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The Cloud as a Globalization Tool in Education System

Nwokolo, C. P.
Department of Computer Engineering
Federal Polytechnic, Oko
Anambra State, Nigeria.
nwokolopc@yahoo.com
Phone: +2348064515115

ABSTRACT

Academic institutions in many countries of the world, both public and private, have suffered socio-economic degradation over the years and more so, in developing countries like Nigeria where provision of adequate educational facilities and infrastructure has been a battle. This has led to variation in educational standards in various localities round the globe. Cloud computing is an excellent alternative for educational institutions which are especially under-funded in order to operate their information systems effectively without scouting for more capital for the computers and network devices. Academic establishments utilize available cloud-based applications offered by service providers and run their academic tasks. This paper tries to showcase that cloud computing provides a means of elevating educational standards to a common platform by making infrastructure accessible to institutions whether financially privileged or otherwise, irrespective of location, by bringing the concept of virtualization into (virtual) reality. It also projects the cloud as an instrument for bridging the gap between theory and practice and as a means of developing linkages and networks among business, industry, government and academia. Cloud computing is however based on existing information communications technology (ICT) as a service on demand.

Keywords*; Cloud computing, ICT, globalization, Virtualization, storage, infrastructure, data center*

Aims Research Journal Reference Format:
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1. INTRODUCTION

By the trend of technological move in our modern day society, it is difficult to discuss the issue of globalization (which generally refers to the process by which businesses or other organizations develop international influence or start operating on an international scale) without talking about ICT. As it relates to knowledge economies, higher education is recognized as an essential driving force for national development in both developed and developing countries. At the same time, in its universality and international dimensions, higher education can be seen as both an actor and reactor to the phenomenon of globalization. This demands that certain requirements must be met by organizations in order to fit into such global socio-economic platform. Cloud storage however offers organizations the potential to dramatically decrease storage costs.

From a lay man's perspective, it appears that cloud storage architecture differs from local storage simply by the remote storage location of the cloud. The reality is that implementing highly efficient cloud storage connectivity is by far more challenging than the on-premises storage. By this, there exists a huge gap between the architecture of the cloud and the local storage which is tactically being bridged to use both local and cloud storage in a seamless manner to make the cloud a suitable tool for educational globalization.

Several institutions under relatively poor economies such as is obtainable in the third world countries cannot meet up with such requirements, they cannot just afford to provide the infrastructure needed to support the required services. Such places can neither build nor maintain local data centers to support their transactions. In Nigeria for example, irregular supply of electric power is a major problem that militates against such project plans. Several opportunities have been lost by applicants in quest of their academic transcripts because they are not uploaded to data centers via the internet for quick access.

2. CLOUD COMPUTING ARCHITECTURE

Cloud architecture **r**efers to the components and subcomponents required for cloud computing. These components typically consist of a front end platform (fat client, thin client, mobile device), back end platforms (servers, storage), a cloud based delivery, and a network (Internet, Intranet, Intercloud). Combined, these components make up cloud computing architecture. It consists of front-end platforms called **clients** or **cloud clients**. These clients comprise servers, fat (or thick) clients, thin clients, zero clients, tablets and mobile devices. These client platforms interact with the cloud data storage via an application (middleware), via a web browser, or through a virtual session.

The zero or ultra-thin client initializes the network to gather required configuration files that then tell it where its OS binaries are stored.[1] The entire zero client device runs via the network. This creates a single point of failure, in that, if the network goes down, the device is rendered useless

2.1 Cloud storage

Cloud storage is simply a model of online network storage where the digital data is stored in logical pools, the physical storage spans multiple servers (and often locations), and the physical environment is typically owned and managed by a hosting company. These cloud storage providers keep the data available and accessible, and the physical environment protected and running. People and organizations buy or lease storage capacity from the providers to store user, organization, or application data. Cloud storage services may be accessed through a co-located cloud computer service, a web service application programming interface (API) or by applications that utilize the API, such as cloud desktop storage, a cloud storage gateway or Web-based content management systems.

