UNIT 1 OVERVIEW OF CLOUD COMPUTING

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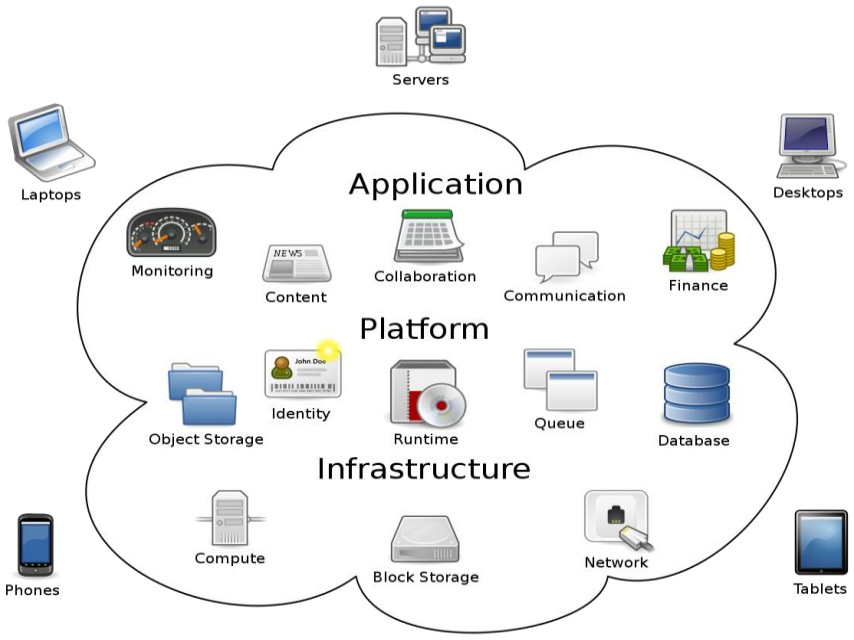
Meaning of the Terms cloud and cloud computing

"**Cloud**" is just a metaphor for the internet.

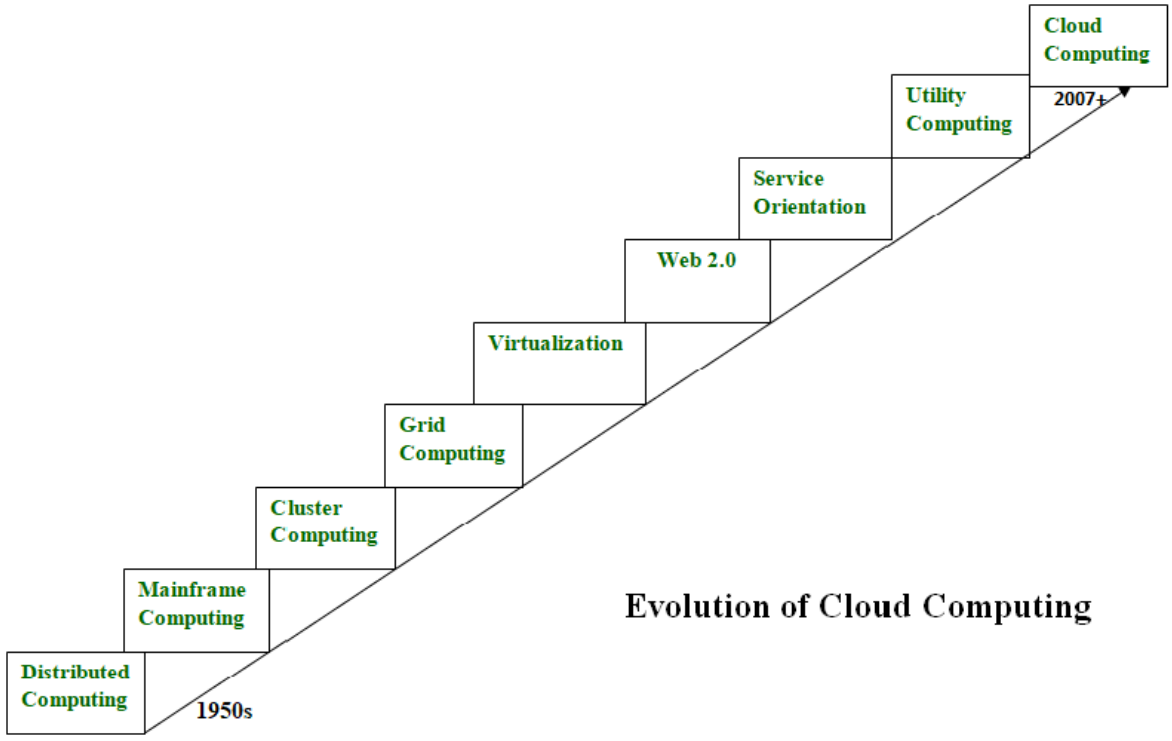
In the simplest **terms**, **cloud computing means** storing and accessing data and programs over the internet instead of your computer's hard drive.

