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Proposed E-Commerce Framework Using Cloud Computing Technology

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ABSTRACT
The existing e-commerce systems are faced with the problems of environmental cost among others but with the introduction of cloud computing, most of the problems will be solved. Therefore, this paper has examined, analysed and discussed the current state of e-commerce and as a result, proposed e-commerce application framework based on the concepts, the origins and development trend of cloud computing which copes with the problem of e-commerce and the storage of resources. As it is on record that cloud computing is widely known for its robust and strong support for data storage and mining. It also offers a most reliable platform for safe, secure and speedy data transaction at very manageable cost and high level of privacy. Therefore, the proposed system is expected to function on state-of-the-art hardware and software resources as well as trusted management, server and business components.

***Keywords*:-** e-Commerce, Cloud, Computing, Technology, e-Commerce Cloud, SaaS, IaaS, PaaS

I. INTRODUCTION

According to [1], e-commerce is a subset of e-business and we can define e-commerce as buying and selling of goods and services over the Internet. In e-commerce the focus is on digitally enabled commercial transactions among organizations and individual. E-commerce includes exchange of value (it is must) because without an exchange of value, no commerce occurs. A main feature of e-commerce through commercial transactions is making money on the Internet and basically it is important to know much that unique features of eCommerce Technology included as stated in [2,3]:

1. Ubiquity- The traditional business market is a physical place, access to treatment by means of document circulation. For example, clothes and shoes are usually directed to encourage customers to go somewhere to buy. E-commerce is ubiquitous meaning that it can be everywhere. E-commerce is the worlds reduce cognitive energy required to complete the task.
2. Global Reach- E-commerce allows business transactions on the cross country bound can be more convenient and more effective as compared with the traditional commerce. On the e-commerce businesses potential market scale is roughly equivalent to the network the size of the world's population.
3. Universal Standards- E-commerce technologies is an unusual feature, is the technical standard of the Internet, so to carry out the technical standard of e-commerce is shared by all countries around the world standard. Standard can greatly affect the market entry cost and considering the cost of the goods on the market. The standard can make technology business existing become more easily, which can reduce the cost, technique of indirect costs in addition can set the electronic commerce website 10$ / month.
4. Richness- Advertising and branding are an important part of commerce. E-commerce can deliver video, audio, animation, billboards, signs and etc. However, it's about as rich as television technology.
5. Interactivity- Twentieth Century electronic commerce business technology is called interactive, so they allow for two-way communication between businesses and consumers.
6. Information Density- The density of information the Internet has greatly improved, as long as the total amount and all markets, consumers and businesses quality information. The electronic commerce technology, reduce the information collection, storage, communication and processing cost. At the same time, accuracy and timeliness of the information technology increases greatly, information is more useful, more important than ever.

Personalization- E-commerce technology allows for personalization. Business can be adjusted for a name, a person's interests and past purchase message objects and marketing message to a specific individual. The technology also allows for custom. Merchants can change the product or service based on user preferences, or previous behavior.

A. **PRESENT STATUS**.

The global trade and economy is rising in recent years. Commercial trade has become the main trend of the market in several countries of the world, including Nigeria. Moreover, technology trade is the development trend of the global economic reform. This is due to the regional openness of Internet. Various types of commercial trade networks [4,5.6.7] have appeared on the Internet, thereby promoting the virtualization construction of economic transaction activities. The increasing use of information technology has fostered e-

commerce (EC) as a popular and growing web application, which enables customers, partners and employees to achieve a variety of purpose and services. E-commerce is any form of business, administrative or information transaction that uses Information and Communications Technology (ICT) as its operational platform. Based on the nature of transactions, e-commerce is classified into business-to-business (B2B), business-to consumer (B2C), consumer-to consumer (C2C), consumer-to-business (C2B), intra-business e-commerce and no business e-commerce. E-Commerce systems provide both commercial information (such as products prices and available quantities) and facilitate selling, negotiation and buying. A typical e-commerce platform is shown in Figure 1.

