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Adopting Cloud Computing Platform for Improving Learning Activities in Higher Institutions in Nigeria

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Abstract: *The 21st century education system is facing drastic shift from analog system of operation to digital operation that is possible due to increase innovation in the information and communication technology. This research work explores the potential of cloud services and suggest education as a service as a platform to be adopted in enhancing learning in our educational institutions. In the research, the characteristics of cloud computing, service models, deployment models and benefits in utilizing cloud computing platforms is discussed. This work shows the massive adoption of Cloud computing resources for improving education because it offers numerous benefits such as flexibility, availability cheap cost and maintenance. Considering the present day challenges of prevalent outbreak of pandemics like the codid-19, it will be of paramount importance if higher institutions in Nigeria will adopt the utilization of cloud computing platforms to curb these challenges and provide convenient learning atmosphere.*

Keys words: *Cloud computing, Cloud deployment models, Cloud service models*

1.0 INTRODUCTION

The educational system in the 21st century is tremendously experiencing a paradigm shift everyday due to the availability of innovation in technology (Odeh et at., 2017). Information and communication technology (ICT) is a major player and enabler that make available powerful tools used in providing educational changes and reform in the academia (Rashidah, et al., 2017). One of the ICT tools used in advanced nations to stir education reforms and learning is cloud computing (Abdulrahman & Salisu, 2020). Cloud computing is the collection of computer system resources such as storage, power, and internet available on demand to the user (Zunair & Waleed, 2018; Atakilti & HenockMulugeta, 2015). National Institute of Standard and Technology (NIST) define cloud computing as the collection of configurable sharable resource available on demand. Cloud computing provides some important services such as Software as a service (SaaS), Platform as a service (PaaS) and Infrastructure as a service (IaaS) (Khan et al., 2023). These services provide users with an opportunity to design and upload application, have an existing platform to develop an application and existing infrastructure to use in setting out activities in the cloud. Computing resources provided by cloud services are used on pay as you go service (Jain & Upadhyay, 2017;

Abdulrahman et al., 2015). Many institutions and organizations have embraced the use of these cloud services because of the availability of unlimited services and resources (Alimboyong & Bucjan, 2021).

This research works explores the potential of cloud services and suggests education as a service as a platform to be adopted in enhancing learning in our institutions. This will help higher institutions of learning like the university to easily move all their activities electronically and remotely accessed without increasing any budget for the purchase of devices.

2.0 Basic Characteristics of Cloud Computing

Cloud computing has some basic characteristic that makes it beneficial and acceptable. Nalini and Andrews (2018) mention some basic characteristics of cloud computing as follows:

i. On Demand Self Service

On demand self-service enable cloud computing users to make provision of computing resources like server time, network and storage automatically without the need to interact with the cloud service providers. Once users have subscribed for cloud computing services, they can easily access their account on a web service portal to view the services they subscribe for and monitor their usage.

ii. Broad Network Access

One major characteristic of cloud computing is broad network access that enable users to access cloud services over the network and on other smart devices like mobile phone, tablets, laptops and desktop computer respectively without restriction in the face of network availability.

iii. Resource Pooling

Cloud computing allows multiple customers to share physical resources using a multi-tenant model using resource pooling. Multi-tenancy model allows the assigning and re-assigning of virtual resources based on demand. It enables users to share the same application or infrastructure and maintain the security and privacy of the users in the process. Users can pool resources like memory, processing and bandwidth in the cloud at the same time.

iv. Rapid Elasticity

Resources in the cloud can be provisioned elastically and automatically so that users can scale quickly based on their demands. Provisioning in cloud computing is practically unlimited, so users can engage this quality at any time and in any quantity. With rapid cloud elasticity users will not have to buy computer hardware but rather utilized service providers cloud computing resources provided.

v. Measured Service

Cloud computing resources use metering to automatically optimize and monitor usage. The resource can be optimized by leveraging the pay-as-you go charges. This indicate all resources utilized in the cloud whether virtual server instances that are running or storage in the cloud are measured, monitored and reported by the cloud service provider. With the measured service in place, your cost is determined by the amount of resources consumed.

