

CLOUD COMPUTING TECHNOLOGY (CCT): A NEW OPPORTUNITY FOR LIBRARY SERVICES

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ABSTRACT

Cloud computing is a new technology model for IT services which many business and organizations are adopting. It allows them to avoid locally hosting multiple servers and equipment and constantly dealing with hardware failure, software installs, upgrades and compatibility issues. In simple terms, cloud computing entails running computer/network applications that are on other people's servers using a simple user interface or application format.

Cloud computing can transform the way systems are built and services delivered, providing organizations with an opportunity to extend their impact. This paper defines Cloud Computing and reveals how it is different and secure from other types of computing. The purpose of this article is to look specifically at how Cloud Computing can be employed by Librarians and what needs to be considered before moving into a Cloud Computing solution. It also discusses how Cloud Computing solutions could be beneficial to libraries in three basic areas: technology, data and community.

Keywords: Cloud computing, Library cloud, Cloud security, Cloud technology

INTRODUCTION

Cloud computing is a latest buzz all around with respect to web technologies and services. As web 2.0, this phrase is also being defined differently but the basic idea is almost same. In which users are getting web services on free or priced manner from service providers located at remote places. Cloud computing seems to be a new phrase but looking into the concept, we all have been using it since quite a long., e.g. email services of yahoo, google, sify or others, YouTube and, Google Docs etc. are embedded with the 'cloud computing'. These services are free and we have also been putting important information on our email IDs, youtube, flicker, and now few social networks (facebook etc.)

where we have been sharing or shifting our personal information or data in different formats on the web. All these servers holding our information on the web can be metaphorically treated as clouds.

Practically, this is what cloud computing is all about – using other people's servers to run applications for our organization, remotely. For example, with cloud computing, we can run all our computer networks and programs as a whole without ever buying an extra piece of hardware or software.

It refers to a computing environment where there are little data and applications at the End User (EU) terminal. All the data and the applications that process the data reside on remote servers which can

be accessed (securely) by the EU. All the data and applications can be imagined to be residing in a cloud; hence the name – **Cloud Computing**.

Cloud-based services go far beyond delivering software. They offer a solution that's more flexible, scalable and available. And the combination of software, knowledge and work drives improved results for all providers and all organizations on the network. It's time to get on the cloud or be left behind.

AREAS OF CLOUD COMPUTING

Cloud computing is again still searching for an established definition but as of now it means using web services of others to satisfy users' computing needs, like – software applications, data storage and using different platforms to build needed applications. On basis of this cloud computing can broadly be divided in following segments:

- **Communication-as-a-Service (“Caas”)** allows for certain messaging tools such as-
 - Voice over IP (“VoIP”), Instant Messaging (“IM”), and video conferencing.
- **Infrastructure as a Service (“IaaS”)** is the delivery of computer infrastructure as a service that allows the customer to maintain owner and management of their application(s) while off-loading infrastructure management to the IaaS provider.
- **Monitoring as a Service (“Maas”)** is the outsourcing of security services to a third party security team.
- **Platform-as-a-Service (“PaaS”)** is an application delivery model that is independent from the specific operation system it is running on it is meant to be only a web-based development infrastructure.

- **Software-as-a-Service (“SaaS”)** is typically when a software vendor supplies software over a network as opposed to the typical distribution of installation on individual computers. For example- various open source solutions such as the Apache web server, database software such as MySQL and PostgreSQL, and virtualization software such as VMWare and Xen. Sun xVM VirtualBox, available free of charge, can virtualize software on a computer.

ADVANTAGES OF CLOUD COMPUTING

If used properly and to the extent necessary, working with data in the cloud can vastly benefit all types of businesses. Mentioned below are some of the advantages of this technology:

First, organization can save a lot of money; second, they are able to avoid the mishaps of the regular server protocols. *For instance*, when a company decides to have a new piece of software, whose license can only be used once and it's pretty expensive, they wouldn't have to buy software for each new computer that is added to the network. Instead, they could use the application installed on a virtual server somewhere and share, in the 'cloud'.

Cloud Computing is very ideal for any library because of the following points as -

- **Cost Efficient** : Cloud computing is probably the most cost efficient method to use, maintain and upgrade. Traditional desktop software costs library a lot in terms of finance. Adding up the licensing fees for multiple users can prove to be very expensive for the establishment. The cloud, on the other hand, is available at much cheaper rates and hence, can significantly lower the Establishment's IT expenses. Besides, there are many one-time-payments, pay-as-you-go and other scalable

options available, which make it very reasonable for library.