Simply put, **cloud computing** is the delivery of **computing** services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the **cloud**") to offer faster innovation, flexible resources, and economies of scale.



The Evolution of Cloud Computing

Cloud computing is all about renting computing services. This idea first came in the 1950s. In making cloud computing what it is today, five technologies played a vital role. These are distributed systems and its peripherals, virtualization, web 2.0, service orientation, and utility computing.



Distributed Systems

It is a composition of multiple independent systems but all of them are depicted as a single entity to the users. The purpose of distributed systems is to share resources and also use them effectively and efficiently. Distributed systems possess characteristics such as scalability, concurrency, continuous availability, heterogeneity, and independence in failures. But the main problem with this system was that all the systems were required to be present at the same geographical location. Thus to solve this problem, distributed computing led to three more types of computing and they were-Mainframe computing, cluster computing, and grid computing.

Mainframe computing

Mainframes which first came into existence in 1951 are highly powerful and reliable computing machines. These are responsible for handling large data such as massive input-output operations. Even today these are used for bulk processing tasks such as online transactions etc. These systems have almost no downtime with high fault tolerance. After distributed computing, these increased the processing capabilities of the system. But these were very expensive. To reduce this cost, cluster computing came as an alternative to mainframe technology.

Cluster computing

In 1980s, cluster computing came as an alternative to mainframe computing. Each machine in the cluster was connected to each other by a network with high bandwidth. These were way cheaper than those mainframe systems. These were equally capable of high computations. Also, new nodes could easily be added to the cluster if it was required. Thus, the problem of the cost was solved to some extent but the problem related to geographical restrictions still pertained. To solve this, the concept of grid computing was introduced.

Grid computing

In 1990s, the concept of grid computing was introduced. It means that different systems were placed at entirely different geographical locations and these all were connected via the internet. These systems belonged to different organizations and thus the grid consisted of heterogeneous nodes. Although it solved some problems but new problems emerged as the distance between the nodes increased. The main problem which was encountered was the low availability of high bandwidth connectivity and with it other network associated issues. Thus. cloud computing is often referred to as “Successor of grid computing”.

Virtualization

It was introduced nearly 40 years back. It refers to the process of creating a virtual layer over the hardware which allows the user to run multiple instances simultaneously on the hardware. It is a key technology used in cloud computing. It is the base on which major cloud computing services such as Amazon EC2, VMware vCloud, etc work on. Hardware virtualization is still one of the most common types of virtualization.

Web 2.0

It is the interface through which the cloud computing services interact with the clients. It is because of Web 2.0 that we have interactive and dynamic web pages. It also increases flexibility among web pages. Popular examples of web 2.0 include Google Maps, Facebook, Twitter, etc. Needless to say, social media is possible because of this technology only. In gained major popularity in 2004.