3.0. Cloud Computing Deployment Models

The Cloud computing deployment model gives the exact picture of the cloud environment and is distinguished on the bases of proprietorship, size and access. Bulla et al., (2016) classify cloud deployment models as follows:

3.1 Public Cloud

The public cloud deployment model provides resources to the public and shares results across all users. Public cloud resources are available to anyone from anywhere using the internet. This deployment model is hosted on the services provider data centre. It has no subscriber restriction as anyone can have the same resources accessible on the internet base on their demand.

3.2 Private Cloud

The Private cloud deployment model provides resources utilized by individuals, organizations or institutions. The resources in the private cloud are not shared with public users, it is only utilized by the subscriber. The difference between private and public clouds is the mode of operation. Public cloud resources are shared among the general public subscribers whereas; just a particular subscriber utilizes private cloud resource.

3.3 Hybrid Cloud

The hybrid cloud model comprises the collection of two other models such as the public and private models. In creating a private cloud a subscriber might have some resource they wish to allow for public use and private resource for personal or private consumptions by the subscriber. Most subscribers, especially organizations and institutions due to security concerns will not want to fully, operate the public cloud. As a result, they employ the hybrid cloud in to make public resources operate on a public cloud while maintaining private resources to operate on a private cloud.

3.4 Community Cloud

Community cloud models enable multiple organizations to share resources and services based on standard regulatory requirements. It is a distributed system created by integrating the services of different clouds to meet up the need of subscribers. The infrastructure of the community cloud is shared among subscribers with common concerns or tasks. This model usually, is managed by a third party or by the combination of one or more organizations in the community.

4.0. Cloud Computing Service Model

Cloud computing has different service models that provides avenue that eases users task by facilitating speedy software development and deployment without the need to bother with infrastructural cost. These models can be classified according to Almajalid (2017) as follows:

4.1 Software as a service (SaaS)

Software as a service model provides a pool where users can have access to software applications without going through the difficulty of developing it themselves. The users do not have to bother with the location of the software, the operating system used to host the software or the programming language used for developing the software. Application on SaaS can be accessible anywhere and with any type of devices. The SaaS models always provide users with up-to-date applications and the services providers handle the maintenance of these software applications. The controls of the infrastructure used in SaaS model such as storage, and processing power are not determined by the users but by the service provider. With SaaS platform, institutions can develop and deploy education and learning software that will augment learning processes.

4.2 Platform as a service (PaaS)

Platform as a service (PaaS) provides a framework where developers can develop and deploy their software applications. This platform serves as apps development and management centre. In this model the servers, storage and network are managed by the service providers while the developers manage the application. It provides all the facilities needed to support the complex life cycle needed to develop and deploy web base applications. The platform enables developers

to speedily develop, deploy and manage their application without the stress of building and maintaining the infrastructure. With the benefit attached to PaaS, higher institutions can leverage the benefit by building and deploying their activities on the cloud for remote access and easy management without accruing device and maintenance cost.

4.3 Infrastructure as a service (IaaS)

Infrastructure as a service (IaaS) provides on-demand computing resources such as storage and network. This model works based on pay-as-you go. This means your budget commiserates your consumption and vice-versa. IaaS model enables institutions and organizations to access and utilize resources as needed without going through the rigour of acquiring them. The service providers of IaaS host the infrastructural components including on-premises data centre, servers, storage, networking hardware and the virtualized layer. The model contains the basic building blocks for web applications and provides complete control over the hardware that runs these applications. It offers the best flexibility in managing ICT resources in the cloud. Considering IaaS platform, education as a service can be deployed and managed by providing necessary academic resources needed for facilitating learning activities.

