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AN INTRODUCTION TO CLOUD COMPUTING

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Abstract

Scalability, availability and efficiency of IT resources has been on the increase with the advent of globalisation, however many claim that the latest trend in technology know as Cloud computing which involves delivering infrastructure, services, and software on demand over the network will go a long way to offer public and private sectors a chance to see the world as a globe. However along with these advantages, storing a large amount of data including critical information on the cloud motivates highly skilled hackers thus creating a need for the secured platform to be considered as one of the top issues while considering Cloud Computing.

Keyword: Cloud computing, cloud models, secured platform

1.0 Introduction
The Internet is often represented as a cloud and the term "cloud computing" arises from that correlation. Cloud computing is a computing paradigm, where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage. With the advent of this technology, the cost of computation, application hosting, content storage and delivery is considerably reduced.

Cloud computing is a practical approach to experience direct cost benefits and it has the potential to transform a data center from a capital-intensive set up to a variable priced environment. The promise of cloud computing has greatly revolutionised the world as IT resources becomes more available and efficient at a much reduced cost.

2.0 Cloud Computing
The term cloud computing was derived from the way the Internet is often represented in network diagrams. Due to the fact it involves the existence of data centers that are able to provide services, the cloud can be seen as a unique access point for all the requests coming from the world wide spread clients.
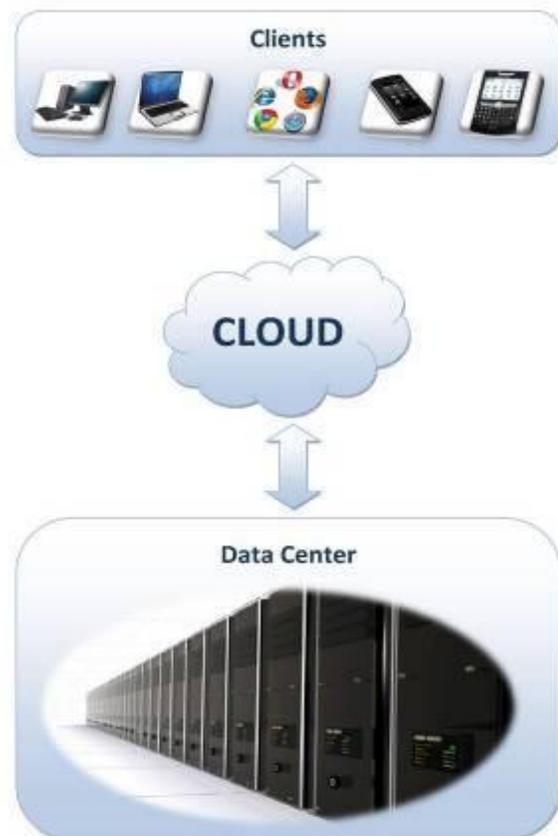

Fig. 1 Cloud computing

Cloud computing is location-independent computing, whereby shared servers provide resources, software, and data to computers and other devices on demand, as with the electricity grid. Cloud computing is a natural evolution of the widespread adoption of virtualization, service-oriented architecture and utility computing. Details are abstracted from consumers, who no longer have need for expertise in, or control over, the technology infrastructure "in the cloud" that supports them [3].

Cloud computing describes a new supplement, consumption, and delivery model for IT services based on the Internet, and it typically involves over-the-Internet provision of dynamically scalable and often virtualized resources. It is a byproduct and consequence of the ease-of-access to remote computing sites provided by the Internet. This frequently takes the form of web-based tools or applications that users can access and use through a web browser as if it were a program installed locally on their own computer [8].

