Function of Cloud Computing in Digital Library Perspective: In Case of Ethiopia Higher Education Institution; Critical Review

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Abstract

The digital libraries have to face with some technique and service problems along with many advantages relative to the traditional libraries, and all these produce the practical needs of cloud computing. Cloud computing has influenced information resources, information users, information personnel and information facilities of digital libraries with its unique advantages and then promoted the development of digital libraries. Developed country like Ethiopia Libraries may soon be building and managing their own data centers. Different models show that libraries maintain more control over the applications and data stores that contain sensitive, private information about patrons.

Keywords

Cloud Computing; Digital Library; Higher Education

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1. Introduction

The term cloud computing is completely new trend and technology which is known as third party revolution after computer and internet, in distributed computing, parallel computing, grid computing and in the case of distributed database improves the power of above in digital library. It provides distributed environment that makes easier to collect information from local computers, personal computers, remote computers, mobile phones or other equipments and also integrate that information to serving users. Digital library technology popularization provides resources sharing with difficulty from each in sequence with aggregate demand. The beginning of the word cloud computing is undecided. Alternative illumination is that the old programs to draw network schematics surrounded the icons for servers with a circle, and a group of servers in a network diagram had several overlapping circles, which resembled a cloud. Cloud was used as a metaphor for the internet and a standardized cloud like shape to denote a network. The use of the Internet and Information and Communication Technologies (ICTs) to deliver educational resources is considered mainstream in the 21st century, yet in Higher Education (HE) in developing countries it is often seen as a luxury. This has far reaching effects on teachers, learners and educational institutions in these countries, which often include a lack of basic ICT infrastructure and limited or no support for the training of teachers and learners in the use of digital online information sources(Giles, 2010). It is increasingly accepted that in the future most information sources and desktop applications currently used will be mainly accessed through the Internet, now increasingly referred to as „the cloud". This means that at higher education level ICTs should be adopted as a matter of urgency to enable teachers and learners to access this new direction in Internet technology and application delivery. Teachers and learners will no longer have to physically carry their documents and data around them; instead they will be able to access them in the cloud anywhere, from any connected device. In recent days, many research institutes are struggling to adapt Cloud Computing for solving problems that are continuously increasing computing and storage. There are three main factors that interests in Cloud Computing: rapid decrease in hardware cost and architecture and modern supercomputers consisting of hundreds of thousands of cores; the exponentially growing data size in scientific instrumentation/simulation and Internet publishing and archiving; and the wide-spread adoption of

Services Computing and Web2.0 applications(Demissie, Dahiru, Bass, & Allison, 2017). The Cloud Computing trend of replacing software traditionally installed on campus computers with applications delivered via the internet is driven by aims of reducing Higher Education Institutions(HEIs) IT complexity and cost. Cloud Computing could be a technological innovation that both reduces IT costs for the HEIs and eliminates many of the time-related constraints for students, making learning tools accessible for a larger number of students. There are many benefits of cloud computing for educational institute and below are listed a few of them with cloud computing, HEIs can open their technology infrastructures to businesses and industries for research advancements(Singh & Sahu, 2016).

- ✓ The comprehensive reach of cloud computing enables institutions to teach students in new, different ways and help them manage projects and massive workloads
- ✓ .When students go through the universal workforce they will better understand the value of new technologies. Cloud computing allows students and teachers to use applications without installing themon their computers and also allow access to saved files from any computer with an Internet connection.

Libraries may soon be building and managing their own data centers. This model would let libraries maintain more control over the applications and data stores that contain sensitive, private information about patrons. Provisioning and maintenance of infrastructure for Web based digital library present several challenges. In this paper we discuss problems faced with digital library and development efforts to overcome that problem developing country higher education institution specially Ethiopia. Infrastructure virtualization and cloud computing are particularly attractive choices which is challenged by both growth in the size of the indexed document collection, new features and most prominently usage. With the purpose of applying Cloud Computing to university library, the paper describes the current status of user service models in university libraries. Then it proposed to improve current user service model with Cloud Computing. This paper explores some of the security issues surrounding data location, mobility and availability. In developed countries libraries are building and managing their own data centers but not in Ethiopia. Model that maintains more control on the applications and data centers that private information about us. The challenging point is provisioning and maintenance of infrastructure for digital library based on web applications. To outcome these challenges we have to apply e-learning system as a product of modern in sequence technology to implement education modernization. Through the cloud computing technology and features of e-learning technology teachers can involve in the e-learning process of students openly. Beginning of computer with sophisticated software has made it potential to explain many composite troubles quickly and at lower cost. Paper introduces the self of the current e-learning and then describes the architecture of cloud computing to building and managing libraries. Cloud computing offers a range of new opportunities for developing countries to do what they could not do in advance with computers and the Internet. Because the mobile phone and devices user market is too big to be ignored, cloud service providers, in collaboration, with mobile service providers have deployed hundreds of cloud-enabled applications and are continuing in their end to provide an endless range of products(Ogbu & Lawal, 2013).

2. Conceptual review

Cloud Computing is a completely new IT technology and it is known as the third revolution after PC and Internet in IT. To be more specific, Cloud Computing is the improvement of Distributed Computing, Parallel Computing, Grid Computing and Distributed Databases. And the basic principle of Cloud Computing is making tasks distributed in large numbers of distributed computers but not in local computers or remote servers. In other words, by collecting large quantities of information and resources stored in personal computers, mobile phones and other equipment, Cloud Computing is capable of integrating them and putting them on the public cloud for serving users(Itana & Omer, n.d.). Cloud computing is making it possible to separate the process of building an infrastructure for service provisioning from the library of providing end user services. Cloud computing provides people the way to share distributed resources and services that belong to different organizations or sites. Cloud computing share distributed resources via the network in the open environment. It is a virtual pool of computing resources through internet. Cloud computing provides people the way to share distributed resources and services that belong to different Organizations or sites. Many companies, such as Amazon, Google, and Microsoft and so on, accelerate their paces in developing Cloud Computing systems and enhancing their services to provide for a larger amount of users. Cloud computing is broken down into three segments: "application" "storage" and

"connectivity." Each segment serves a different purpose and offers different products for businesses and individuals around the world. Libraries are using computers for running services such as Integrated Library Management Software (ILMS), website or portal, digital library or institutional repository, etc. These are either maintained by parent organization's computer staff or library staff. It involves investment on hardware, software, and staff to maintain these services and undertake backup and upgrade as and when new version of the software gets released. Library professionals in most cases not being trained in maintaining servers find it difficult to undertake some of these activities without the support of IT staff from within or outside the organization. Now cloud computing has become a new buzzword in the field of libraries, which is blessing in disguise to run different ICT services without much of a problem as third-party services will manage servers and undertake upgrades and take backup of data. Cloud Computing is internet based computing where virtual shared servers provide software, infrastructure, platform devices and other resources and hosting to customers on a pay-as-you-use basis. All information that a digitized system has to offer is provided as a service in the cloud computing model. Users can access these services available on the "Internet Cloud" without having any previous know-how on managing the resources involved(Kumar, Murthy, Ramakrishna, & Rohit, 2012).

Digital library is a development-oriented hardware and software integration platform, through to technical and the product integration, each kind of carrier digitization, carries on the effective deposit and the organization, provides the network the effective service. After Digital library technology popularization, provided the high grade information service but simultaneously also to expose all sorts of questions unceasingly, because the zones of different the current economic condition limit presented the development not balanced phenomenon, the regional resources shared with difficulty, form each one information isolated island or the resources are redundant, create the resources the waste, satisfied the aggregate demand with difficulty, the cloud computing possibly provides a good plan day by day for this kind of phenomenon. Problems of Digital Library Digital library for our study provide 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. Digital library representative one kind of new infrastructure and the environment, through the cloud computing, it may use resources more effective, and can solve the defects of digital library(Shiferaw, 2016).

2.1. Improvement of User Service Model in University Libraries

With the fast improvement of various IT technologies, users' information requirements are increasingly personalized. And now more and more libraries advocated user-centered services. So librarians should mine and study users' information requirements frequently. And only in this way, they can master the basic demands of their users. And furthermore, library can develop itself according to such information and improve users' satisfaction. University library, as we all know, is famous for its academic and teaching influences. And IT technology has been the driving force of library development. What's more, librarians can keep using new technology to develop library and optimize library service. With the expansion of Cloud Computing application, this paper proposed to apply Cloud Computing in libraries(Itana & Omer, n.d.).

2.2. Libraries and Cloud Computing

Cloud Computing offers to solve the major problems of libraries. This new technology holds the concept of cost cutting and adopting better IT capabilities in libraries to provide better user satisfaction and their need. Although study of Cloud Computing is still in the initial stage.

2.2.1 Some Live examples where Libraries are adopting Cloud Computing

1. **OCLC**: OCLC Online Computer Library Center is a nonprofit, membership, computer library service and research organization dedicated to public purpose of gaining knowledge. In a sense OCLC has been functioning as a Cloud Computing vendor, they provide cataloguing tools over the internet and allow

member(s) to access the data from their centralized data store.

2. **Library Thing**: Library Thing is also one of the sites that combine aspects of social networking and Cloud Computing. Library Thing offers services which are just like social networking site which authorizes people to contribute information and suggestion about books and allow them to interconnect globally to share interests.

3. **Reed Elsevier**: Reed Elsevier is a service provider for scientific information working with hospitals to provide point in time information to medical technicians as they needed.

4. **Amazon and Google:** These are among the leading enterprises also providing solutions for libraries by having partnerships between library automation vendors. For many years they are working for the dissemination of information and also taking interest in library solutions using "AAP Search Engines".

5. **Dura Space**: Dura Space provides a hosted service and open technology to help organizations and end users effectively utilize public cloud services. These services can work on Amazon, Atoms etc and other Cloud services.

6. **Terra Pod**: Terra Pod is a Digital Video Library. It allows the user to outsource upload and data creation to the creators of the contents.

2.3. Scope of Cloud Computing in Libraries

Cloud Computing allows a library to respond more quickly to services needs by allowing a library to scale its technological resources, employ a pay on demand resource model. I will also helpful in providing IT infrastructure in the library which could be difficult to acquire and manage by every library. Some of these services off load technical management responsibilities and even proved a level of data management for libraries. Cloud Computing has large potential for libraries. Libraries can upload more and more contents in to the Cloud which user(s) would be able to browse or download it resulting saving the money and time of the reader and library staff. All historical and rare documents would be scanned into comprehensive, easily searchable databases of Cloud and would be accessible to any researcher. But using Cloud Computing means more than purchasing access to a specified system. A number of companies offer dedicated virtual platforms that enable libraries to completely control their environment. Many libraries are having online catalogues and bibliographic databases with OCLC. More frequent online catalogues are linked to consortium that share resources(Pandey & Kushwaha, 2015).

2.4. Cloud Computing in Higher Education

Technology has grown rapidly with scientific advancement over the world in recent decades. Therefore, there is a need to redesign the educational system to meet industrial needs better. The advent of computers with sophisticated software has made it possible to solve many complex problems very fast and at a lower cost. Almost all studies in various disciplines use computers to solve their problems. Making computers available to all users, particularly students, is difficult in developing countries. This is one of the major problems in educational institutions arising from budget constraints. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited. In this paper, attention is given to possible implementation of Cloud computing technology in the educational field, especially in engineering colleges where there is intensive use of computers and software. In this research, we classified the various applications of Cloud Computing technologies in educational institutions. This paper thus describes the issues that need to be solved in order to arrive at cloud education, including integration, ownership, security and assessment, and offers a holistic approach to cloud education. It also put forward a new perspective in embedding mobile cloud education, an amalgamation between cloud-learning and mobile-learning domains, within a holistic intelligent campus environment. This essay mainly focuses on the research of the application of cloud computing in education information. Firstly, the traditional computer technologies, including the virtualization, network storage technology, distributed computing, parallel computing technology, network technology and automation techniques etc(Giles, 2010).

2.4.1. Adopting Cloud computing in Ethiopian Higher Education

In Ethiopia different initiatives are working as part of a national capacity building program that includes schoolnet, WoredaNet that aims to provide connectivity and specialized applications for schools and for local governments. The Ethiopian Education and Research Network (EthERNet) was launched in 2001 to build and deliver highly interconnected and high performance networks for Universities and other

Educational and Research Institutions in Ethiopia. More specifically, EthERNet was aimed to build and deliver high performance networking that connected these institutions with each other and similar institutions in the world, and by doing this to enable them to share educational resources and collaborate both within Ethiopia and globally. Since its establishment EthERNet has provided services like data center, video conference, e-library and technical support. Even though EthERNet is providing different services to Ethiopian Education and research, it still needs integration of other services, and service delivery based on the new model of computing, which cloud based computing, for a better service delivery strategy and strategic utilization of resources. For a particular IT service, a sufficient level of aggregation for efficiency cannot be achieved within one campus but, rather, must be achieved at a higher level of aggregation, beyond a single institution. Efficiencies may be realized in aggregating personnel, expertise, licensing, business continuity, and other benefits far beyond simply joining computer hardware. Cloud Computing For Ethiopian Higher Education Ethiopia as a developing nation has suffered by limitation of educational budgets. HEIs are being built in very high speed. Currently there are around 45 government owned universities and many private colleges. Without quality education establishing educational institutions by itself cannot give the solution we seek for economic development and poverty reduction through education. Education should be supported through up to date technologies and services. Ethiopian government has been investing millions of dollars every year to support education in higher education institutions with technology. However due to struggling economy it is not able to supply full ICT infrastructure requirements of all universities. Requirements can be solved using cloud computing strategy.i.e. Implementing a central Hybrid Cloud Computing infrastructure that can be used by all HEIs of Ethiopia. The proposed Ethiopian Universities Hybrid Cloud combines private and public clouds. The private cloud is implemented and managed by Ethiopian MOE in collaboration with higher education institutions. Every resource that can be shared by multiple universities will be placed at EUHC and then it will be available to all hosted universities. Whenever some resources can t be deployed into EUPC due to different factors then through the public interface it is possible to access the resource from other CSPs. By deploying Hybrid cloud computing model, the fear of privacy and other related security issues can be avoided, since critical and sensitive data could be owned by university members and responsible bodies from Ethiopian Ministry of Education. Related Works Regarding benefits and challenges of adapting Cloud Computing for the universities, discussed the possible offerings that Cloud Computing could deliver, especially in Malaysian Universities. The 21st century students are not satisfied with the traditional learning process; thus, the researcher used Cloud Computing to enhance the learning environment by using Cloud Computing benefits in cooperation with the multimedia contents, and made the learning process highly interactive to meet student expectations. Discussed more than ten Cloud computing offerings, pointing out that the Cloud Computing users gain the illusion of resource availability as an infinite on-demand resource, which enables storage and huge amounts of information on the Cloud. In addition, the researcher stated that introducing the students to Cloud technology will prepare them to work in the industry since they gained the skill of dealing with new technology. Cloud Computing offers cost effective solutions for Universities, staff, and students since all of the needed hardware and software are available via the Cloud, which makes their files highly portable, easy to share while computing power is easy to manage. Additionally, claimed using Cloud Computing would improve collaboration and communication in the learning environments. On the other hand, he clearly stated that the Cloud Computing has some drawbacks: need for Internet connection and trust in the CSP service availability, privacy of the data, and security. Cloud-Based Services in Ethiopian Higher Education Institutions Building the Framework Cloud Computing technology for delivering different services such as e-learning environment, Class Room Management Systems, Enterprise Resource Planning Systems, researching and similar services will give more flexibilities and dynamic resource utilization which solves the scalability issues. Then the Virtual University Services on top of Cloud Computing layer helps to solve limitations of the current IT service deployment scenario(Shiferaw, 2016).

2.4.2. Cloud Library Framework for Ethiopian higher education intuition

The ever increasing users' information need of electronic resources forced librarians to increase their effort of collecting, organizing, preserving and disseminating huge amount of electronic materials, which require state-of-the-art infrastructures so that the electronic resources be deployed easily,

quickly and economically. Cloud library is the best option for libraries; especially where electronic library services divide is highly visible, like the Ethiopian higher learning institutions. Such library system allows the establishment of information technology infrastructure on demand and lowers the difficulty of control mechanism. The integration of existing library services can be implemented by clustering current library environment(Adem, Pradhan, Workneh, & Engineering, 2018).

3. Report of the Finding

In this technology era, educational institution heavily avail the technology for teaching, learning and researching across the world. The aim of the study is to review the development of Cloud Computing Application in digital library of Ethiopian higher education institution .Today we are living in the age of information. Information technology plays a very vital role in handing library resources ranges from collection, storage, organization, processing, and analysis of information dissemination. Library field facing many challenges in the profession due to applications of information technology. New concepts and technologies are being added to ease the practices in the libraries and satisfy the needs of the knowledge society. With the advent of information technology, libraries have become automated which is the basic need towards advancement followed by networks and more effort are towards virtual libraries. The emergence of digital library, internet usage, web tools application for libraries, consortium practices leads to the advancement in library profession. Cloud computing is a completely new IT technology and it is known as the third revolution after PC and internet in IT(Sahu, Librarian, Gandhi, & Vishwavidyalaya, n.d.). The later technology trend in library science is use of cloud computing for various purposes and for achieving economy in library functions. Since cloud computing is a new. We know that library is not only a knowledge ocean, its ultimate aim is to provide satisfactory services for all the people. So in the new era, library should improve itself constantly by adopting many new IT technologies(Pandey & Kushwaha, 2015). And in this paper, we review current user service model in university library by using Cloud Computing. Although study of Cloud Computing is still in the initial stage now, impacts brought by Cloud Computing are obvious. With the introduction of Cloud Computing to university library, services of libraries will have a new leap in the near future. Services provided by libraries will become more user-centric, more professional and more effective, etc. The Cloud computing techniques and methods applied to digital libraries, not only can improve the utilization rate of resources to address the imbalance in development between regions, but also can make more extensive use of cloud computing to our work life. Now a day universities surprisingly based via information technology for education procedure that teaching learning process, administration service for resource management, commercial enterprise requirement and service deliver. Supply and keeping a wide vary of hardware and software demand essential, current funding and capability to assist them. Universities are being face problem through offering modern necessary need of IT aid for educational and research improvement things to do due to the fact of financial crisis. The research methodology consisted evaluation of latest research on cloud computing as an option to information technology activity and management, it additionally take for fantastic practices for cloud computing utilization with different universities, interviewing with selected ICT sub director, officers and professional authors in information technology and Ethiopian higher education. The challenge of current information technology exercise in Ethiopian universities library(Ogbu & Lawal, 2013). Now a day's Libraries are suffering from common problems like metadata, low level of efficiency, huge cost of knowledge & information, IT Infrastructure etc. Cloud Computing would help us in bridging the gap between Digital Libraries and Information Technological resources. Sharing the data among Libraries will reduce the overall cost and increase the efficiency in all aspect. It will also enhance the user's knowledge and will help in making the Libraries a lot more scalable(Giles, 2010). Making computers available to all users, particularly students, is difficult in Ethiopia. This is one of the major problems in educational institutions arising from budget constraints. Cloud computing is becoming an attractive technology due to its dynamic scalability and effective usage of the resources; it can be utilized under circumstances where the availability of resources is limited. In this paper, attention is given to possible implementation of Cloud computing technology in the educational field, especially in digital library perspective(Sahu et al., n.d.).

4. Discussion on the report

Libraries have the opportunity to improve their services and relevance in today's information society.

Cloud computing is one avenue for this move into the future. It can bring several benefits for libraries and give them a different future. The cooperative effect of libraries using the same, shared hardware, services and data 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 a manner that users want and understand. Nowadays, the most important thing for user is Information and Communication Technology play an important role in the major field of Libraries. A Library which is a system of organized knowledge staff services and users will find it equally accommodating to improve its surroundings in the Internet based epoch. In way to the best service deliver possible Librarians should be willing to take advantage of utile the resources. Cloud computing is a recent concept has emerged as a ray of hope at a stage when Libraries are facing straining work in adjusting to the ever increasing amount of Information gathered in different formats. Cloud computing as an emerging style of computing that involves various technologies and provides virtual and information technology related services over the Internet. Cloud computing can enhance the implementation of digital Library projects by reducing the cost involved in the whole processor and to get connected with all Institutions strictly and efficiently. Cloud Computing provides real time access utilities and user pay for what they use only through various implementation models. This paper shows and highlights the use of cloud computing in Libraries with respect to its concepts, types and general applications Educational institutions throughout the World have become highly dependent on information technology for their teaching-learning, service delivery and business requirements. Procuring and maintaining a wide range of hardware and software require substantial, ongoing investment and the skills to support them(Sanchati & Kulkarni, 2011). In the current financial crisis and being challenged by growing needs, universities are facing problems in providing necessary information technology (IT) support for educational, research and development activities especially in Ethiopia. The paper discusses the advantages of cloud computing for educational institutions specifically digital library, the limitations of current IT utilization in Ethiopian Higher Education institutions. It also discusses alternative solutions to solve the current IT utilizations limitations in Ethiopian Higher Education Institutions. The research finding shows that Cloud Computing is the better ICT utilization mechanism for Education institutions teaching-learning and service delivery requirements, for it enables wise and strategic use of technology which significantly reduces cost.

5. Conclusion

Cloud computing is a new technique of Information Communication Technology because of its potential benefits such as reduced cost, accessible anywhere anytime as well as its elasticity and flexibility. In this Paper defines cloud Computing, Definition, Essential Characteristics, model of Cloud Computing, Components of Cloud, Advantages & Drawbacks of Cloud Computing and also describe cloud computing in libraries. Cloud computing is an evolving technological paradigm that facilitates conveniently, on-demand network access to a shared pool of configurable computing resources like network, servers, storage, applications and services etc that can be presented as a service and released with minimal management effort. The model promotes availability of resources and creates powerful distributed computing system with global reach and super computing capabilities. Cloud computing is enriching and will widen the horizon of human knowledge, empower human capital for sustainable scientific development as well as educational development of nations. This paper tries to explore the vast and immense benefits of cloud computing and its applications in e-library services in Ethiopia today. Libraries are moving towards cloud computing technology in present time and taking advantages of cloud based services especially in digital libraries, social networking and information communication. Therefore it is time for libraries think seriously for libraries services with cloud based technologies and provide reliable and rapid services to their users. Another role of LIS professionals in this virtual era is to make cloud based services as a reliable medium to disseminate library services to their users with ease of use and save the time of users.Cloud computing enables innovation by alleviating the need of innovators to find resources to develop, test, and there innovations available to the user community. Innovators are free to focus on the innovation rather than the logistics of finding and managing resources they enable the innovation. We all know that library is not only a knowledge ocean; its crucial purpose is to offer acceptable services for all the people. So in the new age, library should advance itself constantly by adopting many new IT technologies(Shiferaw, 2016)s. As well as in this paper, we tried to make progress current user service model in university library by using Cloud Computing. Even though study of Cloud Computing is still in the initial stage now, impacts carried by Cloud Computing are

obvious. With the overview of Cloud Computing to university library, services of libraries will have a new leap in the near future. Services provided by libraries will become more user – centric, more professional and more effective, etc. And we all believe that libraries will create more knowledge benefits for our country with the help of Cloud Computing. Cloud environment is a highly developed network environment; it appears to the users of high quality service and high security. The Cloud computing techniques and methods applied to digital libraries, not only can advance the employment rate of resources to address the imbalance in development between regions, but also can make more broad use of cloud computing to our work life.

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