

Cloud Computing: A review

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Abstract- Cloud computing is a shift from computing as a product, to computing as a service which is to deliver to consumers, computing services over the internet, from a large-scale data centers. It is tremendously attractive to organizations and academia because it enables a fundamental move from capital intensive to a flexible operational management scheme. Though having been in existence for years without notice, it has undergone significant changes from parallel computing to distribute computing to grid and now cloud computing. This evolution is towards providing a more effective and efficient services to the user, at the same time shielding them from technical aspect of general computing management. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power and specialized corporate and user application. This paper reviews the cloud computing concepts, highlighting three major cloud architectures; Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), and look at some security issues as it concerns the cloud computing as a service.

Keywords: Cloud computing, IaaS, PaaS, SaaS.

I. INTRODUCTION

Many has been using cloud computing services for their personal needs without realizing it; when you store photos online in a social networking site, this photos are stored online and managed by a third party server. Since you have to login to this site to get access to your data/information by doing so, not working on your local computer but rather on the third party's computer. These are the services the cloud offers ranging from storage space, networking and computer processing capabilities. Cloud computing is a theory which is expected to present computing as a utility, with the potentials of transforming computing services, making software more attractive as a service and improving hardware design to cope with the technological evolution. In trying to manage the cloud infrastructure (physical and virtual resources), they are suppose to be arrange to provide rapid and dynamic response to applications and this has to be done by virtual infrastructure manager (VIM) also called cloud operating system. As highlighted earlier, its immediate predecessor grid computing lacks virtualization as computing jobs where dependent on the underlying infrastructure making computing very expensive to management. The rest of the paper is organized as follows: section 2- discusses the cloud computing and its conceptual framework, section 3- essential characteristics of cloud computing. In section 4- the security of the cloud was highlight and finally, section 5- provides a conclusion.

II. CLOUD COMPUTING AND ITS CONCEPTUAL FRAMEWORK

It is obvious that the mainframe computers which evolved in the mid 19th century is what have metamorphosed to today's cloud computing. As we stated earlier, it has been in use for years without noticing and using it efficiently. The word "cloud" was coined from the telecommunications world of 1990's during the birth of Virtual Private Network (VPN), which was called telecom cloud due to the fact that it supported dynamic routing [1]. Cloud computing is the resultant product of the quest to ensure traditional computer technology and communication technology and businesses mode meets the recent needs of the society [2]. The paper finally submitted that cloud computing is the delivery of the resources rendered by the computer far from the user's present location be it a front end or back end. Meanwhile, [3] sees cloud computing as a computing environment where users can outsources their needs on the internet. Agent based cloud computing [4] perceive the cloud as large group of interconnected computers which sparse beyond one enterprise with internet as the driver for resource sharing. Cloud computing was also defined [5] as a conceptual design which provides efficient and effective network access for the purpose of sharing computer resources with less management effort or service provider interaction. Cloud computing too, [6] is a collection of server which enables the visiting computers to get access to resources at a very fast rate via the internet without necessarily having to install the required software in their computer. Cisco defines cloud computing as a means to deliver Information Technology resources and services with the hope of allowing the user computer to work as a parasite, with traits of at-scale, on-demand and multitenancy [7]. Cloud computing is seen as a model which avail users the opportunity to share a pool of resources at any time, everywhere powered by the internet [8]. The figure 1 describes the concept of cloud computing.

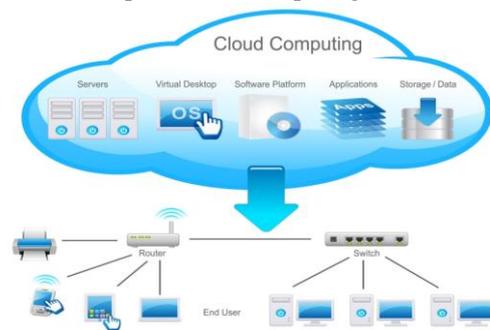


Fig 1 Cloud computing [9]

The cloud computing architecture is sub-divided into two sections in [10], the front end and back end. While the latter constitutes the computers, servers, and data storage systems that provides the cloud, the former are the client computers and the necessary software that enable it to access the cloud system through the internet.

