A Critical Review of Cloud Computing

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Abstract- Cloud computing is the evolution of parallel and distributed computing, followed by cluster, grid and utility. Virtualization is the key factor behind the success of cloud computing. Saas, Paas and Iaas are the different cloud service delivery model. These services can be delivered as public, private, hybrid and community cloud. In this paper, authors have discussed the basic concept of cloud environment, its evolution, characteristics, service delivery mode, deployment model. It has been followed by different research issues in the area of cloud computing.

Index Terms- Cloud Computing, Services, Deployment Model, Virtualization, Issues, Characteristics, Advantages.

1. INTRODUCTION

Now days the amount of data stored in a computer is constantly increasing. To process and exchange this increased amount of data over the network requires more computer tools to meet the various requirements of an organization. The over equipped companies unwrap their infrastructure (to get the most out of their assets) for others by making the use of the Internet by creating a new computing model known as the cloud computing. The tradition of using a group of isolated servers placed on the Internet to perform the storage,
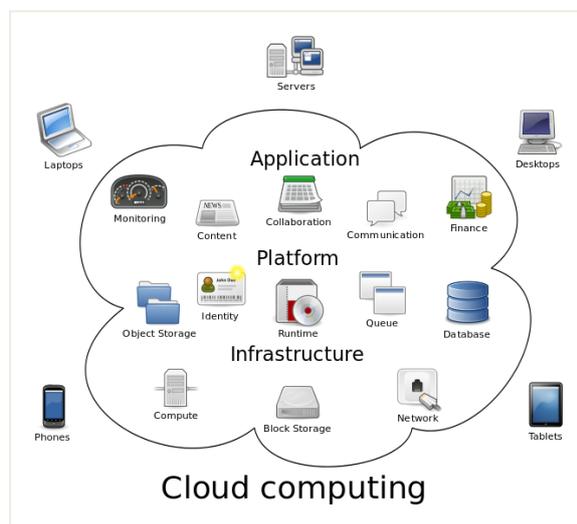

Fig. 1. Outline of Cloud Computing [1]

managing, and processing of data, rather than using a single server is the concept of cloud computing. Figure 1shows the basic concept of cloud computing [1, 2].

2. CLOUD COMPUTING EVOLUTION

Cloud computing is the consequence of evolution through multiple phases. Grid computing is based on the concept of combining dispersed architectures of multiple computers to solve a complex problem. In the

Fig. 2. Cloud Computing Evolution [4]

grid computing all the personal computers communicate through Internet and perform independent tasks. Utility Computing provides the resources such as storage, infrastructure etc. on the pay-per-usage basis. Therefore, depending on these factors various research scholars and organizations give different explanations of Cloud computing. Figure 2 demonstrates the evolution of cloud computing from grid to utility to cloud [3, 4].

3. CLOUD COMPUTING CHARACTERISTICS

The following are some of the characteristics offered by Cloud computing:

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- **Usage Based Pricing**: The services are provided on pay peruse model lowering the total cost.
- **Broad Network Access**: Any device having a fair internet connection can access the cloud services.
- **Resource Sharing**: Using the technology the consumers are provided with various resources as per their demand.
- **Self-Managing**: The service provider is only responsible to manage the flow of resources among the users [5, 6].

4. CLOUD COMPUTING SERVICES

Cloud The cloud offers services like SaaS-Software-as-a-Service, PaaS-Platform-as-a-Service and IaaS-Infrastructure-as-a-Service. Figure 3 shows the diagrammatical representation of three different types
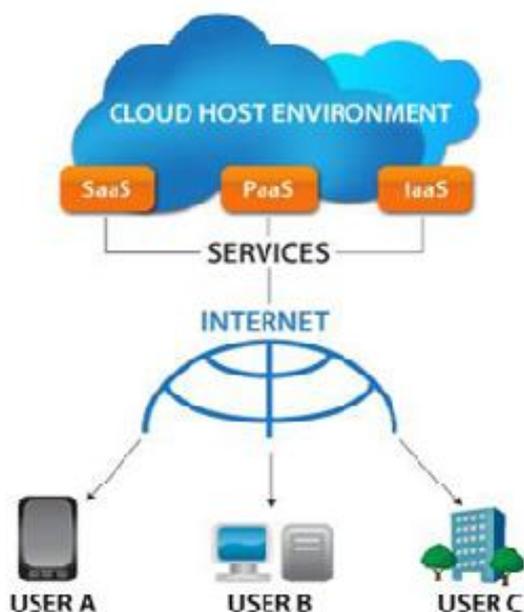

Fig. 3. Cloud Services [7]

of services provided by cloud model.

