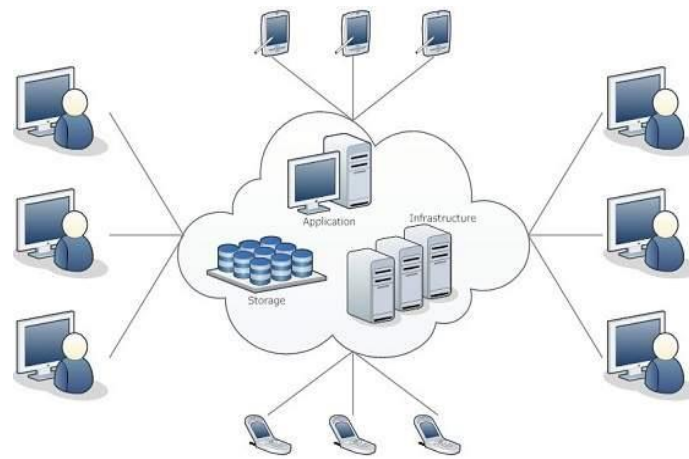# Cloud Computing
Unit – I
Cloud Computing Overview

Cloud Computing: Cloud computing is a range of services delivered over the internet or "the cloud". It means using remote servers to store and access data instead of relying on local hard drives and private data centres.

On demand delivery of IT resources through the internet with payment depending on the use of the service is known as cloud computing. The term cloud refers to a network or the internet. It gives a solution for infrastructure at low cost.

Cloud Computing

It accesses the multiple server-based computer resources through a network. Cloud user accesses the server resources using the computer, smart phones, notebook, tablets or other devices. Cloud server maintains all the processing and storage.

Cloud computing is a computing paradigm where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file 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) <u>Mobility</u>: Cloud computing allows us to easily access all cloud data via mobile.

6) <u>Services in the pay-per-use model</u>: 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) <u>Unlimited storage capacity</u>: 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) <u>Data security</u>: 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) <u>Internet Connectivity</u>: As you know, in cloud computing, every data (image, audio, video, etc.) are 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.

2) <u>Vendor lock-in</u>: 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) <u>Limited Control</u>: 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) <u>Security:</u> 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.

Components of Cloud Computing: Components in cloud refers to platform like front end, back end and cloud based delivery and the network that used. All together forms an architecture for cloud computing with main components like Software As A Service (SAAS), Platform As A Service(PAAS) and Infrastructure As A Service(IAAS).

There are 11 major components in cloud computing that plays major vital role and are as follows:

1. **Storage-As-A-Service:** This is the component where we can use or request storage like as we do in physically using the remote site. It is also called disk space on demand. This is the main component where other components will have base component as Storage-as-a Service.

Figure 1: Storage-as-a-Service

2. **Database-As-A-Service:** This component acts as a live database from remote where its functionality and other features works as though a physical db is present in the local machines. Its main objective is to reduce the cost of database using many softwares as well as hardwares.

Figure 2: Database-as-a-Service

3. **Information-As-A-Service:** Information that can be accessed remotely from anywhere is called Information-as-a-Service. Here the information will be fetched remotely such as live stock prices, internet banking, online news, credit card validation and so on.

Figure 3: Information-as-a-Service

4. **Process-As-A-Service:** This component combines various resources such as data and services. Mainly this is used for business processes where various key services and information are combined to form a process. This helps delivery on demand. For example, in mobile networks internet settings are sent as soon as activated.

Figure 4: Process-as-a-Service

5. **Application-as-a-Service:** Application-as-a-Service also known as Software-As-A-Service(SAAS) is the complete application built ready for use by the client. This is built to use the internet to the end users and the end users normally use browsers and the internet to access this service. This component is ultimate front end for the end users. Some of the applications are Salesforce, Gmail, Google calendar and so on.
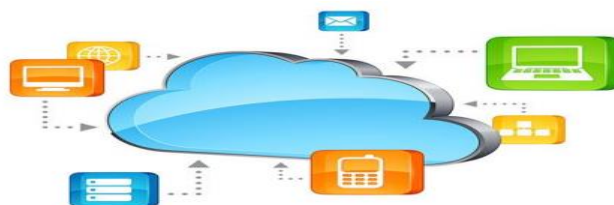

Figure 5: Application-as-a-Service

6. **<u>Platform-as-a-Service</u>:** This is the component where the app is being developed and the database is being created, implemented, stored and tested. This component allows creation of enterprise-level applications easily and is cost-effective.

