Cloud Computing Challenges in the Library Infrastructure

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Abstract - *In many organizations, the Library is having multiple local servers, each of which supports different applications for the users. Implementing a new application meant finding available resources which will arise a lot of technical issues that added a level of complexity to provide user services. By implementing cloud computing platform that gives the Library users in terms of easy scalability along with redundancy and security, but the traditional in-house servers was cost prohibitive. It creates toughness between, how the Librarian has to manage the information & library database and its availability in everyday life. To solve this technical issue, cloud computing refers to a wide field which includes hosted applications, distributed and platform independent server. The Cloud computing challenge will be less about technical hurdles and more about figuring out how to re-shape the Library and provide services to the users. This Article explores the cloud-computing initiatives in the Library to think about how to handle computing resources to save time, resources to improve library services.*

Keywords - *Cloud Computing, Business Outsourcing, Service Oriented Architecture*

I. INTRODUCTION

"Cloud computing is Internet are based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid."

Cloud computing is a word widely used term in business and educational / library environment. Cloud Computing is combination of advanced fields including utility computing, distributed computing, grid computing, web services, and service oriented architecture. Cloud computing is promoted by vision of "Everything as a Service" and offering as service under one umbrella. Cloud Computing consists of four services: Infrastructure as a Service, Hardware as a Service, Software as a Service and Database as a Service.

The cloud computing is emerging as the next generation on – demand Information Technology services in the Library Services. The Librarians in educational universities are aware of benefits and characteristics of minimizing the cost of cloud computing by reducing operation costs while improving quality and access to library users. The evaluation & application of Information Technology in the Library Environment is transformed from Personal Computing, Networking Computing to Internet Computing, Grid Computing and Cloud Computing.

Cloud Computing Characteristics are listed below

- Web-based Interfaces
- Externally hosted
- Pricing: subscription or utility
- Highly abstracted computing model

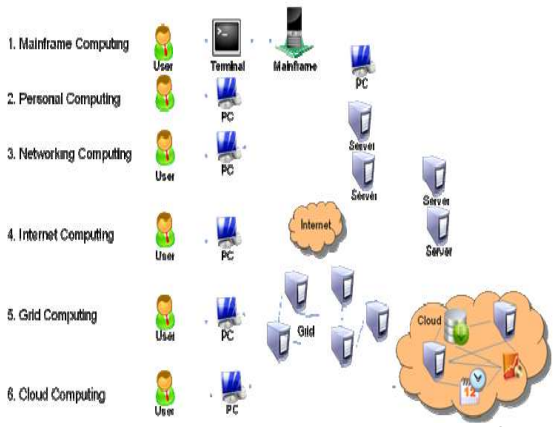

Figure 1: Six Computing Paradigms (adapted from Furht and Escalante 2010)

- Provisioned on demand
- Scaled according to variable needs
- Elastic – consumption of resources can contract and expand according to demand

II. CLOUD COMPUTING IN LIBRARY ENVIRONMENT

The Libraries have necessarily do analysis for complex query processing, both in online and offline batch modes. The service of library grows increasingly complex, specialized user needs are being met by specialized applications, built with varying technologies and delivered by multiple vendors. The IT Infrastructure for the library is mostly sized to meet peak load requirements of

applications, or capacity requirements projected for future applications. The investment locked in idle unutilized hardware infrastructure, holds the potential to be deployed elsewhere, to fetch returns. The underutilized server infrastructure and desktops in a library have the collective potential to offer significant distributed processing capacity to share IT infrastructure across user applications for optimal usage.

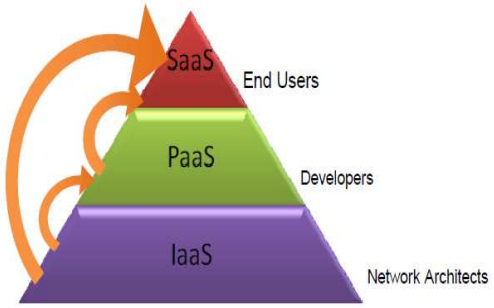

Figure 2: Cloud Computing Service Model in the Library

A Cloud Network is a combination of distributed and heterogeneous environment. The heterogeneous contain the problem of managing multiple technologies and administrative domains. In the library environment have different hardware configuration (OPAC, Dspace, Green Stone, and Content Management Software), Operating system and software configuration. The challenging task is to design/find suitable resources for the task and controlling the execution and data management. The challenges are typically faced by the library data center are

- Lack of agility due to statistically bounded resources- applications are over-provisioned to peek loads and will not scale dynamically or adapt and making difficult to align resources with business imperatives.
- Total cost of ownership- The systems are geographically dispersed and heterogeneous, so it is expensive to manage in the library.
- Need to keep legacy applications operating at the required performance level.

