Cloud Computing and its Adoption Challenges

Saharsh Gaurav[1], Shuchi[2]

[1]MCA, CCE, IPS, University of Allahabad
[2] MCA, CCE, IPS, University of Allahabad

---***---

Abstract - *Cloud computing is currently a buzz in the IT industry. It is technology which provides shared data, resources and information to computers and other hand held devices on-demand. It is universal available model for on-demand access to a shared pool of data. The main purpose of the cloud model is to provide greater flexibility, scalability, availability, reliability to the users at very low cost. Through this way the user can access the resources that actually reside at a location other than the user's computer. It is the amalgamation of network of computer connected by a centralized server.*

Key Words: Cloud Computing, IaaS, SaaS, PaaS, Cloud Deployment.

1.INTRODUCTION

Cloud computing also called "on-demand computing", is a type of service based internet computing. Cloud is used to access the application over the internet as utility by offering online data storage, infrastructure and application.

According to NIST [1] definition of cloud computing the basic concept could be understood as

"Cloud computing gives a convenient access to the shared pool of resources (e.g., networks, servers, storage, applications, and services) being ubiquitous on the user demand with minimal management efforts."

From the above definition we can easily conclude that cloud computing provides the software and hardware support over the internet on the user's demand. Cloud computing is a model providing an easy access to the shared pool of data and information, with the help of network, on the demand of the users for which the user has subscribed and use for the several times it wants. This whole process is achieved with the help of virtualization which is also cost-friendly. The user is never bothered about the physical location of the system providing the service. They also had not to worry about the configuration of the service provider

system. The virtualization behind the cloud technology separates a physical computing device into one or more virtual devices. Cloud computing is more effective by using the concept of centralizing storage, processing, bandwidth and memory [6].

2.CHARACTERISITCS OF CLOUD

According to the NIST [1] definition of cloud computing there are five essential characteristics.

2.1 On-demand self service

It refers to the service provided by the vendors of cloud computing which enables the resource demand availability. In this service the user accesses their shared data pool through an online control panels.

2.2 Broad Network Access

The services of cloud computing are available on network which are accessed through a set of standard mechanisms which helps in accessing the data over a heterogeneous client side platform.

2.3 Resource Pooling

The cloud computing service provider's resources are pooled to serve several consumers using multi-tenant model, with several physical and virtual resources assigned to the users on demand dynamically.

2.4 Measured Service

The service provided by the cloud computing systems automatically monitor and optimize resources use by metering capabilities at an abstraction level appropriate to the type of service.

2.5 Rapid Elasticity

Cloud computing offers scalability to extent that cloud appears infinite to the consumers, so that we can add or remove the computing power as per our need.

3.CLOUD DEPLOYMENT MODEL

The deployment represents the type of cloud primarily differentiated by the access, size and ownership of the cloud. Organizations trying to implement cloud as it reduces expenses and controls operating cost. There are primarily four types of cloud deployment models.

3.1 Public Cloud

A cloud is public if the services which are available on the network that is having an open access to everyone. In this the service providers renders services and infrastructure to the various number of clients. A virtualized environment is developed using the pool of shared resources to be shared on public networks such as internet to provide the service.

The public cloud venders may provide this service free, pay-per use or in the form of the license policy.it avoids the wastage of resources as the clients uses the resources as per their needs.

Advantages

    Easy and simple: Public clouds are service available on the internet. Hence they are easy to deploy.

    Self-service: The user is free to create its own cloud hence dependency on others is removed.

    Availability: The universal availability of the shared data to the user is another big achievement of this cloud as it decreases the delay in work.

    No Maintenance: The cloud service providers are responsible for the hardware and network maintenance client need not to worry.

Disadvantages

    Less security: Since there is a shared pool of hardware and resources and the security issues are there. The data is vulnerable to theft.

    No Control: The clients don't have any control over the data and the infrastructure of the cloud.