A. Layers of the Cloud computing

This layers constitutes the general services offered by the cloud which [8] explained as “that service that is delivered and consumed on demand at any time, through any access network, using any connected devices using cloud computing technologies.” Cloud computing is classified in terms of abstraction and services provided as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) [11], and this is show as in figure 2 while [7] went further to add one more layer which they called IT foundation.

Service Class	Main Access & Management Tool	Service Content
 SaaS	Web Browser	Cloud Applications Social networks, Office suites, CRM, Video processing
 PaaS	Cloud Development Environment	Cloud Platform Programming languages, Frameworks, Mashups editors, Structured data
 IaaS	Virtual Infrastructure Manager	Cloud Infrastructure Compute Servers, Data Storage, Firewall, Load Balancer

Fig 2 The Cloud Computing Stack [11]

Meanwhile, this stack layer was expanded this by including anything as a service (XaaS)[12] as depicted in figure 3.

The three major services in this architecture are as follows: Software as a Service (SaaS): This is when application services are distributed in the network based on demand. It enable users getting access to software which are not locally installed in their computer and having online maintenance incase of software malfunctions [11] thereby making user boarder less of the storage capacity of their computer. An example of the SaaS providers includes Google, Cisco WebEx™, Microsoft, and Salesforce.

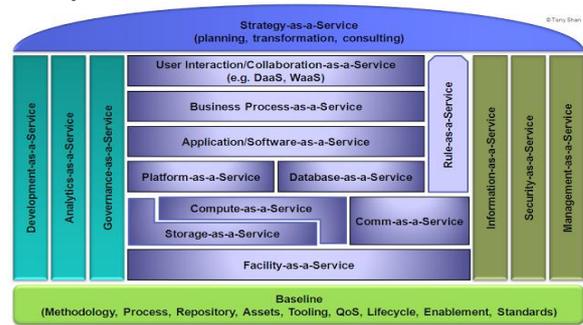


Fig 3 Cloud layer [12]

Platform as a Service (PaaS): They are pay-as-you-go services which are delivered on the network which consists of run-time environments and software development framework [7]. It is a platform which provide developers necessary environment to create and deliver their applications shielding then from worrying on performance processors and memories of various computers [11]. Whereas “A category of cloud services where the capability provided to the cloud service user is to deploy user-created or acquired applications onto the cloud infrastructure using platform tools supported by the cloud service provider.”[8]. Some examples of platform as a service which provides environment for developing and hosting website are Google Apps Engine, Amazon Web Services, and Cisco®WebEx Connect. Infrastructure as a Service (IaaS): This is another pay-as-you-go services which is deployed to the user over the internet to again access to cloud processing, storage and intra-cloud connectivity [7] [8]. Amazon, IBM and HP are few that is providing this service to the user

B. Basic Cloud Computing Deployment

Cloud deployment generally depends on the user perspective, as it involves how the cloud is intended to be used by the customer. Though Cisco in [7] divided cloud computing into four types: public clouds, private clouds, virtual private clouds, and inter-clouds. Equally, it is made up public cloud, private cloud and hybrid cloud and community cloud respectively[3] [5] [8]. The figure 4 shows the three major layers as established [13] and discussed as thus: Public clouds: These are clouds deployed to offer services to the public or organization and it is either managed by the organization or third party. User only pay for the services they used, and they are less secure when compare to other cloud types [3]. Private clouds: They are cloud that are internally deployed within an organization to enable them maintain and manage security, and general upgrades [3]. It is also either managed by the organization of a third party. Hybrid Cloud: In this cloud, services are combination of two or more of private, community or public clouds respectively. This is seen as more secured deployment where user in either of the clouds can share data and information over the internet[3]

