allied Business Intelligence, Inc. (ABI), it was said that cloud services will support more data services.

Cloud Computing is a process where the data and applications are stored, accessed, and shared on the network. The Web Services and Application Programming Interface (API) are designed and developed to support interoperable machine-to-machine interaction; and specifications for allowing the programs to exchange data, over a network. The services are hosted on the internet and are delivered.

Cloud computing doesn't yet have a standard definition, but a good working description of it is to say that clouds, or clusters of distributed computers, provide on-demand resources and services over a network, usually the Internet, with the scale and reliability of a data center.

According to National Institute of Standards and Technology, Information Technology Laboratory, 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. (Mell, P. and Grance, T. 2009)

In his Book, *The Big Switch: Rewiring the World, from Edison to Google*, Carr has argued that computing will also follow the path of electricity which he rightly called “Utility Computing”. The examples mentioned by him are Amazon’s EC2 (Elastic Computing Cloud), and S3 (Simple Storage Services).

This type of providing services is different from the traditional services which are provided by hosting on the local servers. This can be better explained with the help of its very distinct characteristics. This is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources such as networks, servers, storage devices, applications, and services. All these are provided quickly and with least management effort or lesser interaction with those service providers. The ultimate objective of the cloud computing is to provide easy, scalable access to computing resources and Web based IT services. This is typically done on a pay-per-use or charge-per-use basis.

A cloud infrastructure is nothing but the collection of hardware and software which imbibe all the distinct and essential characteristics of cloud computing. The cloud infrastructure will have both a physical layer and abstraction layer. The physical layer consists of all the hardware resources necessary for the cloud computing (eg. Server, storage, and network components) and the abstraction layer contains the software deployed over the physical layer which manifests the essential characteristics of cloud computing. The five distinct characteristics of cloud computing are:

- Service provided on Demand
- Access to High speed Broad Band network
- Pooling of all the Resources
- Quick & Flexible
- Metered service



Fig 1 Cloud Computing Services

In flowcharts the network of computers and other utilities is being represented by using a cloud symbol and may be this is the reason for giving the term cloud computing. A cloud can be of two types (i) Public and (ii) Private.

Flow Charts Example

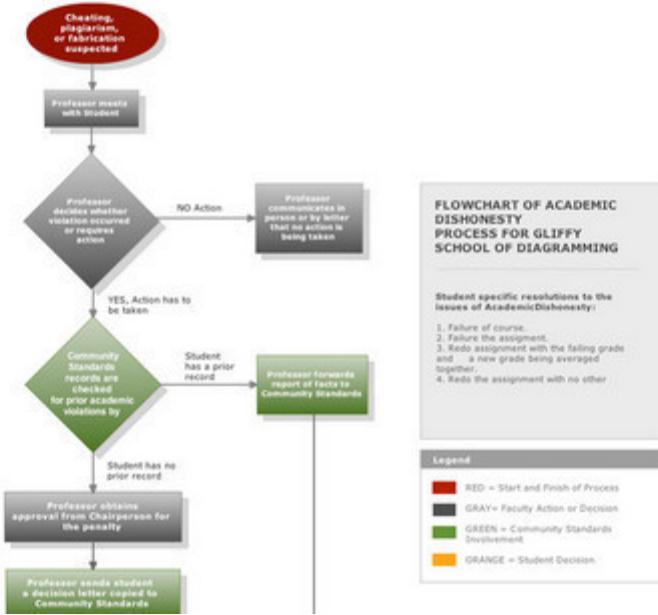


Fig 2: flowchart the network of computers



Fig 3: Public Cloud

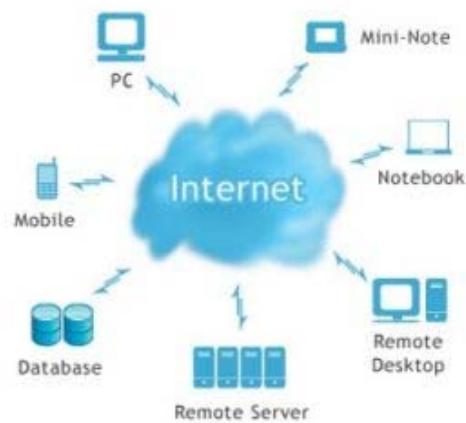


Fig 4: Private Cloud

3.1 Public Cloud:

A public cloud is one where the cloud infrastructure is made available free or on a pay-per-usage mode to the general public over the internet by the service provider.