Service orientation

It acts as a reference model for cloud computing. It supports low-cost, flexible, and evolvable applications. Two important concepts were introduced in this computing model. These were Quality of Service (QoS) which also includes the SLA (Service Level Agreement) and Software as a Service (SaaS).

Utility computing

It is a computing model that defines service provisioning techniques for services such as compute services along with other major services such as storage, infrastructure, etc which are provisioned on a pay-per-use basis.

Cloud Based Service Offerings

Cloud computing can be viewed as a service available for data centers. But cloud computing and centers are not the same.

The main difference between the cloud vs. data center is that a data center refers to on-premise hardware while the cloud refers to off-premise computing. The cloud stores your data in the public cloud, while a data center stores your data on your own hardware.

The Service Offerings include

SaaS: Software that's available via a third-party over the internet

Software as a service (or SaaS) is a way of delivering applications over the Internet—as a service. Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management.

SaaS applications are sometimes called Web-based software, on-demand software, or hosted software. Whatever the name, SaaS applications run on a SaaS provider's servers. The provider manages access to the application, including security, availability, and performance.

PaaS: Hardware and software tools available over the internet.

Platform as a service (PaaS) is a complete development and deployment environment in the cloud, with resources that enable you to deliver everything from simple cloud-based apps to sophisticated, cloud-enabled enterprise applications. You purchase the resources you need from a cloud service provider on a pay-as-you-go basis and access them over a secure Internet connection.

IaaS: Cloud-based services, pay-as-you-go for services such as storage, networking, and virtualization.

In the IaaS model, the cloud provider manages IT infrastructures such as storage, server and networking resources, and delivers them to subscriber organizations via virtual machines accessible through the internet. IaaS can have many benefits for organizations, such as potentially making workloads faster, easier, more flexible and more cost efficient.

SaaS examples: BigCommerce, Google Apps, Salesforce, Dropbox, MailChimp, ZenDesk, DocuSign, Slack, Hubspot.

PaaS examples: AWS Elastic Beanstalk, Heroku, Windows Azure (mostly used as PaaS), Force.com, OpenShift, Apache Stratos, Magento Commerce Cloud.

IaaS examples: AWS EC2, Rackspace, Google Compute Engine (GCE), Digital Ocean

Note:-Explore about Google App Engine and identify it is which type of Cloud service and also about (MSP'S)Managed Service Providers

BENEFITS OF USING CLOUD MODEL

1. Efficiency / cost reduction

By using cloud infrastructure, you don't have to spend huge amounts of money on purchasing and maintaing equipment. This drastically reduces capex costs. You don't have to invest in hardware, facilities, utilities, or building out a large data center to grow your business. You do not even need large IT teams to handle your cloud data center operations, as you can enjoy the expertise of your cloud provider's staff.Cloud also reduces costs related to downtime. Since downtime is rare in cloud systems, this means you don't have to spend time and money on fixing potential issues related to downtime.

2. Data security

One of the major concerns of every business, regardless of size and industry, is the security of its data. Data breaches and other cybercrimes can devastate a company's revenue, customer loyalty and brand positioning.Cloud offers many advanced security features that guarantee that data is securely stored and handled.Cloud storage providers implement baseline protections for their platforms and the data they process, such authentication, access control, and encryption. From there, most enterprises supplement these protections with added security measures of their own to bolster cloud data protection and tighten access to sensitive information in the cloud.

3. Scalability

Different companies have different IT needs -- a large enterprise of 1000+ employees won't have the same IT requirements as a start-up.Using cloud is a great solution because it enables enterprise to efficiently -- and quickly -- scale up/down their IT departments, according to business demands.Cloud based solutions are ideal for businesses with growing or fluctuating bandwidth demands. If your business demands increase, you can easily increase your cloud capacity without having to invest in physical infrastructure. This level of agility can give businesses using cloud computing a real advantage over competitors.This scalability minimizes the risks associated with in-house operational issues and maintenance. You have high-performance resources at your disposal with professional solutions and zero up-front investment. Scalability is probably the greatest advantage of the cloud.

4. Mobility

Cloud computing allows mobile access to corporate data via smartphones and devices, which is a great way to ensure that no one is ever left out of the loop. Staff with busy schedules, or who live a long way away from the corporate office, can use this feature to keep instantly up-to-date with clients and coworkers.Resources in the cloud can be easily stored, retrieved, recovered, or processed with just a couple of clicks. Users can get access to their works on-the-go, 24/7, via any devices of their choice, in any corner of the world as long as you stay connected to the internet. On top of that, all the upgrades and updates are done automatically, off-sight by the service providers. This saves time and team effort in maintaining the systems, tremendously reducing the IT team workloads.

5. Disaster recovery

Data loss is a major concern for all organizations, along with data security. Storing your data in the cloud guarantees that data is always available, even if your equipment like laptops or PCs, is damaged. Cloud-based services provide quick data recovery for all kinds of emergency scenarios -- from natural disasters to power outages.Cloud infrastructure can also help you with loss prevention. If you rely on traditional on-premises approach, all your data will be stored locally, on office computers. Despite your best efforts, computers can malfunction from various reasons -- from malware and viruses, to age-related hardware deterioration, to simple user error.But, if you upload your data to the cloud, it remains accesible for any computer with an internet connection, even if something happens to your work computer.

6. Control

Having control over sensitive data is vital to any company. You never know what can happen if a document gets into the wrong hands, even if it's just the hands of an untrained employee.Cloud enables you complete visibility and control over your data. You can easily decide which users have what level of access to what data. This gives you control, but it also streamlines work since staff will easily know what documents are assigned to them. It will also increase and ease collaboration. Since one version of the document can be worked on by different people, and there's no need to have copies of the same document in circulation.

LIMITATIONS OF CLOUD

1. Risk of data confidentiality

There is always a risk that user data can be accessed by other people. So data and cloud protection must be good because if it won't be dangerous for data confidentiality.

2. Depends on internet connection

The internet is the only way to cloud computing. When there is no internet connection in your place, or the internet path to the cloud provider is in trouble, automatically access to your cloud computing machine will be disconnected. Now this is where the biggest obstacle is happening in developing countries and remote areas that do not have good internet access.And the weakness of public cloud is where everyone accesses the same server and server and will increase the risk of attack, and down the server.

3. The level of security

Secrecy and security are among the most doubtful things in cloud computing. By using a cloud computing system means we are fully entrusted with the security and confidentiality of data to companies that provide cloud computing servers. When you experience a problem, you cannot sue the server for errors in the data.

4. Technical problem

Besides that the use of Cloud Computing makes you unable to manage it yourself when there is a problem or a problem, you must contact customer support who is not necessarily ready 24/7. This is a problem because for some support you also have to pay more money.

5.Low Connection

Does not work well if the connection is slow. The quality of cloud computing servers is one of the most important considerations before we decide to provide cloud computing server service providers. When the server is down or the permorma is not good, we will be harmed because of poor server quality.

Legal Issues

Recently there have been some efforts to create and unify the legal environment specific to cloud for example the united states European union safe harbor provides a seven point framework these are

1. Notify individuals for the pupose for which information is collected and used
2. Give the individuals the choice of weather their information can be disclosed to third party
3. Ensure that if it transfers personal information to a third party ,the third party also provides the same level of privacy protection
4. Allow individuals access to their personal information
5. Take reasonable security precautions to protect collected data from loss misuse or disclosure.
6. Take reasonable steps to ensure the integrity of the data collected
7. Have in place an adequate enforcement mechanism.

