

Aim: Study of NIST model of Cloud Computing

Theory:

1. Define and explain cloud computing

Cloud computing is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. The term is generally used to describe data centers available to many users over the Internet. Large clouds, predominant today, often have functions distributed over multiple locations from central servers. If the connection to the user is relatively close, it may be designated an edge server.

Cloud computing takes all the heavy lifting involved in crunching and processing data away from the device you carry around or sit and work at. It also moves all of that work to huge computer clusters far away in cyberspace. It can be both public and private.

Public cloud services provide their services over the Internet for a fee. Private cloud services, on the other hand, only provide services to a certain number of people. These services are a system of networks that supply hosted services. There is also a hybrid option, which combines elements of both the public and private services.

2. Draw and explain NIST cloud computing Architecture

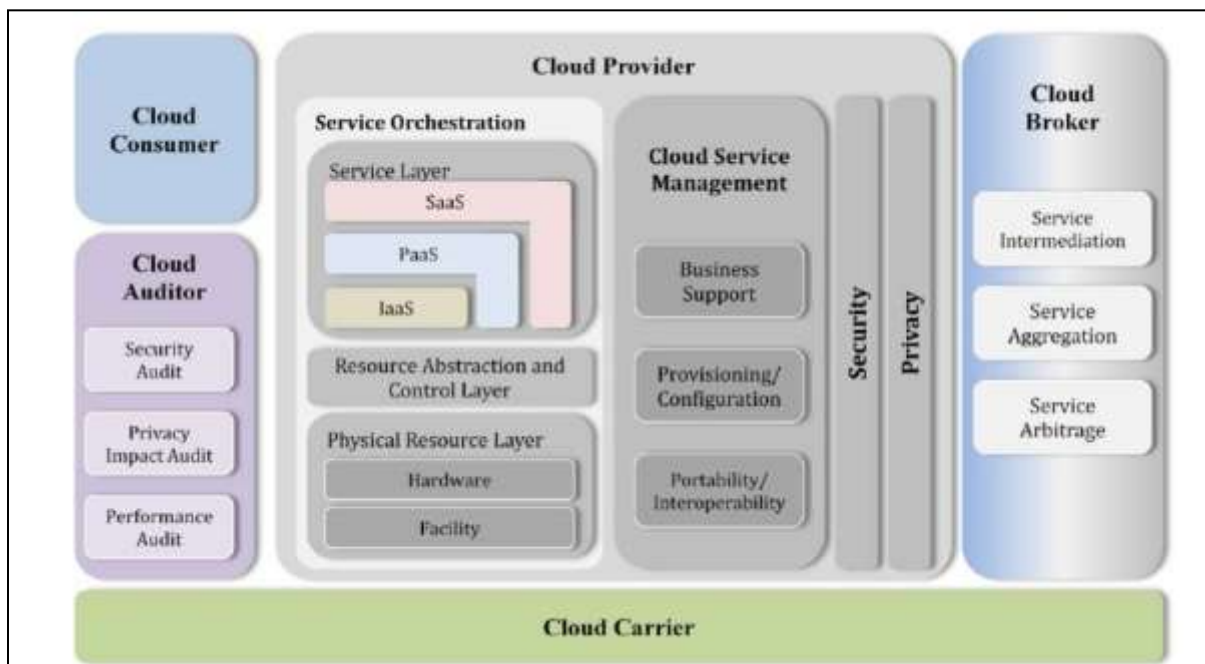


Figure 1 : NIST cloud computing architecture

The NIST cloud computing reference architecture is a generic high-level conceptual model that is a powerful tool for discussing the requirements, structures, and operations of cloud computing. The model is not tied to any specific vendor products, services, or reference implementation, nor does it define prescriptive solutions that inhibit innovation. It defines a set of actors, activities, and functions that can be used in the process of developing cloud computing architectures, and relates to a companion cloud computing taxonomy. It contains a set of views and descriptions that are the basis for discussing the characteristics, uses, and standards for cloud computing.

The NIST cloud computing reference architecture focuses on the requirements of what cloud service provides, not on a design that defines a solution and its implementation. It is intended to facilitate the understanding of the operational intricacies in cloud computing. The reference architecture does not represent the system architecture of a specific cloud computing system; instead, it is a tool for describing, discussing, and developing the system-specific architecture using a common framework of reference.

