Course: Artificial Intelligence and Machine Learning   Code: 20CS51I
WEEK- 2 Cloud Computing

> ➢ **Introduction to Cloud Computing**

> ➢ **Essentials of Cloud Computing**

> ➢ **Cloud Deployment Models**

> ➢ **Cloud Service Models**

Session No. 3

What is Cloud?

The term Cloud refers to a Network or Internet. In other words, we can say that Cloud is something, which is present at remote location. Cloud can provide services over public and private networks, i.e., WAN, LAN or VPN.

Applications such as e-mail, web conferencing, customer relationship management (CRM) execute on cloud.

Introduction to Cloud Computing

Cloud Computing refers to manipulating, configuring, and accessing the hardware and software resources remotely. It offers online data storage, infrastructure, and application.

Cloud computing offers platform independency, as the software is not required to be installed locally on the PC. Hence, the Cloud Computing is making our business applications mobile and collaborative.

Cloud Computing is the delivery of computing services such as servers, storage, databases, networking, software, analytics, intelligence, and more, over the Cloud (Internet). The introduction of automation in a deployment pipeline allowed development teams to focus more on innovating and improving the end product for the user. By reducing the need for any manual tasks, teams are able to deploy new code updates much quicker and with less risk of any human error.
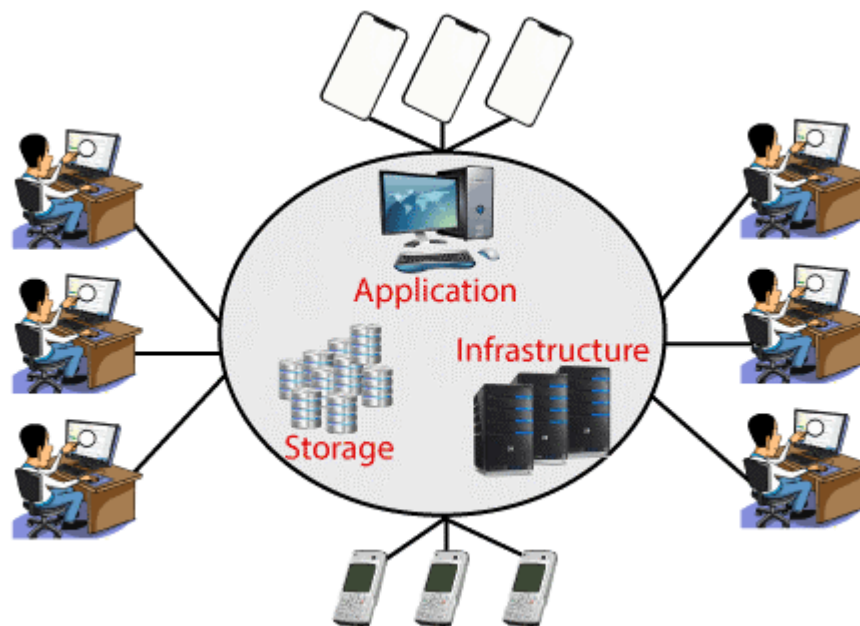
Cloud Computing provides an alternative to the on-premises datacentre. With an on-premises datacentre, we have to manage everything, such as purchasing and installing hardware, virtualization, installing the operating system, and any other required applications, setting up the network, configuring the firewall, and setting up storage for data. After doing all the set-up, we become responsible for maintaining it through its entire lifecycle.