- **Software as Service**: The service provider is responsible for the creating, updating and maintaining and software licensing. The client uses and pays for the software accordingly. Reduction in the upfront and hardware cost are the benefits of SaaS.
- **Platform as Service**: The clients can use the platform as the service as they can build, test, and install their applications on the cloud. Whereas for the creation, updating and

maintaining the application the user is responsible. The uses of PaaS include pay according to usage model for expansion, testing and operating SaaS surrounding.

- **Infrastructure as Service**: The user can use the vital resources that include processors, storage devices, and networks bandwidth provisioned over a network by an infrastructure provider (IP). Low power consumption and cost are the benefits of IaaS, which in turn provides high returns in terms of higher resource utilization [7, 8].

5. CLOUD COMPUTING DEPLOYMENT MODEL

Depending upon the access given to user, we can have three types of cloud deployment model [9, 10].

- **Public Cloud** – The type of cloud, which can be accessed by all, is known as Public cloud. The services, leased by the client, can be accessed on the pay per basis model. The customer is unaware of the location of the cloud computing assets. Actually, there is no capital investment on infrastructure and risk in data transfer is the least. Figure 4 shows
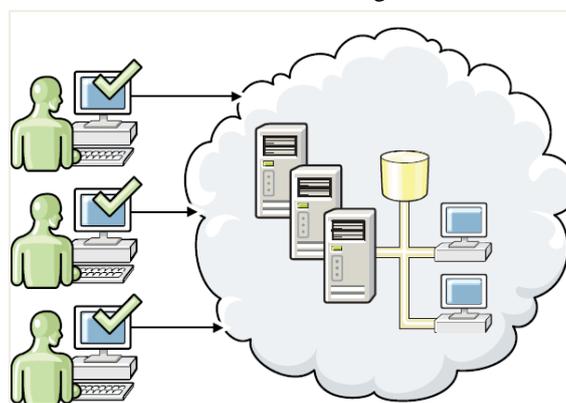

Fig. 4. Public Cloud [9]

the public cloud model.

- **Private Cloud**: A private cloud is meant for the employees of a particular organization and the cloud services are meant for organizational work only. Cloud services are not available for general public. This cloud is more reliable than public cloud as the privacy of data is maintained. Moreover the resources within the organization are optimized thereby

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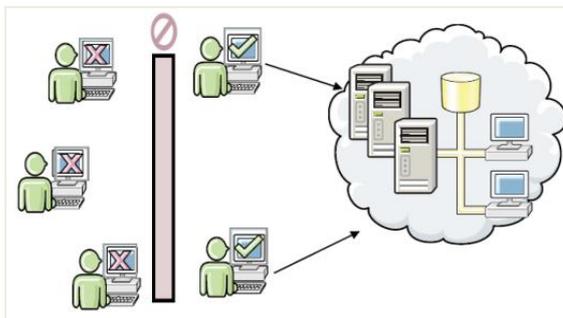minimizing the cost of data transfer. Figure 5

Fig. 5. Private Cloud [9]

shows the private cloud model.

- **Hybrid Cloud** – Hybrid cloud is the combination of both private and public cloud. Organizations use their own resources for normal usage and employ the cloud under the conditions of heavy data. Combining the advantages of both private and public cloud makes hybrid cloud more flexible and secure than the individuals. The cloud can be expanded and contracted according to the requirement by either hiring or releasing the resources. Figure 6 shows the hybrid cloud
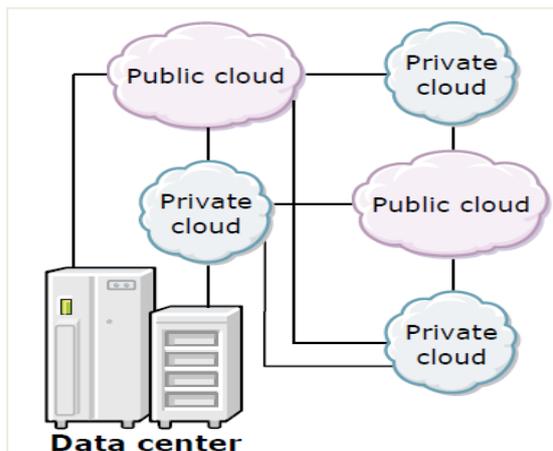

Fig. 6. Hybrid Cloud [9]

model.