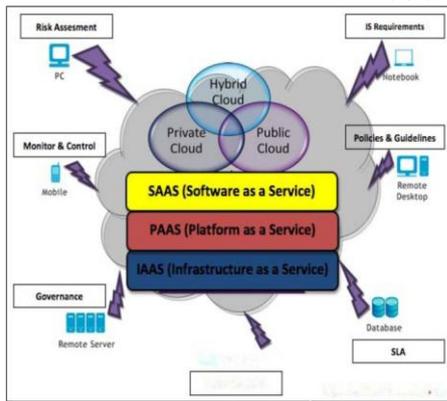


Fig 4 Cloud Computing Deployment [13]

Virtual private clouds: Avails the cloud providers to deploy to the user infrastructure services as part of their private cloud [7] Inter-clouds: This cloud facility allows on demand assignment of computing network, and the workload transfer via internetworking of cloud system.[5] Community cloud: Many organizations which have common ideological concept can come together to build a cloud in order to share data and information using their organizational policies and requirement. This also be managed by the organization or a third party.

III. ESSENTIAL CHARACTERISTICS OF CLOUD COMPUTING

To ensure a complete cloud services, major services are expected to be delivered to the user. They include: The ability to allow user to customize, and use services without any human intervention thereby providing necessary on-demand self services to user. It should provide a pay-as-you-go service, so that only services like bandwidth storage, and processing used are paid for at a time. This removes the payment of service before been used. It should create a mirage of unlimited power of cloud computing, leaving the user with the mind of having full resources at anytime. The sharing of cloud services by different user and the cost of storage, and processing are reduced. The maintenance and security of the user's are shifted to the cloud service providers, making the user have the best performance throughput.

IV. SECURITY OF THE CLOUD

Now we have arrived in the cloud, its security has become the most tasking as individuals and corporate bodies are most disturbed as how secure the cloud can be. "Cybercrime's effects are felt throughout the Internet, and cloud computing offers a tempting target for many reasons." [1] and with the number of users as internet in the organization, and academia it should have an effective security model. Brodtkin [14] highlighted seven major security issues for cloud client to avoid: Privileged user access, Regulatory compliance, data location:, data segregation, recovery, investigative support and long-term viability. To this end, having good and efficient cloud

computing services becomes pertinent, and [15] discloses some management features that the cloud service provider for RAS parameters improvement as availability management, access control management, vulnerability and problem management, patch and configuration management, countermeasure, and cloud system using and access monitoring respectively. They further highlighted two cloud RAS issues as cloud security issues, and data Leakage and submitted that in as much as the data and information are moving from a local computer of the user to reside in a multi-database environment there is a possibility of leaking known user resource by tracking its IP address on the internet. In trying to provide solution to the security on the cloud, two options were suggested, access control mechanism; to ensure that only authorized user gets access while unauthorized is denied access [15]. These accesses are: Control access to information, manage user access rights, encourage good access practices, control access to network services, control access to operating systems, control access to applications and systems. While incident counter measure and response, ensures partitioning, migration and workload analysis and allocation toward providing a tracking tool for the security of the cloud. Dan and Anna proposed a security model to address data privacy issues of the users in [16], which have three major parts; policy enforcement, policy ranking and policy integration to ensure a secure cloud as depicted in figure 5a. And because of the importance of the privacy and security issues of cloud computing [17] proposed a framework which has a client-based privacy manager tool as shown in figure 5b.

