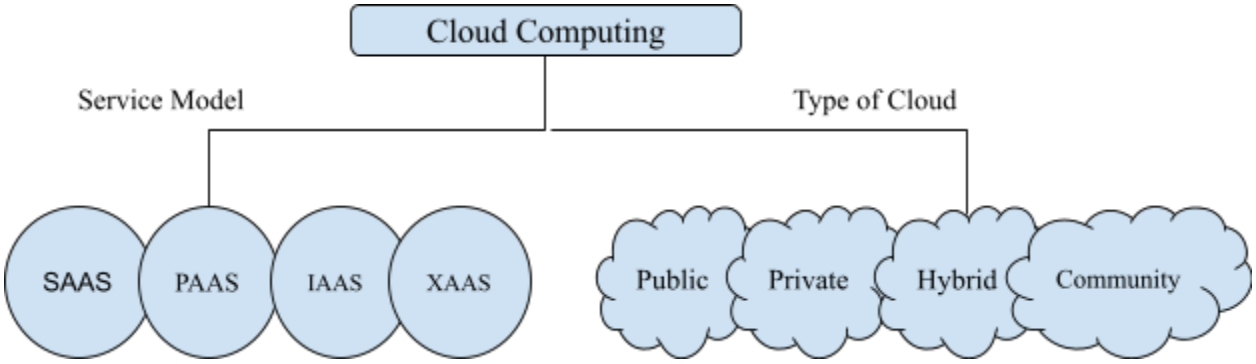
CLOUD COM PUTING

Cloud refers to network or internet and computing refers to accessing any data, modifying the data.

Cloud computing is delivery on demand computing services over the internet on pay-as-use basis (The user only have to pay for the services that he/she uses)
Cloud refers to the internet and computing means to process the data, the processing of data can happen on hardware, database, storage, network, and server.
This refers to delivery of services like processing storage, database, manipulation, networking, and server side programs, to users and organizations based on their requirements.



Few cloud service providers:

- AWS (Amazon Web Services)
- Microsoft Azure
- GCP (Google Cloud Platform)
- IBM Cloud
- VMware

Benefits of using Cloud Services :

- This reduces the maintenance cost as we don't have to invest in hardware.
- You only have to pay for the services that you use.
- By using cloud services we eliminate the setup cost.
- This offers you data storage space. It provides you more secure data storage.
- By using cloud based services it is more scalable.

- The services and the data can be accessed globally.
- We can have less staff or employees.

On premises: It is a traditional approach where all data, hardware, software, are hosted at physical location.

Off premises: This uses cloud provider premises which means you have to pay for services that you use.

On premises	Off premises
You have to buy all licensed software, hardware, security, servers, and provide maintenance and security.	You don't have to buy these software, hardware, security, servers, and you don't have to bother about maintenance and security.
A lot of server space is required, physical space and security is required to maintain the server room	In off premises as the server are in data center so there is no need for physical space and security
It is difficult to do team collaboration	It is much easier to do team collaboration
Deploying projects/implementation of projects takes longer time	While it is much faster in off premises, since we don't have to worry about underlying hardware
Data recovery is difficult	Data recovery is easier
The data cannot be accessed remotely	Data can be accessed from anywhere
A team is required to maintain the hardware, software and servers	No team is required for maintenance

Data center:

It is a facility that is used to store, manage, and distribute large amounts of data. It typically includes a large number of computers, servers, networking equipment, storage devices which work together to support processing and storage of data.

A data center can be used for various purposes.

1. Storing and processing data: A data center is used to store and process large amounts of data including file, database and other digital information.
2. Running application and services: We can run many applications and services like email, online banking and social media platforms.
3. Backup and data recovery: Data centers can also be used to backup important data and provide disaster recovery in the event of system failure or natural disaster.
4. Cloud Computing: This allows business to access and compute the resources over the internet.

To maintain a data center we require a lot of electricity, cooling system, and power backup.

- The largest data center in the world is China Telecom, Beijing.
- In India the largest data center is NTT (Nippon Telegraph and Telephone).
- The largest data center of AWS is North Virginia.

