What is Cloud Computing

The term cloud refers to a network or the internet. It is a technology that uses remote servers on the internet to store, manage, and access data online rather than local drives. The data can be anything such as files, images, documents, audio, video, and more.

There are the following operations that we can do using cloud computing:

- o Developing new applications and services
- o Storage, back up, and recovery of data
- o Hosting blogs and websites
- o Delivery of software on demand
- o Analysis of data
- o Streaming videos and audios

Why Cloud Computing?

Small as well as large IT companies, follow the traditional methods to provide the IT infrastructure. That means **for any IT company, we need a Server Room that is the basic need of IT companies**.

In that server room, there should be a database server, mail server, networking, firewalls, routers, modem, switches, configurable system, high net speed, and the maintenance engineers.

To establish such IT infrastructure, we need to spend lots of money. To overcome all these problems and to reduce the IT infrastructure cost, Cloud Computing comes into existence.
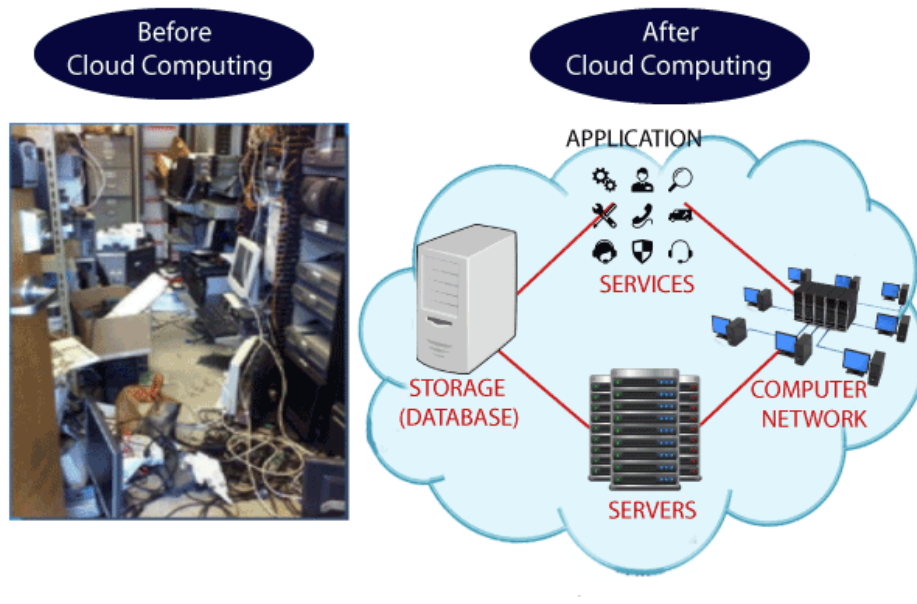
Characteristics of Cloud Computing

The characteristics of cloud computing are given below:

1) Agility
The cloud **works in a distributed computing environment**. It shares resources among users and works very fast.

2) High availability and reliability
The availability of servers is high and more reliable because the **chances of infrastructure failure are minimum**.

3) High Scalability
Cloud offers **"on-demand" provisioning of resources on a large scale**, without having engineers for peak loads.

4) Multi-Sharing
With the help of cloud computing, **multiple users and applications can work more efficiently** with cost reductions by sharing common infrastructure.

5) Device and Location Independence

Cloud computing enables the users to access systems using a web browser regardless of their location or what device they use e.g. PC, mobile phone, etc. **As infrastructure is off-site** (typically provided by a third-party) **and accessed via the Internet, users can connect from anywhere**.

6) Maintenance

Maintenance of cloud computing applications is easier, since they **do not need to be installed on each user's computer and can be accessed from different places**. So, it reduces the cost also.

7) Low Cost
By using cloud computing, the cost will be reduced because to take the services of cloud computing, **IT company need not to set its own infrastructure** and pay-as-per usage of resources.

8) Services in the pay-per-use mode
Application Programming Interfaces **(APIs) are provided to the users so that they can access services on the cloud** by using these APIs **and pay the charges as per the usage of services**.