- **Community Cloud:** Community cloud is the combination of various types of cloud, the resources of which belongs to a particular class of users. The users can develop, check and install their applications on this cloud. All these characteristics make this cloud economically scalable. Figure 7 shows the community cloud model.
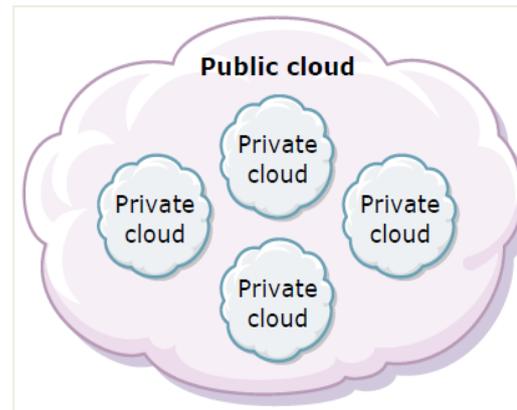

Fig. 7. Community Cloud [9]

6. VIRTUALIZATION & TYPES

Virtualization is the process of creating an actual environment on an existing server to run the desired program, without interfering with any of the other services provided by the server or host platform to other users. It diminishes equipment usage, and expenses thereby expanding the usage, effectiveness and adaptability of existing hardware. Figure 8 shows the diagrammatical representation of concept of virtualization [11, 12, 13].
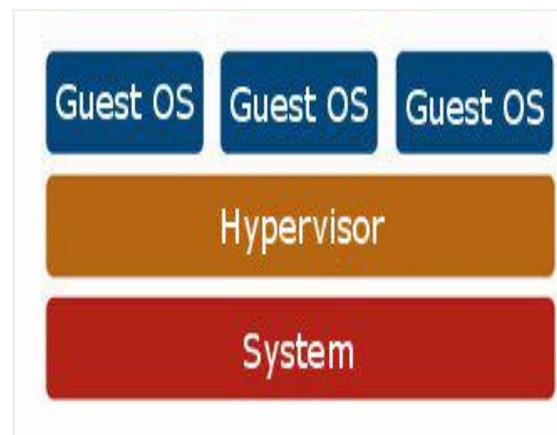

Fig. 8. Concept of Virtualization [11]

Hypervisor or the virtualization administrator is the programming that makes virtualization conceivable. Virtualization, which acts as a Virtual Machine Manager, permits multiple Operating Systems to run parallel on a single host computer. It maps resources among machines. Hypervisors are architecture specific. Some of the commonly used hypervisors are VMware, KVM and VirtualBox. Some of the commonly used types of virtualization types are as follows [14]:

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- **Application Virtualization:** This virtualization is important for the organizations requiring the applications instantly as it is a process in which the applications are delivered from a server to the end user's location which makes it possible for the user to access the application from virtually anywhere, using a fair Internet connection.

- **Desktop Virtualization:** This virtualization separates the user's desktop from the physical device and helps the user to go remotely. The user can conveniently access his desktop from any of his comfort location as the desktop is stored on a remote server. The risk of data loss is also minimum as the data is transferred over secure protocols.

- **Hardware Virtualization:** Hardware virtualization is done by a "hypervisor" that allots the hardware resources. The hypervisor creates virtual versions of multiple servers that run on a large single physical server so that all the hardware utilization is maximized thereby increasing the processing power. Hardware virtualization is further subdivided into: Occupied, Para and Partial virtualization.

- **Network Virtualization:** It is a way out that creates multiple channels on the same network thereby assigning each of them to the servers. The speed of the network may get increased drastically with the distribution of the channels making the network more reliable. Its two categories are internal and external.

- **Storage Virtualization:** It involves aggregation of multiple physical storage devices in a single storage cluster. This integration provides cost effectiveness and optimized performance and speed. It becomes advantageous in case of data recovery, as the data stored on the virtual storage can be re-generated and used. Block and File are its two types.

- **Memory Virtualization:** A memory pool is created by combining several physical memories across different servers that provides an enlarged immediate working memory. Some OS such as Microsoft Windows OS allows a portion of the storage disk to serve as an extension of RAM.

- **Software Virtualization:** It provides the capacity to create multiple virtual environments on the host machine that is complete in hardware and allows a visitor OS to run. Types of software virtualization are:
  - ➢ Working Frame work
  - ➢ Application virtualization
  - ➢ Service virtualization

- **Data Virtualization:** The data can be easily manipulated because it is present theoretically, free from database system and the structure. It decreases the information errors.