The Library Application Software is hosted by the service provider with the stand alone application / discrete using virtualized hardware. This Library Application Service provider concept became famous and established as a deployed model during the time 1990's. The Library staff and users can access the Application software through Internet with same user interface and functionality as if installed in the local server. As a Contradictory business model, Software as a Service is a complete software application which will be customized for the library user.

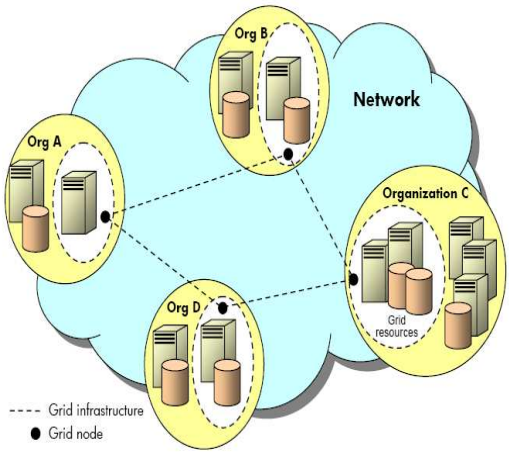

Figure-3: Cloud Architecture Difference between the Application Service Provider Vs Software as a Service

The Software and its access delivered through Cloud Infrastructure and data is stored in the Cloud (Example: Salesforce.com is the widely used business application based upon the Cloud Infrastructure). The difference between ASP Vs SaaS is listed below.

Table 1: ASP Vs SaaS

ASP Attributes	SaaS Attributes
Resold Legacy Applications	New net-native applications
Retained perpetual licenses	Subscription model
Difficult to Upgrade	New functionality delivered regularly
Customized	Configurable

III. BUSINESS VALUE OF CLOUD SERVICES IN LIBRARY

- Leveraging existing hardware investments and resources: All the libraries use grid computing by using return on investment (ROI), total cost of ownership (TCO), and return on assets (ROA). Cloud can be implemented or deployed on a Library's existing infrastructure including multitude of desktops and existing servers. Cost savings are not limited to reducing hardware and software expenditure, but also being derived by eliminating expenditure on air conditioning and electricity in the library data centers.
- Reducing operational expenses: The cloud used in cross departmental and geographical boundaries uniformly increases the level of computational

capacity across the whole library and enhance the level of redundancy in the infrastructure.

- Creating a scalable and flexible enterprise IT infrastructure: Cloud environment allows library to add resources linearly based on real time requirements. Cloud computing allows the resource maintenance in local control.
- Increased Mobility service for the Library users
- Implementing Green Environment in the Library
- Increased availability of Information to the Library users

IV. CLOUD COMPUTING CHALLENGES IN THE LIBRARY AUTOMATION

- Libraries must have adequate bandwidth to support access to remote applications without latency
- Quality of service agreements that guarantee performance and reliability factors
- Configurability and customizability limitations
- Access to API's
- Ability to interoperate with 3rd party applications
- Technologies promoted by companies and organizations have a vested interest in their adoption
- Critically assess viability of the technology and its appropriateness for your organization

V. CLOUD COMPUTING INITIATIVES IN THE LIBRARIES

A number of universities, vendors and government organizations are investing in research around the topic of cloud computing. YAHOO has expanded its partnerships with top U.S. universities : The University of California at Berkeley, Cornell University, University of Massachusetts and Carnegie Mellon University to advance cloud computing research through Yahoo!'s cloud computing cluster large-scale systems software.

VI. FUTURE CHALLENGES

Digital Libraries can be considered as such if any of the axes user management, content management, functionality management and policy management becomes very large with respect to volume, velocity and variety. The long term goal of the libraries is to establish Very Large Digital Libraries with well-defined areas, models, trends, open problems and technology. The Very Large Digital Libraries cannot be simply regarded as very large databases storing Digital Library (DL) Content. The Digital Library system cannot be approached from the perspective of Content Management only; the dimension of user, functionality, policy, quality and architecture management are equally important.

The Very Large Digital Libraries have been developed because of the demand for infrastructure, and service promoting collaboration and knowledge sharing on large scale is growing. Researchers are more and more realizing the need of tools capable of dealing with the so-called tsunami of data in order to make it accessible, searchable, renewable or linked. In future many researches have to be done on Digital Libraries due to the multidisciplinary nature and cross-organizational character of data archives, with the very large nature of Digital Libraries.

VII. CONCLUSION

Cloud computing is one of the most important technology trends of the times. The phase of client/server computing is fading into obsolescence, replaced by entirely web-based systems, increasingly deployed through SaaS. Libraries and other technology-oriented organizations now have options through infrastructure-as-a-service offerings such as Amazon's Elastic Compute Cloud and Simple Storage Service to ramp up computing capabilities quickly, enjoy free access for smaller projects, and take advantage of usage- based subscription models for larger-scale production projects. Breeding expands on these topics and provides a basic explanation of cloud computing that focuses on real advantages and disadvantages for libraries.

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