    No privacy: There is a lack of privacy and integrity of data those are available on the public cloud.
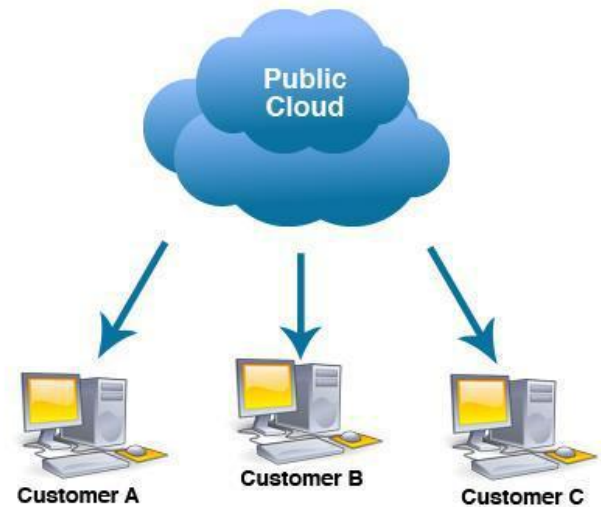

Fig. 1: Public Cloud [19]

3.2 Private Clouds

These clouds are developed for a private organization in which only authorized members can get access and use the shared pool of data. These types of clouds are generally created to stop the interference of the outsiders. This makes the cloud more secure. E.g. Amazon Virtual Private Cloud, Microsoft Private Cloud, etc.

Advantages

    More Secure: The private cloud is more secure as compared to public cloud.

    Control: It is having a better control on shared pool of data, user's data.

    Security: this type of cloud generally belongs to an organization hence the infrastructure can be configured to provide a high level security.

    Superior Performance: This type of cloud is implemented inside an organizations firewall which ensures good network and efficiency of the cloud.

    Easy Customization: The customization of the system and the infrastructure of the private cloud is very easy for the organization.

Disadvantage

    Cost: The cost of implementing the private cloud for an organization is high.

    Under-utilization: The private cloud could be underutilized in some cases. This is due to the less subscription of the resources. Hence the optimization of the resources is a big problem.

Capacity ceiling: The physical hardware with the service providers are limited hence there could be a ceiling of capacity to handle certain amount of servers and storage.
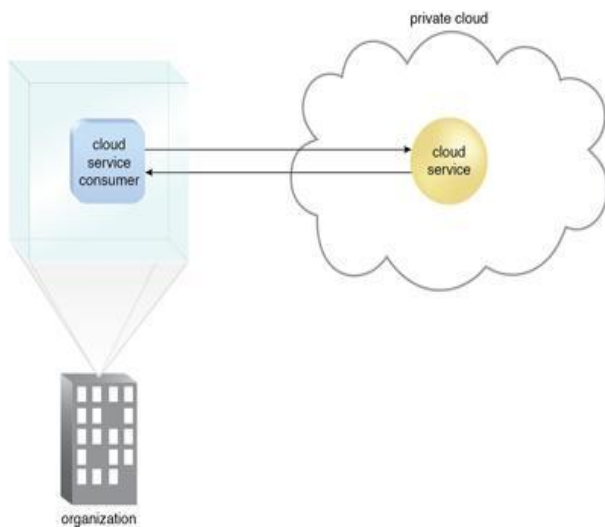

Fig. 2: Private Cloud [20]

3.3 Community Cloud

This cloud infrastructure is created for the use of only a specific community of consumers form an organization that have a need of shared data. This cloud is similar to public cloud except that only a specific community of people can have access to it. The cloud can be owned by the community members of that organization or by any third party cloud service providers.

Advantages

Cheaper than private: The cost of implementing the community cloud is cheaper than the cost of implement private cloud.

> **Outsourced management:** The management of the community cloud can be outsourced to a third party cloud provider.
> **Information leveraging:** The community cloud tools can be used in leveraging the information stored to serve consumers and supply chain.

Disadvantages

> **Costlier than public:** The implementation is costlier than public cloud.
> **Fixed bandwidth:** Only a fixed amount of bandwidth and data storage can be shared with the members of the community cloud.

3.4 Hybrid Cloud

This type of cloud is the mixture of two or more distinct cloud infrastructures. In simpler words, it is the collection of several clouds like public, community or private clouds. All these clouds are determined as same entities but are having their own unique identities.

Advantages

> **Reduced cost:** Needs of these clouds can be outsourced to the public cloud vendors hence it reduces the infrastructure expenses of the organization.
> **Cloud-Bursting:** Provides support for the cloud-busting.
> **Improved resource allocation:** The use of public clouds for the temporary projects removes the removes the need of investment for these project by having an improved resource allocation to the projects.
> **Great control:** The Hybrid cloud provides a great control over the cloud network to the hybrid cloud vendors, the organization having hybrid cloud.

