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A Review on the Benefits of Cloud Computing in Education

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Abstract

Educational Institutions in Nigeria today are dependent upon Information Technology (IT) to discharge their services efficiently with more reduced costs. Procuring and maintaining such IT infrastructure require extensive ongoing investment and the skills to support the services and the equipment. Cloud computing approach can help in reducing such overhead cost with much higher availability than can be provided by the institutions. This paper discusses concepts of cloud computing, cloud computing models, cloud computing services, and cloud computing architecture. also, the paper reviewed the emerging benefits of utilizing cloud computing approach in education.

Keywords: Cloud Computing, IaaS, PaaS, SaaS, XaaS, EaaS, Moodle

Introduction

With proliferation of new computing methodologies, Information Technology (IT) and Information and Communication Technology (ICT) are taking new dimension in terms of infrastructure and service delivery, IT is essentially associated with human capacity and welfare development, however, it is becoming very dynamic. Some of these new methodologies requires careful examination relative to IT which tremendously reshaped the way of life. Cloud computing is one of these many methodologies that have a very wide gap in research (Qi, Lu, & Raouf, 2010) and required enormous contribution so that it can be exploited. Cloud computing is regarded as a model that represent *clusters of distributed computer which conveniently provide on-demand resources and services over a networked medium - usually the internet* (Sultan, 2010). The cloud model promotes availability of services at any place, provided the infrastructures are in place. Cloud computing is composed of five essential characteristics (Peter & Timothy, 2011); on-demand self-services, network access, resource pooling, rapid elasticity and measured services. However, the service models are not restricted to the three fundamental services which are; Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), anything can become part of the service models (XaaS), such as Network as a Service (NaaS), Communication as a Service (CaaS), Data as a Service (DaaS), Education as a Software (EaaS). And the four deployment models are: private, public, community, hybrid (Mamta, 2015).

Cloud Overview

Cloud computing is a methodology for service delivery through internet infrastructure, possibly public or private. Cloud computing can be well-defined as a model for allowing suitable, on-

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demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, application and services) that can be rapidly provisioned and released with minimal management effort or services provider interaction (Peter & Timothy, 2011)

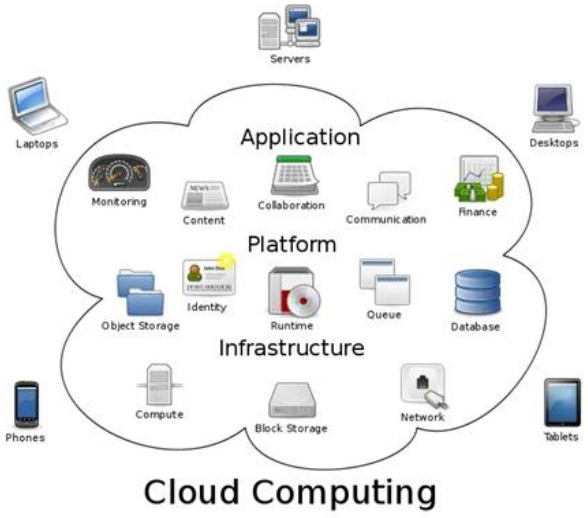

Figure 1: Cloud Computing Infrastructure (Mittal, 2021)

Cloud computing services are generally regarded as four service-levels. Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS), and Anything as service (XaaS).

Cloud Computing Architecture

The essential components and subcomponents that made up cloud computing are refers to Cloud computing architecture. These components typically consist of a front end platform - the side of computer user or client which involves the interfaces and the applications that are necessary to access the Cloud Computing system (fat client, thin client, mobile device), back end platform - the resources which are necessary to give Cloud computing service (servers, huge data storage, virtual machines), a cloud based delivery, and a network (Internet, Intranet, Intercloud). Combined, these components make up cloud computing architecture (Mohmed, Majzoob , & Osama, 2015).

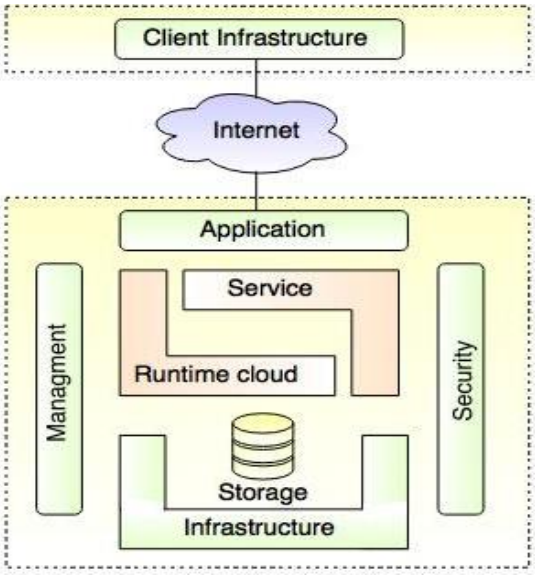

Figure 2: Cloud Architecture (TutorialRide, 2017)

Cloud Computing Providers

An institution can deploy private cloud or outsource educational services; Learning Management System (LMS) such as Moodle for distance learning and eLearning projects to promote quality education from service providers

Microsoft live@edu mainly intended for educational institutions for enabling facilities for their academic activities. Presently, several Universities and training institutions had employ the use of live@edu collaboration and communication services. The tools are free or pay for premium edition with additional features. Education edition can be acquired at no cost with some extra from premium edition included. Google apps allow client organization to use their own domain name with the service (Ramkumar, Binod, & Raju, 2013).