3. Explain the need for cloud computing.

Cloud computing helps businesses solve a lot of problems. The need for cloud computing is given as follows :

Efficiency : Efficiency in business operations is achieved in the following ways through the use of cloud computing:

- Accessibility : Cloud computing facilitates the access of applications and data from any location worldwide and from any device with an internet connection.
- Cost savings : Cloud computing offers businesses with scalable computing resources hence saving them on the cost of acquiring and maintaining them. These resources are paid for on a pay-as-you-go basis. This has proven to be much cheaper than acquiring the resources on their own.
- Security : Cloud providers especially those offering private cloud services, have strived to implement the best security standards and procedures in order to protect client's data saved in the cloud.
- Disaster recovery : Cloud computing offers the most efficient means for small, medium and even large enterprises to backup and restore their data and applications in a fast and reliable way.

Flexibility : Flexibility is achieved in the following ways when using cloud computing:

- Scalability : Cloud computing is the best option for businesses with fluctuating workloads since cloud infrastructure scales depending on the demands of the business.
- Tools selection : Cloud computing allows businesses to select specific prebuilt tools and features to derive solutions tailored to their specific needs.

- Cloud options : Cloud computing offers private cloud, public cloud and hybrid cloud solutions each with different features. Organizations can choose these options depending on what best serves their need.
- Control choices : Businesses can determine their level of control with as-a-service options offered by the cloud provider. These options include SaaS, PaaS, and IaaS.

4. Explain various service models of cloud computing with examples

As far back as 2009, the USA's National Institute for Standards and Technology (NIST) published a definition for cloud computing which bundled different approaches. It is still generally accepted as the fundamental definition and names three principal service models:

Here the different cloud service models are split into stacks

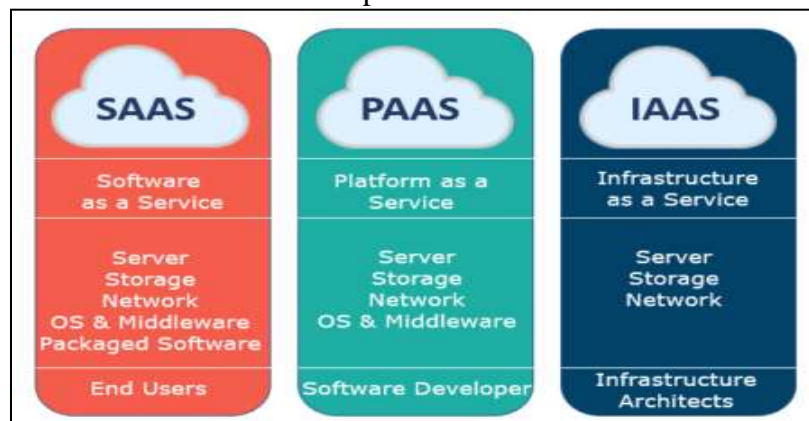


Figure 2 : Service models of cloud computing

IaaS – Infrastructure as a Service :

The customer rents an external infrastructure for its applications, data and operating system. The provider takes care of installing the servers, setting up and running the networks and storing the data.

PaaS – Platform as a Service :

Offers the same services as IaaS but goes one step further: As well as the servers, storage space and networks, the provider also supplies what are known as middleware applications – i.e. operating systems, databases, web servers, etc. The customer rents the use of the servers and the integrated tools.

SaaS – Software as a Service :

The common choice for private users: The customer buys a monthly subscription and uses specific selections of software directly from the provider's platform. The provider is responsible for installing, configuring and operating the interface. Examples of SaaS are Google Apps, Zendesk and Sales Force.

5. Explain various deployment models of cloud computing

According to the NIST working definition of cloud, the deployment model is one of the two categories of the model illustrated by NIST. The NIST model doesn't require cloud technology to use virtualization to share resources. Cloud support multi-tenancy; multi-tenancy is the concept of sharing of resources among two or more clients. The latest NIST model of cloud computing requires virtualization and utilizes the concept of multi-tenancy.

As cloud computing, we have to approach a set of interactive components, such as service-oriented architecture; users can expect that future versions of the NIST model may also include more features. The four sub-categories of the deployment model are:

1. **Public Cloud Model** : It is a type of cloud hosting that easily allows the accessibility of systems & its services to its clients/users. Some examples of companies that provide public cloud facilities are IBM, Google, Amazon, Microsoft, etc. This cloud service is open for use.

This type of cloud computing is a true specimen of cloud hosting, where the service providers render services to various clients. This type of cloud is economical due to the decrease in capital overheads.