The advantages of a public cloud service are:

- Easy to Setup
- Inexpensive as all the cloud infrastructure are covered by the provider
- Scalability according to the needs
- Optimum utility i.e., Wastage of resources is not there as we pay for what we use only

Some of the examples of public clouds are: Amazon Elastic Compute Cloud (EC2), IBM's Blue Cloud, Sun Cloud, Google AppEngine and Windows Azure Services Platform, Animoto, flightcaster, NY Times

3.2 Private Cloud:

A Private Cloud is a proprietary network of an Organisation which is managed and operated by itself or the Organisation which it serves or a combination of them. This can be located on or offsite. The organization provides hosted services exclusively to a single organization or to a limited number of consumers.

If a service provider uses the resources of a public cloud and created its own private cloud, then this is called a virtual private cloud.

Private cloud is also sometimes called as internal cloud or corporate cloud. The organization which wants or needs more control over their data uses Private cloud approach.

3.3 VARIOUS OTHER TYPES OF CLOUDS

3.3.1 Hybrid cloud

It is a composition of two or more distinct cloud infrastructures may be public, private or community cloud having a unique identity but are bounded by standardized or proprietary technology, which enable application interoperability and data portability. In simple words, a cloud consisting of at least one private cloud and public cloud is called as hybrid cloud.

A hybrid cloud can be provided in two ways:

- (i) A vendor with a private cloud forming a partnership with a public cloud provider,
or
- (ii) A public cloud provider forming a partnership with a vendor that provides private
cloud platforms

It is an environment wherein an organization provides and manages some resources internally and has others provided externally. Hybrid cloud is the business where scalability and cost-

effectiveness is provided by a public cloud twined with private cloud and where no exposure is given to critical data and also avoiding vulnerabilities from the third party. The hybrid cloud is maintained by both internal and external providers. This type of hybrid cloud is sometimes called as hybrid IT.

Eg. An organization using Amazon Simple Storage Service (Amazon S3) a public cloud service provider for archived data and continues to have in-house storage for operational customer data.

3.3.2 Federated cloud (Cloud Federation)

A federated cloud (also called as cloud federation) is the deployment and management of multiple external and internal cloud computing services according to the requirements of the business that perform a common action.

4. BUSINESS MODELS OF CLOUD COMPUTING SERVICES

The services are broadly divided into three different types: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).

4.1 Infrastructure-as-a-Service: In this type of service the consumer is provided with processing capabilities, storage, networks and other fundamental computing resources. The consumer is given provision to access and run software (including operating system) and applications. This “pay for what you consumed” service is like utility computing.

Ex: Amazon Web Services provides virtual server instance API to start, stop, and access and configure their virtual servers and storage.

4.2 Platform-as-a-Service (PaaS): A set of software and product development tools are hosted on the provider's infrastructure and the developers are allowed to create using programming languages, libraries, services and other tools. This type of service is called as Platform-as-a-service (PaaS) in the cloud. The providers may use APIs, website portals or gateway software which is installed on the customer's computer.

Ex: Force.com and GoogleApps

There are no standards for interoperability or data portability in the cloud. A few providers are not allowing the software created by their customers to be moved off the provider's platform.

4.3 Software-as-a-Service: The vendor supplies the hardware infrastructure, the software product and interacts with the user through a front-end portal. This kind of services in the cloud are called as Software as a Service (SaaS). The Services such as providing Web-based email, inventory control, database processing etc. comes under this type of service where in the provider hosts both the application and the data on the server and the

consumer is free to use the service either from the same place or remotely. This has a wide range of business opportunities in the market.

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. (Mell e Grance).

5. CONVERGED INFRASTRUCTURE AND CLOUD COMPUTING

The characteristics of a converged infrastructure such as ability to pool IT resources, to automate resource provisioning are well suited to implement cloud computing. Converged infrastructure can serve as an enabling platform for private and public cloud computing services, including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Landscape as a Service (LaaS) and Software as a Service (SaaS) offerings.

Several characteristics make converged infrastructure well suited to cloud deployments. These include the ability to pool IT resources, to automate resource provisioning, quick scalability to meet the needs of dynamic computing workloads.

