
CLLOUD COMPUTING AND ITS APPLICATION IN LIBRARY MANAGEMENT: A REVIEW OF RESEARCH

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Abstract

Cloud computing is a recent revelation of Information Communication Technology. The application of cloud computing in library and information services has brought a novel trend in the scheme of information provision and services. Researchers from different parts of the world have tried to reveal some interesting traits of this new technological operation by exploring its possible application in different key areas of information access, storage, and dissemination. This paper highlights the research reports and viewpoints of authors who have recently made precise contributions on cloud computing and its application in library management.

KEYWORDS :

Cloud data centre, open source software, web 2.0, cloud computing model, OPAC.

INTRODUCTION

Cloud computing is an operational model of information technology which has recently witnessed its application in various aspects of library and information services. Therefore, library and information professionals need to be aware of the concept and know the basic principles that govern cloud computing implementation in any specific information system say libraries and information centres. Moreover, library and information managers need to have a thorough understanding on what constitute cloud computing and how can it be applied to the environment of information storage, processing and retrieval.

Cloud computing in its wider sense, as contemplated by information technology industry, is the most potential model to change how the internet and information systems of new generation based on the latest information and communication technology function and are effectively used everywhere in the world at large (Sharif, 2010; Min, 2012). It is the latest discovery of the development of the Internet enabling execution of all sorts of programmes and activities as the network does. The practice of Librarianship is confronted with tough challenges in regard to constant change of technologies, therefore, the emergence of cloud computing has made the role a library manager more practical and pragmatic to the services they offer to the clientele on day to day basis (Liu et al 2013; Grant, 2013). A considerable increase of digitized contents urges libraries, archives, and learning resource centres to integrate new medias of all types like record labels and film archives, neo documents, and similar such materials into their collection and repositories. Therefore, this is really a tough ask as the multimedia substances and all other associated metadata are very much heterogeneous (Nandzik, et al, 2013). In the

afore said direction, researchers are engaged to find out feasible solution as to how to divide, allocate, compute and hand out the plethora of information resources and services consumed by the Internet patrons through the use of various advanced methods, technologies and systems of realizing virtualization data service (Patel, et al, 2011; Gao & Zhao, 2011). Moreover, the libraries of the modern generation have witnessed rapid transformation from conventional libraries to digital libraries thus, adopting the newly developed model in the form of cloud computing (Shafi & Kumar, 2012) to redesign and restructure the scheme of information provision and services. Therefore, researchers are striving hard how to find suitable methods of applying cloud computing to stream line the huge channel of information in libraries and data centres in successful accumulation, storage, preservation and dissemination. The recent researches both theoretical and practical explorations on different aspects of cloud computing, and its application, cases, and best practices are highlighted under different heads so that future researchers can find the results of such studies at one place.

CLOUD COMPUTING: DEFINITION AND THE CONCEPT

As a novel computing model, the development of cloud computing has brought to the field of library and information science a new perspective to look at the current resource-sharing problem (Han, 2010; Yang & Liu, 2010; Han & Wang, 2011). Yang (2012) in his paper cites three distinct definitions of cloud computing propounded by Murley (2009), Wolf (2010), and Goldner (2011). In the words of Murley (2009) cloud computing is “an emerging architecture by which data and applications dwell in cyberspace, facilitating access to users through any web-connected device”. According to Wolf (2010), cloud computing is “any server usage or software application one can access outside of his/her local server”. The precise definition of cloud computing offered by) includes “a new technology model for IT services”. In this context, Cervone (2010) is of opinion that cloud (common location independent, on-line utility on demand) computing takes this concept of virtualization even further and adds a couple of additional twists as well. The author adds that cloud computing offers an organization a great flexibility and stability to satisfy computing requirements for multifarious needs.

Hoy (2012) opines that, “most cloud computing applications and infrastructure are built with the assumption that users will access them from the Internet, on multiple platforms and from anywhere in the world”. In views of Mavodza (2013) libraries and information centres have rightly diving into the dominion of digital librarianship to explore all facets of information technology, therefore, information organizations are extensively banking on the cloud. In the words of Behrend et al., (2011) “the term cloud computing describes the software applications or other resources that exist online and are available to multiple users via the Internet, rather than being installed on a particular user's local computer”. Generally, the service provider owns the equipment and is responsible for housing, running, and maintaining it. Salesforce.com, Google Apps, Amazon web services and Facebook are the popular examples of cloud computing (Kambil, 2009; Goscinski & Brock, 2010; Low, et al, 2011).