Education as a Service - EaaS

The education cloud can simplify, and lower the cost of education transformations. The COVID-19 global pandemic and it strict measures of social distancing, revealed the necessity for better and resilience "*anytime anywhere*" services - digital and software, which is at high increase. Educators flawlessly require digital transformation opportunity much more than Google apps & Zoom platforms in providing sustainable and high-quality learning experiences. Marc Andreesen, proclaimed the fact "software is eating the world." (Andreessen, 2011). Today, one can witness the explosion of digital innovation brought by the software companies. Evidently, the next frontline to experience such boom in digital transformation is education. Suddenly it is here - EaaS, and no turning back (Yeh, 2020).

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Conceivably, institutions already offer fragmentary online courses, but now is the time to create entirely digital learning platforms and extend these to new user who were previously unreachable due to geographical location (Yeh, 2020).

Applying Cloud Computing in Education

Today learning is boundless and extended to use digital devices and no more restriction to textbooks and other paper materials. Cloud computing is an important agent in making this change, especially in the higher education. Cloud computing provide virtual resources located at remote locations rather than physical (Mittal, 2021). Cloud computing technologies let institutions of higher education to efficiently upgrade communication and learning systems without large-scale capital investments in infrastructure which depends on advanced data center that provide large storage for users (Quddusi, 2020).

G Suite for Education now as Google Workspace for Education, is a special classroom version, which includes extra features for apps like Google Docs, Sheets, Drive, Gmail and others. With the use of this learning tool, students can use natural language to input formulas in Sheets or get layout suggestions in Slides. Another product, Google Classroom, links Google's online cloud applications (like Calendar or Docs) so it's easier to complete or schedule assignments using a central hub (Gottsegen, 2019). There are several programs based on cloud computing technologies that can be employed in the educational field such as: Apple Pages, Apple Keynote, Office 365 Education, Amazon Cloud Drive, Dropbox, Apple iCloud, Memopal, Cloud printer and Zip cloud

In a way to start applying Cloud computing in higher education is to begin the shift by outsourcing student email service, however, in Sclater (2010) it is mentioned that email service is not primary to the educational mission. Nonetheless Vance (2011) acknowledged the fact that email service remains the primary means of collaboration, it is very convenient service that almost everyone uses it, and to date email service still works with enhanced features incorporating web-based collaborative tools, thus the reasons behind it popularity.

Google and Microsoft providers offer email services for free to the educational institution in many countries (Sclater, 2010). The services come as part of suites package including communication tool such as Instant messaging, contact management and calendar software which are usually made available to students alongside email.

Another how-to is using cloud computing to host institutional Learning Management Systems (LMS) in the cloud. It makes sense for institutions to outsource the provision of LMS and enjoy the benefit of pay-per-use and scalability features and save huge cost of procuring and maintaining the hardware and software.

LMS such as Moodle, is a free and open-source software learning management system, Moodle can be used for various types of learning such as blended learning, distance learning and other e-learning systems in colleges, universities and even workplaces.

Educational institutions are employing the cloud to increase connectivity between Universities, Colleges and students. The benefits of cloud computing in education are evident; better accessibility, reduced costs and increased collaboration (Naser, 2020).

Cloud Collaboration

A university can utilize cloud collaboration services in group-related-functions, such as research groups, project groups, senate/faculty and various university committee meetings at different level, to connect and work together as a team efficiently and productively. Student as well can leverage cloud collaborative services in their academic endeavors. Also Naser (2020) articulates the fact that teachers can also benefit from increased collaborative learning by using live chats, streamed lectures, online assessments and virtual laboratory in their lesson plan.

Cloud collaboration is a process where several people can access, review and edit a document in real time. Cloud collaboration services; OneDrive, DropBox, M-Files and so on, led to a number of paybacks to an organization, such as providing improved access to large files that most email server cannot handle (Burgard, 2020). With enhanced security features that helps to ensure data protection.

Benefits of Utilizing Cloud Computing in Education

Saju (2012) agrees that shift towards cloud computing would enable the universities and educational institutions to save money and take benefit of the developing technology at an affordable cost. Following are some benefits:

- Personalized learning: students can access a wide collection of resources and software tools that suit their learning pace and interests.
- Cost effectiveness: the primary advantage to any institution is to reduce cost and effectively use the new technologies to meet evolving educational needs
- Elasticity: this allows small-scale services and build them up gradually without significant advances investment
- Availability: cloud computing services are available 24/7 anytime anywhere with reliability
- User friendly: it is easy to understand and easy to use, there is no of complexity.
- **Green computing**: cloud in education will surely maximize energy efficiency and reduce harmful resources as stated in (Sindhu, 2014).

Potential Risk

Data roaming over the internet and its storage in remote locations present a risk (Kiran, 2014). Educational institution may consider storing their data within the institution is more secure than to involve third party to host the data in remote centre which location may be anonymous and that present risks. Indeed, this may raise the scale of exposure to possible breaches, both unintentional and intentional. Many security frameworks were introduced to protect cloud environment and resources. Some scholars proposed a collaborative 2-tier framework, called WAY via the use of Virtual Machine (VM) monitoring system. The term 'WAY' denotes a way of secure data communication between the Cloud Service Provider (CSP) and the Cloud Service User (CSU) in a heterogeneous cloud computing environment (Shantanu, Sunirmal, Nabendu, & Sugata, 2011).

Conclusion

With cloud computing technology, Educational institutions have an opportunity to concentrate more into research, teaching and learning activities, rather than the IT infrastructure. The cloud allows us to access resources anywhere, anytime and share it with anyone, collaboration and communication becomes as easy as granting someone access, without having to transfer files or worry about software compatibility. Cloud education system is introduced and how it is beneficial for educational institutes for providing quality education.

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