The Library and Information Centres should focus on the potential of cloud computing technology which is capable of providing optimal design and plan in providing the best information services.

6. UTILITY STORAGE

Utility storage is a service model wherein storage capacity is made available to the customer or an organization on pay-per-use basis by the provider. The utility model is also referred as metered services or *storage on demand*. The resources are utilized efficiently and optimally here making it cost effective for an organisation.

These utility storage services are provided to the customers in three different ways. They are:

- (i) The vendor provides the required and necessary storage capacities when the customer requests for extra storage during the peak periods and the amount is charged for this extra usage.
- (ii) The internal storage resources of an organization are pooled at one place and these storage capacities are allocated to the departments where there is requirement.
- (iii) The utility storage service is also provided by offsite Storage Service Providers (SSPs). Based on lease arrangements with Service Level Agreements these provide guaranteed Quality of Service (QoS) to the customers. Many companies are using these for their off-site backup replacing or augmenting onsite data storage. This is referred to as *Storage as a Service (SaaS)*

7. CLOUD STORAGE SLA (SERVICE LEVEL AGREEMENT)

A cloud storage SLA is a Service-Level Agreement between a cloud storage service provider and a customer who specifies details of the required services in quantifiable terms.

This type of SLA details includes:

- maximum amount of time a read request can be taken,
- percentage of uptime
- number of retries
- compensation for users or alternate course of action if the agreement is not completely met and so on.

Usually these storage services are provided on a credit plan based on the disagreement between SLA specifications and the actual service levels delivered to the customers.

The Service Level details for all the users of public cloud storage services usually will be same. There might be some changes in the case of an enterprise which would like to establishing service with a private cloud storage provider and it will be able to negotiate a more customized deal. This type of SLA specifications might include the retention policies, the number of copies going to be retained, storage locations etc.

Before entering into SLA the specifications are to be read carefully and closely and examine ramifications.

8. IMPLEMENTATION OF THE CLOUD COMPUTING TECHNOLOGY IN LIBRARY AND INFORMATION CENTRES

The popular Web 2.0 services have made greater impact over the past few years (e.g. Gmail, Wikipedia, Flickr or Twitter) on the Library and Information Centres. Most of these applications which are hosted in the large online data centers are the hallmark of cloud computing.

A computing cloud is a communally-shared resource which can be given for lease on a metered basis, paying for as little or as much as we need, when needed. For Eg. The Bandwidth of a Library Website is automatically increased and other resources are made available only when the web traffic is at its peak otherwise it will be normal. The payment to be made will be according to the usage.

Cloud Computing is the emerging concept in Library and Information Centres in our country. At present there is no Library and Information Centre in India which has implemented or implementing the Cloud computing technology in their organizations.

8.1 Need for implementation of cloud computing in LICs

Implementation of Cloud Computing is essential to modernize the LICs. As already discussed the opportunities provided by the Cloud Computing are enormous and particularly for the LICs they are essential and meaningful. The affordability, efficiency, savings and cooperation are the buzz words of this concept which are apt to the LICs. The scalability and elastic nature of this concept will be the greatest advantage in providing effective services to the massive user community of LICs.

The advances in Information Technology has made it possible for the library community to move the data into a more cohesive whole in a cloud environment and in bringing rapid changes in the provision of information services in the future. The librarians should identify the uses the cloud computing offers, consider these advantages and implement this according to the needs of the LICs.

8.2. IMPACTS OF CLOUD COMPUTING IN THE LIBRARY AND INFORMATION CENTRES

8.2.1 Reduced Economy

Running the Library and Information Centres is becoming harder every year because of decrease in the allocation of substantive budget from the state. The increased cost in acquisition of new infrastructure, maintenance of servers periodically has become burden to the LICs. Even if the LICs are going ahead with the heavy expenditure they are not being used to their optimum levels. Cloud computing offers price savings due to economies of scale and the fact that we only pay for the resources what we actually use.

8.2.2 Scalability

LICs now need not worry in allocating their limited server resources between the OPAC's overflow traffic and a new web application. The scalability factor of the cloud computing will enable the cloud to expand and shrink as traffic rises and drops during the peak hours and non peak hours respectively. The Creation and configuration of new virtual server instances is also very easy and fast in the cloud.