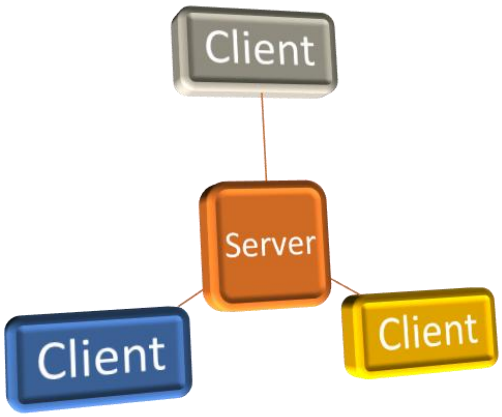

Figure 1: e-commerce system

B. OVERVIEW OF CLOUD COMPUTING

According to [8], (2010), cloud computing has developed as an alternative computing model where Web-based services take into consideration various types of clients to acquire an extensive variety of resources, for example, software and hardware. Cloud computing has exhibited applicability to an extensive variety of issues in several domains, including logical ones. Sincerely, a few researchers are beginning to embrace this computing model and moving their investigations (programs and data) from local environments to the cloud [9, 10, 11]. A critical preferred standpoint gave by mists is that researchers are not required to gather costly computational infra-structure to execute their experiments or even configure numerous bits of software. A normal researcher can run experiments by assigning the essential resources in a cloud [9].

Cloud computing (whose typical service model is shown in Figure 2) has been one of the top-flight technologies among the professionals of ICT businesses due to its elasticity in the space occupation and tremendous support for software and infrastructure [12]. It provides backbone for on-demand, self-service computing resources with ubiquitous network access, location-independent resource pooling, rapid elasticity and a pay per use business model. It evolved from continuous research in virtualization, distributed computers, utility computing, networking, World Wide Web (WWW) and software services [13]. Cloud computing technology requires low cost of implementation, has attracted more specialist, plays vital role in smart economy and provides possible regulatory changes required in the implementation of better applications [7]. Cloud computing as a new service model, with network storage, on-demand access to nature, provides a new information resource sharing and processing mechanisms. In the existing conditions, cloud-computing framework attracts enterprises with less investment to e-commerce business applications (B2B & B2C) and research on e-commerce and cloud computing focuses on attaining high technical levels and application frameworks with high practical values [14, 15].

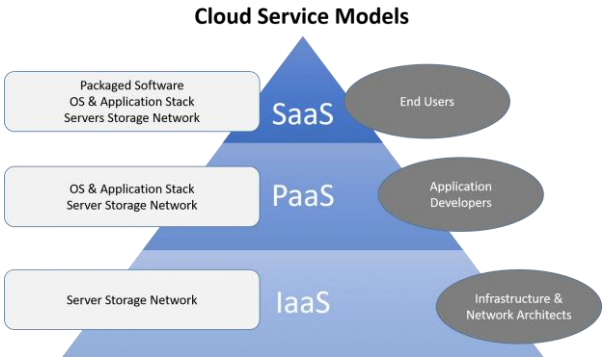

Figure 2: Cloud Service Models (Source: [16])

The infrastructure, platform and services from cloud computing is of great benefit to e-commerce. Cloud computing offers new delivery and deployment models for IT resources, provides safer and faster way for data storage, decision-making on business intelligence level and break the bottleneck of mobile terminal. It promotes availability and accessibility, cost saving (pay as used), efficiency, scalability and flexibility of e-commerce [17, 18]. Furthermore, cloud-computing-based e-commerce provides user-oriented ubiquitous adaptive hardware resources, computing environment and software services. Users can access digital services transparently at anytime and anywhere as well as obtain necessary network and computing services very naturally at any position.

Layers of cloud computing

Cloud computing is made up of a variety of layered elements, starting at the most basic physical layer of storage and server infrastructure and working up through the application and network layers. The cloud can be further divided into different implementation models based on whether it's created internally, outsourced or a combination of the two. As discussed in [19].

The three cloud layers are:

- Infrastructure cloud: Abstracts applications from servers and servers from storage
- Content cloud: Abstracts data from applications
- Information cloud: Abstracts access from clients to data

The three cloud implementation models are:

- Private cloud: Created and run internally by an organization or purchased and stored within the organization and run by a third party
- Hybrid cloud: Outsources some but not all elements either internally or externally
- Public cloud: No physical infrastructure locally, all access to data and applications is external

An **infrastructure cloud** includes the physical components that run applications and store data. Virtual servers are created to run applications, and virtual storage pools are created to house new and existing data into dynamic tiers of storage based on performance and reliability requirements. Virtual abstraction is employed so that servers and storage can be managed as logical rather than individual physical entities.

The **content cloud** implements metadata and indexing services over the infrastructure cloud to provide abstracted data management for all content. The goal of a content cloud is to abstract the data from the applications so that different applications can be used to access the same data, and applications can be changed without worrying about data structure or type. The content cloud transforms data into objects so that the interface to the data is no longer tied to the actual access to the data, and the application that created the content in the first place can be long gone while the data itself is still available and searchable.

The **information cloud** is the ultimate goal of cloud computing and the most common from a public perspective. The information cloud abstracts the client from the data. For example, a user can access data stored in a database in Singapore via a mobile phone in Atlanta, or watch a video located on a server in Japan from his a laptop in the U.S. The information cloud abstracts everything from everything. The Internet is an information cloud.

Rapid growth of cloud computing, 2015–2020

Cloud computing spending is growing at 4.5 times the rate of IT spending since 2009 and is expected to grow at better than 6 times the rate of IT spending from 2015 through 2020. According to [20], worldwide spending on public cloud computing will increase from $67B in 2015 to $162B in 2020 attaining a 19% CAGR (See figure 4).

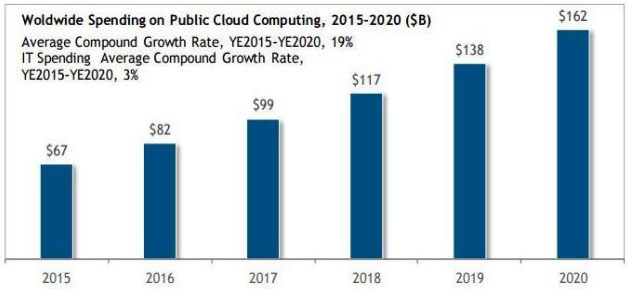

Figure 4: Rapid growth of cloud computing. Source: [20]

The worldwide public cloud services market is projected to grow 18 percent in 2017 to total $246.8 billion, up from $209.2 billion in 2016, according to Gartner [21], Inc. The highest growth will come from cloud system infrastructure services (infrastructure as a service [IaaS]), which is projected to grow 36.8 percent in 2017 to reach $34.6 billion. Cloud application services (software as a service [SaaS]) is expected to grow 20.1 percent to reach $46.3 billion (see Table 1) [21].

Table 1. Worldwide Public Cloud Services Forecast (Millions of Dollars)

	2016	**2017**	**2018**	**2019**	**2020**
Cloud Business Process Services (BPaaS)	40,812	43,772	47,556	51,652	56,176
Cloud Application Infrastructure Services (PaaS)	7,169	8,851	10,616	12,580	14,798
Cloud Application Services (SaaS)	38,567	46,331	55,143	64,870	75,734
Cloud Management and Security Services	7,150	8,768	10,427	12,159	14,004
Cloud System Infrastructure Services (IaaS)	25,290	34,603	45,559	57,897	71,552
Cloud Advertising	90,257	104,516	118,520	133,566	151,091
Total Market	**209,244**	**246,841**	**287,820**	**332,723**	**383,355**

Source: [21]

II. RELATED WORKS

A review of the concepts and types of clouds as well as the advantages and disadvantages of cloud computing for the e-Commerce sector is presented in [22]. Analysis of the benefits and challenges of cloud computing and its applications in the context of e-government and e-commerce is presented in [18]. The concepts of cloud computing on the basis of business issue and impact on e-commerce industry are presented in [23]. Summaries of the characteristics of cloud-computing, network security problems and solutions are also presented with how traditional e-commerce businesses and industries are influenced by cloud computing and provide an overall perspective of cloud computing and highlights of the security concerns.

Reference [12] proposed an e-commerce framework that is based on the concepts, origins and development trend of cloud computing. The framework provides a good way of coping with the problem of storage of resources and lowering of costs. It however lacks support for analyzing network security, technical standards as well as regulatory and other core services. In [24], a cloud-computing-based data processing network platform is proposed. With the overlapping

relationship and model settings, the security workflow of the cloud data computing processing is presented for automated processing on B2C network data. Moreover, the overlapping network plan and flow network technique formed the basis of the model, and a diversified security control platform is created by combining different modeling tools. Though the proposed framework looks promising in terms of mass storage and security, its technicality, adequacy and suitability are not presented. [17] describe the conception and characteristic of cloud computing with special analysis of the main aspect of improving e-commerce. Apart from highlighting some of the solutions brought by cloud-computing to e-commerce, security, privacy, cost and so on were also presented as some of the core issues that require attention for reliable implementation of cloud-computing-based e-commerce.

In [25], a fuzzy and encryption-based architecture for cloud-computing-based e-commerce was proposed. The architecture is suitable for resolving some of the present e-commerce problems that are related to cloud computing execution platform with very few behavioural parameters and optimized rules. The major limitation of the architecture is the failure of its encryption module in the preservation of the integrity of files and data. In [26], a theoretical framework for the integration of e-commerce and cloud computing for promoting business and technological growth is presented. The technicalities and the implementation strategies are not presented. In [27], a cloud-computing-based e-commerce architecture that solves the major issues related to e-commerce like bandwidth and scalability and provides easy solution was presented. A 3G mobile e-commerce platform that is based on cloud computing and uses 2D-Barcode technology to improve application convenience is presented in [28]. Based on the analysis, the technology looks promising in terms of convenience and privacy but it does not consider the integration systems of heterogeneous information.

III. PROPOSED E-COMMERCE FRAMEWORK BASED ON CLOUD COMPUTING

The proposed framework will be divided into hardware resource (HR), software resource (SR), resources management (RM), server and business layers as shown in Figure 3. The HR layer is the bottom most layer in the cloud service middleware and the most important infrastructure of the system. It is virtualized as providing a flexible and adaptive platform for improved resource utilization. The enterprise data center infrastructure supports services that ensure resources in the data center are efficiently managed, provisioned, deployed, and rapidly configured. With the help of virtualization, physical servers, network and storage are grouped as upper software platform. For uninterruptible power supply to the cloud middleware e-commerce systems servers, physical host pool will be expanded dynamically while the memory is made scalable at any time for additional memory support. The SR layer is created to serve as a communication platform with the operating systems and middleware technology. Several software solutions will combine to offer grouped interface as well as the creation and embedding of cloud-based applications.

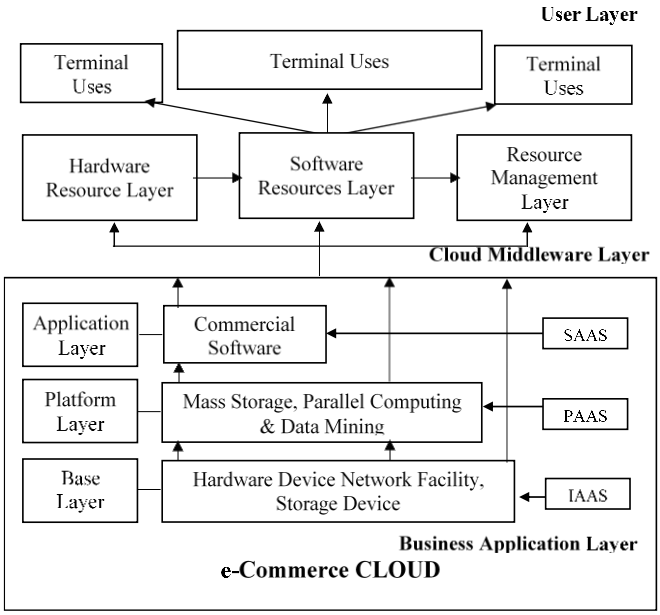

Figure 3: Proposed Cloud-computing-Based E-Commerce Framework

On top of the hardware layer, the resource management layer is responsible for both sharing of hardware resources and the enforcement of mandatory access control rules based on the available hardware resources. It plays important role in the management of the last two layers. It get loose coupling of software and hardware resources. Based on the virtualization and scheduling technique of cloud computing, software distribution to different hardware resources will be performed without interruption.

This cloud model is composed of five essential characteristics, three service models, and four deployment models.

Essential Characteristics of the Architecture:

On-request self-service. A buyer can singularly arrange computing capacities, for example, server time and system network storage, as required naturally without requiring human interaction with each service provider.

Broad network access. Client platforms, such as mobile phones, tablets, laptops, and workstations can be advanced through the use of standard instrument over the network.

