
Cloud Computing: The Frontier of Computing

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Abstract

Now a day use of online trading and ecommerce are increasing rapidly. Use of Internet is also increased day by day. Most of the people use Internet based computing called cloud computing. In cloud computing software and hardware resources are available to the users as per their demand. Remote computing sites can use these resources easily with the help of Internet. Cloud computing allows the users to share the infrastructure, storage and computing resources. This helps to reduce the cost of the various applications. Cloud computing uses distributed network to provide different services and applications to the users. It also support for virtualized resources. To adopt cloud by maximum number of people mobility support is very important. But mobile devices have some limitations. Some of the major limitations of mobile devices are bandwidth limitations, battery lifetime and small storage. Use of cloud with mobile devices can solve these problems.

Keywords: *Cloud, security, deployment models, service models, mobile devices*

INTRODUCTION

As per the definition by National Institute for Standards and Technology (NIST) the cloud can be defined as: It is a model which allows suitable, on demand access to shared computing resources which can be speedily provisioned and at large with least administration endeavor or service provider interface [1].

Some of the important characteristics of cloud computing are: resource pooling, measured service, broad network access, multi tenacity, rapid elasticity and on-demand self-services.

Resource Pooling

Resources pooling means that users draw the resources from a pool of computing resources which are generally stored in remote data centers. These services are

based on performance, security, consumer demand.

Measured Service

On the cloud environment, the use of resources can be measured, managed and reported. In cloud computing, there is a metering capability which makes it able to optimize and control the use of resources. This is used for calculating the usage charges for the user. So that different type of services can have different charges. This allows optimizing the resources at different level of abstraction which are suitable to the services [2, 3].

Broad Network Access

Cloud computing has offer different services to the users. User can access these services through the network. Internet is the backbone of these capabilities of cloud. All these services can access by the use of some protocols and standard mechanisms.

MultiTenacity

Multitenacity means same resource or application can be use by several users of same or different organizations. Cloud computing has the property of multitenacity. It implies the need of requirement for isolation, segmentation, governance, policy driven enforcement,

service levels and charge for usages models for users. Users make use of service, provided by a public cloud provider or from the same company, such as different branch or business office of the same rather than different company which share the infrastructure [4, 5].

Rapid Elasticity

The important characteristic of cloud computing is elasticity. The resources available on the cloud to users are indefinite. These resources can be accessible to the end users at any time and in any number of times. These resources can be available without the intervention of the service provider. These resources can be scale in and scale out quickly as per user's requirements in a secure way so that user can get high quality services.

On-Demand Self-Services

Computers are used to provide different services which include email and applications services. It also includes network or server services [6]. The end user can access services like computing capabilities, storage services, software services etc. through the cloud without human interaction. On-demand self services means users ask for resources and also share the resources they have. On demand self services are provided by

cloud service providers. Various on-demand services include Google, Amazon Web Services (AWS), IBM, Salesforce.com, HP and Microsoft.

THE CLOUD COMPUTING MODEL

As per classification suggested by National Institute of Standards and Technology (NIST) the cloud computing is categorized into two models:

- Deployment Models.

- Service Models.

Deployment models refer to the management and the location of the infrastructure used for cloud. Service models include the types of services those are available to the user on a cloud computing platform. These models are again classified into sub model as illustrated in Figure 1.

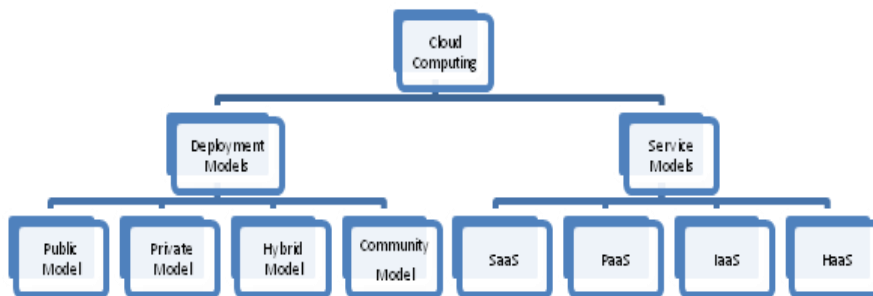


Fig. 1: Classification of Cloud.