8.2.3 Innovation and Skill Improvement in Librarians

The librarians have to manage complex projects and evaluate competing vendors on a variety of criteria. The data security is primary concern while managing a significant chunk of your online data and IT infrastructure. The IT Experts should write algorithms, standards to help data binding, enforceable agreements that hold vendors with regards to reliability and security of their services according to the terms and conditions specified. Cloud computing helps the Librarians and employees to become well-formed employees with advanced decision-making skills.

8.2.4 Cloud OPAC's and Cloud ILS

Many vendors of Integrated Library System (ILS) are now-a-days offering cloud-hosted versions of their products. OCLC started offering a cloud-based ILS tools that complement their existing cataloging tools (e.g. WorldCat and FirstSearch).

8.2.5 Tag Cloud

A tag is a user-supplied keyword (free tags) to identify the list or collection. A tag cloud is different than the traditional way of displaying a vertically arranged list. It is called a TAG Cloud not a SUBJECT HEADING cloud. The difference is that tags are created and applied when the item being tagged is examined. The subject heading involves the selection of a term from an authorized list of static controlled vocabulary. Eg. Library of Congress Subject Headings

Free tagging should be allowed by taking actual users perception towards the collection. OPACs out there that have some form of free tagging functionality built in. The appropriateness of the display should be determined by the nature of the information need or question the user demands of the system.

There should be enough tags added to the system to make the display meaningful. The emphasis should always be on the users' needs and anticipating the information seeking behaviours while designing the OPAC.

8.2.6 Private clouds, Hybrid clouds and Community Clouds for the LICs

With the help of Cloud Computing the Libraries in our country may soon be building and managing their own data centers. In addition to the advantages the cloud computing offers, there are significant fears, doubts and Industry Challenges. The security, privacy and reliability concerns made 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 (Eg. Amazon or Rackspace) whenever required. This hybrid model would let libraries maintain more control over the applications and data stores that contain sensitive, private information about patrons. Moreover, libraries can continually adjust and fine-tune the balance between the tight control of a private IT infrastructure, and the flexibility and savings of cloud-hosted infrastructure.

A community cloud is the best solution if Libraries would like to build and manage their own collection. This also addresses the security and privacy fears among the LICs. Eg. Google is planning to launch a government-only cloud this year to address government concerns about security and privacy.

Just as libraries presently cooperate with one another in buying IT equipment, bandwidth and the services of IT professionals, they may soon cooperate in the building and management of data.

A group of libraries may come forward and might build a Library cloud with vendors such as Google, Amazon, Microsoft. Eg. OCLC or SirsiDynix might build library-centric cloud services on top of cloud infrastructure leased from one of the more established players.

8.2.7 Cloud Computing and Digital Libraries

The growth in the size of information, security concerns in the storage of data, mobility and availability, were the issues of concern for the librarians before the Digital Libraries. The emergence of Digital Libraries has made the life of Librarians easy.

The Digital Libraries provide highest grade of information services but they also pose certain limitations. The sharing of resources scattered and isolated in the region, making balanced and optimum use of these by satisfying massive demand is becoming a difficult task. There has been an enormous increase in the daily requirements of a digital library. Due to uneven economic conditions and lack of teaching focus in different regions there is lesser utilization of resources and inadequate use of database resources. Being the Libraries having meager funds the optimum utilization of the infrastructure and other resources is needed urgently for effective realization of the mission of the LICs.

The cloud computing answers to all the problems faced by the digital libraries. All the deployment models can be applied to the LICs. It can be software, platform or infrastructure model. Having own Infrastructure or software is costly and the LICs cannot afford, the cloud computing comes to the rescue. The LICs need not purchase the software. The software can be hired and used as per the requirement and paid to the utility. There will not be much requirement for the daily users with regard to the specific software or networking infrastructure, purchasing is not recommended.

The platform can be used for developing many user oriented applications, putting them in the cloud and providing permissions to access through internet to the users. By implementing cloud computing the cost is getting decreased and greater efficiency is achieved.

8.2.8 Permissions

The data is well protected in the cloud platform and set of rules can be defined for providing access to the users. The control over the data transfer over the network, data modification and data access can be achieved fully by restricting the illegal users. The users can be located remotely and can be given right to access the data over the network and they can be charged for their utilization. The data which is located remotely on the other server can be accessed by the LIC as a mediator and is provided to the user clientele. The LICs need not have the data always with them thereby they are reducing the server capacities and improving server capabilities by increasing the speed with which the reliable, authentic and updated information is provided.