Cloud computing is a model for enabling 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." [18]

According to Wikipedia cloud computing is the provision of dynamic scalable and often virtualized resources as a service over the internet

Fig 2: Cloud computing conceptual diagram from Wikipedia

The field of cloud computing involves the following players; Google, Microsoft, Amazon, Yahoo and some legacy hardware vendors like IBM and Intel. Cloud Computing applications are mainly intended to help companies and individuals to stretch resources and work smarter by moving everything to the cloud. One of the biggest promoters of the cloud computing is Google that already owns a massive computer infrastructure (the cloud) where millions of people are connecting to. Today, the Google cloud can be accessed by Google Apps [9] intended to be software as a service suite dedicated to information sharing and security. Google Apps covers the following three main areas: messaging

(Gmail, Calendar and Google Talk), collaboration (Google Docs, Video and Sites) and security (email security, encryption and archiving). Microsoft is developing a new Windows platform, called Windows Azure, which will be able to run cloud based applications [10].

Comparisons

Cloud computing can be compared to the following :

1. Autonomic computing — "computer systems capable of self-management" [12]
2. Client–server model – *client–server computing* refers broadly to any distributed application that distinguishes between service providers (servers) and service requesters (clients) [13]
3. Grid computing — "a form of distributed computing and parallel computing, whereby a 'super and virtual computer' is composed of a cluster of networked, loosely coupled computers acting in concert to perform very large tasks"
4. Mainframe computer — powerful computers used mainly by large organizations for critical applications, typically bulk data-processing such as census, industry and consumer statistics, enterprise resource planning, and financial transaction processing. [14]
5. Utility computing — the "packaging of computing resources, such as computation and storage, as a metered service similar to a traditional public utility, such as electricity"[15]

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6. Peer-to-peer – distributed architecture without the need for central coordination, with participants being at the same time both suppliers and consumers of resources (in contrast to the traditional client–server model)

7. Service-oriented computing – Cloud computing provides services related to computing while, in a reciprocal manner, service-oriented computing consists of the computing techniques that operate on software-as-a-service. [16]\

2.0   Components of cloud computing

Infrastructure as a Service (IaaS): The IaaS layer offers storage and compute resources that developers and IT organizations can use to deliver business solutions.

Platform as a Service (PaaS): The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations [8].

Software as a Service (SaaS): In the SaaS layer, the service provider hosts the software so you don't need to install it, manage it, or buy hardware for it. All you

3.0   CLOUD DEPLOYMENT MODELS

Private cloud: This is a fully functional cloud that is owned, operated, and probably restricted to a particular organisation [5]. Some vendors have used the terms to describe offerings that emulate cloud computing on private networks. These (typically virtualization automation) products offer the ability to host applications or virtual machines in a company's own set of hosts. These provide the benefits of utility computing -shared hardware costs, the

ability to recover from failure, and the ability to scale up or down depending upon demand. Depending on operational/security considerations, private clouds may be interconnected with public clouds.

Public clouds: these are multi tenant clouds that tended to focus on particular layers, public clouds include; Google, Amazone, Salesforce among others. Public cloud or external cloud describes cloud computing in the traditional main stream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who bills on a fine-grained utility computing basis[17].

Vertical clouds (community cloud): these are public clouds organized around a group of competing/cooperating businesses in a particular vertical market such as financial services that are able to provide industry-specific capabilities such as governance, auditing and security, [12].

Hybrid cloud: **Hybrid Cloud**: Organizations host some critical, secure applications in private clouds. The not so critical applications are hosted in the public cloud. The combination is known as Hybrid Cloud. **Cloud bursting** is the term used to define a system where the organization uses its own infrastructure for normal usage, but cloud is used for peak loads.

ADVANTAGES OF CLOUD COMPUTING
- the cost is low or even free in some cases. Also, there are no costs (or very small ones) for hardware upgrades;
- for some applications (like spreadsheets) it can be used even in the offline mode, so when the client goes back online a synchronization process is refreshing the data;
- (VIVIAN, 2014)the strong connection that exists today between the users and their

personal computers can be completely broken because a customer can reach the same result by using any Internet connected device having minimum software requirements;

▪ devices with minimal hardware requirements (mobile phones, for example) could be successfully used as cloud clients;

▪ in order to become part of the cloud, there is no need to download or install a specific software, only the Internet connection is required;

▪ the cost of licensing different software packages is moved to the data center level, so there is no need to upgrade the local system when new service packs or patches are released;

▪ crash recovery is nearly unneeded. If the client computer crashes, there are almost no data lost because everything is stored into the cloud.

