

Cloud Computing Services In Libraries: An Overview

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Abstract

The purpose of this paper is to provide an overview of current uses of cloud computing services in libraries. Examines how cloud based information systems and services can support emerging and future requirement of library users and also manage records in the Cloud computing environment. The authors try to address the gap, benefits and opportunities identified in integrating cloud storage in IaaS (Infrastructure as a Service) level and the other two layers of cloud computing like PaaS (Platform as a Service) and SaaS (Software as a Service).

Keywords: Cloud Computing, Virtual Library, Library Services, Digital Repository

1. Introduction

A shift has started in the computing landscape where cloud computing is becoming an increasingly popular choice for many organizations. IDC predicts that by 2020, as much as 15% of the information in the digital universe could be part of a cloud service. Whereas much of this information may not be considered preservation worthy, an increasing amount of business and administrative records are being stored in the cloud (Gantz and Reinsel, 2010). Cloud computing is simply a general term for anything that involves delivering hosted services over the internet. It is the delivery of computing as a service rather than a product, where resources, software and information are shared and provided to computers and other devices. Cloud computing is a relatively new and somewhat “hyped” concept. This means that there is not yet single agreed definition. As a definition for the purposes of this paper, we have come up with four characteristics of cloud computing:

- ❖ Cloud computing is an abstracted, scalable platform for service delivery.
- ❖ Cloud computing makes use of existing technologies that can be described via a layered model
- ❖ Access to both platform and services is available via the internet on a pay-per use basis, and
- ❖ The availability, quality and number of services are offered according to agreements with a cloud service provider.

Cloud computing delivers commonly centralized services with the available data, software and computation on a published application programming interface over a network. Business software and data are stored on servers at remote location and end users access this information via a web browser or a light weight desktop or mobile application.

Cloud application providers strive to give equal or improved services and performance than if the software was locally installed on end users computers. Cloud computing introduces strategic options and



offers ubiquitous access to applications for interacting all parts of an organization and connects with rich learning opportunities percolating in communities formed by the users of the service. Cloud computing offers the potential to do more with less, thus benefiting an agile, strategic adopter of its rapidly evolving technology and service. It allows users to choose from a pool of hardware, software and networking infrastructure managed independently within an organization or externally by a vendor. These computing capabilities are available on a pay-per use basis either as infrastructure, platform or services and are used to deliver business applications typically via World Wide Web.

2. Layers of Cloud Computing in Brief

A common way of distinguishing between different cloud services is by dividing them into layers, such as SaaS (Software as a Service), PaaS (Platform as a Service) and IaaS (Infrastructure as a Service). In a layered model, each layer builds on services offered by the layer below, and in turn offers services to the layer above. Each layer uses its own information types (data classes and properties) to provide specific functionality.

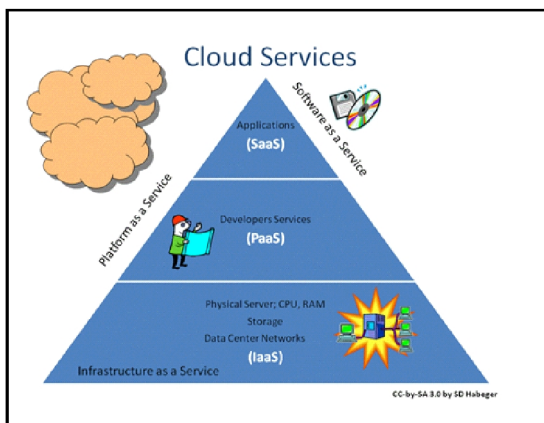


Figure:1 Three layers of Cloud Computing Services

2.1 SaaS: It is the highest level of abstraction on the cloud and the applications are delivered over the World Wide Web as a service. This layer of cloud service offers a wide range of applications from productivity (e.g., office-type) applications to enterprise applications such as e-mail hosting, supply chain management or enterprise resource planning.

2.2 PaaS: It is the next level of abstraction, which not only does the technical abstraction but essential application infrastructure services such as computation, messaging, connectivity, access control, etc. In the traditional in-house computing model, a group of network, database, and system management experts are needed to keep everything up and running with cloud computing, these services are now provided remotely by cloud providers under this layer.