- **Almost Unlimited Storage:** Storing information in the cloud gives almost unlimited storage capacity. Hence, library will have no need to worry about running out of storage space or increasing its current storage space availability.
- **Backup and Recovery :** Since all library data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device. Furthermore, most cloud service providers are usually competent enough to handle recovery of information. Hence, this makes the entire process of backup and recovery much simpler than other traditional methods of data storage.
- **Automatic Software Integration:** In the cloud, software integration is usually something that occurs automatically. This means that library does not need to take additional efforts to customize and integrate their applications as per their preferences. This aspect usually takes care of itself. Not only that, cloud computing allows the library to customize their options with great ease.
- **Easy Access to Information :** Once library register itself in the cloud, it can access the information from anywhere, where there is an Internet connection. This convenient feature lets the Establishment move beyond time zone and geographic location issues.
- **Quick Deployment :** Lastly and most importantly, cloud computing gives library the advantage of quick deployment. Once it opts for this method of functioning, their entire system can be fully functional in a matter of a few minutes.
- **High Availability :** Most cloud based services implement Continuity and DR (Disaster Recovery) solutions that back up

the user data. This means that even if the primary server is down, or is brought down for maintenance, the backup system still serves the end users. Also, it is safe to assume that most cloud based services are run from world class Datacenters, thus minimizing the risk for any kind of downtime in the first place.

- **No need for an Antivirus :** As the data resides on service providers they implement security solutions to protect the data.

DISADVANTAGES OF CLOUD COMPUTING

In spite of its many benefits, cloud computing too has its pros and cons. While the technology can prove to be a great asset to any organization, it could also cause harm if not understood and used properly. Library need to be aware of these cons before going in for this technology. The Risks Involved in Cloud Computing are --

- **Technical Issues :** Though it is true that information and data on the cloud can be accessed anytime and from anywhere at all, there are times when this system can have some serious dysfunction. Library should be aware of the fact that this technology is always prone to outages and other technical issues. Even the best cloud service providers run into this kind of trouble, in spite of keeping up high standards of maintenance. Besides, library will need a very good Internet connection to be logged onto the server at all times. It will invariably be stuck in case of network and connectivity problems.
- **Security in the Cloud :** Before adopting this technology, library should know that it will be surrendering all its sensitive information and resources to a third-party cloud service provider. This could potentially put the library to great risk. Hence, library need to

make absolutely sure that it chooses the most reliable service provider, who will keep its information totally secure.

For instance, from Sony to Google, various corporations have at various times come out in the open about their services being hacked and user data compromised. In a cloud based environment this threat takes on a whole new meaning as by definition cloud computing does not all any data including the most private and confidential documents to remain off the net!

- **Prone to Attack** : Storing information in the cloud could make the library vulnerable to external hack attacks and threats. As we are well aware, nothing on the Internet is completely secure and hence, there is always the lurking possibility of stealth of sensitive data.

These are just some of the benefits and limitations. One might imagine (and hope) that with times to come the list benefits gets longer and that of limitations loses some entries; however, for now it is safe to say that Cloud Computing hasn't matured to a level so advanced that all systems across the globe be shifted to this computing model.

*Google plans to launch a **government-only cloud** this year to address government concerns about security and privacy. Just as companies presently cooperate with one another to buy IT equipment, bandwidth and the services of IT professionals, R&D organizations may soon cooperate in the building and management of data centers. Alternately, if enough R&D centres express interest, a company such as Google, Amazon, Microsoft or another cloud vendor might create a Cloud similar to Google's Government Cloud. Or, a cloud vendor with deep IT resources might build R&D-centric cloud services on top of cloud infrastructure leased from one of the more established players.*

INTRANET AND THE CLOUD

Ironically, some Libraries use cloud computing to deliver their products & services over intranet. Intranets are customarily used within an organization and are not accessible publicly. That is, a web server is maintained in-house and library resources & information is maintained on it that others within the organization can access. However, now intranets are being maintained on the cloud. To access the library's private, in-house information service, users have to log on to the intranet by going to a secure public web site.

Similarly, we can use the same sorts of principles within every library to develop its IT infrastructure. By setting up thin clients to run applications and services on a local server, rather than on their desktops, we can ease the costs of deployment and maintenance, as well as reducing power costs.