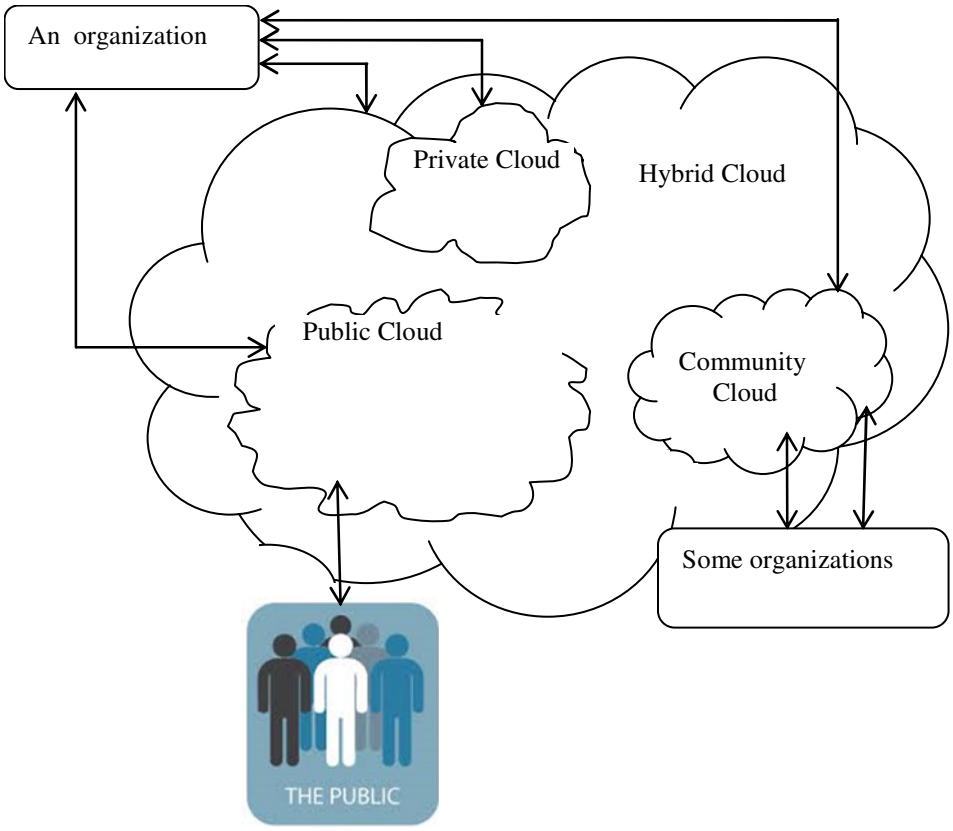


Figure 1: Cloud deployment models

2.2 Cloud Deployment Models

Cloud storage is generally deployed in the following configurations*: **public cloud**, **private cloud**, **community cloud***, or some combination of the three also known as ***hybrid cloud*** as shown in figure 1.0.

2.3 Public Cloud

A *public cloud* is a publicly accessible cloud environment owned by a third-party cloud provider. The IT resources on public clouds are usually provisioned via the previously described cloud delivery models and are generally offered to cloud consumers at a cost or are commercialized via other avenues (such as advertisement). The cloud provider is responsible for the creation and on-going maintenance of the public cloud and its IT resources.

2.4 Private Cloud

In this model, hosting is built and maintained for a specific client The cost of using this model is almost as high as buying, building and managing one's own infrastructure although it addresses the security and privacy concerns that are inherent in other cloud computing models. The infrastructure required for hosting can be on-premises or at a third-party location.