But if we choose Cloud Computing, a cloud vendor is responsible for the hardware purchase and maintenance. They also provide a wide variety of software and platform as a service. We can take any required services on rent. The cloud computing services will be charged based on usage.
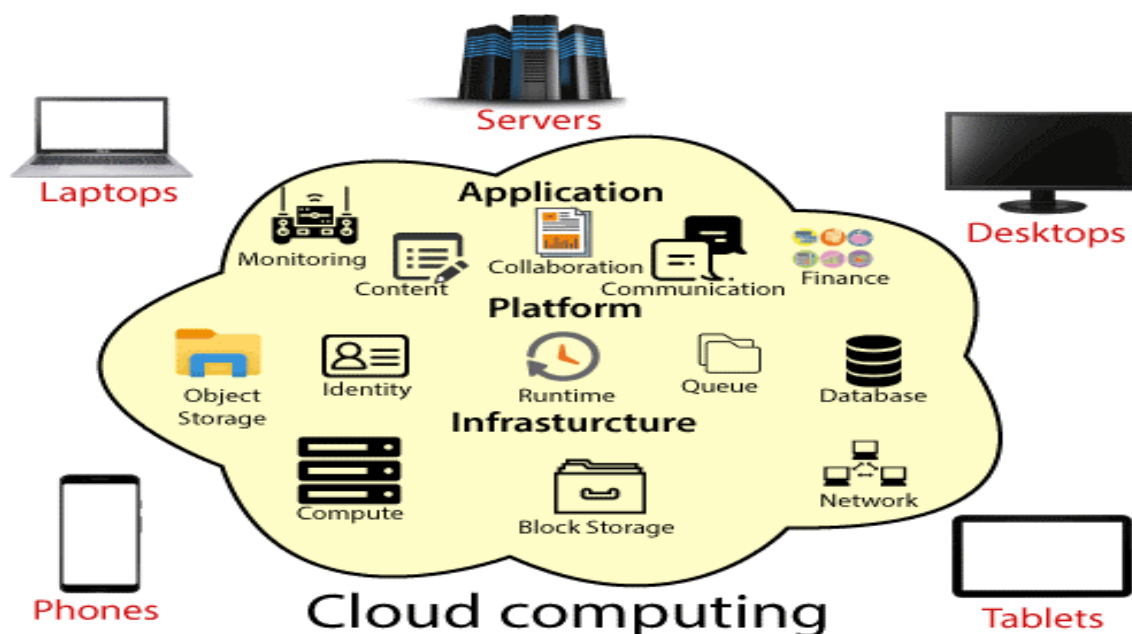
Advantages of cloud computing

- ❖ **Cost:** It reduces the huge capital costs of buying hardware and software.

- ❖ **Speed:** Resources can be accessed in minutes, typically within a few clicks.

- ❖ **Scalability:** We can increase or decrease the requirement of resources according to the business requirements.

- ❖ **Productivity:** While using cloud computing, we put less operational effort. We do not need to apply patching, as well as no need to maintain hardware and software. So, in this way, the IT team can be more productive and focus on achieving business goals.

- ❖ **Reliability:** Backup and recovery of data are less expensive and very fast for business continuity.

- ❖ **Security:** Many cloud vendors offer a broad set of policies, technologies, and controls that strengthen our data security.

Benefits

- ✓ Cloud Computing has numerous advantages. Some of them are listed below -

- ✓ One can access applications as utilities, over the Internet.

- ✓ One can manipulate and configure the applications online at any time.

- ✓ It does not require to install a software to access or manipulate cloud application.

- ✓ Cloud Computing offers online development and deployment tools, programming runtime environment through **PaaS model.**

- ✓ Cloud resources are available over the network in a manner that provide platform independent access to any type of clients.

- ✓ Cloud Computing offers **on-demand self-service.** The resources can be used without interaction with cloud service provider.

- ✓ Cloud Computing is highly cost effective because it operates at high efficiency with optimum utilization. It just requires an Internet connection

- ✓ Cloud Computing offers load balancing that makes it more reliable.

