

# A CLOUD\_ACCLIMATIZE ALLUSION CONSTRUCTION TO DIGITAL LIBRARY SYSTEMS

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**Abstract** - Cloud computing is an emerging computing model which has evolved as a result of the maturity of underlying prerequisite technologies. There are differences in perspective as to when a set of underlying technologies becomes a “cloud” model. In order to categorize cloud computing services, and to expect some level of consistent characteristics to be associated with the services, cloud adopters need a consistent frame of reference. The Cloud Computing Reference Architecture (CCRA) defines a standard reference architecture and consistent frame of reference for comparing cloud services from different service providers when selecting and deploying cloud services to support their mission requirements. Cloud computing offers information retrieval systems, particularly digital libraries and search engines, a wide variety of options for growth and reduction of maintenance needs and encourages efficient resource use. These features are particularly attractive for digital libraries, repositories, and search engines.

**Keywords** – Digital library management system, cloud system design, coradls.

## I. INTRODUCTION

Digital library provides a convenient, along with the increasing knowledge level, the requirement of digital library and growing. But because of uneven economic development in different regions causes the digital library’s resources to be relatively short, to university digital library as an example. Various colleges and universities while are raising the respective teaching level unceasingly, have established a digital library to purchase its own database resources, but because of the teaching focus and economic conditions, library resources between university’s has the differences, meanwhile looked from the whole that the Digital library has certain flaw. Data resources between various universities are relatively independent, building redundant projects possibility was high, has created the manpower, the financial resource and

the resources waste, or some colleges and universities to use only part of database resources, inadequate use of resources, and cannot play resources maximum utilization.

Objectives of cloud acclimatize allusion construction to digital library systems:

1. Delivery of core library services: making them more efficient and accessible.
2. User satisfaction: due to improved information access and knowledge management.
3. Library operations: making them more streamlined and less costly.
4. The library’s ability to provide for future growth and changing information demands. With the rapid development of various IT technologies, Library users’ information requirements are increasingly personalized. And now more and more libraries advocated user-centered services. Library can develop itself according to such information and improve users’ satisfaction.

## II. BACKGROUND

This section provides the necessary background on commonly used technology in Cloud environment. This chapter gives a brief overview of the Digital Library, Cloud Computing and Reference Architecture. Digital Library is currently used to refer to systems that are heterogeneous in scope and yield very different functionality

**Digital Content:** The digital content concept encompasses the data and information that the Digital Library handles and makes available to its users. Digital content is used to aggregate all forms of information objects that a Digital Library collects, manages and delivers.

**Library User:** The library user concept covers the various actors entitled to interact with Digital Libraries. The different users of DL are Teacher, Student and Administrator.

### III. DIGITAL LIBRARY MANAGEMENT SYSTEM

The Digital Library Management System (DLMS) functionality includes Digital Library Portal (DLP), Catalog, Library Administration, System / database configuration and Integration. The DLP provides the users a branded knowledge portal with access to custom links, RSS feeds, blogs, and wikis, along with an OPAC that provides access to your resources in text, audio and video formats.

**A. Catalog:** This highly flexible and functional repository can manage a wide variety of physical and electronic materials, with sophisticated cross referencing, poly hierarchical thesaurus and full-text electronic document indexing

**B. Library Administration:** Includes acquisitions, reporting and enhanced inquiry reference management. Acquisitions manages suppliers and acquisition of all types of materials including books, electronic materials and serials.

**C. System/Database Configuration:** The Digital Library System Administrator (DLSA) can easily design and maintain the database by creating fields, content types and record templates, or we can do it for you.

**D. Integration:** It streamlines processes and share information integrating the library management system with other aspects of the organization. Using this facility, we can create a single sign on (SSO), automatically reflecting changes in a user's record.

### IV. Cloud Computing

The Digital Library has brought new opportunities for the advancement of digital library. Cloud computing can take the library facility at the most convenient state to its stakeholders than other technical approaches. Many people are getting more used to with the e-copies of books, journals, newspaper and other resources than paperback format.