2.5 Community Cloud

A community cloud contains features of the public and private cloud models. Like a public cloud, the community cloud may contain software, data storage, and computing resources that are utilized by multiple organizations. Where this model differs from the public model is that the infrastructure is only utilized by a group of organizations that are known to each other. Similarly to a private cloud, these organizations are responsible for the operation of their own infrastructure. The community cloud model can provide greater cost savings than the private cloud while offering some of its security features. This model is best suited for organizations that share common requirements such as security or legal compliance policies. Various state-level government departments requiring access to the same data relating to the local population or information related to infrastructure, such as hospitals, roads, electrical stations, etc., can utilize a community cloud to manage applications and data. It can be managed by the member organizations or by a third party provider.

2.6 Hybrid Cloud

The hybrid cloud computing model employs aspects of all of the other cloud models and it is the most common method of cloud deployment within a large organization. A company may use internal resources in a private cloud maintain total control over its proprietary data. It can then use a public cloud storage provider for backing up less sensitive information. At the same time, it might share computing resources with other organizations that have similar needs. By combining the advantages of the other models , the hybrid model offers organizations the most flexibility.

3. THE FIVE ESSENTIAL CHARACTERISTICS OF CLOUD COMPUTING

Cloud technology is in the news quite often these days, but it still seems to be mysterious and confusing to the non-techie crowd. Cloud options are enticing various industries across the board, which is why it's important to know it's essential characteristics as a software offering. Here are the five main characteristics that cloud computing offers businesses today.

1. **On-demand capabilities:** A business will secure cloud-hosting services through a cloud host provider which could be your usual software vendor. You have access to your services and you have the power to change cloud services through an online control panel or directly with the provider. You can add or delete users and change storage networks and software as needed. Typically, you are billed with a monthly subscription or a pay-for-what-you-use scenario. Terms of subscriptions and payments will vary with each software provider.
2. **Broad network access:** Your team can access business management solutions using their smartphones, tablets, laptops, and office computers. They can use these devices wherever they are located with a simple online access point. This mobility is particularly attractive for businesses so that during business hours or on off-times, employees can stay on top of projects, contracts, and customers whether they are on the road or in the office. Broad network access includes private clouds that operate within a company's firewall, public clouds, or a hybrid deployment.
3. **Resource pooling:** The cloud enables your employees to enter and use data within the business management software hosted in the cloud at the same time, from any location, and at any time. This is an attractive feature for multiple business offices and field service or sales teams that are usually outside the office.

4. **Rapid elasticity:** If anything, the cloud is flexible and scalable to suit your immediate business needs. You can quickly and easily add or remove users, software features, and other resources.
5. **Measured service:** Going back to the affordable nature of the cloud, you only pay for what you use. You and your cloud provider can measure storage levels, processing, bandwidth, and the number of user accounts and you are billed appropriately. The amount of resources that you may use can be monitored and controlled from both your side and your cloud provider's side which provides transparency.

4. CLOUD SERVICE MODELS

A cloud service is any IT resource that is made remotely accessible via a cloud. Although a cloud is a remotely accessible environment, not all IT resources residing within a cloud can be made available for remote access. For example, a database or a physical server deployed within a cloud may only be accessible by other IT resources that are within the same cloud.

The service models basically include;

The software as a service (SaaS)
Software as a service-model involves the cloud provider installing and maintaining software in the cloud and users running the software from their cloud clients over the Internet (or Intranet). The users' client machines require no installation of any application-specific software - cloud applications run on the server (in the cloud). SaaS is scalable, and system administration may load the applications on several servers. In the past, each customer would purchase and load their own copy of the application to each of their own servers, but with the SaaS the customer can access the application without installing the software locally. SaaS typically involves a monthly or annual fee.
Software as a service provides the equivalent of installed applications in the traditional (non-cloud computing) delivery of applications.