Essentials of Cloud Computing

Essential elements lead to flexibility

Elasticity

Faster and/or self-provisioning and de-provisioning

Application Programming Interfaces

Pay-as-you-go billing model

Essential element: Elasticity

* Creating, launching, and terminating computing resources, as needed
* The more resources active and available, the more elastic
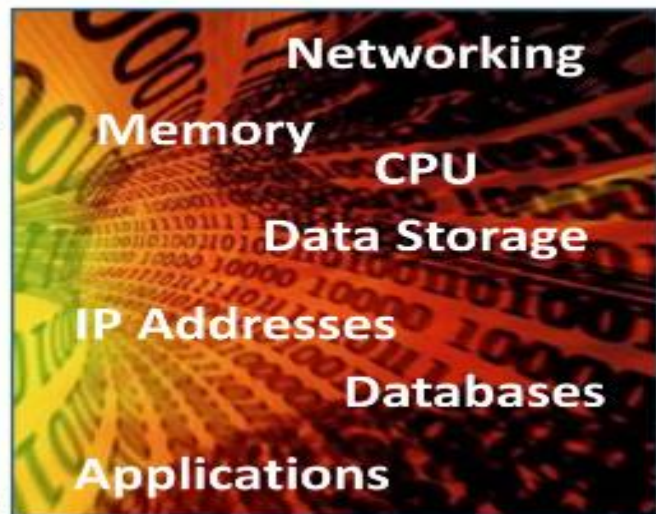
➤ Often enabled by virtualization technology

elasticity

Essential element: Provisioning

* Companies or their service providers control the deployment of cloud services through a defined service catalog

Essential element: Application Program Interfaces

* Control APIs: allow cloud infrastructure to be added, reconfigured, or removed in real time
* Data APIs: are the conduits through which data flows in and out of the cloud
* Application functionality APIs: enable the functionality with which end users interact with infrastructure and data

➢ APIs will evolve as cloud offerings become more complex.

Essential element:
Billing

- Cloud computing employs a usage billing model
- Billing models include:
  - per user
  - per gigabyte (GB)
  - per server
  - pay per-use

➤ Billing types will evolve based on the imagination of the service provider and the user.

billing

Oracle cloud computing:
5 essentials

1. Rapid Elasticity
2. On-Demand self-service provisioning
3. Broad network access
4. Measure service (Billing and metering of service usage)
5. Resource pooling

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Types of Cloud Computing /Cloud Deployment Models

Different types of cloud computing deployment models are:

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

1. Public Cloud

The public cloud makes it possible for anybody to access systems and services. The public cloud may be less secure as it is open for everyone. The public cloud is one in which cloud infrastructure services are provided over the internet to the general people or major industry groups. The infrastructure in this cloud model is owned by the entity that delivers the cloud services, not by the consumer. It is a type of cloud hosting that allows customers and users to easily access systems and services. This form of cloud computing is an excellent example of cloud hosting, in which service providers supply services to a variety of customers. In this arrangement, storage backup and retrieval services are given for free, as a subscription, or on a per-use basis. Example: Google App Engine etc.

Advantages of the public cloud model:
- **Minimal Investment:** Because it is a pay-per-use service, there is no substantial upfront fee, making it excellent for enterprises that require immediate access to resources.
- **No setup cost:** The entire infrastructure is fully subsidized by the cloud service providers, thus there is no need to set up any hardware.
- **Infrastructure Management is not required:** Using the public cloud does not necessitate infrastructure management.
- **No maintenance:** The maintenance work is done by the service provider (Not users).
- **Dynamic Scalability:** To fulfill your company's needs, on-demand resources are accessible.

2. Private Cloud

The private cloud deployment model is the exact opposite of the public cloud deployment model. It's a one-on-one environment for a single user (customer). There is no need to share your hardware with anyone else. The distinction between private and public cloud is in how you handle all of the hardware. It is also called the "internal cloud" & it refers to the ability to access systems and services within a given border or organization.

The cloud platform is implemented in a cloud-based secure environment that is protected by powerful firewalls and under the supervision of an organization's IT department. The private cloud gives the greater flexibility of control over cloud resources.