**A. Software as a Service (SaaS):** Applications or software is delivered as a service to the customer who can access the program from any online device. The customers benefit from low initial costs, have access to (usually 24/7) support services.

**B. Platform as a Service (PaaS):** With PaaS, a computing platform is provided which supplies tools and a development environment to help companies

build, test, and deploy Web-based applications. Applications which are built using these provider's services, however, are usually locked into that one platform.

**C. Infrastructure as a Service (IaaS):** It involves both storage services and computing power. IaaS provides computing resources, and Storage Service for data storage. Most institutions are using IaaS to host or backup their websites, for content delivery, to run high performance computing simulations, to host media collections, and much more.

**D. Cost Efficient:** Cloud computing is probably the most cost efficient method to use, maintain and upgrade.

**E. Unlimited Storage:** Storing information in the cloud gives you almost unlimited storage capacity. Hence, you no more need to worry about running out of storage space or increasing your current storage space availability.

**F. Backup and Recovery:** Since all the 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.

**G. Automatic Software Integration:** In the cloud, software integration is usually something that occurs automatically. This does not need to take additional efforts to customize and integrate DL applications as per user's preferences.

**H. Easy Access to Information:** Once register in the cloud, it can access the information from anywhere, where there is an Internet connection. This convenient feature lets the users move beyond time zone and geographic location issues.

**I. Quick Deployment:** Lastly and most importantly, cloud computing gives you the advantage of quick deployment. Once you opt for this method of functioning, your entire system can be fully functional in a matter of a few minutes. Of course, the amount of time taken here will depend on the exact kind of technology that you need for your business.

### V. Cloud System Architecture

In cloud computing, scalable and elastic IT-enabled capabilities are delivered as a service to customers using the network. The most important capabilities are a self-service portal; a pool of shared resources; and release of resources; and ubiquitous access. Within this architecture, the delivery layer provides

application service delivery; the demand layer contains the selfservice portals and is where services are actually consumed by end users or subscribers; and The supply layer provides all the infrastructure services for Cloud system; this is where the physical and virtual assets reside The Cloud system is based on the converged infrastructure.

#### **A. Cloud Computing Reference Architecture (CCRA)**

The reference architecture is an architectural design pattern indicating an abstract solution that implements the concepts and relationships identified in the reference model (Reed, Jr., 2004). There may be more than one reference architecture that addresses how to design digital library systems built on the reference model. The Reference Architecture based approach has been proven to be useful in several customer engagements. According to Rational Unified Process (RUP), “a Reference Architecture, is in essence, a predefined architectural pattern, or set of patterns, possibly partially or completely instantiated, designed, and proven for use in particular business and technical contexts, together with supporting artifacts to enable their use. Often, these artifacts are harvested from previous projects”. The Cloud Computing Reference Architecture (CCRA) is intended to be used as a blueprint/ guide for architecting cloud implementations, driven by functional and non-functional requirements of the respective cloud implementation.

### **VI. Literature Review & Related Works**

This section presents the literature review on various cloud computing models available. Various models of cloud computing are Unified search service, integrating consulting service, Real-time access service, Knowledge service and All-oriented service and they are discussed below (Sanchati & Kulkarni, 2011).

**A. Unified Search Service Model:** With the adoption of Cloud Computing in Digital Library, the integrated library resources support distributed uniform access interface. The uniform access platform can promote library resources, guide and answer users’ questions by using high-quality navigation. As a result, users can grip more information retrieval methods and make better use of library resources

**B. Integrated Consulting Services Model:** The integrated digital reference service can realize the sharing of technology, resources, experts and services of Digital Libraries. This will bring great conveniences for library users.

**C. Real-time Access Services Model:** By introducing Cloud Computing, Digital Libraries can establish a shared public cloud. As shared cloud can have infinite storage capacity and computing power theoretically. It can bring obvious benefits to libraries.

**D. Knowledge Service Model:** Digital Libraries are of storing, processing and spreading knowledge. The establishment of shared public cloud can save manpower and material resources greatly among university libraries.

**E. All-oriented Service Model:** Digital Libraries provide services for all the people like the professors, teachers or students can access to the library resources. They permit users access to many libraries’ resources by handling related certificate of that library.