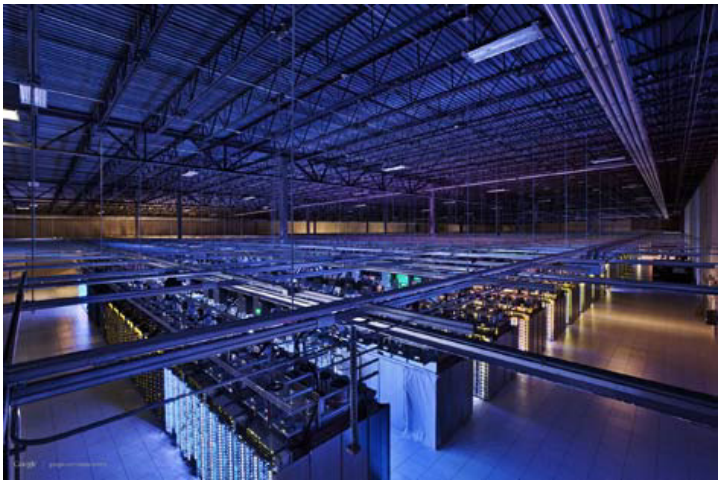
Platform as a service (PaaS)

Platform as a service is cloud computing service which provides the users with application platforms and databases as a service.[3] This is equivalent to middleware in the traditional (non-cloud computing) delivery of application platforms and databases.

Infrastructure as a service (IaaS)

Infrastructure as a service is taking the physical hardware and going completely virtual (e.g. all servers, networks, storage, and system management all existing in the cloud). This is the equivalent to infrastructure and hardware in the traditional (non-cloud computing) method running in the cloud. In other words, businesses pay a fee (monthly or annually) to run virtual servers, networks, storage from the cloud. This will mitigate the need for a data center, heating, cooling, and maintaining hardware at the local level.

What are Data Centers?
A **data center** is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression) and various security devices. Large data centers are industrial scale operations using as much electricity as a small town. Google, for example, has many data centers with at least 12 significant Google data center installations in the United States, with another three under construction. In Europe, Google is known to have equipment in at least five locations, with new data centers being built in two other venues.



Map of Google Data Centre

Fig. 2: An overhead view of the server infrastructure in Google's data center in Council Bluffs, Iowa. (Photo: Connie Zhou for Google)

5. ICT AND CLOUD COMPUTING

Cloud computing is an IT service that provides computing power and storage away from your own company or organisation. The 'cloud' simply means a remote data centre is handling the services required rather than a local IT system. It is a virtual, scalable and flexible IT infrastructure that offers a myriad of cost-saving, efficiency and security benefits for any or all of one's critical operations.Fig.2.0 shows a cloud computing scenario, depicting secure accessibility to one's applications and data from any network device such as tablets, smart phones, notebooks, desktops, PDAs (Personal Digital Assistants), etc

5.1 The Internet and the Cloud computing

Internet is a global network of billions of interconnected computers around the world. It offers many resources and services such as the World Wide Web and email. For example, World Wide Web offers users the access to trillions of hyperlinked documents. More recently, the focus has moved towards offering all of the resources (which are traditionally available locally) over the Internet. Cloud Computing is a direct result of this initiative, which offers many resources such as software, platforms and infrastructure as services. Cloud computing is the emerging technology of delivering many kinds of resources as services, mainly over the internet.

5.2 Cloud computing and Web hosting

Cloud computing and Web hosting can seem similar because these two types of services can have very similar kinds of setups and deliver a lot of the same results. However, there are some critical differences between cloud computing and Web hosting services that have to do with the technical definition of each.

Web hosting is simply the process of offering remote location and maintenance for files and server space used to support Web projects. Conventional kinds of Web hosting include services where individual users can build and store small websites with a Web hosting provider, and enterprise Web hosting, where businesses enter into contracts with third-parties like Internet Service Providers to host their sites. Cloud computing can also support remote Web hosting. The definition of cloud computing services involves the connection of clients to vendors through wireless or IP connected networks. In cloud computing, a client sends data to a vendor through an abstract network trajectory called "the cloud." Data is then stored and maintained on remote servers owned and operated by the vendors. In general, cloud computing services that include Web hosting can be an alternative to other traditional kinds of Web hosting that are not based on cloud computing principles. One of the biggest differences could be called a "single client" versus "multi-tenant" approach. Cloud computing services that include Web hosting are usually multi-tenant. That means that the files and data resources of multiple clients are housed on the same server. This provides flexibility and on-demand services for individual clients, so that providers can scale up or scale down delivery easily.