Types of Cloud

There are the following 5 types of cloud that you can deploy according to the organization's needs-
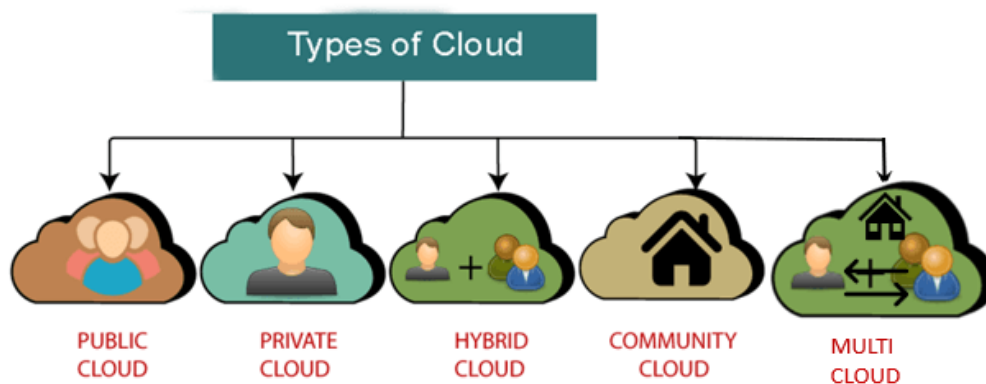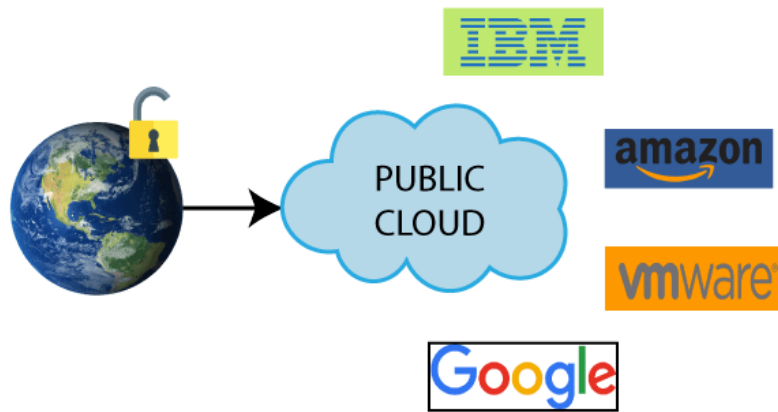

Public Cloud
Public cloud is open to all to store and access information via the Internet using the pay-per-usage method.

In public cloud, computing resources are managed and operated by the Cloud Service Provider (CSP). The CSP looks after the supporting infrastructure and ensures that the resources are accessible to and scalable for the users.

Due to its open architecture, anyone with an internet connection may use the public cloud, regardless of location or company size. Users can use the CSP's numerous services, store their

data, and run apps. By using a pay-per-usage strategy, customers can be assured that they will only be charged for the resources they actually use, which is a smart financial choice.

Example: Amazon elastic compute cloud (EC2), IBM SmartCloud Enterprise, Microsoft, Google App Engine, Windows Azure Services Platform.

Characteristics of Public Cloud

The public cloud has the following key characteristics:

- o **Accessibility:** Public cloud services are available to anyone with an internet connection. Users can access their data and programs at any time and from anywhere.

- o **Shared Infrastructure:** Several users share the infrastructure in public cloud settings. Cost reductions and effective resource use are made possible by this.

- o **Scalability:** By using the public cloud, users can easily adjust the resources they need based on their requirements, allowing for quick scaling up or down.

- o **Pay-per-Usage:** When using the public cloud, payment is based on usage, so users only pay for the resources they actually use. This helps optimize costs and eliminates the need for upfront investments.

- o **Managed by Service Providers:** Cloud service providers manage and maintain public cloud infrastructure. They handle hardware maintenance, software updates, and security tasks, relieving users of these responsibilities.