- a. The advantages of the public cloud are: Flexible, Reliable, High Scalable, Low cost, Place independence.
 - b. This type also holds some disadvantages, such as: Less Secured, Poor Customizable.
2. **Private Cloud Model** : It is also termed as 'Internal Cloud', which allows the accessibility of systems and services within a specific boundary or organization. The cloud platform is implemented in a cloud-based secure environment guarded by advanced firewalls under the surveillance of the IT department that belongs to a particular organization. Private clouds permit only authorized users, providing the organizations greater control over data and its security. Business organizations that have dynamic, critical, secured, management demand-based requirements should adopt Private Cloud.
 - a. The advantages of using a private cloud are: Highly private and secured, Control Oriented
 - b. The Private cloud has the following disadvantages: Poor scalability, Costly, Pricing is inflexible, Restriction

3. **Hybrid Cloud Model** : Hybrid Cloud is another cloud computing type, which is integrated, i.e., it can be a combination of two or more cloud servers, i.e., private, public, or community combined as one architecture, but remain individual entities. Non-critical tasks such as development and test workloads can be done using the public cloud. In contrast, critical tasks that are sensitive such as organization data handling, are done using a private cloud.

It can cross isolation and overcome boundaries by the provider; hence, it cannot be categorized into any of the three deployments - public, private, or community cloud.

- a. Advantages of Hybrid Cloud Computing are: Flexible, Secure, Cost-Effective, Rich Scalable.
 - b. Disadvantages of Hybrid Cloud are: Complex networking problem, Organization's security Compliance.
4. Community Cloud Model : Community Cloud is another type of cloud computing in which the cloud setup is shared manually among different organizations that belong to the same community or area. An example of such a community is where organizations/firms are there, along with the financial institutions/banks.
- A multi-tenant setup developed using cloud among different organizations that belong to a particular community or group having similar computing concerns.
- For joint business organizations, ventures, research organizations, and tenders, a community cloud is an appropriate solution. The selection of the right type of cloud hosting is essential in this case. Thus, community-based cloud users need to know and analyze the business demand first.

6. Advantages and disadvantages of cloud computing

Advantages:

1. Easy implementation : Cloud hosting allows business to retain the same applications and business processes without having to deal with the backend technicalities. Readily manageable by the Internet, a cloud infrastructure can be accessed by enterprises easily and quickly.
2. Accessibility : Access your data anywhere, anytime. An Internet cloud infrastructure maximizes enterprise productivity and efficiency by ensuring your application is always accessible. This allows for easy collaboration and sharing among users in multiple locations.
3. No hardware required : Since everything will be hosted in the cloud, a physical storage center is no longer needed. However, a backup could be worth looking into in the event of a disaster that could leave your company's productivity stagnant.
4. Cost per head : Overhead technology costs are kept at a minimum with cloud hosting services, enabling businesses to use the extra time and resources for improving the company infrastructure.
5. Flexibility for growth : The cloud is easily scalable so companies can add or subtract resources based on their needs. As companies grow, their system will grow with them.
6. Efficient recovery : Cloud computing delivers faster and more accurate retrievals of applications and data. With less downtime, it is the most efficient recovery plan.

Disadvantages:

1. No longer in control : When moving services to the cloud, you are handing over your data and information. For companies who have an in-house IT staff, they will be unable to handle issues on their own.
2. May not get all the features : Not all cloud services are the same. Some cloud providers tend to offer limited versions and enable the most popular features only, so you may not receive every feature or customization you want. Before signing up, make sure you know what your cloud service provider offers.
3. Still require some management : You may have fewer servers to handle which means less for your IT staff to handle, but that doesn't mean you can let go of all your servers and staff. While it may seem costly to have data centers and a cloud infrastructure, redundancy is key for backup and recovery.
4. No Redundancy : A cloud server is not redundant nor is it backed up. As technology may fail here and there, avoid getting burned by purchasing a redundancy plan. Although it is an extra cost, in most cases it will be well worth it.
5. Bandwidth issues : For ideal performance, clients have to plan accordingly and not pack large amounts of servers and storage devices into a small set of data centers.

CONCLUSION:

- From this experiment we learned about NIST cloud computing model, service models of cloud computing and deployment models of cloud computing
- The factors to consider before opting for Cloud Computing are Pricing , Reliability, Expertise of a cloud service provider that is an industry expert and is an established brand, Consider the financial stability of the cloud vendor. Easily manageable system, Transparency, Ease of Integration ,Openness, Network Ownership
- The difference between containers and Virtual Machine is The container's system requires an underlying operating system that provides the basic services to all of the containerized applications using virtual-memory support for isolation.
- In VMs, a hypervisor, on the other hand, runs VMs that have their own operating system using hardware VM support. Container systems have a lower overhead than VMs and container systems typically target environments where thousands of containers are in play.
- Container systems usually provide service isolation between containers. As a result, container services such as file systems or network support can have limited resource access.

- Finally from this experiment we understood the advantages and disadvantages of cloud computing with its need.

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