Disadvantages

> **Vulnerable:** The hybrid cloud is having access across the boundaries of the organization which makes these clouds more attack prone as they are sharing data from inside of the organization to the outside of the organization.
> **Privacy and Integrity breach:** A hybrid clouds shares internal data of an organization to the public access across the boundaries of the organization hence the privacy and integrity issues may arise with some data.
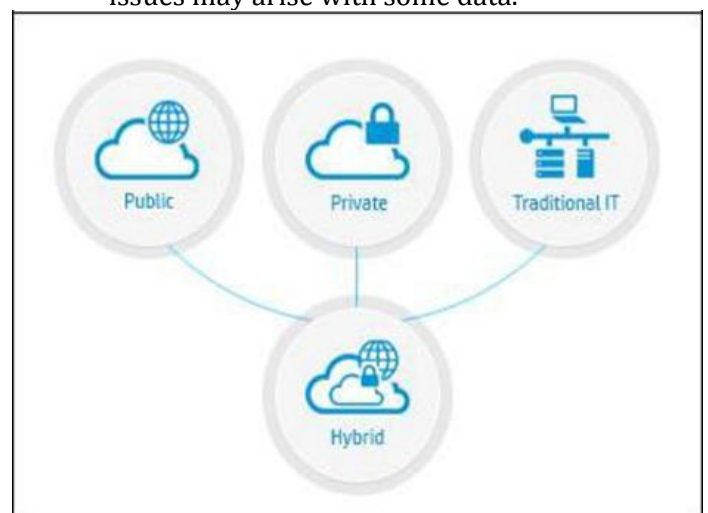

Fig. 3: Hybrid Cloud [21]

4. Cloud Computing Service Models

The service models of cloud computing are the specific pre-packed combination of IT services provided by the cloud vendors to the customers. There are basic three types of service models provided by the vendors of cloud.

1.Infrastructure as a Service(IaaS)
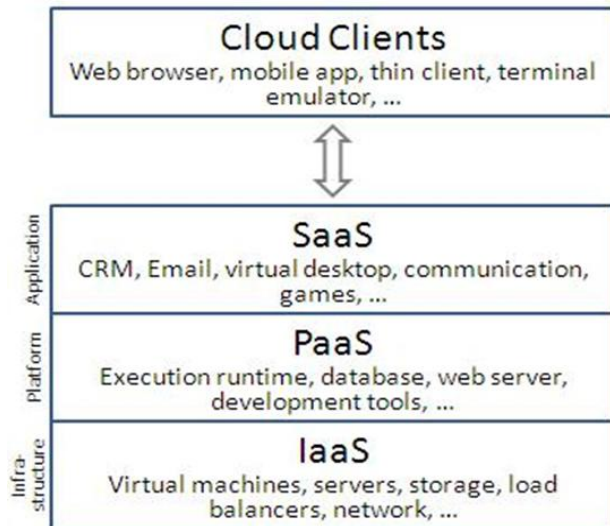2. Platform as a Service(PaaS)
3. Software as a Service(SaaS)

Fig. 4: Service models hierarchy [22]

4.1 Infrastructure as a Service(IaaS)

According to Internet Engineering Task Force (IETF)- the IaaS service providers offers computers-physical or virtual and other resources in cloud. An IT environment consisting of infrastructure-centric IT resources which are accessed and maintained by a cloud service based interface and tool are being represented in this service. The IaaS environment consist of hardware, network, connectivity, operating system and other raw IT resources. The IaaS providers provides the services like virtual resource(VR), physical resource load balancers and local area network. The consumers of IaaS don't have the control of the cloud infrastructure but they can control operating systems, storage and deployed applications. IaaS [4-5] is comprised of following components.

- Servers (physical and virtual)
- Storage system through the means of Network attached systems(NAS) and storage area network(SAN).
- Platform virtualization environment.
- Utility computing billing
- Segmentation of networks by using different network blocks and virtual LAN.

- Communication networks which include routers, switches, firewall, load balancers etc.
- High speed internet connectivity.
- Security by virtual machine or hardware based firewalls and intrusion detection and prevention system.
- Hardware load balancer.
- Dynamic Host Control Protocol(DHCP), Domain Name System(DNS) and other support and management protocols.

Advantages

Reduced cost: Reduced expenses on hardware and human resources.

Low barriers: Low barriers to entry.
Scalability and Flexibility.

4.2 Platform as a Service(PaaS)

PaaS is a cloud service which provide a platform for customers allowing them to develop, run and manage web applications without having the complexity of creating and maintaining the infrastructures associated with the application [7]. PaaS provides all the necessary requirements needed in a life cycle of development and delivery of web application. With PaaS the consumers are able to manage application and data while the provider manages runtime, middleware, operating systems, virtualization, server, storage and networking [8]. The user can customize the development tools provided by the vendors. This service also offers the mechanisms of service management, such as monitoring, workflow management, reservation and discovery.