- o **Reliability and Redundancy:** Public cloud providers ensure high reliability by implementing redundant systems and multiple data centers. By doing this, the probability of losing data and experiencing service disruptions is reduced.

- o **Security Measures:** Public cloud providers implement robust security measures to protect user data. These include encryption, access controls, and regular security audits.

Private Cloud

Private cloud is also known as an **internal cloud** or **corporate cloud**. It is used by organizations to build and manage their own data centers internally or by the third party. It can be deployed using Opensource tools such as Openstack.
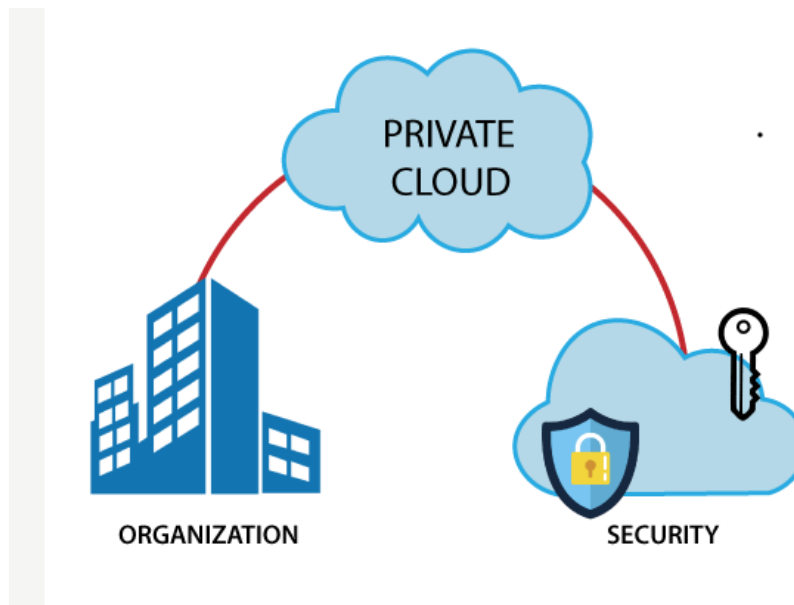
Examples: VMware vSphere, OpenStack, Microsoft Azure Stack, Oracle Cloud at Customer, and IBM Cloud Private.

Based on the location and management, National Institute of Standards and Technology (NIST) divide private cloud into the following two parts-

- o **On-premise private cloud:** An on-premise private cloud is situated within the physical infrastructure of the organization. It involves setting up and running a specific data center that offers cloud services just for internal usage by the company. The infrastructure is still completely under the hands of the organization, which gives them

the freedom to modify and set it up in any way they see fit. Organizations can successfully manage security and compliance issues with this degree of control. However, on-premise private cloud setup and management necessitate significant hardware, software, and IT knowledge expenditures.

o **Outsourced private cloud:** An outsourced private cloud involves partnering with a third-party service provider to host and manage the cloud infrastructure on behalf of the organization. The provider may operate the private cloud in their data center or a colocation facility. In this arrangement, the organization benefits from the expertise and resources of the service provider, alleviating the burden of infrastructure management. The outsourced private cloud model offers scalability, as the provider can adjust resources based on the organization's needs. Due to its flexibility, it is a desirable choice for businesses that desire the advantages of a private cloud deployment without the initial capital outlay and ongoing maintenance expenses involved with an on-premise implementation.

Compared to public cloud options, both on-premise and external private clouds give businesses more control over their data, apps, and security. Private clouds are particularly suitable for organizations with strict compliance requirements, sensitive data, or specialized workloads that demand high levels of customization and security.

The private cloud has the following key characteristics:

o **Exclusive Use:** Private cloud is dedicated to a single organization, ensuring the resources and services are tailored to its needs. It is like having a personal cloud environment exclusively for that organization.

o **Control and Security:** Private cloud offers organizations higher control and security than public cloud options. Organizations have more control over data governance, access controls, and security measures.

o **Customization and Flexibility:** Private cloud allows organizations to customize the infrastructure according to their specific requirements. They can configure resources, networks, and storage to optimize performance and efficiency.

