CLOUD ARCHITECTURE

Any technological model consists of an architecture based on which the model functions, which is a hierarchical view of describing the technology. The cloud also has an architecture that describes its working mechanism. It includes the dependencies on which it works and the components that work over it. The cloud is a recent technology that is completely dependent on the Internet for its functioning.

CLOUD SERVICE MODELS:

There are the following three types of cloud service models -

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

1.INFRASTRUCTURE AS A SERVICE (IAAS)

IaaS is also known as Hardware as a Service (HaaS). It is a computing infrastructure managed over the internet. The main advantage of using IaaS is that it helps users to avoid the cost and complexity of purchasing and managing the physical servers.

Characteristics of IaaS

There are the following characteristics of IaaS -

- Resources are available as a service

- Services are highly scalable
- Dynamic and flexible
- GUI and API-based access
- Automated administrative tasks

Example: DigitalOcean, Linode, Amazon Web Services (AWS), Microsoft Azure, Google Compute Engine (GCE), Rackspace, and Cisco Metacloud.

2.PLATFORM AS A SERVICE (PAAS)

PaaS cloud computing platform is created for the programmer to develop, test, run, and manage the applications.

Characteristics of PaaS

There are the following characteristics of PaaS -

- Accessible to various users via the same development application.
- Integrates with web services and databases.
- Builds on virtualization technology, so resources can easily be scaled up or down as per the organization's need.
- Support multiple languages and frameworks.
- Provides an ability to "Auto-scale".

Example: AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, Apache Stratos, Magento Commerce Cloud, and OpenShift.

3.SOFTWARE AS A SERVICE (SAAS)

SaaS is also known as "on-demand software". It is a software in which the applications are hosted by a cloud service provider. Users can access these applications with the help of internet connection and web browser.

Characteristics of SaaS

There are the following characteristics of SaaS -

- Managed from a central location
- Hosted on a remote server
- Accessible over the internet
- Users are not responsible for hardware and software updates. Updates are applied automatically.
- The services are purchased on the pay-as-per-use basis

Example: BigCommerce, Google Apps, Salesforce, Dropbox, ZenDesk, Cisco WebEx, ZenDesk, Slack, and GoToMeeting.

Difference between IaaS, PaaS, and SaaS

The below table shows the difference between IaaS, PaaS, and SaaS -

IaaS	Paas	SaaS
It provides a virtual data center to store information and create platforms for app development, testing, and deployment.	It provides virtual platforms and tools to create, test, and deploy apps.	It provides web software and apps to complete business tasks.
It provides access to resources such as virtual machines, virtual storage, etc.	It provides runtime environments and deployment tools for applications.	It provides software as a service to the end-users.
It is used by network architects.	It is used by developers.	It is used by end users.
IaaS provides only Infrastructure.	PaaS provides Infrastructure+Platform.	SaaS provides Infrastructure+Platform +Software.

Four Cloud Deployment Models

Deployment models describe the ways with which the cloud services can bedeployed or made available to its customers, depending on the organizationalstructure and the provisioning location. One can understand it in this manner too: cloud (Internet)-based computing resources—that is, the locationswhere data and services are acquired and provisioned to its customers—can take various forms. Four deployment models are usually distinguished,namely, public, private, community, and hybrid cloud service usage:

1. Private cloud: The cloud infrastructure is provisioned for exclusiveuse by a single organization comprising multiple consumers (e.g. Business units). It may be owned, managed, and operated by theorganization, a third party, or some combination of them, and it mayexist on or off premises.