Advantages

Consumes Cloud infrastructures.
Underlying infrastructure security Streamline version deployment.
Allows higher-level programming with low complexity.

Helpful for the developers who are remotely located and working on the same application.

The PaaS cloud service provider is responsible for the maintenance and upgrades of the tools, databases, etc. and the underlying infrastructure.

4.3 Software as a Service (SaaS)

It is a way to deliver applications over the internet as a service. The software is simply accessed through the internet freeing the user from complex installing and maintaining hardware [12]. This can be

also referred as "on-demand software". It is a very common business delivery model in IT industry for many business applications such as DBMS software, CAD software, accounting, collaboration, customer relationship management, management information system, etc.

There is no physical need for indirect distribution of applications in SaaS model because the applications are not distributed physically and is deployed almost instantaneously.

Characteristics of SaaS

- Software is managed from a central location.
- Internet access is provided to commercial software.
- "One to many" model is used in software delivery.
- Software upgrades and patches are handled by the service providers.
- API allows the integration between different pieces of software.

Advantages

Lower cost of entry

Reduced time to rapid prototyping

The service provider is responsible for upgrades, and security.

Integrity and scalability rate is very high.

No physical boundary of work i.e. you can work from anywhere.

5. Challenges in Cloud Computing

There are numerous challenges in the adoption of the current cloud computing because customers are still skeptical about the correctness and authenticity of cloud.

Security: Security plays a very important role in restraining the cloud computing acceptance. Without any hesitation putting your data on someone else storage device is quite daunting task. The cloud is a big black box to the clients, they have no control over what happens inside the cloud. The well-known security issues like loss of data, phishing, attacks, botnets, etc. pose some serious threats to the data and information of any organization [9].

Costing Model: Pricing is a way to determine what a service provider will get form the client in exchange of their services. The pricing process is can be of two types.

- **Fixed Pricing:** In this the customer is charged only a fixed amount all the time.

- **Dynamic Pricing:** In this the price changes dynamically or it market dependent in which the customers is charged accordingly on the real time market condition.
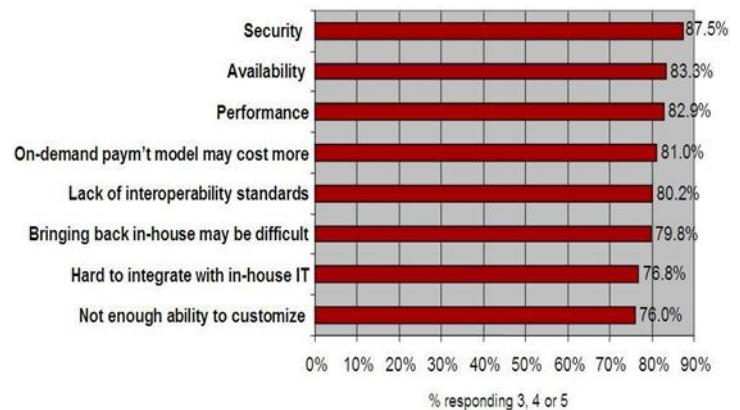

Fig. 5: Adoption Challenges (Source: IDC Survey, Aug 2008)

Service Level Agreement: When consumers migrate their core business to their entrusted cloud they must be ensure about the quality, availability, reliability and performance of the underlying computing resources of the cloud. To provide the guarantee of the cloud services from the cloud vendors the Service Level Agreement come in existence, which is negotiated between the providers and the customers over the term of service. The very first issue of SLA is their definition of specifications in such a way that it has an appropriate level of trade-offs between the expressiveness and complicatedness, so as to cover the most of the customer's expectations and is relatively simple to be weighted, verified, evaluated and enforced by the resource allocation mechanism on the cloud [9].

What to Migrate: According to the survey conducted by IDC [17] the seven IT system are being migrated to the cloud are Storage Capacity (15.5%), Server Capacity (15.6%), Application Development and Deployment (16.8%), Business Application (23.4%), Personal Application (25%), Collaborative Application (25.4%) and IT Management Application (26.2%). These statistics shows the insecurity among the customers/organizations regarding the data and services. The organizations show conservatisms in employing IaaS as compared to SaaS. The reason behind this is marginal functions are outsourced to cloud and the core service are kept inside.

Interoperability Issue: Every cloud vendor wants to define the way of interaction of applications/users/clients with the cloud and on the other side the customers don't want to be locked into a single cloud vendor, since it provides the users to switch between the clouds providing the better services. But the switching between cloud vendors is not easy as it has some obstacles like rebuilding the application and its stack in the target cloud, to setting up the network to provide the support to the application same as original cloud, setting up the security architecture of the cloud to make it more secure. Moving up the data and encryption of the data also is handled while transmitting it to the target cloud.