- o **Scalability and Resource Allocation:** The private cloud can scale and allocate resources. According to demand, businesses may scale up or down their infrastructure, effectively using their resources.

- o **Performance and dependability:** Private clouds give businesses more control over the infrastructure at the foundation, improving performance and dependability.

- o **Compliance and Regulatory Requirements:** Organizations may more easily fulfill certain compliance and regulatory standards using the private cloud. It provides the freedom to put in place strong security measures, follow data residency laws, and follow industry-specific norms.

- o **Hybrid Cloud Integration:** Private cloud can be integrated with public cloud services, forming a hybrid cloud infrastructure. This integration allows organizations to leverage the benefits of both private and public clouds.

Hybrid Cloud

- o Hybrid cloud is a combination of **public and private** clouds. **Hybrid cloud = public cloud + private cloud**

- o The main aim to combine these cloud (Public and Private) is to create a unified, automated, and well-managed computing environment.

- o In the Hybrid cloud, **non-critical activities** are performed by the **public cloud** and **critical activities** are performed by the **private cloud**.

- o Mainly, a hybrid cloud is used in finance, healthcare, and Universities.

- o The best hybrid cloud provider companies are **Amazon, Microsoft, Google, Cisco,** and **NetApp**.
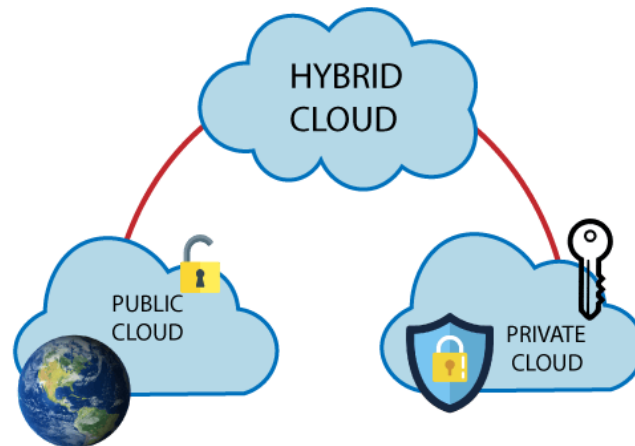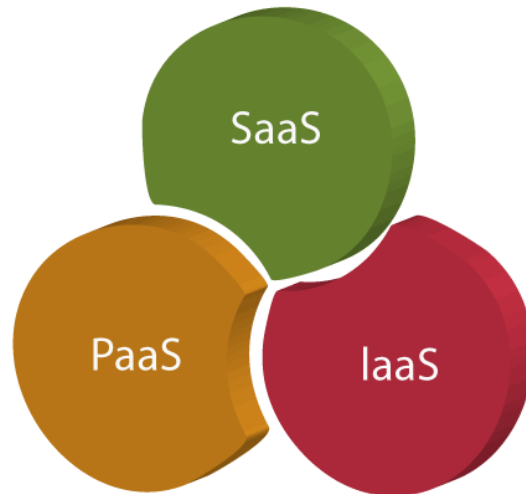
Cloud Service Models

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)

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 -

- o   Resources are available as a service

- o   Services are highly scalable

- o   Dynamic and flexible

- o   GUI and API-based access

- o   Automated administrative tasks

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

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 -

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

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 -

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

Example: BigCommerce, Google Apps, Salesforce, Dropbox, ZenDesk, Cisco WebEx, ZenDesk, Slack, amn nd 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.

Network as a Service (NaaS)

NaaS is a cloud model that enables users to easily operate the network and achieve the outcomes they expect from it without owning, building, or maintaining their own infrastructure.

Network as a service (NaaS) is an emerging model for organizations to consume network infrastructure through flexible operating expense (OpEx) subscriptions, inclusive of hardware, software, management tools, licenses, and lifecycle services.

Like other cloud services, NaaS vendors run networking functions using software, essentially allowing companies to set up their own networks entirely without hardware. All they need is Internet connectivity.