In expanding the idea of cloud computing little further, Jing et.al (2012) opine that, “in the cloud computing mode, the user's data and computing do not run in the terminal equipment such as PC, laptops, tabs, etc, but in the dedicated cloud server through network” so that the users can access to more information resources through exchange and sharing with others. In extension to the idea, Armbrust (2010) aptly remarks that, “the data center hardware and software constitute a cloud. When a cloud is made available in a pay-as-you-go manner to the general public, is called a public cloud; the service being sold is utility computing. We use the term private cloud to refer to internal data centers of a business or other organization, not made available to the general public, when they are large enough to benefit from the advantages of cloud computing”.

In all fairness, 'cloud computing' provides computing services which potentially uses open source software and web 2.0 principles. Primarily, users just need a web browser to avail required information services offered by the server hosted in cloud. In such situation, the users need not understand the intricacies of the computing infrastructure; simply they require having a terminal with internet connectivity to work on.

Why Cloud Computing?

With the emergence of World Wide Web, the service and information provision of libraries have been restructured recognizing that future libraries shift focus from huge collection building to networked services. Rather they should emphasize on referral services to “potentially appropriate points in a vast network of resources accessible through the internet or its successors” (Lancaster, 1997). This prediction has come true and libraries have extended their link and connection to wide networks and full-content databases through web (Cohn et al., 2002). According to Sadeh (2007), the incredible use of Internet among library users has indeed made it imperative that libraries offer their services online since users do have viable alternatives of finding information than using the conventional library. Cosh et al. (2008) in their paper have reminded that Web 2.0 technologies have proved themselves very much popular amongst web designers they do lead to further librarianship challenges. When the content is generated by a more diverse and disparate group, how can that content be managed? Fox (2009) in his paper expresses that, “currently the bandwidth potential at the back of internet has been triggered up exponentially, and network based applications have become much more efficient on the wire and data compression standards have strengthened transmission of multi-media contents over the internet”.

Wei, et al. (2012) discussed the application future of cloud computing in digital libraries, and analyzed the advantages of building the digital libraries on the basis of cloud computing. Contextually, Breeding (2012) addresses that, “the current momentum of open access publishing will continue to build, allowing libraries to focus more on building services based on widely available scholarly content rather than exhausting their resources on procuring it”. Wang, et al. (2012) candidly remarked that, “cloud services can share resources ubiquitously. Most users meet normal operating flows in the cloud environment and must face the derived problems after one of the potential problems is occurred. The authors emphasize that the proposed cloud based service can still efficiently backup the given web site that is constructed by Google Sites and allow users save such web site in their local storages”. To this effect, they sought the need for cloud vendors to harmonize a series of commercial standards for its successful implementation.

In discussing cloud computing technology Nie, et al, (2013) stressed that it has brought a great change in library and information service provision which was badly lacking in last decade so the cloud computing technology has gradually caught the attention of the library world. Liu & Cai (2013) provided “an overview of cloud computing and its increasing impact on systems librarianship, and proposed strategies for systems librarians as they embrace the shift to cloud computing. The authors found that cloud computing has a great impact on systems librarianship”. Nie, et al. (2013) studied cloud computing related theory, analyzed the cloud computing technology in library individualized information service, the application feasibility, on cloud computing in all possible domains of library information services. Additionally, they proposed the guiding principles that govern the factors associated with personalized information services intended for faculty, students, and research scholars. Therefore, cloud computing of late is promising to provide a solid web based library platform by offering has viable information services to its clients with incredible speed and in quick time all around 24x7 hours.

Cloud Computing Model

Cloud computing is a novel model with the distributed computing, grid computing, parallel computing and the Internet working together to offer the users with dynamic, stable assimilation and, processing and dissemination of digital information resources and services(Sun, 2013). In this direction, Wang, et al. (2011) developed library based B/S model based on the library automation system, combined with cloud computing technology. The authors made vivid analysis of cloud computing technology, application prospects in the library, as well as the library facing the management, data security, copyright, and other aspects of the challenges. Esteves, et al, (2012) proposed the use of a novel consistency model for replicated data across data centers with framework and library support to enforce increasing degrees of consistency for different types of data targeting cloud tabular data stores which could offer rationalization of resources.

An interesting discussion on the latest discovery of an algorithm library to run on the cloud was initiated by Fazenda, et al. (2012) who demonstrated, “how Hadoop open-source MapReduce distributed data processing framework was used to implement a single island with a potentially very large population”. Nandzik, et al. (2013) presented the contentus approach towards an automated media processing chain for cultural heritage organizations and content holders. In this context, they provided a set of tools for the processing of digitized print media, audio/visual, speech and musical recordings.

Yang, Liao & Ye (2012) pointed out that, “community library has been an effective complement to the large public libraries. But a single community library is always facing some difficulties in management, costs and resource”. To this effect, they recommended establishing the community libraries alliance based on network which could solve the problems effectively. Chen et al. (2013) focused their study on the design and development of the online 3D model library. Considering the construction of efficient interaction, stable and reliable model library, they designed a web 3D model library system based on the Amazon cloud service platform that adopted model simplification, model size adaption methods to make the system more efficient and interactive.

Cloud Computing implementation in Library and Information Services

Romero (2012) described the features of cloud computing and its usefulness in information delivery services and how it can be used in a professional environment. The author found that, “cloud computing is a highly scalable platform promising quick access to hardware and software over the internet relying on new technologies such as virtualization, programming techniques such as multi-tenancy and/or scalability, load balancing that ensured relatively easy and quick access to information resources”. Liu et al, (2013) studied the use of cloud computing in university employment information library by examining the relationship between companies and graduates in order to build a cloud of labor market information, namely cloud computing database.

Sosa & Ramirez (2012) emphasized that cloud computing as a recent operational model allows the provision of information technology resources on demand, lowering management complexity. In emphasizing the implementation of cloud computing exclusively for resource sharing in academic library systems, Shivalingaiah & Sheshadri (2012) identified the potential areas that a certain library needs to be consider before switching over to its implementation. Abidi, et al, (2012) in their paper stressed that cloud computing would help us in bridging the gap between digital libraries and IT by facilitating huger sharing of data among other which in turn can reduce the overall cost incurred by the individual libraries. The cost reduction and easy maintenance factor in implementing cloud computing was also addressed by Bansode & Pujar (2012). Huang & Du (2011) and Wang & Xing (2011) in their respective studies addressed the feasibility of setting up cloud based digital libraries, digital library architecture and security issues.

Mahalakshmi & Ally (2012) conducted a questionnaire based study conducted to identify the awareness and applications of cloud computing in libraries in Indian context and found that a great majority of the respondents are aware of the term cloud computing and half of them offered optimistic opinions on the feasibility of application in library ambience. Grant (2013) comprehended the mission of librarianship in cloud computing environment and how professionals differentiate themselves from other information suppliers by keeping the values of librarianship intact and preserved when using technology. Yang (2012) reported the works of Breeding (2011) and Stearns & Larson (2011) and mentioned that library vendors have started to deliver integrated library systems (ILS) and discovery tools as cloud solutions. The new generation of information service for the cloud has many revolutionary features including the user interface or OPAC of the new generation information system using integrated staff and user (Breeding, 2011; Stearns & Larson, 2011; Yang, 2012).

Feng & Bao (2010) studied the applicability of cloud computing in university library system and Zhang et al (2011) lauded how the model can be integrated into the university book information system. In another typical study Dula & Ye (2012) vividly discussed Pepperdine University Libraries' migration to OCLC's WorldShare Management Services and the rationale for the decision by focusing on the effects of the new system on the libraries. A very qualitative research results on sustainability governance was reported by Truong & Dustdar (2012). The authors stressed that, the intricacies of data assimilation; storage, processing sharing, analysis, the process of integration and several such issues are

the real challenges for any sustainability governance platform. More particularly, the issue of sustainability monitoring and analysis of large facilities demands the participation of stakeholders and multi-objective optimization. Therefore, the authors comprehended the reliability, stability, and trustworthiness cloud computing services that could provide stable platform for the sustainability governance in the light of data accumulation, integration, sharing, access and management.

Yuvaraj (2013) in his survey explored the librarians' inquisitiveness in adoption of cloud computing in libraries of Indian Central Universities. Moreover, he studied the tools and techniques of Cloud Computing used in their daily library services and found that librarians are heavily reliant on cloud computing tools and majority of them are using various devices for improving the quality of library and information services though they are a bit worried about the security prospect of the system. In the similar vein, Singh & Verlakshmi (2012) pointed out that the cloud computing model could help libraries and information centres to maintain proper administration and control over the data assimilation, storage and dissemination providing utmost customer's satisfaction.