2. Public cloud: The cloud infrastructure is provisioned for open use bythe general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

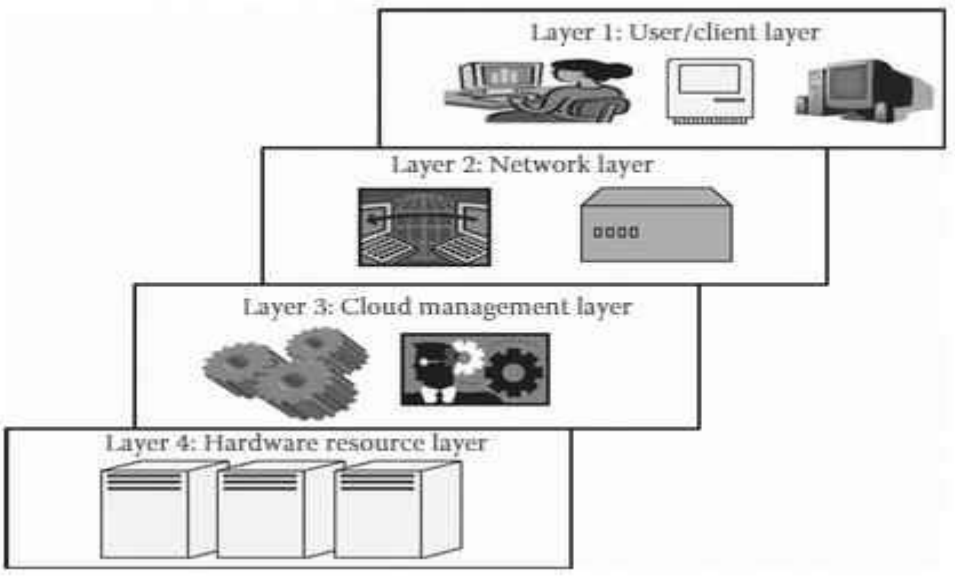
3. Community cloud: The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and complianceconsiderations). It may be managed by the organizations or a thirdparty and may exist on premise or off premise.

4. Hybrid cloud: The cloud infrastructure is a composition of two ormore distinct cloud infrastructures (private, community, or public) that remain unique entities but are bound together by standardizedor proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds)

CLOUD COMPUTING ARCHITECTURE- Layered architecture of cloud

There are 4 layers in the cloud architecture. They are as follows:

1. Layer 1 (User/Client Layer)
2. Layer 2 (Network Layer)
3. Layer 3 (Cloud Management Layer)
4. Layer 4 (Hardware Resource Layer)



Layer 1 (User/Client Layer)

This layer is the lowest layer in the cloud architecture. all the users or client belong to this layer. this is the place where the client/user initiates the connection to the cloud. the client can be any device such as a thin client, thick client, or mobile or any handheld device that would support basic functionalities to access a web application.

Layer 2 (Network Layer)

This layer allows the users to connect to the cloud. the whole cloud infrastructure is dependent on this connection where the services are offered to the customers. this is primarily the internet in the case of a public cloud. the public cloud usually exists in a specific location and the user would not know the location as it is abstract. and, the public cloud can be accessed all over the world. in the case of a private cloud, the connectivity may be provided by a local area network (lan).

Layer 3 (Cloud Management Layer)

This layer consists of software's that are used in managing the cloud. the software's can be a cloud operating system (os), a software that acts as an interface between the data centre (actual resources) and the user, or a management software that allows managing resources. This layer comes under the purview of (SLA) , that is, the operations taking place in this layer would affect the (SLA) that are being decided upon between the users and the service providers.

Layer 4 (Hardware Resource Layer)

layer 4 consists of provisions for actual hardware resources. usually, in the case of a public cloud, a data centre is used in the back end. similarly, in a private cloud, it can be a data centre, which is a huge collection of hardware resources interconnected to each other that is present in a specific location or a high configuration system. this layer comes under the purview of (SLA) . this is the most important layer that governs the (SLA). this layer affects the (SLA) most in the case of data centres. whenever a user accesses the cloud, it should be available to the users as quickly as possible and should be within the time.

VIRTUALIZATION IN CLOUD COMPUTING

Virtualization is the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources".

In other words, Virtualization is a technique, which allows to share a single physical instance of a resource or an application among multiple customers and organizations. It does by assigning a logical name to a physical storage and providing a pointer to that physical resource when demanded.

What is the concept behind the Virtualization?

Creation of a virtual machine over existing operating system and hardware is known as Hardware Virtualization. A Virtual machine provides an environment that is logically separated from the underlying hardware.