Deployment Model

Deployment models are categorized on the basis of infrastructure location and availability to the users. There are four types of deployment models:

1. Public Cloud.
2. Private Cloud.
3. Community Cloud.
4. Hybrid Cloud.

Public Cloud

When the infrastructure provided by a cloud are owned, controlled and operated by a cloud provider, then that cloud is called Public cloud [7]. Examples of such services are social networking sites or email.

Private Cloud

When the cloud infrastructure are operated exclusively for some particular organization and it is controlled and managed by that organization or by third party then that cloud is called Private cloud.

Community Cloud

When the service and infrastructure is used by many organizations and it is accessible only to those organizations then that cloud is called Community cloud. In Community cloud the infrastructure may belong, manage, control and operated by a

cloud service provider or by the organizations.

Hybrid Cloud

When there is a grouping of different clouds then that cloud is called Hybrid cloud. Hybrid clouds are developed heterogeneously using resources such as private or public virtual infrastructures, clusters and computers. Figure 2 shows the classification of deployment model [8, 9].

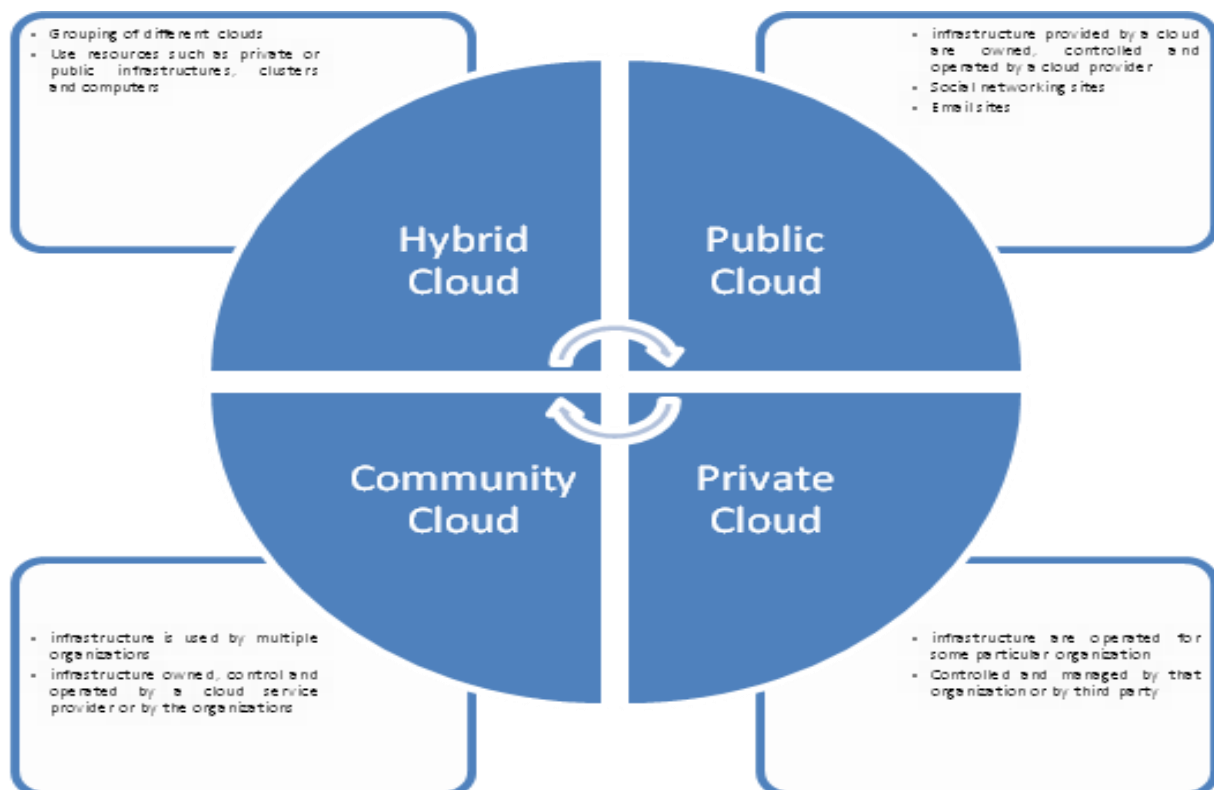


Fig. 2: Classification of Deployment Model.