8.2.9 Current Awareness & Selective Dissemination of Information Services

The Libraries need not have all the latest information resources. A network of libraries is created with a public cloud (atleast University Libraries) where the latest information is put for consumption of member libraries for their user clientele. The information can be analysed and

updated regularly at one place. This reduces the cost of manpower, duplication of efforts and improved sharing of resources.

Information can be provided to the users through Bulletin Board Service and Email Service within a short period of time. The communication can be reached to many users simultaneously saving the valuable time of the users. The information can be either text based or graphic based multimedia message.

8.2.10 Access to the resources

The integration of resources among the libraries and providing services through distributed uniform access platform can be achieved with cloud computing. The information retrieval through OPAC and Inter Library Loan services can sometimes be not fully satisfactory. This can be obtained through cloud computing technique. The reference service, advises of the experts can be provided to the users with great convenience. A shared public cloud will have infinite storage capacity and computing power which enhances the productivity and capabilities of providing information services. The users need not visit the libraries regularly. They can search for information from a terminal located in their place. The terminals can be a PC, a Mobile or any other electronic equipment which can be utilized for storage as well as information dissemination.

The Librarians need not have the full knowledge of IT and other hardware equipment. The LICs can choose the deployment models of the cloud computing as per their requirement and their needs. The economy and productivity can be greatly achieved using cloud computing.

The shared online computing resources are the fundamental common component that most modern networked applications and communities run on the same basic mix of IT infrastructure. The flexibility and scalability of cloud computing means that virtual clouds can form and dissipate as often as real clouds, depending on the interests and demands of end users.

9. A SURVEY ON USE OF CLOUD COMPUTING IN LIBRARY AND INFORMATION CENTRES AROUND THE WORLD

A survey was conducted by *Allied Business Intelligence, Inc. USA* on Use of Cloud Computing among the selected 72 academic, public and special libraries predominantly from the USA, Canada, Australia and the UK. The survey examined closely how academic, public and special libraries are using cloud computing services. The questions were mainly on the use of cloud services, security issues, overall cost, impact on IT staff, data reliability, Use of specific services from Amazon, Google, Rackspace, DuraCloud, DropBox and many other issues.

In the survey it was found that:

- 22.54% of libraries sample use paid subscription software as a cloud computing service, including just 13.64% of libraries outside the United States.
- Major cloud computing services have been used for hosting and/or distributing special collections by 2.82% of libraries in the sample.

- 63.04% of libraries categorize Google as trustworthy and 8.7% as highly trustworthy. The remaining 28.26% say that Google is usually trustworthy and none consider it untrustworthy.
- 66.67% of libraries agree that, while data and file losses are possible with major cloud computing services, these losses would not be any worse than those occurring with traditional storage systems.
- Less than 3% of libraries currently use platforms as a service (PaaS), which enable end users to build their own applications online.
- 2.82% of libraries are considering using Rackspace in the future, including 5.56% of public libraries and 2.44% of academic libraries.
- 15.38% of libraries with budgets between \$750,000 and \$5,000,000 use server space rented from cloud computing services,
- 16.9% of libraries have adopted Google Apps as their default means of word processing.

This survey finding can help the librarians and the staff to know where to implement cloud computing technology, the experience of the libraries which are using and how much impact will it be on the Library budget.

10. BEST PRACTICES AND STRATEGIES TO BE ADOPTED

To Summarize the following best practices are to be adopted by Libraries and Information for getting optimum benefits.

10.1 Data Security

Data should always be encrypted for data security and privacy. There should be clear understanding in the dynamics of the structure, form, evolution of workflows, flow of data, file location and application input and output. The LICs should have complete hold on the key process control flows, execution and performance. The Librarians should have sound knowledge on the System information, Operating system, compilers, versions and Load libraries and total cost of the ownership. There should be regular monitoring and reporting about the traffic to restrict moving of data to unauthorized clouds.

The key risks includes Geographical dislocation of data, Multi-tenancy & self-provisioning, Hackers and Potential for malicious co-tenants to hack into our instance. Necessary firewalls to be installed and algorithms are to be written for protection from the above risks.

10.2 User Orientation

Proper training to be imparted to the users on the functionality and awareness should be created among them.