The machine on which the virtual machine is going to create is known as Host Machine and that virtual machine is referred as a Guest Machine

Types of Virtualization:

1. Hardware Virtualization.
2. Operating system Virtualization.
3. Server Virtualization.
4. Storage Virtualization.

1) Hardware Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is directly installed on the hardware system* is known as hardware virtualization.

The main job of hypervisor is to control and monitoring the processor, memory and other hardware resources.

After virtualization of hardware system we can install different operating system on it and run different applications on those OS.

Usage:

Hardware virtualization is mainly done for the server platforms, because controlling virtual machines is much easier than controlling a physical server.

2) Operating System Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is installed on the Host operating system* instead of directly on the hardware system is known as operating system virtualization.

Usage:

Operating System Virtualization is mainly used for testing the applications on different platforms of OS.

3) Server Virtualization:

When the virtual machine software or virtual machine manager *(VMM) is directly installed on the Server system* is known as server virtualization.

Usage:

Server virtualization is done because a single physical server can be divided into multiple servers on the demand basis and for balancing the load.

4) Storage Virtualization:

Storage virtualization is the *process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device*.

Storage virtualization is also implemented by using software applications.

Usage:

Storage virtualization is mainly done for back-up and recovery purposes.

ADVANTAGES OF VIRTUALIZATION

Virtualization is being pursued with great attention by numerous IT businesses. One of the main benefits of virtualization for platforms that support remote working is their integration with the cloud.

1. Cheap

IT infrastructures find virtualization to be a more affordable implementation option because it doesn't require the use or installation of actual hardware components. Dedicating substantial amounts of space and money to create an on-site resource is no longer required. We need a licence or access from a third-party vendor to begin using the hardware, just as if it were locally produced.

2. Efficient

By downloading the new versions of the software and hardware from a third-party supplier, efficient virtualization also enables automatic upgrades of both. By handling the problem themselves and saving money, IT specialists are able to avoid having to hire specialists. Virtualization also lessens the difficulty of managing resources to increase the effectiveness of virtual environments.

3. Disaster recovery

When servers are virtualized, disaster recovery is relatively simple thanks to fast backup restoration and current snapshots of your virtual machines. Organizations were better able to create a low-cost replication location thanks to virtualization. If a disaster occurs in the data centre or server room itself, you can still relocate such virtual machines to a cloud provider. Having the flexibility level guarantees that the disaster recovery plan will be simpler to implement and will have a 99% success rate.

4. Deployment

Resources may be deployed much more quickly when employing virtualization technology. It is feasible to significantly reduce the amount of time required for setting up physical devices or creating local networks. As a result, users really need is at least one connection to the virtual world. Additionally, the implementation of virtual machines is frequently simpler than the installation of actual models.

5. Encourages digital entrepreneurship

Prior to widespread virtualization, the average person found it nearly impossible to start a digital business. Thanks to the multiple networks, servers, and storage devices that are now accessible, almost anyone can start their own side business or turn into a business owner. Everyone can hang out their shingle and start looking for employment.

6. Saves energy

Both individuals and businesses can save energy by using virtualization. The rate of energy consumption can be reduced because no local hardware or software alternatives are being employed. To boost the total ROI of virtualization, monies can be used over time for other operational expenses rather than paying for a data centre's cooling costs and equipment operation costs.

7. improved uptime

Virtualization technologies have increased uptime dramatically. An uptime of 99.9999% is offered by some providers. Even low-cost carriers now offer uptime at a rate of 99.99%.

8. Consistent cost

People and corporations can have predictable expenses for their IT requirements because third-party vendors frequently offer choices for virtualization.

DISADVANTAGES OF VIRTUALIZATION

Numerous complex dimensions that digital technology had to explore have been resolved through virtualization. However, virtualization still shows signs of minor but significant problems. **As a result, virtualization has a lot of drawbacks, which are listed below:**

1. Exorbitant costs of implementation

Virtualization would result in very low costs for the common person or business. In a virtualization environment, the suppliers, however, may incur very significant implementation expenses. It follows that devices must either be created, made, or purchased for implementation when hardware and software are eventually required.