Advantages of the private cloud model:
- **Better Control:** You are the sole owner of the property. You gain complete command over service integration, IT operations, policies, and user behavior.
- **Data Security and Privacy:** It's suitable for storing corporate information to which only authorized staff have access. By segmenting resources within the same infrastructure, improved access and security can be achieved.
- **Supports Legacy Systems:** This approach is designed to work with legacy systems that are unable to access the public cloud.
- **Customization:** Unlike a public cloud deployment, a private cloud allows a company to tailor its solution to meet its specific needs.

3. Hybrid cloud

By bridging the public and private worlds with a layer of proprietary software, hybrid cloud computing gives the best of both worlds. With a hybrid solution, you may host the app in a safe environment while taking advantage of the public cloud's cost savings. Organizations can move data and applications between different clouds using a combination of two or more cloud deployment methods, depending on their needs.

Advantages of the hybrid cloud model:
- **Flexibility and control:** Businesses with more flexibility can design personalized solutions that meet their particular needs.
- **Cost:** Because public clouds provide for scalability, you'll only be responsible for paying for the extra capacity if you require it.
- **Security:** Because data is properly separated, the chances of data theft by attackers are considerably reduced.

4. Community cloud

It allows systems and services to be accessible by a group of organizations. It is a distributed system that is created by integrating the services of different clouds to address the specific needs of a community, industry, or business. The infrastructure of the community could be shared between the organization which has shared concerns or tasks. It is generally managed by a third party or by the combination of one or more organizations in the community.

Advantages of the community cloud model:
- **Cost Effective:** It is cost-effective because the cloud is shared by multiple organizations or communities.
- **Security:** Community cloud provides better security.
- **Shared resources:** It allows you to share resources, infrastructure, etc. with multiple organizations.
- **Collaboration and data sharing:** It is suitable for both collaboration and data sharing.

Sample Questions

Question 1. List the disadvantages of the public cloud model?
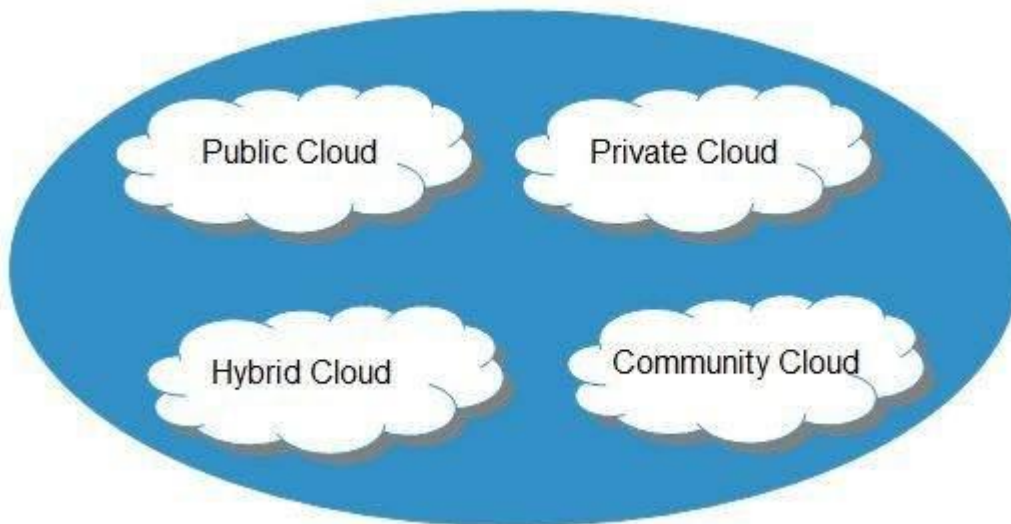
- o **Public Cloud:** The cloud resources that are owned and operated by a third-party cloud service provider are termed as public clouds. It delivers computing resources such as servers, software, and storage over the internet

- o **Private Cloud:** The cloud computing resources that are exclusively used inside a single business or organization are termed as a private cloud. A private cloud may physically be located on the company's on-site datacentre or hosted by a third-party service provider.