By contrast, dedicated Web hosting will involve a Web hosting company serving only one client on any given server. This provides more individual security and a more focused approach to serving an individual customer.

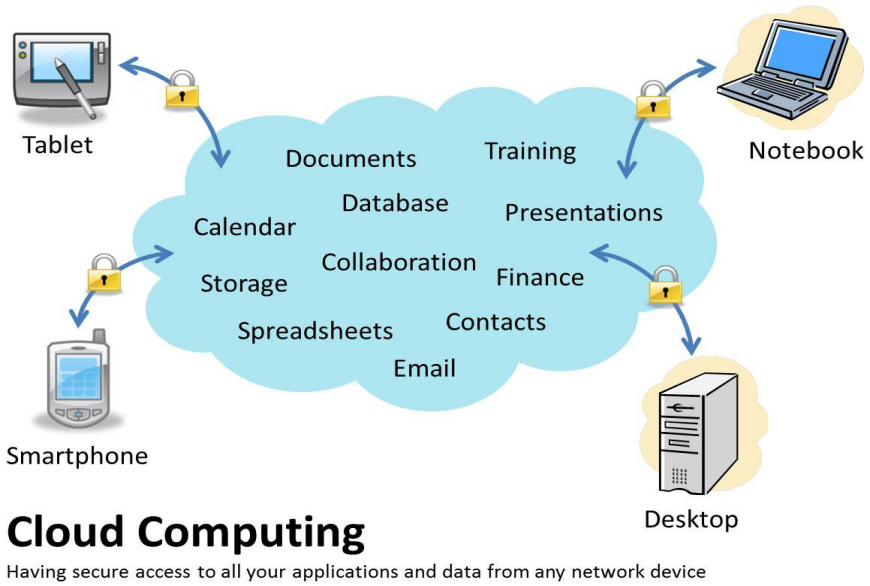


Figure 3: Cloud computing scenario

From the users point of view, the virtual infrastructure-oriented nature of the cloud makes it to be viewed as a remotely located **hard e-tool.**

6. WHO NEEDS THE CLOUD?

Individuals who want some off-site storage for their material such as family photos or work files. If somebody's house gets burnt, or the documents get stolen, copies stores remotely becomes a solution.

Companies such as Amazon has a vast IT infrastructure built to deal with its own business. But they realised that they had a lot of idle computing power and storage - so why not rent it out to other companies or people? So that is what they did and is called the 'S3' service. Another huge company - Google - also has lots of spare capacity in its data centers around the world. So they too are offering companies the ability to rent that resource.

Organizations that cannot afford ICT infrastructure: Cloud service centers take care of the infrastructure and simply renders the service to such organizations. The opportunity to access the cloud provides room to operate on the international, global scale.

Irrespective of the apparently non-convergent views on what Globalization actually entails, various scholars have concurred that the driving forces behind economic globalization include; A reduction in transport and communication costs in the private sector.

- Reduced policy barriers to trade and investment by the public sector.
- An increase in the availability of and access to information and technology.
- The speed with which information and technology can be transmitted across national boundaries (Frankel, 2000; Rodrik, 1997)

All the outlined driving forces to globalization are easily achievable through ICT and/or the cloud.

6.1 Other key features

Features that one should look for when selecting a cloud storage provider and a cloud storage gateway;
The first is a unified namespace, sometimes referred to as a global namespace. End users need to access their data, even after it's been moved to the cloud. A unified namespace presents local and cloud storage collectively as a single file system. From a user's standpoint, there's no visual indication that some files reside locally while others do not.