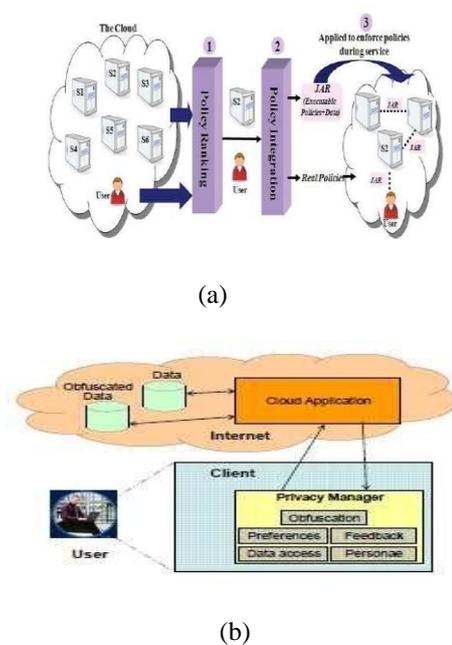


Fig. 5 Cloud Security framework. (a) [16] (b) [17]

Meanwhile, the threat are categorized into two [8], for cloud service users and cloud service providers and they stated that cloud computing without proper security measures will create fear making those who have arrived in

the cloud to come back and those who are still contemplating not to dream of going there since their data will be vulnerable to attack.

V. CONCLUSION

This paper have presented a concise review of cloud computing, highlighting what it is, by discussing its meaning, architectural design, and various deployment types. It also explains the cloud computing essential characteristics, and examines the security challenges of the cloud computing with its possible solutions. Cloud computing offers us the opportunity to delivering computer resources as service but still has unresolved security issues are to be address to sustain its usability. It is believed that this paper will avail non-researchers and researchers in this area an in-depth knowledge about cloud computing concepts and principles.

REFERENCES

- [1] John Harauz, Lorti M. Kaufinan, and B. Potter, Data Security in the World of Cloud Computing. IEEE Security & Privacy, Copublished by the IEEE Computer and Reliability Societies, 2009.
- [2] Liu, W., Research on Cloud Computing Security Problem and Strategy in Consumer Electronics, Communications and Networks (CECNet), 2012 2nd International Conference 2012, IEEE: Yichang. p. 1216-1219.
- [3] Yashpalsinh Jadeja and K. Modi, Cloud Computing - Concepts, Architecture and Challenges, in 2012 International Conference on Computing, Electronics and Electrical Technologies [ICCEET] 2012, IEEE: Kumaracoil. p. 877-880.
- [4] Sim, K.M., Agent-Based Cloud Computing. IEEE TRANSACTIONS ON SERVICES COMPUTING, 2012. 5(4): p. 564-577.
- [5] Peter Mell and T. Grance, The NIST Definition of Cloud Computing 2011.
- [6] Hope, C. Cloud computing. Available from: <http://www.computerhope.com/jargon/c/cloudcom.htm>.
- [7] Baksh, K., Cisco Cloud Computing - Data Center Strategy, Architecture, and Solutions 2009.
- [8] Computing, F.G.o.C., Introduction to the cloud ecosystem: definitions, taxonomies, use cases and high-level requirement, 2012.
- [9] DeMarco, J. Cloud Computing. Available from: http://www.defenginc.com/solutions/cloud_computing.
- [10] Strickland, J. How Cloud Computing Works. Available from: <http://communication.howstuffworks.com/cloud-computing1.htm>.
- [11] William Voorsluys, James Broberg, and R. Buyya, Cloud Computing: Principles and Paradigms, 2011, John Wiley and Sons, Inc.
- [12] Shan, T. Cloud Taxonomy and Ontology. 2009; Available from: <http://cloudonomic.blogspot.com/2009/02/cloud-taxonomy-and-ontology.html>.
- [13] Ramgovind S, Eloff MM, and S. E. The management of security in cloud computing. IEEE, 2010.
- [14] Brodtkin, J., Gartner Seven cloud-computing security risks. 2008.
- [15] Sabahi, F., Cloud Computing Security Threats and Responses IEEE, 2011.
- [16] Dan Lin and A. Squicciarini, Data Protection Models for Service Provisioning in the Cloud. SACMAT' 2010, 2010.
- [17] Siani, M., A Client-Based Privacy Manager for Cloud, in COMSWARE'092009: Dublin, Ireland.