#### **F. Review on DL Architectures**

There are number of research regarding Cloud Computing architectures on Digital Library systems. A broad collection of reference architectures and reference models were considered. The existing architecture/models systems are revisited and analyzed in terms of the above quality attributes. These reference architecture / model identifies the main components of the reference architecture and indicates inter-relationships between the components. For brevity’s sake only those relevant architectures/models are described and compared below. Suresh Chandra Padhy and RK Mahapatra proposed to improve current user service model with Cloud Computing. This paper explores the application of cloud computing in academic library in Orissa. Pradeep Teregowda discuss constraints and choices faced by information retrieval systems like CiteSeerx by exploring in detail aspects of placing CiteSeerx into current cloud infrastructure offerings (Teregowda, Urgaonkar, & Lee Giles, 2010). We also implement an ad-hoc virtualized storage system for experimenting with adoption of cloud infrastructure services. Our results show that a cloud implementation of CiteSeerx may be a feasible alternative for its continued operation and growth. Matt Goldner (2010) defines cloud computing and shows how it is different from

other types of computing. It also discusses how cloud computing solutions could be beneficial to libraries in three basic areas: technology, data and community

### **1. MAIN FOCUS OF THE CHAPTER**

This section of the chapter describes the proposed reference architecture called a CORADLS. This includes the identification of Digital Library services, proposed model / architecture and evaluating the proposed architecture.

### **2. Motivation Example**

Cloud computing can take the library facility at the most convenient state to its stakeholders than other technical approaches. Many people are getting more used to with the e-copies of books, journals, newspaper and other resources than paperback format. Cloud computing can provide the optimum library services to the people by centralizing the resources and disk spaces of any digital library. The Library users are connected to the Digital Library Portal Server (DLPS) via internet. The Authentication Service is the entry point of Identity Server. A user must pass an authentication process before accessing the Identity Server console and its corresponding management functions. A user attempting to access a service or application protected by Identity Server must also authenticate before access is allowed. The Authentication Service invokes authentication modules to collect and validate the necessary credentials.

### **G. Challenges and Issues**

The challenges and issues occurs are performance and scalability. Scalability without the right infrastructure can degrade efficiency when service delivery policies can't be applied intelligently across Digital Library applications. This can result in poor performance for users and, ultimately, undesirable downtime. Some of the challenges in designing DL applications are as follows:

**1. Ensure Availability:** The higher density of virtual machines increases the potential for a failed application to affect the availability DL applications. With flexible, intelligent scalability technology, we can automatically handle application failure without affecting other applications.

**2. Scale Seamlessly:** Seamless, transparent scaling of applications in the cloud requires collaboration across application delivery and provisioning systems.

**3. Improve Performance:** The library users expect content to load in the blink of an eye. This expectation is difficult to meet with the complexity of systems and variability in location, user devices, and application profiles.

**4. Maximize Resources:** Caching consume significant resources, leading to decreased capacity and poor performance. Commoditization of server sizing intensifies this effects, requiring DL applications to scale out faster and incur higher costs. So it needs solutions to

1. Offload this services to a shared application delivery tier, improving performance and capacity.

2. Ensure the elasticity of DL applications we expect from the cloud computing initiatives.

3. Employ a variety of offload, acceleration, and optimization technologies that help you achieve this seemingly impossible goal.

4. Enable the multi-tenant architectures required to protect DL applications from noisy or failing neighbors.

### **H. Statement of the Problem**

The Architecture concept refers to the Digital Library System entity and represents a mapping of the functionality and content offered by a Digital Library on to hardware and software components. There are two primary reasons for having architecture as a core concept: (i) Digital Libraries are often assumed to be among the most complex and advanced forms of information systems; and (ii) interoperability across Digital Libraries is recognized as a substantial research challenge. A clear reference architectural for the Digital Library System offers ammunition in addressing both of these issues effectively. Challenges adding to the DL concerns of IT include:

The need to maintain compliance with stringent privacy and security regulations, The need to provide users with access to DL applications and organizational computing resources, The growing need to support user owned devices in the network environment. As Cloud Computing has become more and more popular, various Cloud Computing architectures have been defined for Digital Library Applications.