5.0 Adopting Cloud Computing In Higher Institutions

In the face of the rapid adoption of information and communication technology for teaching and learning, cloud computing is a good platform to enable higher institution in facilitating their migration to digital learning (Abdulnoor, 2018). This will be achieved by utilizing one of the cloud services for implementing education as a service in order to improve learning in our higher institutions. All teaching curriculums, class presentations, attendance and lecture materials can be uploaded to the cloud to allow for remote monitoring of class activities and the availability of teaching resources. Since the post-COVID era, there has been an increased move to migrate from physical learning to remote learning in a bid to decongest our learning environment in order to prevent the spread of pandemics (Mohd et al., 2022; Helaimia, 2023). Cloud computing is one of the flexible tools to make this move a reality because of its efficiency, minimal cost, scalability, and ease of maintenance (Qasem et al., 2020; Al-Ramahi et al., 2022). With cloud, computing there is no need to acquire any devices, institutions just pay for whatever service they are uploading or requesting from the cloud (Humphrey et al., 2016). With the help of cloud computing service, institutions can easily move all their activities electronically and remotely accessed without increasing the budget for the purchase of devices (Nyachiro et al., 2023).

6.0 Benefits of Adopting Cloud Computing in Higher institutions

Cloud computing provides a lot of benefits that is attractive as follows

i. Speed of deployment

With cloud computing, it is easy to spin up new cloud instances or retire them within seconds, allowing developers to accelerate development with quick deployments. Developers in the cloud can quickly test new ideas and design applications without hardware limitations or procurement processes.

ii. Efficiency and cost reduction

By using cloud computing, customers will not have to purchase and maintain devices. There is no need for investing in hardware facilities, utilities or even building large data centres to grow business. Cloud computing also reduced down time related cost. Because downtime is a rare issue in cloud systems customers will be relieved of the burden of spending money on fixing potential down time related challenges.

iii. Data Security

The major concern of every business regardless of size and type in recent times is the security of their data. Cloud computing offers some vital security features that guarantee that data are securely stored and managed. Cloud storage providers implement baseline protection for their platforms and the data they processed like access control, authentication and data encryption.

iv. Scalability

Considering the different needs of companies in respect of their size and existence, cloud computing can provide a great solution by enabling organizations to efficiently scale either up or down their IT units according to their business demands. Cloud computing is a good solution for growing or fluctuating bandwidth demands. When there is an increase in demand, organization can increase their cloud capacity without investing in physical infrastructure.

v. Unlimited Storage capacity

the cloud has unlimited capacity to store any type of data in various cloud data storage types depending on the availability, performance and frequency the data has to be accessed.

vi. Data Back-up and Restore

Considering that, data can be stored without capacity restrain in the cloud, also helps with backup and restore purposes. With the continuous change in end users data over time and the need for the data to be monitored for regulations or compliance purposes, the older software version can be stored for later stages in case they could be needed for recovery or rollback.

vii. Mobility

Cloud computing allows mobile access to corporate data via smartphones and devices which serves as a great way to ensure that no one is left. This mobility allowed staff to engage with clients remotely irrespective of location to be up to date with the clients. It enables cloud resources to be stored, retrieved, and recovered with just a click, and maintained round-the-clock access to data when connected to the internet.

viii. Data Control

Cloud computing allows customers to have complete control and visibility of their data. Customers can decide the level of data accessibility in the cloud and determine who will have that access. Though the cloud service provider manages the data yet, the customer determines the control on the data.

7.0 Conclusion

Looking at the significant benefits offered by cloud computing it is obvious that it plays a vital role in revolutionizing the education system at either tertiary or secondary education level. In that light, it will be good practice for the education system in Nigeria to migrate their physical document to digital using cloud computing platforms for optimal security, availability, cheap cost and maintenance. With the help of cloud computing resources, education can be flexible with remote access on the internet. Finally, the research shows that cloud-computing platforms when utilized in the education system can offer flexible solution for running smooth education activities that can be accessible by all irrespective of pandemic or any other physical challenges that may be a barrier.

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