2. Restraints

Virtualization is hampered by a number of issues. Virtualization cannot be used with every server and application currently in existence. Therefore, certain firms' IT infrastructures would not be able to support the virtualized solutions. They no longer receive support from a number of vendors as well. The demands of both individuals and organisations must be served using a hybrid approach.

3. Problems with availability

The accessibility of a company is another important factor. Long-term data linking is required. If not, the business would become less competitive in the market. Because every document from and for the client is essential to the service provider, availability difficulties might be seen as one of the drawbacks of virtualization. It seems as though the virtualization servers are taken offline. Additionally, hosted websites would be useless. The user has no control over this; it is completely the responsibility of the third-party providers.

4. Time-intensive

In comparison to local systems, virtualization takes less time to implement, but it ultimately costs users time. This is due to the fact that there are additional procedures that need to be completed in order to attain the desired result.

5. Threats to security

Information is our current currency. Having money allows you to make money. Without it, people will forget about you. The success of a corporation depends on information, hence it is frequently targeted.

6. Problems with scalability

People can grow a business or opportunity quickly owing to virtualization, but won't be able to grow it as large as they would like. In a virtualization network, growth generates latency since multiple firms share the same resources. There wouldn't be much that could be done to stop it, but one powerful presence could syphon money away from other, smaller businesses.

7. A Number of links must interact

If users have access to local equipment, they have complete control over their options. With virtualization, people lose control because numerous ties are required to cooperate in order to complete the same task. We can take the example of saving a document file. Using a local storage device like a flash drive or HDD, users can instantly save the content and even create a backup. In order to use virtualization, the ISP connection must be reliable.

TOP TECHNOLOGIES EXAMPLES

VMWARE CLOUD SERVICES?

VMware Cloud services are services that enable you to integrate, manage, and secure applications on cloud resources. These services work for any cloud service using VMware and can help you centralize the management and maintenance of hybrid or multi-cloud environments.

VMware Cloud services enable you to determine how resources are used and where workloads are deployed while applying a single operational model. This enables you to standardize security, reduce management complexity, and improve your ROI.

You can use VMware Cloud services with either public or private clouds. When integrating these services you do not need to re-architecture applications or convert data. This can help you simplify app modernization and ensure high performance.

VMware Cloud services are available in a variety of technologies provided as part of a VMware Cloud subscription. This subscription offers a wide range of services. The following services are particularly helpful for monitoring and managing your cloud environments:

- VMware Cloud on AWS
- Cloud Provider Metering
- vRealize Network Insight Cloud
- vRealize Log Insight
- vRealizeAutomatioN

MICROSOFT HYPER-V DEFINITION

Hyper-V is a Microsoft virtualization product allowing you to create and run multiple VMs on a physical host.

How does Hyper-V work?

A hypervisor can be defined as the software creating an abstraction layer between the virtual OS and the physical host machine. This helps create and run multiple VMs on a single physical machine.

Similarly, Hyper-V is also known as the virtualization technology using Windows hypervisor to perform its primary function. However, it requires a physical processor with specific features, including VM monitor mode extensions, a 64-bit processor with second-level address translation (SLAT), and up to 4GB of RAM.

The purpose of a hypervisor is to manage interactions between the physical Hyper-V server and the VMs. The hypervisor provides an isolated environment to the VMs by controlling the access of the host hardware resources. This helps eliminate system crashes and makes VMs more flexible, efficient, and convenient.

Alternatively, in some configurations, VMs or the OS can directly access the graphics, networking, and storage hardware of the physical host.

When setting up Hyper-V, it's essential to understand its different components. They're collectively known as virtualization platforms and integrated as a set of tools when you install the Hyper-V role in your physical machine. These parts work together to create and run VMs effectively. The virtualization platform includes:

- Hyper-V Virtual Machine Management Service
- Windows hypervisor
- The virtual machine bus (VMbus)
- Virtualization WMI provider
- Virtual infrastructure driver (VID)
- Virtualization service provider (VSP)