### ***I. Solution to the Problem***

The Solution to the problem is to investigate and design a scalable reference architecture for DLS using Cloud Computing. The proposed reference architecture is called CORADLS. CORADLS is layered architecture and it consists of demand layer, supply layer and delivery layers. This architecture provides several benefits. Because it includes a SaaS approach for data along with PaaS option and even an IaaS offering, the data can be stored based on the security, consistency, and other properties desired.

1. *User Performance*: The Library users can interact with multiple channels such as mobile, Laptop, or online. Some of the content that must be retrieved when a user approaches the DL server are how frequently the user comes back and what are the interests of the user.

2. *Security*: Library transactions are always critical and should be secured so security as service will enable security requirements including multi-factor authentication.

3. *Scaling of Library User Systems*: The Library administrator should enhance the number of systems available for users.

4. *Common Infrastructure*: Identify the common functionalities and provide them with a common infrastructure for better coordination and implementation.

5. *Collaboration Services*: Design Library applications for collaboration services like sharing the information on common utilities, information, attractive provisions offers, etc.

6. *Load Balancing*: Handle load balancing using Infrastructure as a Service.

### ***F. Requirements***

The main objective of cloud computing is to use a specific software through calculation and the data stored in a desired computer distribution which causes the enterprise to reduce cost and improve performance. Digital library represents one kind of new infrastructure and the environment; through cloud computing technology since it uses resources more effectively and can solve the constraints in digital library. Cloud providers should provide mechanisms to support data portability & system portability, service interoperability, security and privacy (NIST, 2013).

1. *Portability*: For portability, customers or library users are interested to know whether they can move their data or applications across multiple cloud environments at low cost and minimal disruption.

2. *Interoperability*: Service interoperability is the ability of cloud consumers to use their data and services across multiple cloud providers with a unified management interface.

3. *Security*: Security in cloud computing architecture concerns is not solely under the purview of the Cloud Providers, but also Cloud Consumers and other relevant actors.

4. *Privacy*: Cloud providers should protect the assured, proper, and consistent collection, processing, communication, use and disposition of personal information in the cloud (NIST, 2013).

### ***G. DL Services Identified***

The services identified during design of CORADLS are registration, DL portal service, Alert/ Notification service, Library service, Monitoring service, Remote Connection service, etc. The services can be specified as a set of messages of a XML.

1. *Registration Service*: It enables an application to register as a participant. The Registration service provides methods for collecting the information required to build the User personal details. The tasks have to be covered by registration are registration process, sending e-mails to the registered users, conform registration and enable/disable of users account.

2. *DL Portal Service*: CORADLS provides role-based portals and interfaces. They enhance the user experience for designing, building, and consuming private and public cloud services. Among the interfaces CORADLS provides consumers of services, service designers, service assurance, and IT administration.

3. *Alert/Notification Services*: Library users receive an e-mail or SMS alerts or notifications whenever adding/updating content to the DL Server. The chief function of the notification service is to notify the library users with the latest information they are interested in automatically without any users' information retrieval and request. The users only need to do is to register the kind of their subject. The information types to be notified are subject information, subject navigations, the digital

magazines/journals, book records in the OPAC and the library news/notification, new services provided by library.

4. *Personalization Services*: The personalization services in a Digital Library environment would help the users to find information resources available in a digitally chaotic world. The reasons of developing a digital library include increasing access to information serving and users' needs and bringing organization to the unstructured universe of electronically available information.

5. *Digital Reference Services*: Digital Reference Services include either finding the required information on behalf of users, or assisting users in finding information themselves. Instruction in the use of library resources and services, and user guidance in which users are guided in selecting the most appropriate information sources and services.

6. *Library Service*: The Digital Library has Discovery service, Indexing service, Metadata service and Repository service. The Discovery services are capable of searching quickly and seamlessly across a vast range of local and remote content and providing relevancy-ranked results to the library users (Vaughan, 2011).

7. *The Indexing Service*: Provides the generic functionality of an inverted file, mapping elementary tokens to documents/entities (Sinha & Sanyal, 2011).