Figure 6: Platform-as-a-Service

7. **<u>Integration-as-a-Service</u>:** Integration-As-A-Service deals with the components of an application that has built but must be integrated with other applications. It helps in mediating between the remote servers with the local machines. For example Salesforce has recently integrated Google maps into it.
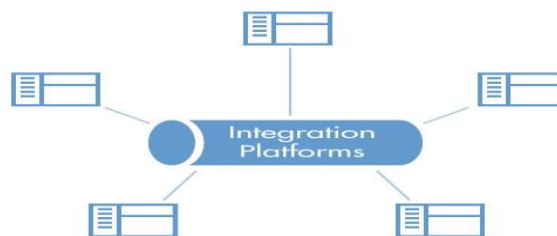

Figure 7: Integration-as-a-Service

8. **<u>Security-as-a-Servive</u>:** This is the main component many customers require since all the data and operations are handled remotely. This component keeps organizations data private and safe.

Figure 8: Security-as-a-Service

9. **<u>Management-as-a-Service</u>:** This is a component that is mainly useful for management of the clouds like resource utilisation, virtualisation and server up and down time management. This will be like a small roll like an admin point of view.

Figure 9: Management-as-a-service

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10. **Testing-as-a-Service:** Testing-as-a-Service refers to the testing of the applications that are hosted remotely, whether there is a requirement to design a working database and there is enough security for the application and so on.

Figure 10: Testing-as-a-Service

11. **Infrastructure-as-a-Service:** Infrastructure in cloud computing refers to hardware, software, servers and networking that is completely virtual. This is where all the processes and purchases of resources will take place in the cloud. Our processes will happen but we can't see what's happening at the backend. This avoids the running of multiple servers, heat, cold temperatures and so on.
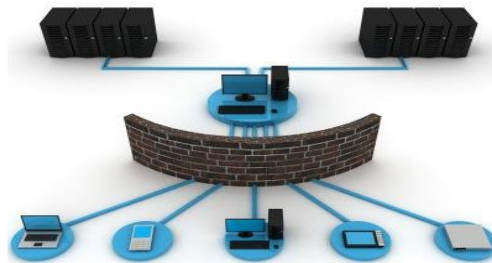

Figure 11: Infrastructure-as-a Service

History of Cloud Computing: Before emerging the cloud computing, there was Client/Server computing which is basically a centralized storage in which all the software applications, all the data and all the controls are resided on the server side.

On the basis of above computing, there was emerged of cloud computing concepts that later implemented.

- At around in 1961, John MacCharty suggested in a speech at Massachusetts Institute of Technology(MIT) that cloud computing can be sold like a utility, just like a water or electricity.

- In 1999, **Salesforce.com** started delivering of applications to users using a simple website. The applications were delivered to enterprises over the Internet, and this way the dream of computing sold as utility were true.

- In 2002, **Amazon** started Amazon Web Services, providing services like storage, computation and even human intelligence. However, only starting with the launch of the Elastic Compute Cloud in 2006 a truly commercial service open to everybody existed.

- In 2009, **Google Apps** also started to provide cloud computing enterprise applications.

- In 2009, **Microsoft** launched Windows Azure, and companies like Oracle and HP have all joined the game. This proves that today, cloud computing has become mainstream.

Features of Cloud Computing: The following are the important features of cloud computing:

1. High scalability: On demand provisioning of resources on a large scale without requiring human interaction with each service provider.

2. High availability and reliability: Availability of servers is more reliable and high because it minimizes the chances of infrastructure failure.

3. Agility: It shares the resources between users and works very quickly.

4. Multi-sharing: Multiple users and applications work more efficiently with less cost by sharing common infrastructure using cloud computing.

5. Maintenance: Maintenance of cloud computing applications is easier as they are not required to be installed on each computer and also can be accessed from various places, which reduces the cost.

6. Low cost: It is cost effective because the company no more needs to set its own infrastructure and ultimately results in no maintenance cost.

7. Services in pay-per-use: Application Programming Interfaces(API's) are provided to the users for accessing the services on the cloud and pay according to use of the service.

Characteristics of Cloud Computing: There are basically 5 essential characteristics of Cloud Computing**.** They are:

1. **On-demand self-services:** The Cloud computing services does not require any human administrators, user themselves are able to provision, monitor and manage computing resources as needed.
2. **Broad network access:** The Computing services are generally provided over standard networks and heterogeneous devices.
3. **Rapid elasticity:** The Computing services should have IT resources that are able to scale out and in quickly and on as needed basis. Whenever the users require services it is provided to him and it is scale out as soon as its requirement gets over.
4. **Resource pooling:** The IT resource (e.g., networks, servers, storage, applications, and services) present are shared across multiple applications and occupant in an

uncommitted manner. Multiple clients are provided service from a same physical resource.

5. **Measured service:** The resource utilization is tracked for each application and occupant, it will provide both the user and the resource provider with an account of what has been used. This is done for various reasons like monitoring billing and effective use of resource.

The characteristics of Cloud Computing are shown in the following diagram: