

ENHANCING LIBRARY SERVICES DELIVERY IN THE 21ST CENTURY IN AFRICA: THE ROLE OF CLOUD TECHNOLOGIES

Kenneth Ohis Irenea¹, Rukayya Ibrahim Tijani² and Oluwabunmi Bakare

¹Federal University, Otuoke, Bayelsa State

²Ahmadu Bello University, Zaria

³PostDoctoral Fellow, University of Cape Town, South Africa

ABSTRACT: *The impact of technological advancements has been greatly felt in virtually every sphere of human society. Libraries are no exception to this trend and the need for libraries to embrace this change is pertinent to their survival. The new patronage of libraries and information centres are now more techno-savvy than the previous generation of library users. The preference for internet and web-based services has become more evident. Libraries and information centres now compete with rival agencies who provide similar and alternative services which have made users rely more on the alternatives provided by these agencies. With the changing information seeking behaviour of library patrons, libraries must consider alternative options to service delivery. The paper explores cloud services, the types and models, and the roles that cloud computing and technologies can play in enhancing library services in the 21st century. Cloud computing was x-rayed, the roles were discussed at item level, benefits of cloud to libraries, and the implication to libraries and library and information professionals for service delivery.*

KEYWORDS: 21st Century, Library Services, Cloud Technologies, LIS Professionals, Service Delivery

INTRODUCTION

Right from unknown antiquity, libraries have served as the memory of the human race but in recent times, it has continually seen a significant fall as first point of call whenever information is needed by information seekers. Old workflows, limited collaborations, shallow expertise, resistance to outsourcing, ineffective service paradigm, and a host of other challenges have watered down the impact libraries make in today's changing world. The inadequacies of traditional librarianship in the face of increased technological demands, current realities, and the need to improve on services in the libraries has become more evident. With the continued rise of competitors and rival agencies with more sophisticated software, hardware, products and services. The survival of libraries now depends on its creative abilities to remain relevant in the 21st century. For this survival to subsist, libraries must repackage their services, enhance the skills of the staff and leverage technology for improved services for it to reclaim the glory days.

The paper highlighted some of old and problematic workflows which are currently bedevilling library patronage and service delivery among libraries in Africa and suggested alternative means of enhancing library services in the 21st century using cloud technology-enabled services.

Library Services in the 21st Century

For centuries, the defining role of the library has been as a repository of books. However, 21st century library faces a more significant challenge as there is a paradigm shift from the printed pages to digital screens for information and communication (Mullaney, 2013). Some of the core issues under review include – technology integration, innovative services, institutional identity and right-sizing collections (plan for shaping a library's physical collection into one that meets its users' needs - (Ward, 2015). The 21st century library patron has significantly evolved as Matthews (2011) grouped them into three categories which are: (1) the digital fugitive – these patrons are not digital migrants and have not really accepted digital technology and still prefer the 'good old library' as their source; (2) the digital migrant – these group did not grow up with digital technology but have absorbed and integrated it into their lives as a necessity; and (3) the digital native – these are the group of users who grew up learning digital technology and have come to depend on it as an integral part of their lives. Aside the relatively small group of digital fugitives who are not really into technology, majority of libraries clienteles fall into the younger generation of users. Therefore, libraries must acknowledge technology trends and re-invent their services in order to remain relevant in the scheme of things. Otherwise users will bypass processes and institutions that they perceive to be slow, unresponsive, unappealing and irrelevant in favour of a more direct approach to services offered by others that just might be "good enough" for what they need to do (Miller and Jensen (2007). This implies that libraries have to be proactive, re-strategize and restructure its mode of service delivery to as to so as to meet the information needs of their 21st century clienteles (McCallum, 2015) and significantly counter the current library ennui that pervades our society about the library (Bell, 2007).

Having establish the only means of survival of libraries in this dispensation is by embracing technological trends that can improve her service delivery to her clienteles. One fundamental way of enhancing library services in the 21st century is via cloud computing, which Qusay (2011) defined as a type of Internet-based computing that provides shared computer processing resources, data to computers and other devices on demand instead. Sahu (2015) opined that cloud computing can transform the way systems are built and services delivered, providing libraries with an opportunity to extend their impact. Thus, the importance of cloud computing to 21st century service delivery cannot be over emphasized. Libraries should therefore in essence 1. Make a move from the physical to virtual – for decades, libraries have existed exclusively as physical spaces, but with the paradigm shift from offline to online contents which implies that libraries have to take steps to better meet its community information needs, provide computer access, subscription to academic databases, trained assistants to help the users navigate and search for qualitative and well researched information;

2. Promote libraries as strong community anchors that enhance civic engagement, cultural opportunities and economic vitality (Miller, 2012). Libraries should offer services that help to advance solutions to community problems by providing safe spaces for gatherings, and connecting points to community services by creating partnerships with businesses, agencies, institutions, for engagement with the host community. Libraries should host events that bring the people together;

3. Libraries should focus less on collection and more on creation – libraries should not just be places to store content, but should become places where people of all ages create and produce content themselves. Libraries should become places of innovation and exploration and should create programmes focused on digital literacy and training.

Cloud Computing

Cloud computing works on a principle of sharing of resources and infrastructure for effective and efficient service delivery. It encompasses the provision of software services and with the essential hardware resources used as a virtualized platform across numerous host computers connected by the Internet or an organization's internal network (Treacy, 2009; Buyya, et al., 2009). The US department of Commerce's National Institute of Standards and Technology defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Email servers like Gmail, Hotmail, Yahoo are popular providers of electronic mail services handling the hardware and software needed to support personal email accounts (Huth & Cebula, 2011) used by individuals and organizations for their day-to-day tasks. Which simply requires a web browser, a smart device, or any Internet enabled devices, and an access to a registered email account.

Cloud computing provides new opportunities for innovation and offers unprecedented new levels of configurability for diverse groups of users of which the library is not left out. Creates possibilities for services to be dynamically configured to the needs of each user with a single unified, usually global-scaled, architecture (Kushida, Murray, & Zysman, 2011). It delivers services incorporated in any of the following nomenclature: data storage, computation (processing power), and networking. That is, sharing of data storage, computing power, and network infrastructure by multiple user groups. Cloud services can be provided to users at any time, regardless of location, with the cost based only on the resources used. Users or subscribers only need to procure from the providers the 'amount of computing' required without needing to invest in the entire computing infrastructure (Kushida, Murray, & Zysman, 2011).

Types

Clouds computing come in different forms precipitated on need. They are also tied to who provides the services and where they are located. They include: public, private, community, and hybrid clouds.

Public Cloud: - this is a type of cloud in which the computing infrastructure is possessed, run and situated within the sites of the host company's data centres (not in the customers' premises). That is, it is an off-premise arrangement from which services are provided. The subscriber does not have physical control over the infrastructure. This type of cloud uses a shared infrastructure pool from which many companies and institutions that need their services share same infrastructure to run their services. It can be accessed from any location with internet connectivity which is the only requirement. A typical example is the institutional mails (abc@unionuniversity.edu.ng) been used by many universities and colleges around the world, hosted by Google, Microsoft, and other email servers. Examples include: Google App Engine, IBM Smart Cloud, and Amazon EC2

Private cloud – this is not shared infrastructure, but could still be located in a remote facility. This type also allows organizations the option of choosing an on-premise infrastructure set-up which is usually expensive, with more control over the infrastructure. It is more secure with high control levels. They are deployed in closed environments, maintained and operated for a specific organization (Balan, Gupta, Kanal, Singh, & Bhanumurthy, 2014). Some examples

include: Ubuntu Enterprise Cloud, Amazon VPC (Virtual Private Cloud), and VMware Cloud Infrastructure Suite.

Community cloud – community infrastructure is shared between organizations, usually with the shared data and data management concerns (organizations with similar interests). Several organizations can jointly construct and share the same cloud infrastructure as well as policies, requirements, values and concerns (Dillon, Wu, & Chang, 2010). The infrastructure could be hosted by a third-party vendor or within one of the organizations in the community. Some examples include: Google Apps for Government, and Microsoft Government Community Cloud.

Hybrid cloud – this is a combination of clouds (private and public cloud offerings) that allow for transitive information exchange (the cloud has the ability through their interfaces to give room for data, and applications to be moved from one cloud to another), that is, compatibility and portability across disparate cloud service offerings is possible. They use standard methodologies regardless of the ownership or location. Hybrid cloud providers can use third party providers in part or full depending on demand, thereby increasing flexibility of computing. Examples, Microsoft Windows Azure, and VMware vCloud, etc. are some clouds with hybrid capabilities.

Models of Cloud Computing

Cloud computing models are broadly grouped into three categories which are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

- a) **Software as a Service (SaaS):** this model avails to the consumer the use of the provider's applications, running on a cloud infrastructure and accessible from various client devices through a thin client interfaces (e.g. web browser). It offers full applications to a customer on demand. The individual subscribing does not require investment in servers or software licences, and the provider's cost are reduced, since a single application needs to be hosted and maintained. The applications are released on a hosting environment which can be accessed through networks from various clients (e.g. web browsers, PDAs, Smart Devices, etc.) by application users (Dillon, Wu, & Chang, 2010). Consumers do not have control over the cloud infrastructure which employs a multi-tenancy system architecture. Applications are organized into a single logical environment on the SaaS cloud to achieve economies of scale and optimization in terms of speed, security, availability, disaster recovery, and maintenance (Dillon, Wu, & Chang, 2010). Some of known providers include: Salesforce, LinkedIn, Workday, Netsuite, ServiceNow, Concur Technologies, Athenahealth, The Ultimate Software Group.
- b) **Platform as a Service** – this supports full “software lifecycle” which allows consumers to develop cloud service applications (e.g. SaaS) directly on the PaaS cloud. The difference between SaaS and PaaS is in the fact that SaaS only hosts completed cloud applications, whereas, PaaS offers a development platform that hosts both completed and in-progress applications (Dillon, Wu, & Chang, 2010). Major cloud providers include: Google, Microsoft and Amazon with services like the popular email services (Gmail, Hotmail), Windows Azure, Google's Android.
- c) **Infrastructure as a Service** – in this model, what is been shared or used by the cloud consumers are the IT (Computational) infrastructure (that is, processing, storage, networks, and other fundamental computing resources) (Huth & Cebula, 2011) provided in the IaaS

cloud. This model relies extensively on virtualization. This is so because the need to integrate/decompose physical resources in an ad-hoc manner to meet growing or shrinking resource demand from cloud consumers (Dillon, Wu, & Chang, 2010). EC2 and S3 (a data storage service), CloudFront (a content distribution network) and Virtual Private Cloud (VPC) service offered by the pioneer cloud service provider Amazon are examples of IaaS offerings. Other providers include: RackSpace, CloudSigma (Kushida, Murray, & Zysman, 2011).

The role of the Cloud computing for enhanced library service delivery

Switching services to the cloud environments or running services alongside the traditional library routine will afford the libraries the opportunities to revolutionize service delivery in present-day libraries. This move means that library housekeeping operations, digital libraries, etc. are now hosted on cloud-based networks. However, with the current day challenges libraries and information centers face for survival due to the roles played by competing agencies and services, it is pertinent for libraries to step up their game and enlist the services of cloud providers, among other innovative steps for service delivery, so as to improve the present state of libraries and with a view to appeal more to the current crop of techno-savvy patronage.

Cloud computing could play pivotal roles in: extending the reach of libraries, create a seamless environment for interaction between the library and its patrons, increase the potentials for collaboration, and enhance the general service routine within the library. The roles are discussed below:

1. **Extending patron reach** – providing libraries on the cloud will enable the library to reach more patrons than would have been possible using traditional means. Patrons in their spare time can reach and have access to resources without the hindrance of time and place. With the innovation and dynamism provided by cloud options, which are offered via the Internet, this provides libraries with opportunities to extend their impact. With cloud services, the library will surmount the challenge of distance, closing hours, and a host of other restrictive tendencies to service provision. This will also give the library the global appeal and reach in terms of services and outlook.
2. **Real-Time interaction with the library** – users today want quick access to information. Most organizations now offer customer care services on real-time basis and available on a 24-hour basis. This buttress the emphasis on the need to keep their patrons close. Libraries can leverage on cloud offerings to provide online, real-time access to information. Digital/Virtual reference services for example, will help give the patrons information required and where they have other needs, the library is just a click away. Widgets for Instant Chat/Messaging (IM), video chat (skype), social media chat, etc. could be added by libraries on their cloud portals to increase efficiency of services.
3. **Potentials for collaboration** – using cloud services creates the possibility and opportunity for resource pooling, that is, many patrons and libraries can use the same network, same platforms and tools, and functions simultaneously. With the possibilities created by cloud services platforms, libraries and library professionals can share same resources and services for the interests of their patrons. Pooling and sharing of resources is an offer that cloud services could afford libraries. With community clouds for example, libraries could come together to have a shared platform where their patrons

will have more and a richer experience with the resources of the individual libraries made available under a common platform.

4. **Enhanced service delivery** – use of modern information and communication technologies in libraries has potentials for positively impacting services. With cloud services, libraries can create applications in an online environment and make available to their patrons with the barrier of time and place. The change in information seeking behaviour of today's techno-savvy users has greatly changed, many now prefer services that are provided on internet and web environments. Libraries can build, test, and deploy web-based applications (Kroski, 2009) to offer services to users even outside business hours. Platform-as-a-Service model affords the library the liberty to explore development options without the need to purchase and maintain the required infrastructure. Cloud services could make it much easier for the library to try out new software without necessarily purchasing the hardware required, conditions for operation is simplified (power consumption issues – Air conditioning, constant power supply for massive devices, etc) and with less space consumed by large gadgets.