8. *The Metadata Service*: Associates metadata records to all the objects managed by Digital Library and organized as repository (Mazurek, Stroinski, Werla, & Weglarz, 2006). In the context of Digital Libraries, the Metadata Service becomes equivalent to the service providing the corresponding interface.

9. *The Repository Service*: Provides the functionality of a content repository which contains all the content that is available in the storage server (Sinha & Sanyal, 2011). It provides an effective solution to concerns such as copyright management or mirroring.

10. *Security or Identity Service*: Security service offers authentication, authentication, access control and confidentiality (IBM Developer Network, 2003). The authentication handles the authentication requests sent to the DL portal

11. *Remote Connection Service*: This service offers establishing connection to the DL Server from a remote place. It accepts the requests from the

authorized Library users and allow them to access the contents available in the DL server.

12. *Monitoring Service*: Monitoring Service can be implemented as support to predict, track and remediate site problems in a timely and efficient manner. This secure service will interpret events and activate the proper response mechanism with user defined notification rules, including e-mail or SMS.

#### ***H. Cloud Computing DL Model***

The cloud computing model allows access to information and computer resources from anywhere that a network connection is available. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power, and specialized corporate and user applications.

1. *Subscriber Tier*: All the Library users or subscribers are exists in the Subscriber Tier. Various users of the Library are students, teachers, guests and administrator. The Library users connects to the DLPS via Desktop, Laptop, etc.

2. *Service (Demand) Tier*: The Digital Library portal service and Service registry are exists in this tier. All the services discovered in the above section should be registered in the Service Registry. The registered Library users demand the necessary content to the DL Applications.

3. *Application (Delivery) Tier*: Various applications related to the DL are placed in this layer. These applications perform registration, user identity, search or query, send alerts/ notifications, monitoring, remote connection management, etc.

4. *Storage (Supply) Tier*: All the data or content are available in Storage tier. They supply necessary data/ information to the registered users or subscribers. The data are available in the form of databases like user database, e-content database, e-mail database, message database, etc.

#### ***I. CORADLS***

The request for Library functionality, which comes from the Library users over network, is passed to the Service or Demand Layer. The Demand Layer implements business processes for the different modules, including batch processing and report generation. The Identity Service includes

authentication and authorization. It authorizes the user for every request made by the user.

*1. Cloud Consumer:* The cloud consumer (example Student, Teacher, Guests) is the principal stakeholder for the cloud computing service. A cloud consumer browses the service catalog from a cloud provider, requests the appropriate service, sets up service contracts with the cloud provider, and uses the service.

*2. Cloud Provider:* A cloud provider (Digital Library Applications, SMS, Notification, E-mail, Monitoring, etc.) is the entity responsible for making a service available to interested parties. A Cloud Provider acquires and manages the computing infrastructure, runs the cloud software, and makes arrangement to deliver the cloud services to the Library users through network access.

*3. Cloud Broker:* A cloud broker is an entity that manages the use, performance and delivery of cloud services and negotiates relationships between cloud providers and cloud consumers.

*4. Cloud Carrier:* A cloud carrier acts as an intermediary that provides connectivity and transport of cloud services between cloud consumers and cloud providers. Cloud carriers provide access to consumers through network, telecommunication and other access devices. Each actor is an entity (a person or an organization) that participates in a transaction or process and/or performs tasks in cloud computing.

#### ***J. Layered Architecture***

CORADLS consists of various layers like supply layer, delivery layer and demand layer and their functions are explained below:

*1. Consumer Layer:* The consumer are students, teachers, guests designer and administrator. The consumer layer is more strictly and carefully separated from the services and service provider to allow pooling and substitution of cloud services or providers. This end layer is more about the data consumers.

*2. Supply Layer:* The supply layer provides for service delivery of infrastructure elements such as compute, network, storage, and other resources both physical and virtual.

These infrastructure elements may be hardware and virtualization, or they may be provided by a customer's existing infrastructure or by third parties, including public clouds.