DISADVANTAGES OF CLOUD COMPUTING
▪ the Internet connection speed may affect the overall performances;

▪ on a long term basis, the data center subscription fee may be more expensive than buying the hardware;

▪ the service quality is crucial and the need of the backups is critical when speaking about data security.

Cloud ComputingVulnerabilities

Cloud computing shares in common with other network-based application, storage and communication platforms certain vulnerabilities in several broad areas:

▪ Web application vulnerabilities, such as cross-site scripting and sql injection (which are symptomatic of poor field input validation, buffer overflow; as well as default configurations or mis-configured applications.

▪ Accessibility vulnerabilities, which are vulnerabilities inherent to the TCP/IP stack and the operating systems, such as denial of service and distributed denial of services [5]

▪ Authentication of the respondent device or devices. IP spoofing, RIP attacks, ARP poisoning (spoofing), and DNS poisoning are all too common on the Internet. TCP/IP has some "unfixable flaws" such as "trusted machine" status of machines that have been in contact with each other, and tacit assumption that routing tables on routers will not be maliciously altered.

▪ Data Verification, tampering, loss and theft, while on a local machine, while in transit, while at rest at the unknown third-party device, or devices, and during remote back-ups.

▪ Physical access issues, both the issue of an organization's staff not having physical access to the machines storing and processing a data, and the issue of unknown third parties having physical access to the machines

▪ Privacy and control issues stemming from third parties having physical control of a data is an issue for all outsourced networked applications and storage, but cloud architectures have some specific issues that are distinct from the usual issues. Christodorescu, et al. show a significant gap between what is assumed and what is reality, i.e., all virtual machines are brought into existence clean, when in reality a compromised hypervisor can spawn compromised VMs, or all VM operating systems are known and available for audit, when in reality the Windows source-code, among others, is not available for audit [2].

4.0   CLOUD COMPUTING SECURITY
Security is a sensitive issue that requires adequate consideration in every area of computing of which cloud computing is not different. There is need to ensure that sensitive data items of an individual, government or organisation is well protected to avoid loss of data and unauthorised access to sensitive data items. As with other major technological change, the evolution of cloud computing has brought a lot of publicity though in many developed countries. It has also raised policy questions concerning how people, organizations, and governments handle

information and interactions in this environment.

An important point to have in mind is that the cloud does not introduce any new security threats or issues. To put security in perspective, cloud computing as a whole can be considered the ideal use case to highlight the need for a consistent, transparent, standards-based security framework regardless of cloud deployment model. As companies move or build solutions in the cloud, having this consistent security model is vital to simplify development and to avoid vendor lock-in and preserve their IT investments. The most significant difference when considering security from a cloud perspective is the consumer's loss of control, as opposed to any particular technical challenge. With an in-house application, controlling access to sensitive data and applications is crucial. With a cloud-based application, access control is just as important, but the infrastructure, platform and application of security is under the direct control of the cloud provider. These are the areas of concern to security within the Cloud Computing space, Identify and Access Management, Data Encryption, Regulatory Compliance, Interoperability, Virtualisation, Security, Risk Management, Network breakdown, Infrastructure Reliability, Recovery and Shared Servers.