10.3 Audit Policies and guidelines

The Annual Risk Assessment of all the Cloud vendors should be done and registry is updated accordingly. While designing, the LICs have to work with CSPs (Cloud Service Providers) and implement SOC2/3 (Service Organisation Control) assurance reports based on ENISA Cloud Computing Information Assurance Framework or equivalent. Regular auditing of the cloud should be taken up.

10.4 Shared Assessments program

The Shared Assessments Program was originally developed by Bank of America Corporation, The Bank of New York Mellon Corporation, Citi Group, Inc, JPMorgan Chase & Company, U.S. Bankcorp, and Wells Fargo & Co., Inc. in collaboration with leading service providers and the Big 4 accounting firms to promote adoption of their standards. Shared Assessments was created to inject standardization, consistency, speed, efficiency and cost savings into the vendor risk assessment process. Through membership in the Shared Assessments Member Forum and use of the Shared Assessments Tools (the Agreed Upon Procedures and the Standard Information Gathering questionnaire), Shared Assessments eliminates redundancies and creates efficiencies, giving all parties a faster, more efficient and less costly means of conducting rigorous and comprehensive risk, security, privacy and business continuity assessments.

The Shared Assessments Tools are reviewed annually by Shared Assessments members and updated for consistency with evolving risk, security, privacy and business continuity standards.

A dynamic assurance product/ service relevant and proportional to nature and extent of use of CSP products/ services have to be developed. These probably require that audit firms strengthen their technical IT audit capability.

11. OTHER FACTORS

The policy pertaining to the Infrastructure and policy for multiple providers and application should be consistent. Both providers and users should have provisions for software management, technology adoption & implementation, design of optimal rules for adoption. The Government policy & regulation, audit policy, security standards, risk assessment, forensics, & evidence gathering are important factors while going for cloud computing in the LICs.

12. COMMON ASSURANCE MATURITY MODEL (CAMM)

The Common Assurance Maturity Model (CAMM) is a business assurance barometer which gives an assurance oriented model provisioning clear, concise and standardized results. The main objective of this model is to provide a framework in support of necessary transparency attesting the Information Assurance Maturity of a Third Party Providers & Suppliers such as Cloud providers. It Publishes results in an open and transparent manner, without the mandatory need for third party audit functions, or due diligence engagements. It allows for data processors to demonstratively publicise their attention to Information Assurance in comparison to other supplier's levels of compliance, and security profiles. It negates the operational requirement for

time consuming, expensive, subjective, and resource intensive bespoke arrangements to attest security and compliance.

The CAMM utilises existing standards such as ISO 27001, ISO 27002, BS 25999, CobIT, PCI-DSS etc, to develop a series of control questions specific to the organization and publishes its responses to such questions.

13. CONCLUSION

The Websites of all the Library and Information Centres should be simple, easy to browse and should have all the information sources which the user needs frequently. The cataloging services in the present library systems are silos and are not very user friendly.

Cloud computing can be financially advantageous for libraries as you pay for what you use and spend significantly less for local IT services and software. Eg. Salesforce.com can be adapted to libraries.

The following are some of the advantages of Cloud Computing:

- Quick and easy Introduction of desired functionality into the system
- High Potential for Cost Reduction
- Moving expenses from Operational Expenses to Capital Expenses
- Reduced maintenance costs, especially SaaS
- More efficient use of computing resources

The following are some of the disadvantages in Cloud Computing:

- High risk in provisioning public clouds
- The key risks includes
 - Geographic dislocation of data
 - Multi-tenancy & self-provisioning
 - Hackers
 - Potential for malicious co-tenants to hack into our instance

The changing behavior of information seekers to cloud computing and the changing nature of the collections to electronic make this a natural progression. Moving to the cloud can reduce infrastructure costs of a library from 70-30 percent of budget, giving the staff more time for creativeness and novelty.

The possibility of service interruption can also be there due to power outages. There are several factors which might slow the transition from traditional to cloud computing including the open source software for library management systems, which is basically a different business model for the same technology already being used.

Basically, the Libraries do not have the knowledge base for selecting, implementing and managing these services. Every stakeholder has to take steps towards cloud computing, such as by using Google Docs.

OCLC's Web-Scale Management Services is recommended for the IT librarians who are seriously thinking about implementing cloud computing.

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