Service Models

Service models illustrate the type of service provided by the service provider.

The types of service models are:

1. Software as a Service.
2. Platform as a Service.
3. Infrastructure as a Service.

4. Hardware as a Service (HaaS).

The classification is based on the services provided as shown in Figure 3.

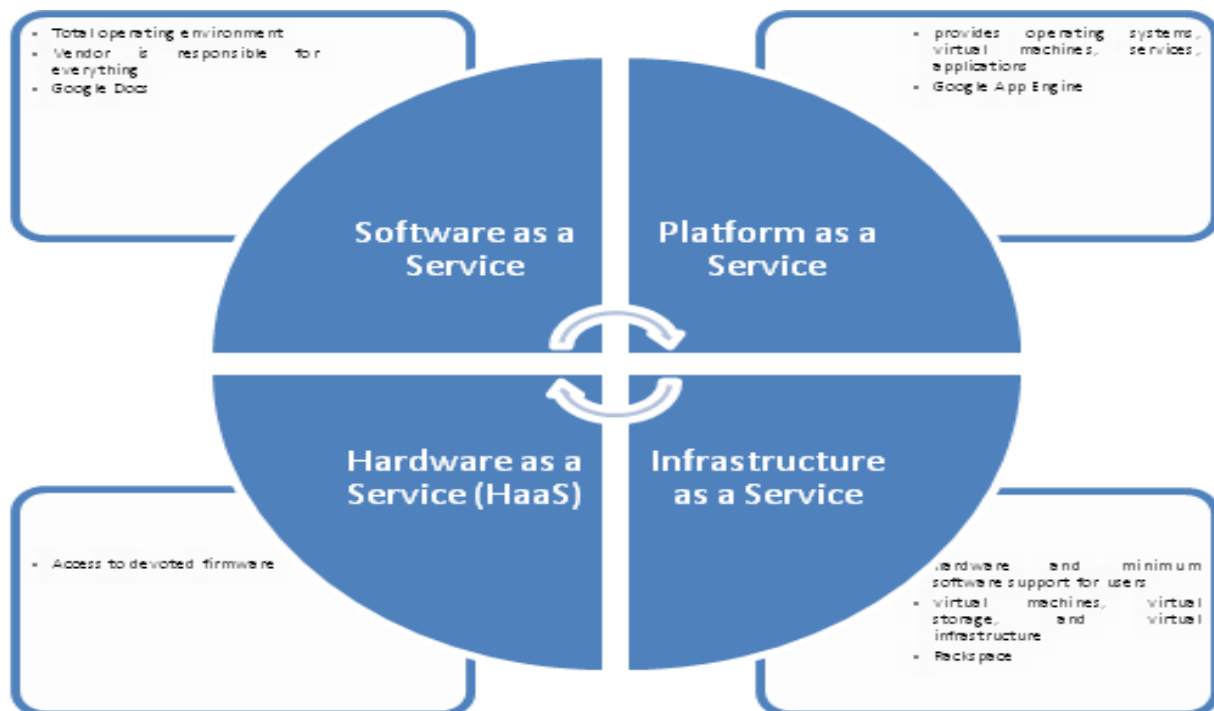


Fig. 3: Classification of Service Model.

Software as a Service

Software as a Service model is a total operating environment with interface, applications and management. In this model, a web browser is used to provide the access to the application to the user [10]. The user is accountable only for enter and manage his/her data. Vendor is responsible for everything from the

downloading of the application to providing the infrastructure. For example: Google Docs.

Platform as a Service (PaaS)

Platform as a Service model provides operating systems, virtual machines, services, applications, frameworks for development, control structures and

transactions. In this model the users can deploy their applications on the infrastructure available in the cloud environment. Also, it allows the user to use applications those are developed using tools supported by the CSP. In PaaS model, cloud infrastructure, the operating systems and the software are managed by the service provider. Whereas users are responsible for install and control the application. An example of a Platform as a Service provider is Google App Engine.

Infrastructure as a Service (IaaS)

Infrastructure as a Service model offers hardware and minimum software support for users to develop an application, e.g., virtual machines, virtual storage and virtual infrastructure. All the infrastructures are managed by the cloud service provider.