Cloud Computing in Digital Preservation

The need of cloud computing in expanding the provision of digital library services and preservation issues was vividly discussed by Nürnberg and Mark (2012). Yang and Yu (2012) discussed the application of cloud computing in the university library consortium, and made some constructive comments and suggestions on cloud based applications in the university library system. Chun (2010) indicates that cloud computing affords powerful data storage and web service functions and the model is extremely helpful in digital preservation. Decman & Vintar (2013) discussed the need for Digital preservation providing a theoretical framework for modern digital preservation which includes Physical level, Logical level, and Conceptual level. Moreover, they provide feasible organizational and technological solution through a model of centralized digital preservation repository which is depicted in fig-1 for a view.

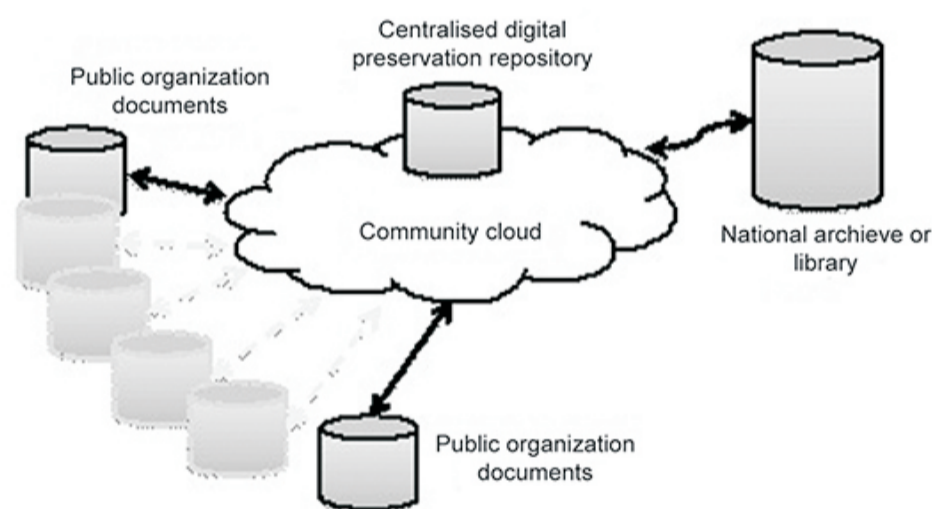


Fig- A model of centralised digital preservation repository

Source: Decman & Vintar, 2013

The authors suggested possible solution for short- and long-term digital preservation for the public sector with the idea of a centralised digital preservation repository in the form of a community cloud, available to all public administration organizations which subsequently link the ideas of cloud computing with the concept of digital preservation.

Advantages of Cloud Computing

Application of cloud computing to any data centric organization, offers a good number of advantages for the management of large chunk of data. The following key advantages mentioned by Romero (2012) are noteworthy:

Automatically increases or reduces the consumption of hardware or software resources as per the requirements.

It can offer more efficient and effective control of expenditures.

Provides immediate access to the improvements and updating of hardware and software;

Provides remote access to electronic resources with less cost irrespective of geographical barrier.

Moreover, Koury & Jardine (2013) opine that it is extremely useful for content organization and sharing, creating tutorials, collaboration, scheduling and data storage. In this regard, Yang (2012) mentions that agile updating, is another remarkable merit cloud computing as it is expected to use the release of latest software while Galvin & Sun (2012) advocated that flexibility and cost savings are the best reason for moving projects to the cloud.

Disadvantages of Cloud Computing

In spite of its several merits, cloud computing suffers from certain setbacks that are of a bit concern. In this context, the pitfalls of cloud computing applications hinted by Kambil (2009), Yang (2012) Romero (2012) Tang (2013) may be outlined as:

The issues of data security, internet bandwidth user privacy leaks, virtualization security are matter of concerns to cloud computing application;

May create doubt in the minds of professionals about data security as In the case of digital data there is still a huge fear of putting information in the hands of third parties;

The customers may lose ownership as the data is often stored in servers; and

It is very difficult to migrate from cloud to cloud

CONCLUSION

In regard to the complex nature of data management, handling, and administration, cloud computing is recently considered as the most striking model for supporting the libraries in effective service provision, long term preservation and perpetual access of data though there must be a quest for a certain service provider who can host, run and maintain the library data system. Through the application of cloud computing, libraries can be in a better position to manage complex data storage, information access, sharing and consumption. The papers reviewed have rightly addressed both theoretical and practical aspects of application of cloud computing in libraries, institutional data systems of various parts of the world. It is believed that many researchers would come forward to exploit the existing platform of research and garner all their possible experience to reveal new findings on cloud computing applications in libraries so that it would be congenial for information scientists and librarians to follow the cases with interest and enthusiasm.

NOTES

1.<http://mm3b03-group11.wikispaces.com/Cloud+Computing>

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