6.2 Five capabilities to look for in a cloud storage solution

- Global namespace : (i.e storage management idea of centralizing storage on the file level that allows admins to see distributed storage as one pool).
- Non-disruptive file migration capabilities
- Automated storage tiering: A feature that allows dynamic movement of information between different disk types and RAID (Redundant Array of Inexpensive Disks) levels to meet space, performance and cost requirements.
- Deduplication/WAN optimization : **process of eliminating redundant data so as to reduce storage needs.**
- Internal caching or local storage replication

Another important capability is automatic storage tiering. In a SAN (*Storage Area Network*) environment, various types of storage are aggregated into storage tiers. For instance, solid-state drive storage can be treated as a high-speed tier, while commodity storage can be treated as a standard tier. Like local storage, cloud-based storage has unique characteristics such as high latency and low cost. From a storage management perspective, that means cloud storage can be treated as a separate tier within your storage architecture. To derive the greatest possible benefit from storage tiering, an organization must determine what type of data should be stored on each tier.

6.3 Considerations

All this costs money. One would have to work out whether it is cheaper to use local machines or to hire virtual machines in the cloud. One would have to consider whether it is better to have IT expertise within one's company or to 'outsource' it to a cloud service. If you have huge data sets to handle then the issue of downloading / uploading can also be a problem.

6.4 The future of the Cloud

Cloud computing will continue to expand its services. Standard 'office' type applications are now available as a cloud service: word processing, spreadsheet etc are not loaded on a local computer but instead the person is connected to a cloud version. The risk of course, is if the internet link breaks or if some other problem occurs then no-one in your company can do their work. But the benefits of virtual office software may outweigh the risks.

6.5 Summary of Benefits of the cloud

1. No need to invest in their own IT hardware or hardware maintenance staff
2. Critical company data is safe in dedicated data centres, with multiple backups around the world.
3. If an organsation's capacity expands or there is a surge in customer demand, they simply rent more computing power and storage.
4. Private individuals are reassured in the knowledge that their most important material is stored safely online.
5. **Ownership of Virtual computer:** A very handy feature is the 'virtual computer'. A normal computer is only useful if it is loaded with an operating system and the software applications you want to use. This takes a lot of time and effort to set up and it takes even longer if something goes wrong so you have to re-install everything again. With a virtual computer, the entire software setup is stored as an 'image' - a binary file that is an exact copy of the 'real' computer. This image is then loaded onto powerful hardware in the cloud and runs as if it were a normal machine - this is called an 'instance'. One could open and shut as many instances as one desires to pay for. An example of this kind of facility is offered within the Amazon EC2 service.
6. Agencies can easily access the latest versions of common software, which deliver improved and robust functionality, and eliminating significant costs associated with version upgrades. If academic institutions are able to access the same programmes, and up-to-date versions of those programmes, this will enhance globalization in education standard and system round the globe.

7. CONCLUSION

Unavailability of functional ICT infrastructure have been an impediment in elevating the standard of education to a globally acceptable platform in various institutions the world over. Today, many engineering design projects can be modeled and test-run through simulation softwares as they would in real life at relatively no cost. Similarly, Cloud computing has come to profer solution as alternative to the costly infrastructure and render the service to the users, bringing home the reality in virtuality at relatively low cost. Institutions may be able to drive down storage costs by moving aging file data to cloud storage instead of thinking of building their own data centers for data archiving.

8. RECOMMENDATIONS

For many enterprises, a private cloud should be the closest match to their goals, but the journey to the cloud is a step-by-step one that begins with virtualization and ends with moving mission-critical applications into the cloud. However, many enterprises fall at the hurdle of security, while others see applications as a natural fit, but are less sure about their hardware infrastructure. Such a journey requires expert advice and testing to ensure both the closest fit with the enterprise, and the maximum advantages overall in terms of efficiency and scalability. Governments should therefore include the cloud concept in institutions' curriculum to create better awareness of the cloud and its benefits both to the students and the management of our institutions. This will enable the students gain access to their required platforms, the softwares, infrastructure and other applications and data, so that they could come up to a standard that befits the global scale performance in education. Further insight could be made as regards integration of the cloud as a globalization tool in other sectors of the economy.

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