Resource pooling. The provider's computing resources are pooled to serve various clients using a multi-tenant model, with various physical and virtual resources powerfully allotted and reassigned by buyer's request. There is a sense of location autonomy in that the client generally has no control or knowledge over the exact location of the provided resources however might have the capacity to determine location at a higher level of abstraction (e.g., country, state, or datacenter).

Examples of resources include storage, processing, memory, and network bandwidth.

Fast flexibility. Capacities can be flexibly provisioned and discharged, at times consequently, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities accessible for provisioning often appear to be unlimited and can be appropriated in any amount whenever.

Measured service. Cloud systems automatically control and enhance resource use by utilising a metering capability at some level of abstraction appropriate to the sort of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be checked, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Service Models:

The service layer is divided into three sub-levels; namely Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

Software as a Service (SaaS). The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure2. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings [29].

Platform as a Service (PaaS) or application platform as a Service (aPaaS) or platform base service is a category of cloud computing services that provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app [30]. According to [31, 32, 33], PaaS can be delivered in three ways:

i. as a public cloud service from a provider, where the consumer controls software deployment with minimal configuration options, and the provider provides the networks, servers, storage, operating system (OS), middleware (e.g. Java runtime, .NET runtime, integration, etc.), database and other services to host the consumer's application.
ii. as a private service (software or appliance) inside the firewall.
iii. as software deployed on a public infrastructure as a service [34, 29].

Infrastructure as a Service (IaaS) is a form of cloud computing that provides virtualized computing resources over the internet. It provides additional resources, for example, a virtual-machine disk image library, IP addresses, firewalls, virtual local area networks (VLANs) and other software packs. IaaS-cloud providers give these resources on-request from their enormous pools installed in data centres. For wide-area network connectivity, organizations can utilize either the Internet or carrier clouds (dedicated virtual private networks) that IaaS clouds offer. It also provides a common interface for large-scale cloud computing integration that enables the publication of calculation. The base layer will also provide the basic hardware resources for the platform layer for it to function in the same manner as the local devices.

Deployment Models:

Private cloud. The cloud infrastructure is provisioned for select use by a solitary organization comprising numerous clients/consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

Public cloud. The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

Hybrid cloud. The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, yet are bound together by standardized or proprietary technology that empowers information and application versatility (e.g., cloud bursting for load balancing between clouds).

Community cloud. The cloud framework is provisioned for selective use by a particular community of consumers from organizations that have shared concerns (e.g., mission, security prerequisites, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

Business application layer goes about as the business logic of the framework and frames the extension of its group of components. It recommends how business objects interface with each other and enforces the routes and the strategies by which business objects are gotten to and updated. It will enable clients to add items to a shopping cart, indicate a shipping/delivery address, and supply payment information. The business logic of the site will likewise incorporate a work process, for example, the sequence of events that occurs amid checkout, for instance a multi-page form which initially requests the shipping/delivery address, at that point for the billing address, next page will contain the payment method, and last page will show congratulations.

The business rule of the design will incorporate adding an item more than once from the item description page increments the quantity for that item and specific formats that the client's address, email address, and credit card information must follow. A specific communication protocol for talking to the credit card network will likewise be incorporated.

Various SaaS services will be utilized to give diverse aspects of capacity enabling business to use cloud platform to run and manage business processes. These incorporate sales tracking management, products creation and evaluation, Customer Relationship Management (CRM), Self Serves Customer Portal, Supply Chain Management (SCM), Finance and Cost Accounting (FCA), Enterprise Resource Management (ERP), Human Resource Management (HRM) et cetera. In this way, the propose framework will ensure against recruitment and training of IT staff on costly equipment and exclusive software.

Cloud Application Layer - is the layer that is visible to the end-users of the cloud. Clients usually access the services provided by this layer through web-portals, and are sometimes required to pay fees to use them.

Cloud Middleware Layer - Cloud Middleware Layer is normally situated between the operating system and an application. It gives various functionalities to the client. It helps in the formation of business applications; encourages simultaneousness, transactions, threading and messaging; and provides a service component architecture framework for creating service-oriented architecture (SOA) applications. Web servers, application servers and databases are cases of cloud middleware. Middleware programs by and large provide communication services and serve the need of a messenger with the goal that different applications can send and receive messages. Different applications situated at various physical locations can be "tied" together to play out a task through cloud middleware [35].