2.3 IaaS: This is the lowest layer of Cloud computing. The providers of IaaS abstract information technology infrastructure resources such as storage and memory as services. A cloud service provider manages the physical infrastructure and makes provisions virtualized infrastructure of operating systems to the end user. The user here is given complete ownership of the virtual image which one can configure according to the requirement. Services offered through this layer include the remote delivery and support (via www) of a full computer infrastructure (e.g., virtual servers, storage devices, etc.)

A well-known example of a layered model is the open system interconnection reference model for network communication. The benefit of a layered model is

that once data types and services are defined, layers can be abstracted. That is when considering any specific layer, it is possible to disregard the inner workings of the layer below. Because of their scalability and networked nature, Cloud services can also be easily shared between a numbers of systems. For example, the records producing institution may share storage with the archive it is submitting records to. This would bring benefits to both parties by reducing the need to duplicate services.

3. Cloud Computing Services in Libraries

Library and information centers are in the business of creating, managing and delivering information. Most of the libraries have their own websites and maintain integrated library management systems. Providing access to digital collections through repositories, maintain storage and backup of their content and data. A subject search of cloud computing services and libraries in library and information science literature, addressed public to academic libraries and concerned topics ranging from websites to repository systems. Most of the libraries are using SaaS and IaaS services since 2009 and they are interested in using SaaS services for daily routine work like, office applications, Google Doc, Calendar, Scheduling applications and cloud storage for synchronizing and backup files. Secondly, majority of the libraries also using IaaS services for content delivery such as websites, repositories and online backup (e.g., virtual machines and cloud storage). As it is a new phenomenon in the field of LIS, we do not have much literature at present on IaaS and its implementation details, difficulties, comparisons of different services like Simple Storage Services (S3), Google Cloud Service (GCS), upgrades and backup, etc. However, in this paper, attempt has been made to give an overview on these services in brief.

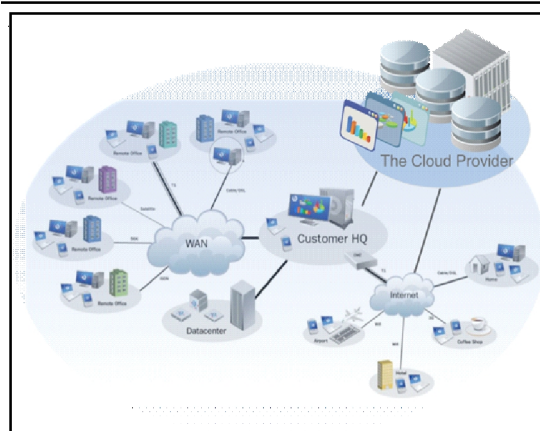


Figure:2 A Model of Cloud Computing Services

4. SaaS Services in Libraries

Libraries are using SaaS services in most of the aspects of library routine work from instruction to scheduling office applications. The common SaaS services used by libraries and information centers include Gmail, Google Calendar, Google Docs/Drive, Drop box, and the OCLC world share management service. Some of the SaaS services are built on top of PaaS and/or IaaS platforms, e.g., Drop box uses S3 service for storage, DuraSpace uses cloud storage services such as S3 and Microsoft Azure. SaaS services are primarily used by the general public. Most popular SaaS Cloud storage services are Apple iCloud, Amazon Cloud Drive, SugarSync and Microsoft SkyDrive. Some SaaS Cloud storage service providers are building their services on top of the IaaS service providers.

Some of the important libraries in the world which are using SaaS services in their libraries for different purposes are listed below:

- ❖ The District of Columbia Public Library used Google Docs for Staff (Tonjes, 2010).
- ❖ New York City College of Technology used Google Calendar for instruction scheduling and daily work (Leonard, 2011).

- ❖ Eastern Kentucky University Library used Google Docs and Google Calendar for instruction (Kroski, 2009)
- ❖ The University of Wisconsin-Eau Claire used Google Forms for reference and instruction

5. Uses of PaaS AND IaaS Services in Libraries

Cloud storage services include Amazon, Simple Storage Services (S3), Google Cloud Service (GCS), Rackspace Cloud Files and Microsoft Azure and the Library and Information Centers are exploring using on-demand Cloud storage services since 2009. Most popular PaaS and IaaS services include Amazon web services, such as EC2 and S3, Google App Engine, GCS, RackSpace Cloud Files and Microsoft Azure. Cloud storage providers are generally a large IT companies such as Apple, Amazon, Google, Nirvanix, Rackspace and Microsoft. Google and Microsoft are well known cloud storage service providers in both SaaS and IaaS areas too. EC2 is an IaaS scalable virtual machine service. It is the most popular IaaS service used by libraries to host websites, repositories and library management systems. It gives users complete control of virtual resources and is easily scalable. It is working as a central hub. But integration of PaaS and IaaS requires programming and database administration skills. All though system administration skills have been removed, technical skills and ongoing support are still required for integration IaaS is intended for developers to store and access data primarily through an API for enterprise-level applications. Uses of IaaS cloud storage service include online archives, backups and big data.