Users are responsible for install and control of applications, OS and interactions. An example of IaaS provider is Rackspace [11, 12].

Hardware as a Service (HaaS)

Hardware as a Service (HaaS) model offers access to devoted firmware through the Internet.

ISSUES AND CHALLENGES FOR CLOUD COMPUTING

There are many challenges with cloud computing, some of them are as follows.

1. Interoperability and Portability.
2. Scalability and Elasticity.
3. Energy Consumption.
4. Security and Privacy.
5. Availability and Reliability.
6. Virtualization.
7. What to Migrate.
8. Performance.
9. Service Delivery and Billing.
10. Bandwidth Cost.

Figure 4 shows various issues and challenges of the cloud computing.

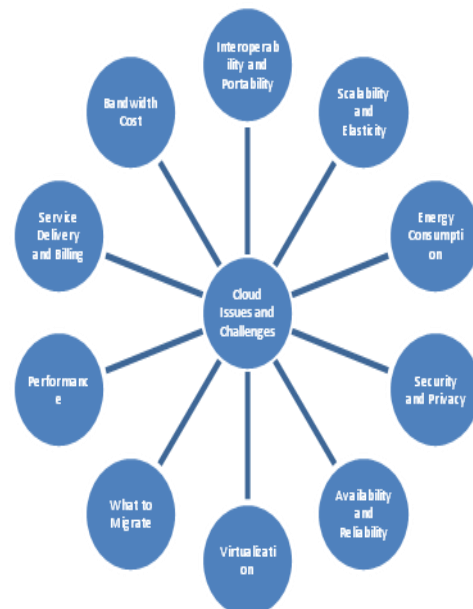


Fig. 4: Cloud Computing Issues and Challenges.

Interoperability and Portability

Different platforms are used by different service providers. Same tools or applications can be used on all these different platforms. This property is called interoperability. It can be defined at different levels such as service level, application level, data level and management level. The users can migrate from one cloud to another cloud as per his wish. But there is lack of open standards, APIs and interfaces for virtual machine formats. Portability means the solution for one cloud will be work with other clouds having different platforms.

Scalability and Elasticity

Scalability and elasticity allow the customers to use cloud resources as per their requirement. For traditional database systems most cloud database systems offer easier scalability to the users. Scalability of the system means its ability to give better performance even when the resources have been scaled up.

Elasticity of the system means its ability to scale resources as and when required. Elasticity allows the dynamic integration and pulling out of physical resources to the infrastructure. In cloud computing the elasticity enables scalability in vertically or horizontally. In horizontal scaling the

resources allocated or released are of the same type. In vertical scaling existing resources are replaced by lower or higher capacity resources.

Energy Consumption

Cloud computing infrastructure consumes large power/energy. Amazon conducted a survey for energy consumption by the cloud computing model. As per this survey the servers consumed about 53% of the overall cost for a paying off period of 3 years [12].

Security and Privacy

Security and privacy are the major components of network security. Data and application are portable on the networks; the resources are heterogeneous in nature, there is no control of the organization on the data. All these create security and privacy issues. The significant challenge is how it addresses security and privacy issues. There is no control of an organization on processing, storage and movement of data. This increases the risk and makes it easy for the attackers to make an attack.

Availability and Reliability

Availability and reliability of the resources are directly related with substantial benefits of the business. The degree of

availability and reliability also important for the success of cloud computing. Availability is the measure to which a system or information is accessible and usable upon request by an authorized person at any particular time. Availability means a functioning condition of a system at any particular instance. For example, the access to a system or information should not be prevented to the legitimate users. Reliability means how often the system or resources are available at any particular instant without interruption. For cloud computing, down time of the system is the major problem which affects its reliability. Maximum reliability can be achieved by the redundant utilization of the available resources.

CONCLUSION

Now a day most of the people use Internet based computing. This is called Cloud computing. In this software and hardware resources are available to the user as per his/her demand. Remote computing sites can use these resources easily with the help of Internet. Cloud computing allows the users to share the storage and computing resources. Cloud can be defined as: It is a model which allows suitable, on demand access to shared computing resources which can be speedily provisioned and at large with

least administration endeavor or service provider interface. Some of the important characteristics of cloud computing are: resource pooling, measured service, broad network access, multi tenacity, rapid elasticity and on-demand self-services.

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