- o **Hybrid Cloud:** It is the combination of public and private clouds, which is bounded together by technology that allows data applications to be shared between them. Hybrid cloud provides flexibility and more deployment options to the business.

- o **Community Cloud :** The community cloud allows systems and services to be accessible by a group of organizations

Cloud Service Models / Types of Cloud Services
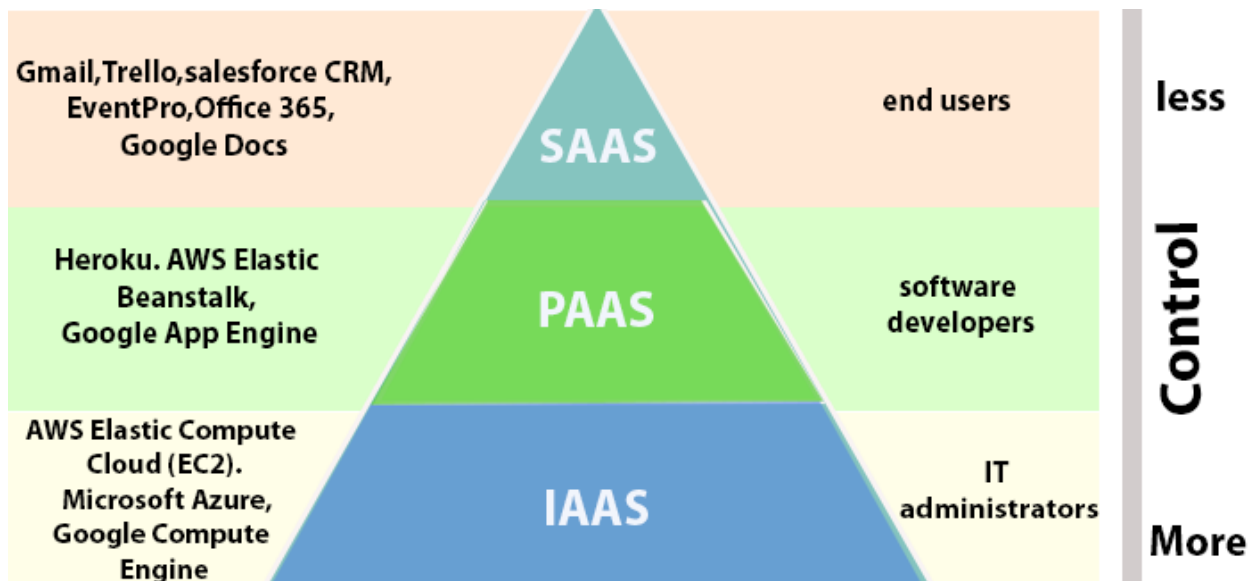
1. **Infrastructure as a Service (IaaS):** In IaaS, we can rent IT infrastructures like servers and virtual machines (VMs), storage, networks, operating systems from a cloud service vendor. We can create VM running Windows or Linux and install anything we want on it. Using IaaS, we don't need to care about the hardware or virtualization software, but other than that, we do have to manage everything else. Using IaaS, we get maximum flexibility, but still, we need to put more effort into maintenance.

2. **Platform as a Service (PaaS):** This service provides an on-demand environment for developing, testing, delivering, and managing software applications. The developer is responsible for the application, and the PaaS vendor provides the ability to deploy and run it. Using PaaS, the flexibility gets reduce, but the management of the environment is taken care of by the cloud vendors.

3. **Software as a Service (SaaS):** It provides a centrally hosted and managed software services to the end-users. It delivers software over the internet, on-demand, and typically on a subscription basis. E.g., Microsoft One Drive, Dropbox, WordPress, Office 365, and Amazon Kindle. SaaS is used to minimize the operational cost to the maximum extent.

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