7. ISSUES IN CLOUD COMPUTING

Although Cloud computing is a rising technology and had managed to control the IT industry in recent years yet it is in its growing phase and still suffers from many issues. Some issues related to cloud are described below [14, 15, 16, 17].

- **Traffic Management:** Traffic management includes the design and management of a complex internal or external communications network in order to control traffic on the network so that data packets move smoothly via stable connection. Presently, very less focus is laid on measurement of resources and analysis the traffic of data center.

- **Data Issues:** Traditionally users of Cloud environment are more concerned about price hike, reliability problems and data security related issues that still exist in cloud environments. The outsourcing of data has made it difficult to use traditional security techniques for securing applications and data in the cloud. It has also become challenging to protect data reliability and storage correctness in long term span. If proper measures are not taken, this problem can obstruct the successful installation of cloud architecture. Extra tasks could not be run in private clouds compare to the public cloud due to high traffic. Cloud providers should lower the costs on the load and placing the data at each level of the system.

- **Bugs in Large Scale System:** The removal of bugs or errors in the large scale distributed systems have to be done in the production data centers.

- **Automated Service Provisioning:** For the proper functioning Cloud providers assign

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and release the resources time to time. This assigning process involves three steps:

(i) Application level which handles the dynamic request of resources at each level;

(ii) With the on going consumption, the resources requirement for future use is predicted regularly.

(iii) Allotting the resources automatically as per demand.

- **Management of Energy:** To deal with the pressure and in order to meet the environmental benchmarks the service provider has to reduce energy consumption by designing efficient data centers to properly manage the energy. As discussed in, the server consolidation and energy aware job scheduling are the methods to save the energy by turning off the unused machines.

- **Performance issues:** Migration of Virtual machines is done with the help of virtualization by load balancing techniques within the data centers. By migrating the complete Operating System including gall its components and applications the problems in the VM migration could be overcome.

- **Security Issues:** The two main security issues are:

  o **Availability of Service:** More availability problem is Distributed Denial of Service (DDoS) attacks which is another openness issue. Attackers make the services of DDoS unavailable by using large botnet's to reduce the profits of SaaS providers.
  The long duration attacks provides a way to uncover and defend against, and also the attacking bots could not be immediately re-used for other attacks which makes a long botnet attack difficult to maintain.
  The attacks are shifted to the Utility Computing provider by cloud computing from the SaaS provider. The more willing provider can absorb the attack and can also maintain DDOS protection in this capability.

  - **Data Security:** Service providers in the cloud can specify the security settings but cannot access the security system of datacenter in order to achieve confidentiality and auditability of data.

Cryptography techniques are deployed for secure data transmission whereas to check whether a security settings of the system has been tempered or not audit ability is necessary.

- **Workflow Management Issue:** Management of workflow is one of the main issues in cloud. Work process includes the arrangement of tasks necessary for completing various trade processes. Although responsibilities of work processes move on shifting yet it is responsible for job conjuring and job synchronization. Other main job of work process management is work process planning which is a procedure for deciding the right execution arrangement for the work process activities because during execution of the work process it becomes difficult to distinguish the accessible resource from the available resources.

8. BENEFITS OF CLOUD COMPUTING

Several uses of Cloud computing are given below [18]:

- **Pay per usage:** This characteristic of cloud states that cloud computing and cloud services are truly cost-effective as the users have to pay only for the amount of service used by them.

- **Open Access/ Mobility:** The Cloud services can be accessed with the help of reasonable internet connection.

- **Optimization of Existing Resources:** To overcome the situation of shortage of resources, cloud services are managed in order to relax the existing servers from the over loaded traffic.

- **Flexible Architecture:** The concept of cloud computing is divided into Public cloud, Private Cloud and Hybrid Cloud. According to the requirements of the business they are used.

- **Cost Efficiency:** Training is required when any new software is installed in an organization but with cloud usage the training cost can be saved.

9. CONCLUSION

In this paper, author has explained the basics of cloud computing along with its types, implementation model and issues. Authors have discussed the different types of services and deployment model. It has been followed by discussion of virtualization and its types. Virtualization is the key factor behind the success of cloud computing. At the end, authors have discussed the key issues in the area of cloud computing.

In future, authors have planned to work in area of scheduling, resource management and load balancing in the cloud computing.

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