6. CONCLUSIONS

In this paper we put a light on the cloud computing, the cloud deployment models, cloud computing service models and the challenges in cloud computing. Beside of growing rapidly in the IT industry the cloud computing is still facing a lot of challenges to find the place in between the customers. The security issues in the cloud computing makes it difficult for the customers to rely on the technology. We highlighted the challenges faced by the cloud customers while changing their cloud vendor. After all the security in cloud is biggest issue on which the user not relying. Cloud computing has the power to lead the IT industry from the front in promoting the virtually and economically viable IT solution for the future.

REFERENCES

[1] Peter Mell, Timothy Grance "*The NIST Definition of Cloud Computing*" 2011.

[2] Kuyoro S. O., Ibikunle F. & Awodele O. "Cloud Computing Security Issues and Challenges", International Journal of Computer Networks (IJCN), Volume (3) : Issue (5) : 2011

[3] Sumit Goyal, "Public vs Private vs Hybrid vs Community - Cloud Computing: A Critical Review," I.J. Computer Network and Information Security, 2014, 3, 20-29.

[4] W.J. Rittinghouse and F.J. Ransome, ― Cloud Computing Implementation, Management, and Security,‖ Boca Raton, FL, CRC Press, 2010.

[5] G. Reese, ―Cloud Application Architectures,‖ O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472, 2009.

[6] Arora Pankaj, Wadhawan C.Rubal, Er.Ahuja P.Satinder, 2012, "Cloud Computing Security Issue in Infrastructure as a Service", International Journal of Advance Research in Computer Science and Software Engineering.

[7] William Y. Chang, Hosame Abu-Amara, Jessica Feng Sanford, Transforming Enterprise Cloud Services, London: Springer, 2010, pp. 55-56.

[8] R. K. Balachandra, P. V. Ramakrishna and A. Rakshit. "Cloud Security Issues." In PROC '09 IEEE International Conference on Services Computing, 2009

[9] S. Ramgovind, M. M. Eloff, E. Smith. "The Management of Security in Cloud Computing" In PROC 2010 IEEE International Conference on Cloud Computing 2010.

[10] Muhammad H. Raza, Adewale Femi Adenola, Ali Nafarieh, William Robertson "The Slow Adoption of Cloud Computing and IT Workforce" 3rd International Workshop on Survivable and Robust Optical Networks (IWSRON)

[11] F. Gens. (2009, Feb.). "New IDC IT Cloud Services Survey: Top Benefits and Challenges",*IDC eXchange*, Available: <http://blogs.idc.com/ie/?p=730> [Feb. 18, 2010].

[12] Dimitrios Zissis , Dimitrios Lekkas "Addressing cloud computing security issues", Future Generation Computer Systems 28 (2012) 583–592, Elsevier.

[13] https://en.wikipedia.org/wiki/Cloud_computing

[14] https://www.ibm.com/developerworks/community /blogs/722f6200-f4ca-4eb3-9d64-8d2b58b2d4e8/entry/4_Types_of_Cloud_Computing _Deployment_Mo del_You_Need_to_Know1?lang=en.

[15] http://www.statechmagazine.com/article/2014/03/ 5important-benefits-infrastructure-service.

[16] https://www.salesforce.com/saas/

[17] http://www.ibm.com/developerworks/cloud/library/c lcloudserviesliaas/

[18] https://tools.ietf.org/html/draft-golovinsky-cloud-services-log-format-03#section-3.3.

[19] https://www.znetlive.com/blog/why-move-to-the-public-cloud/

[20] https://quizlet.com/80411722/cloud-module-1-fundamental-cloud-computing-flash-cards/

[21] http://www.bitsolutions.net/cloud-solutions/hybrid-cloud/

[22] Heena I. Syed, Naghma A. Baig2"Survey On Cloud Computing" International Journal of Emerging Technology and Advanced Engineering.

BIOGRAPHIES

Saharsh Gaurav is a scholar of MCA 4th Semester from Center of Computer Education, Institute of Professional Studies, University of Allahabad, Allahabad, India. His key area of interests is Cloud Computing, MANETs Routing Protocols, Algorithms, Network and its Security.

Shuchi is a scholar of MCA 4th Semester from Center of Computer Education, Institute of Professional Studies, University of Allahabad, Allahabad, India. Her key area of interests is Cloud Computing, Network Security, Network Protocols.