Different type of data centers:

➔ Traditional Data centers: These kinds of data centers are established/ setup within the organization itself where the organization owns all the hardware, software and server.

➔ Colocation Data Centers: These data centers used by an organization are hosted by a third party firm. The third party firm provides power, cooling, to the data center. And the organization provides server, hardware, storage and networking. The company can have equipment located at multiple geographical locations. The company can have its own devices and maintenance, security and power will be handled by a third party.

Benefits:

- It is low cost as some of the resources are rented.
- As few resources are rented we need less manpower.

- We have freedom to set up data centers in any geographical region.

➔ Enterprise Data Centers: These data centers are built only for a particular organization, the organization's own their infrastructure storage, server, networking equipment, IT components. These kinds of data centers can be on premises or off premises. The primary function of an enterprise data center is to provide secure, reliable access to data and applications that are critical to an organization operating a business. These kinds of data centers can range from small server rooms to large complex multiple buildings and thousands of servers.
These kinds of data centers are owned by the company itself.
Eg. Amazon, Apple, IBM, Tesla, Microsoft, Meta.

The key component for enterprise data centers:

1. **Power and cooling system**: These are critical to maintain optimal operating conditions for the computing infrastructure and prevent hardware failure.

2. **Serve hardware**: These are physical servers that run the organization's application and store the data.

3. **Backup and Disaster Recovery**: It ensures that critical data and applications can quickly be restored in the event of system failure.

Service provided by data centers can be divided into 4 tiers:

1. Tier 1: Basic capacity that includes power supply.

2. Tier 2: Basic capacity that includes power supply and cooling facilities.

3. Tier 3: Basic capacity that includes power supply and cooling facilities along with maintenance.

4. Tier 4: Basic capacity that includes power supply,cooling facilities along with maintenance and backup / protection of data.

Cloud	Data Center
Cloud is used only to fetch the resources when needed	Data centers are physically present
In cloud it is much less as compared to data center	Maintenance cost in data center is higher
It is much easier to operate, and anyone can operate	Data centers are handled by much experienced developer and it is more complex to operate than cloud
Full time internet connection is required	Power supply is required to run data center

Data centers comprises of :

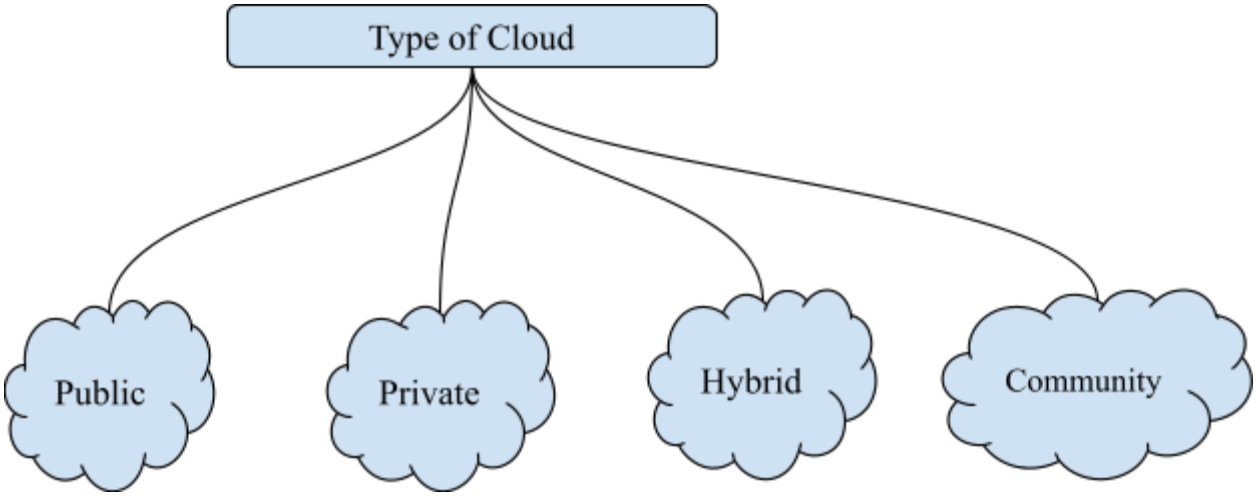
- Servers : Server is designed to process the requests and deliver the response over cloud.