6. Benefits and Opportunities of Cloud Computing Services

- ❖ Cloud computing has a multi-tenancy value: A single instance of particular software runs

on a server and it can serve multiple users (tenants) simultaneously. By implementing multi-tenant architecture, each software application is configured to virtually partition its data and each client works with a customized pre-configured virtual application instance.

- ❖ Cost effective: Through shared infrastructure, reduces the total cost of the ownership. Cloud computing always depends on service providers called as cloud providers for various low level management and service levels of their multi-user applications and infrastructures. This leads to minimize capital expenditure through pay-as-you-use model. Some of the SaaS services are free of charge and IaaS services are billing ‘pay only for what you use’ basis. However, it is more cost effective than locally hosted services and the users are encouraged to consider the total costs of ownership.
- ❖ Lowered expenditure with elastic IT services: Cloud computing lowers IT expenditure in two ways. Firstly, it leverages a virtual suite of pre-integrated cloud based applications and infrastructure and simplifies the complexity of traditional IT services. Secondly, it reduces infrastructure management and monitoring costs and optimizes utilization of information resources by making a provision on demand. It can be acquired at any time, with many services to choose from and the libraries are no longer limited to the boundaries of their own IT resources.
- ❖ Scalability and Convenient: Capabilities can be rapidly scaled up or down to match the

workload. Rapid scalability, especially for short duration events is possible. Increasing and the creating a new instance can be completed easily without the creation of downtime. So that the library users will be happy not to see an e-mail informing them of system downtime.

- ❖ Availability: Large IT companies have tremendous technical and financial resources and the availability of their Cloud computing services is much higher than that of locally maintained servers.
- ❖ Access anywhere, any time: Capabilities are available over the network via multiple devices, including mobile phones, laptops and PDA's.
- ❖ Additional functions: Plug-in applications and tools and community actions can provide quick access to additional capabilities.
- ❖ Easy End-user Startup: Users can access computing capabilities without waiting for internal similar projects to be completed. Users can get immediate access to new capabilities. Now cloud based services are core software functions and a variety of applications have become universally and constantly available for use.

7. Gaps Observed

- ❖ Security and Privacy: Libraries have a role to keep sensitive data safe as circulation records need to be secure. Readers should also not forget that security is a major concern. For sensitive data, one must follow policies and perform encryption to secure it in the cloud. Encryption of sensitive data and appropriate clauses in contracts with cloud computing

service providers are good practices to keep data safe.

- ❖ Policies and procedures depend on the nature of data to be stored, size of the data, period of data to be preserved (how long), etc.
- ❖ Issues related to data security, reliability, speed, accuracy and inevitable legacy when introducing the cloud computing services are to be sorted out.

8. Conclusion

Cloud computing services in the libraries and information centers represents a fundamental shift in how a library pays for and accesses IT oriented services. Well-developed library and information centers have created new opportunities for IT service providers and the outsourcing vendors. Cloud computing will have significant impact on outsourcing vendors who must adopt new strategies to include cloud services as part of their offerings to keep up with the profound changes in the IT services industry. They should experiment with cloud services and understand which models are appropriate/suitable for their users. This will help them to identify new business opportunities that arise through cloud computing. The outlook of IT services industry looks promising as IT outsourcing vendors enhance their portfolio with various cloud computing offerings. But many emerging trends may impact the future of IT services and cloud computing that include the integration of new services with the existing ones. Increasing number of applications that utilize cloud infrastructure and reliable global delivery models are on demand. The deployment of new innovative cloud services with attractive business models will lead to high level of customer satisfaction and unprecedented adoption of cloud services in the LIS field. The cloud computing service providers also should be aware that security is a great concern for

most institutions. Data protection and privacy issues are holding back wide scale adoption of cloud computing in the R & D enterprises. The current challenges must be addressed including developing acceptable compliance and security policies, reducing the risk by developing robust infrastructure for reliability and high availability along with performance guarantee.

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