Q: Rate the challenges/issues ascribed to the 'cloud'/on-demand model
(1=not significant, 5=very significant)
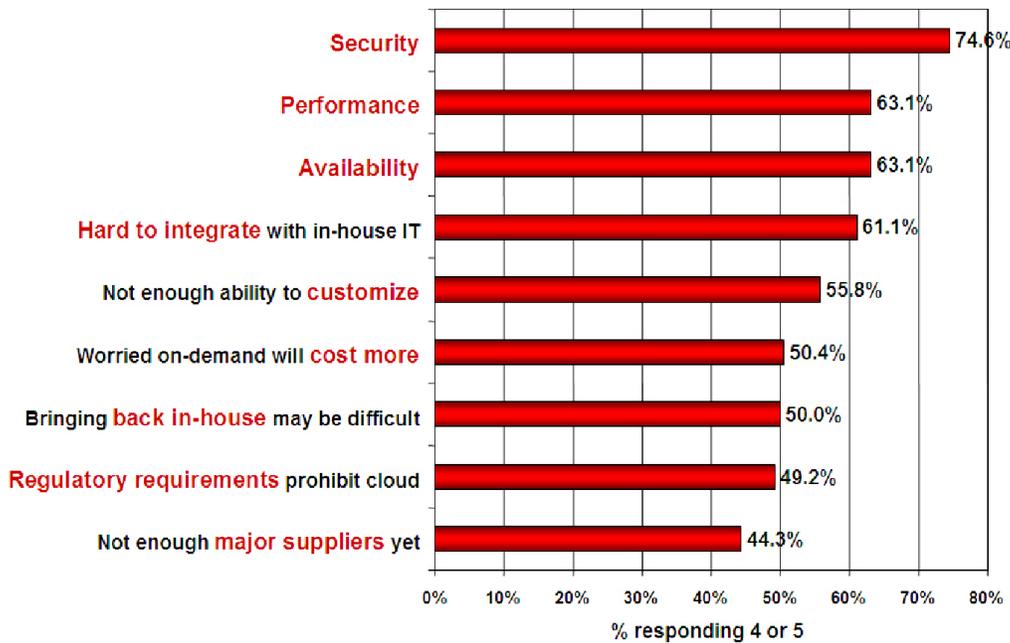
Source: IDC Enterprise Panel, August 2008 n=244

Security of data in the cloud must ensure the following [1]

Confidentiality: This refers to keeping data private. Privacy is of utmost importance as data leaves the borders of the organization. Not only must internal secrets and sensitive personal data be safeguarded, but metadata and transactional data can also leak important details about firms or individuals. Confidentiality is supported by, the following Continuity Disaster Recovery (Phoenix 2010):

- **Access control:** with access control you can control how and what information users can access. How could be by authentication through passwords and/or biometrics.

- **Passwords:** password is the basic authentication method and to make it even

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more secure it can be used alongside smart cards or biometrics.

- **Biometric:** biometrics concerns the use of humans physical characteristics for identification and authentication. It could be for example fingerprint scanning, retina scanning or face recognition.
- **Encryption:** by encrypting information from plain text to be unreadable prevents unauthorized users to access information. Encryption is performed through a mathematical algorithm to alter the information.
- **Ethics**: through policies employees can get the necessary guidance to know how to behave and prevent unethical use of for example an information system.

Integrity: This is a degree of confidence that the data in the cloud is what is supposed to be there, and is protected against accidental or intentional alteration without authorization. It also extends to the hurdles of synchronizing multiple databases. Integrity is supported by well audited code, well-designed distributed systems, and robust access control mechanisms.

To maintain the integrity of information one can adopt:

- **Configuration Management:** this is how you manage change when it comes to the information technology environment.
- **Configuration Audit:** this mechanism controls that information that is altered is allowed to be performed. The auditing can be done by monitor log changes either manually or through an automated system.

Availability: This implies being able to use the system as anticipated. Cloud technologies can increase availability through widespread internet-enabled access, but the client is dependent on the timely and robust provision of resources. Availability is supported by capacity building and good architecture by the provider, as well as well-defined contracts and terms of agreement. This can be achieved through the following:

- **Data Backup Plan:** to have a plan of how you backup your information is always important. It includes what information is being backed up and at which time interval.

This depends on what type of business you run and how often information is altered.

- **Disaster Recovery Plan (DRP):** this includes the procedures for how a quick backup is performed with minimum impact on the business.
- **Business Continuity Plan or Business Resumption Design:** this is a part of the DRP and documents of how a business gets back to normal after a disaster has struck

CONCLUSION

Cloud computing is the order of the day. Many people are talking about the cloud, but in reality, many firms and institutions are unsure or confused about what it means to be in the cloud. And many are concerned about the safety of their data and information hosted in the cloud. The paper try to give a introduction to of cloud and the Security concerns that any institution or firm should know

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