- Networking Equipments :

  Switch - Switches are used to connect multiple network devices.
  Router - A router is connected to multiple switches. A router is used to receive and send data over a network.

- Server Racks : Server racks are used to organize multiple server and internet equipment.

- Cooling devices and backup generator :



Different types of cloud:

- **Public**: This kind of cloud is open for all, the cloud infrastructure is made available to the general public over the internet and owned by cloud providers. These kinds of clouds can be accessed by any users, they can access the information or store the information by paying per use.
  These cloud computing resources are managed and operated by cloud server providers.
  Eg. Amazon EC2, Google App

  Advantages:
  - Highly Scalable. It offers the user to scale up and down as per the usage and demand of the resource.
  - It is also cost effective, the user only has to pay for the resources they have used.

  Disadvantages:
  - As the users are public, there are chances of security breach.
  - It cannot be 100% customized as per organizations requirement.

Key point:

- **Resources owned and operated by third parties.**
- **Resources and services provided to the users or companies over the internet.**
- **Used for hosting a website or an application or adding data to a storage or database.**

- **Private**: Cloud resources are operated by a single organization. The cloud is operated by the organization itself or by a third party.
  This is further divided into:
    On premises:
    Out source private cloud:
  Eg. IBM, Oracle, VMware, etc

  Advantages:
  - It provides high security as only authorized users can access the resources.
  - These kinds of infrastructure are generally preferred in financial institutes like the banking sector.
  - In this organization has full control over the cloud resources.

  Disadvantages:
  - Skilled people are required to manage and operate the cloud.
  - Scaling up and scaling down is a bit difficult in this kind of cloud.
  - As the cloud is accessible only within the organization, so the area of operation is limited.

Key points:
- **It is operated by a single organization.**
- **It is used by organizations with sensitive data (banking sector).**

- **Hybrid**: Hybrid is a combination of public and private cloud. It allows the organization to share data between them. Hybrid cloud is partially secured because services running on public cloud can be accessed by anyone while services running on private can be accessed by organization users.

- These kind of cloud can be combination of :
  - At Least 1 public and 1 private
  - 2 or more private cloud
  - 2 or more public cloud

These kinds of clouds should be able to move workload between one cloud to another as it is a combination of 2 or more kinds of clouds. Performance of hybrid cloud is dependent on development and management of its connection (networking connection)
The linking between private and public cloud is done either through LAN, API or VPN.
In this cloud provider gives the customer a pre configured connection.

Eg.

- Dedicated interconnection - Google Cloud
- Direct connected - AWS
- Express Cloud - Microsoft Azure

Advantages:

- Private cloud is secure hence public is also secure.
- As the public cloud is used, it is scalable.
- Users can access both the cloud, as it provides flexibility.
- Hybrid Cloud helps to deliver new products and services more effectively in less time.

Disadvantages:

- As we have both public and private clouds the connection can be a bit complex. Hence there are chances of security breach.

- **Community**: It allows systems and services to be accessible by a group of several organizations to share information between organizations or any specific group.
  - It is owned managed and operated by many more organizations in a community (Even third party can be involved in this)
  - The infrastructure of community cloud can be shared between organizations which have common concern or interest like the healthcare department, media, etc.

  Advantages:

  - The maintenance can be shared by different organizations which fall under the same community or group.

- It is more secure than public cloud and less expensive than private cloud.

Disadvantages:

- It is difficult to distribute the responsibilities among and organization between different communities.
- It is difficult to segregate the data between organizations of a community.

Key points:

- **Different cloud services are integrated into a single cloud.**
- **These are designed for a specific need of an industry or a community or group.**
- **Infrastructure is shared among the different organizations in the community.**

Multi Cloud Strategy:

Public	Private	Hybrid	Community
Host are service providers	Third party are the hosts	Third party are the hosts	Third party are the hosts
User are general public in this	Authorized users	Authorized users	Users that belong to same interest/group/community
Can be accessed through internet	Internet and VPN	Internet and VPN	Internet and VPN
Owners in public are service providers	Organizations are the owners	Organizations are the owners	Group / community are the owners