IV. IMPORTANCE OF CLOUD COMPUTING IN E-COMMERCE

The Gartner Group, [21] explicated cloud computing as "a style of computing in which massively scalable IT-related capabilities are provided 'as a service' using Internet technologies to multiple external customers". With the arrival of Salesforce.com in 1999, the idea of cloud computing came to the fore and since then a lot has been done in this field. Its strength can be judged from the fact that it's predicted that Cloud's deployment will be in default by 2020. An area which is hugely benefitting from cloud computing is e-commerce. There are myriad of advantages e-commerce is drawing from cloud computing today. Cloud computing in e-commerce enables the business to look big virtually and operate extensively [36]. The importance are as follows:

i. Scalability - Often referred to as "elastic", these cloud services allow a business to scale quickly and support seasonal spikes in demand or those triggered by special promotions [37]. Cloud Computing enables an e-commerce application to cater to the changing demand and scenarios of the market. It allows to upscale or downscale the services according to the demand, traffic, and seasonal spikes. Cloud provides the scalable architecture your business needs. The fact that your business will increase in the coming time, it is vital to scale the business as it grows.

ii. Trust – One of biggest challenges facing e-commerce pioneers in the early days of the web turned out not to be a technical problem, but a human one: Trust. [38]. It took time to build trust into their networks and establish a set of online credentials that made buyers feel comfortable initiating an online purchase. With the advent of cloud computing, existing businesses and startups can immediately leverage the trust built into established cloud systems such as Google, Amazon and Salesforce. A business can now point out to its customer base that their technical platform is managed and secured by the best cloud engineers in the world.

iii. Speed - For an e-commerce business, speed plays an important role to make the customers stay glued. A study by Akamai found out that 40% of customers abandon a web page if it takes more than three seconds to load. Even Amazon experienced an increase of 1% in revenue for every 100 milliseconds improvement to their site speed. While a sudden spike in traffic can slow down a website and make it unresponsive, cloud computing provides you with greater bandwidth, computational power, and storage.

iv. Cost Reduction - The facility of paying per use enables to consume the services according to your requirement. As the business grows you don't need to invest in hardware or software infrastructure. With cloud computing, the costs of developing and maintaining IT infrastructure cuts down. In 2016, Snapdeal launched its own private cloud Cirrus, which the firm believes will bring down the costs and improve performance. Cirrus, which is built on open source will help the e-commerce company visualize big data and give a personalized experience to its customers by understanding the behavior of the customers. Generally, a cloud-based initiative on a virtualized server may save a company 80% of the costs normally associated with a traditional e-commerce roll out [39].

v. Redundancy in Cloud Services - Cloud-based architectures are disaster tolerant. A cloud-based platform with built-in redundancy can save the business from data loss. It keeps the data secure, backed-up and easily accessible. An e-commerce business depends hugely on the data of its customers. At the time of catastrophic data losses or security threats, redundancy (or the built-in duplication of systems, data, equipment, and other components) helps to overcome the disaster and resume the business in a streamlined way.

vi. Security - Securing applications, physical facilities and networks is a critical consideration. Many cloud vendors complete third-party certification, including ISO 27001 and SysTrust audits. VI has been audited in for ISO 9001 and ISO 27001. Further security measures are implemented at the application, facility and network levels including data encryption, biometric screening of

personnel and certification through third-party vulnerability assessment programs [40].

vii. Interoperability - The explosive growth in cloud ecommerce offerings in the next few years will also see an increase in the ability to share information between clouds and communities of clouds. Leading-edge cloud vendors will offer a standards-based framework, which allows programmatic access for users, partners and others who want to leverage additional functionality from within the cloud.

V. CONCLUSION

It is predicted that global market for cloud equipment will reach $79.1 billion by 2018. Cloud services are making it possible for the e-commerce companies to reach its goals and provide a customized experience to the customers. The companies which have embraced cloud have a competitive advantage over the ones who have not adopted it yet. The agility and innovation which it has brought have led to an increase in revenue. According to Gartner [21], a Corporate "No-cloud" policy will be as rare as "no-internet" policy today. Hence there is no doubt that this disruptive technology which is changing the market from last decade will keep on changing

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