CLOUD COMPONENTS

In a simple topological sense, a cloud computing solution is made up of several elements: **clients, the datacenter, and distributed servers**. These components make up the three parts of a cloud computing solution. Each element has a purpose and plays a specific role in delivering a functional cloud based application.

There are two main components in **client/server computing**: servers and thin or light clients. The servers house the applications which our organization needs to run, and the thin clients—which do not have hard drives—display the results.

HYPERVISOR APPLICATIONS

Applications like **VMware** or **Microsoft's Hyper-V** allow us to virtualize our servers so that multiple virtual servers can run on one physical server.

These sorts of solutions provide the tools to supply a virtualized set of hardware to the guest operating system. They also make it possible to install different operating systems on the same machine. *For*

example, we may need Windows 7 to run one application, while another application requires Linux. It's easy to set up the server to run both operating systems.

Thin clients use an application program to communicate with an application server. Most of the processing is done down on the server, and sent back to the client. Some thin clients require an application program or a web browser to communicate with the server.

GETTING LIBRARY ON THE CLOUD

There are scores of vendors who offer cloud services. What they have to offer varies based on the vendor and their pricing models are different, as well. Moreover, Cloud computing is a growing field, and there will likely be new players in the market in the foreseeable future. Let's take a look at some of the famous vendors of cloud computing - *Amazon Google, and Microsoft*.

AMAZON

Amazon was one of the first companies to offer cloud services to the public, and they are very sophisticated. Amazon offers a number of cloud services, including

- **Elastic Compute Cloud (EC2)** : Offers virtual machines and extra CPU cycles for your organization.
- **Simple Storage Service (S3)** : Allows you to store items up to 5GB in size in Amazon's virtual storage service.
- **Simple Queue Service (SQS)** : Allows your machines to talk to each other using this message-passing API.
- **SimpleDB** : A web service for running queries on structured data in real time. This service works in close conjunction with Amazon Simple Storage Service (**Amazon S3**) and Amazon Elastic Compute Cloud

(**Amazon EC2**), collectively providing the ability to store, process, and query data sets in the cloud. These services can be difficult to use, because they have to be done through the *command line*.

Amazon's virtual machines are versions of *Linux distributions*. In fact, applications can be written on LIBRARY own machine and then uploaded to the cloud. Amazon is the most extensive cloud service to date. We can see more about Amazon's cloud services at <http://aws.amazon.com>

GOOGLE

In bare contrast to Amazon's offerings is **Google's App Engine**. On Amazon we get root privileges, but on App Engine, you can't write a file in your own directory. Google removed the file write feature out of Python as a security measure, and to store data we must have to use Google's database.

Google offers online documents and spreadsheets, and encourages developers to build features for those and other online software, using its *Google App Engine*. Google reduced the web applications to a core set of features, and built a good framework for delivering them. Google also offers handy debugging features.

Groups and individuals will likely get the most out of App Engine by writing a layer of Python that sits between the user and the database. Look for Google to add more features to add background processing services. It can be found online at code.google.com/appengine/

MICROSOFT

Microsoft's cloud computing solution is called **Windows Azure**, an operating system that allows Libraries to run Windows applications and store files and data using Microsoft's datacenters. It's also offering its *Azure Services Platform*, which are services that allow

developers to establish user identities, manage workflows, synchronize data, and perform other functions as they build software programs on Microsoft's online computing platform.

Key components of Azure Services Platform include

- **Windows Azure** : Provides service hosting and management and low-level scalable storage, computation, and networking.
- **Microsoft SQL Services** : Provides database services and reporting.
- **Microsoft .NET Services** : Provides service-based implementations of .NET Framework concepts such as *workflow*.
- **Live Services** : Used to share, store, and synchronize documents, photos, and files across PCs, phones, PC applications, and web sites.
- **Microsoft SharePoint Services and Microsoft Dynamics CRM Services** : Used for business content, collaboration, and solution development in the cloud. Microsoft plans the next version of Office to offer a browser-based option so that users can read and edit documents online as well as offer the ability for users to collaborate using web, mobile, and client versions of Office.

Microsoft is a little late to the cloud party and isn't a leader in cloud computing.

Google and Amazon are leader in cloud computing, and more and more companies are offering cloud services. Microsoft's cloud offerings can be found online at www.microsoft.com/azure/default.aspx

For some, the term "cloud computing" is simply hype. But for others who want to embrace it, cloud computing is a great way for Library professionals to focus less on their datacenters, and more on the work of library and information technology.