Features:

- NaaS allows the customer to access the internet directly and in a secure manner. In addition, it allows the customer to run custom routing protocols.

- With the help of a virtualized network, the NaaS provides network service to the consumer. This feature benefits the customer as they don't have to manage and worry about the infrastructure and can focus on developing the business.

- It helps the user in a way by providing them with a virtual environment which saves their physical costs such as the cost of the hardware and their maintenance.

- Also, it has a feature of remote access through which a customer can access the data from anywhere and at any time with the help of internet connection.

Database as a Service (DBaaS):

Like SaaS, PaaS and IaaS of cloud computing we can consider DBaaS (also known as Managed Database Service) as a cloud computing service. It allows users associated with database activities to access and use a cloud database system without purchasing it.
DBaaS and cloud database comes under Software as a Service (SaaS) whose demand is growing so fast

In simple we can say Database as a Service (DBaaS) is self service/ on demand database consumption coupled with automation of operations. As we know cloud computing services are like pay per use so DBaaS also based on same payment structure like how much you will use just pay for your usage. This DBaaS provides same function as like standard traditional and relational database models. So using DBaaS, organizations can avoid data base configuration, management, upgradation and security.

DBaaS consists of an info manager element, that controls all underlying info instances via API. This API is accessible to the user through a management console, typically an online application, that the user might use to manage and assemble the info and even provision or deprovision info instances.

Key Characteristics of DBaaS:
- A fully managed info service helps to line up, manage, and administer your info within the cloud and conjointly offer services for hardware provisioning and Backup.
- DBaaS permits the availability of info's effortlessly to Database shoppers from numerous backgrounds and IT expertise.
- Provides on demand services.

- Supported the resources offered, it delivers a versatile info platform that tailors itself to the environment's current desires.
- A team of consultants at your disposal, endlessly watching the Databases.
- Automates info administration and watching.
- Leverages existing servers and storage.

Advantages of Cloud Computing

1) Back-up and restore data

Once the data is stored in the cloud, it is easier to get back-up and restore that data using the cloud.

2) Improved collaboration

Cloud applications improve collaboration by allowing groups of people to quickly and easily share information in the cloud via shared storage.

3) Excellent accessibility

Cloud allows us to quickly and easily access store information anywhere, anytime in the whole world, using an internet connection. An internet cloud infrastructure increases organization productivity and efficiency by ensuring that our data is always accessible.

4) Low maintenance cost

Cloud computing reduces both hardware and software maintenance costs for organizations.

5) Mobility

Cloud computing allows us to easily access all cloud data via mobile.

6) IServices in the pay-per-use model

Cloud computing offers Application Programming Interfaces (APIs) to the users for access services on the cloud and pays the charges as per the usage of service.

7) Unlimited storage capacity

Cloud offers us a huge amount of storing capacity for storing our important data such as documents, images, audio, video, etc. in one place.

8) Data security

Data security is one of the biggest advantages of cloud computing. Cloud offers many advanced features related to security and ensures that data is securely stored and handled.

Disadvantages of Cloud Computing

A list of the disadvantage of cloud computing is given below -

1) Internet Connectivity

As you know, in cloud computing, every data (image, audio, video, etc.) is stored on the cloud, and we access these data through the cloud by using the internet connection. If you do not have good internet connectivity, you cannot access these data. However, we have no any other way to access data from the cloud.

2) Vendor lock-in

Vendor lock-in is the biggest disadvantage of cloud computing. Organizations may face problems when transferring their services from one vendor to another. As different vendors provide different platforms, that can cause difficulty moving from one cloud to another.

3) Limited Control

As we know, cloud infrastructure is completely owned, managed, and monitored by the service provider, so the cloud users have less control over the function and execution of services within a cloud infrastructure.

4) Security

Although cloud service providers implement the best security standards to store important information. But, before adopting cloud technology, you should be aware that you will be sending all your organization's sensitive information to a third party, i.e., a cloud computing service provider. While sending the data on the cloud, there may be a chance that your organization's information is hacked by Hackers.