*3. Delivery layer:* Above the supply layer is the delivery layer, where Cloud Service Automation software enables and manages the delivery of application services. User interfaces allow infrastructure design, for specifying what assets will be available, and service design, where a service designer can add to and manage service catalogs.

*4. Demand layer:* Cloud Service Automation also provides the portal services for the demand layer, where consumers or business users can request services. The Demand layer exposes services and products to the consumer through a user portal. It maintains a catalog of all internal (provided by the Delivery layer) and external (aggregated) services available to end users.

#### ***K. Workflow of CORADLS***

The Digital Library Portal Server (DLPS) provides single window access to the user. User interface is based on the keywords related to meta-data.

The Library users login into the DLPS. The security checks the user whether authorized user or not. The authorized user can submit query to the central server. The DLPS translates the query and passes the query to the Storage Server. The Searching service checked with indexing services. Searching service do the ranking on the outcome of the indexing service. Application servers execute query provided by the central server and return results. The Searching services passes the response to the DLPS. The DLPS reformulates the ranked response according to the format expected by primary servers. The DLPS server returned results to user after translation, summarization, filtering etc. of the content as required or the link to the content.

The advantages of the CORADLS are availability, scalability, performance and maximize resources and they were given below:

*1. Availability:* Improve capacity and performance of applications by offloading services, simplifies provisioning of application delivery services and increase virtual machine density for maximum efficiency

*2. Scalability:* Increase operational efficiency by transparently scaling applications and ensure availability by proactively monitoring application health and capacity.

3. *Performance*: Improve response time by offloading resource-heavy processing to the network, enhance performance by integrating feedback from application services into provisioning decisions and speed delivery times by applying the appropriate device-, location-, and application-specific policies that can optimize content to reduce bandwidth and transfer times.

4. *Maximize Resources*: Ensure availability with seamless application-layer failover, enable a multi-tenant service delivery strategy to ensure fault isolation and self service capabilities and integrate on- and off-premises cloud resources to ensure the highest levels of availability.

#### Evaluating CORADLS

In order to assess the success of Cloud Computing in DL, it is assessed the following central areas.

The quality of the Library service has been very positive. Many libraries have become comfortable using SaaS-style services for other solutions and are increasingly reliant on Internet connectivity. So moving the Digital Library application infrastructure outside the campus network proved to be a non-issue. By using an infrastructure level service, it is able to bring DLAs online without having to find a service that supported the correct versions of the underlying technology.

The impact of cost comparisons on cloud computing indicate that minimal cost savings may not be a sufficient inducement to change.

Efforts to concentrate on investigations and aim at the development of a common platform that could span over different cloud implementations.

#### VII. FUTURE RESEARCH DIRECTIONS

Service-oriented and cloud computing combined will indeed begin to challenge the way in which we think about enterprise computing. However, the potential for sharing could not only remove historical barriers but also encourage organizations to think more collaboratively.

There is a wide range of available platform offerings that a cloud developer can choose from today.

Each platform may have unique characteristics and use certain technologies, tools, APIs etc. Moreover the provided services may vary significantly across platforms.

A realistic approach would be to focus on a certain set of platform offerings, services, technologies whose scope is to support all type applications.

Many of the activities loosely grouped together under cloud computing have already been happening and centralised computing activity is not a new phenomena.

There are concerns that the mainstream adoption of cloud computing could cause many problems for distributed users.

#### VIII. CONCLUSION

Libraries have the opportunity to improve their services and relevance in today's information society. Cloud computing can bring several benefits for libraries and give them a different future. Cloud computing which is applied in digital libraries, analyzes current situation and existing problems of the cloud computing in digital library All library resources and service distributed on the Internet can be integrated as a whole, which forms a new type of adaptive control service system supporting interlibrary collaboration and service access, as well sharing resources from different libraries. This chapter described the issue of scalability in the domain of Digital Library. It also described the proposed reference architecture for Digital Library systems. The main issues of cloud security are all related to architecture are scalability and security which is the basic issue of cloud computing. Cloud computing technology is still relatively young in terms of maturity and adoption. However, there are some issues like caching, routing, etc., to be resolved to build a highly scalable reference architectures in Digital Library systems.

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