8.0 How Secure is the Cloud?

Of late, cloud computing has taken the IT world by a storm. More and more Libraries are migrating to the cloud instead of local storage. Not only is cloud storage cheaper and requires lesser maintenance, it also fosters greater collaboration and resource sharing capabilities. It is good when data from these web based clouds is accessible to users but what will happen when we see any *cloud burst*?

While cloud-based services offer you increased visibility and flexibility, security is still the most important aspect of any Library Information System. Some library professionals may be reluctant to have information "out there" on the cloud; it is safe to say that cloud-based services offer distinct advantages in providing security.

- The ability to back up data at a secure location that's geographically separate from the primary location.
- The ability to apply a uniform, high level of security, privacy controls, and resources that can continually improve over time. By scaling security and control over an entire network, small library systems benefit from a level of investment that they would be unable to leverage on their own.
- A single, integrated database platform that makes information available without the risks inherent in mending together multiple information platforms.

Perhaps most important, a cloud-based network can offer a level of constant monitoring that's simply impossible with paper-based and client-server software models. Physical files can get lost or misplaced and there is little ability to determine exactly who has touched (or even altered) a document.

Both Google and Amazon are now offering attractive cloud services for library and business organizations. The service is extremely reliable—our resource is

stored across multiple servers and can be seamlessly shared among all our patrons and staffs.

At this junction, with cloud computing on the rise, questions are being raised about security issues. For a start, any document stored on an internet/intranet, no matter how big or small, can be subject to malicious hackers. However, generally speaking cloud based storage has often been under the attack of tech critics claiming it to be an insecure medium for storage of data.

Google and certain other cloud service providers have had their cloud of outages – however, this does not essentially make them less secure. **Cloud outages** are in no way more serious than traditional outages – the documents remain secure, only the server goes offline temporarily.

On the contrary, owing to such risks and security issues, most cloud based service providers take security as an important factor. Apart from **data redundancy**, providers such as Amazon also offer **data encryption** for enhanced security.

However, this is where as the end user, our decision comes into play. Of course, if libraries are opting for the cloud, chances are that they are doing it to minimize the cost of local storage – in other words, it does not make sense to use local storage for backups of our cloud resources. In such a scenario, before we opt for a cloud-based storage provider, look for the backup offerings – chances are, they will surely provide nightly backups, in which our documents and transactions are backed up every day. But a wiser choice will be to opt for **incremental backup**, wherein our data is backed up after each transaction. Obviously, **incremental backup provides to-the minute backup and is more reliable**.

In this case, usage of cloud computing cannot be discharged on account of security myths. Trusting on a cloud based service provider to secure our resources is much the same way as trusting a postal or courier company with our letters – we often place our important letters and parcels in their hands,

don't we? A mere isolated event or mishap with the courier service provider cannot essentially be generalized as the overall measure of service offered by that provider.

It goes without saying that the future of data and resource storage is cloud storage. Most providers offer a secure product with encryption, redundancy and backups. This persistent dedication to optimal security and the attention paid to it over the cloud ensures peace of mind for library professionals and users.

CONCLUSION

We know that library is not only a knowledge ocean; its ultimate aim is to provide satisfactory services for all the people. Libraries have the opportunity to improve their services and relevance in today's information society. So in the new era, library should improve itself constantly by adding many new IT technologies. Cloud Computing is one avenue for this move into the future. It can bring several benefits for libraries and give them a different future.

Although Cloud computing can be seen as a new phenomenon which is set to revolutionize the way we use the Internet, there is much to be cautious about. There are many new technologies emerging at a rapid rate, each with technological advancements and with the potential of making human's lives easier. However libraries must be very careful to understand the limitations and security risks posed in utilizing these technologies. Cloud computing is no exception.

To increase the adoption of Web and cloud services, *cloud service providers* (CSPs) must first establish trust and security to alleviate the worries of a large number of users. A healthy cloud ecosystem should be free from abuses, violence, cheating, hacking, viruses, rumors, pornography, spam, and privacy and copyright violations. Both public and private clouds demand "*trusted zones*" for data, *virtual machines*

(VMs), and user identity, as VMware and EMC3 originally introduced.

The cooperative effect of libraries using the same, shared hardware, services and data- rather than hosting hardware and software on behalf of individual libraries- can result in lowering the total costs of managing library collections and enhancing the both library user's experience and library staff workflows.

The vision is to use Cloud Computing to deliver library resources, services and expertise at the point of need, within user workflows and in manner that users want and understand. It should be free libraries from managing technology so they can focus on collection building, improved services and innovation. 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.

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