Benefits of Cloud Computing to libraries

Cloud computing provides a scalable online environment which facilitates the ability to handle an increased volume of work without impacting on the performance of the system (Choo, 2010). It offers a significant computing capability and economy of scale that might not otherwise be affordable to non-profit and small-scale entities.

- a) **Cost reduction** - Ability to increase or decrease the consumption of hardware or software resources immediately and in some cases automatically (the need to purchase servers, and other network infrastructure is removed from the expenditure of the budgeting librarians/library management). Also the billing system which is a pay as per usage model, infrastructure is not purchased which reduces maintenance cost. Initial and recurring expenses are significantly lower than traditional computing.
- b) **Increased storage** – due to the vast infrastructure offered by cloud providers in recent times, storage and maintenance of large volumes of data has become a more realistic and attainable goal for organizations in need of large storage. With cloud options, libraries can offer more services and resources without the limitation of physical storage.
- c) **Scalability** – “Pay as you go” allowing a more efficient control of expenditures. This feature of cloud computing also makes it possible for organization/library to improve on their services as the need arises without having to purchase more infrastructure to accommodate growing demands.
- d) **Support** – most cloud services providers have customer support services set up to assist their customers in the usage of the provided services. Call centres equipped with facilities to attend to the complaints and challenges of the customers in real time via dedicated telephone lines, email, social media accounts, etc.

Implications of Cloud use in Libraries

Adapting information and communication technologies by Libraries and librarians in developing countries has been a slow process. Many factors have been attributed to this which include but not limited to: Funding, technical skill deficiencies, poor political will on the part

of government, resistance to change on the part of library managers and technophobia, are some. However, with the obvious changes in information seeking behaviour of library users, the need for the acceptance of these technologies in libraries and librarianship has become a necessity (Yuvaraj, 2015). Also, with the proliferation of electronic resources and databases, coupled with the growth of digital libraries, and the geometric rise in the number of library users who now have access to and use web 2.0 services (Wikipedia, Blogging, Facebook, Flickr), use of cloud computing services has equally risen albeit unconsciously among library patrons (Abidi & Abidi, 2012).

with the presence of smart technologies and other innovative IT gadgets, today's library patron is very techno-savvy and most prefer to interact via email, instant messaging services, streaming news and media outlets, with each competing with each other and the library institutions for attention of the users (Gisolfi, 2015). With a laptop, tablet, or smart phone access to information has become much more readily available and the library building is now seen as very far.

Libraries adopting cloud-based resources and services will thereby increase reach, foster efficiency in service delivery, create more opportunities for collaboration, reduce need for in-house technical expertise, save costs, and improve services with faster access to the latest IT functionality. The cloud will also expedite workflow, automated software updates, redundancy, and back-ups. 'Libraries and librarians need to be more efficient in processing operations, markedly in maintaining print and electronic content in a single set of workflows said Burke(ProQuest) (Bright future with library clouds, 2014). Also the creation of a centralised knowledge-base is important in the drive to deliver unified collection management. Cloud-based computing if properly harnessed can become pronounced enabler of library services; enhancing collaboration across departments, institutions and disciplines, and relieving staff of routine, repetitive and technical tasks so that they can concentrate on delivering improved and innovative services to end-users (Brisson, European strategy director at Ex Libris). Libraries and librarians need also consider reallocating resources from managing technology to developing added-value services that satisfy demands of patrons.

Libraries and librarians should focus more on faculty and student needs, by using the increased data access and efficient administrative tools and work smarter using mobile devices, tablets, and computers to fashion user-centred applications that will reflect the libraries vision and objectives for the provision of access to online content (e-journals, videos, databases, etc.) and more from their personal devices, without the barrier of location.

Libraries need also to channel their energies to sourcing creative ways of getting new technologies and empowering their employees in the handling, maintenance, and general relationship with new media. Librarians should individually develop more interest in the use of these new technologies for services and open to new knowledge as they come.

CONCLUSION

The trends in technology are unrelenting, new gadgets and services keep flocking into the market with possibilities for new services unending. Cloud technologies offer possibilities for reach and collaboration that hitherto would have been impossible with traditional library services. Also, libraries and its practitioners need to accept the fact that modern patrons have altered their information seeking behaviour to a great extent, which calls for new means of

reaching these dynamic patrons. With the alternatives at the beck of patrons today, and the seeming reduction in the cost of technology, dependence on libraries will shift. The only way of keeping these patrons will depend on the innovativeness and creativity displayed in terms of services and relationship with the patrons. Libraries and information professionals have to embrace this technologies and leverage them for improved service delivery.

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