Key Characteristics of cloud computing

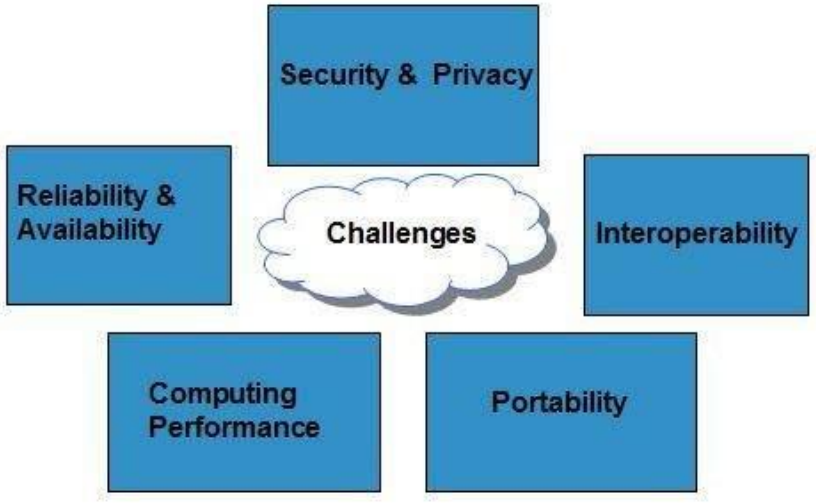
There are several characteristics of cloud computing environment. Service offering are the most often made available to specific consumers and small businesses.**Multitenancy** enables sharing of resources and costs among large pool of users chief benefits of Multitenancy include

Centralization of Infrastructure and lower costs
Increased peak-load capacity
Efficiency improvements for systems that are often underutilized
Dynamic allocation of CPU

Other Characterstics include: **Relaibility,Scalability,Disaster Recovery**

Challenges for the Cloud

The biggest challenge this company face are secure data storage,high-Speed Access to the internet,and standardization



Security and Privacy
Security and Privacy of information is the biggest challenge to cloud computing. Security and privacy issues can be overcome by employing encryption, security hardware and security applications.

Portability

This is another challenge to cloud computing that applications should easily be migrated from one cloud provider to another. There must not be vendor lock-in. However, it is not yet made possible because each of the cloud provider uses different standard languages for their platforms.

Interoperability

It means the application on one platform should be able to incorporate services from the other platforms. It is made possible via web services, but developing such web services is very complex.

Computing Performance

Data intensive applications on cloud requires high network bandwidth, which results in high cost. Low bandwidth does not meet the desired computing performance of cloud application.

Reliability and Availability

It is necessary for cloud systems to be reliable and robust because most of the businesses are now becoming dependent on services provided by third-party.

Introduction to Service Oriented Architecture

The Service Oriented Architecture is an architectural design which includes collection of services in a network which communicate with each other. The complication of each service is not noticeable to other service. The service is a kind of operation which is well defined, self contained that provides separate functionality such as checking customer account details, printing bank statements etc and does not depend on the sate of other services.

Why to use SOA?

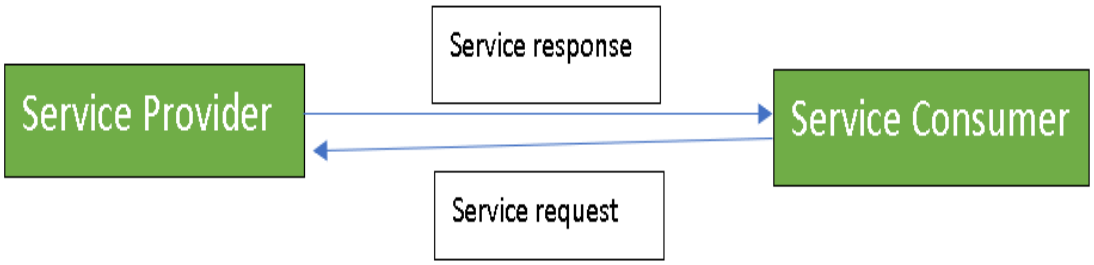
SOA is widely used in market which responds quickly and makes effective changes according to market situations.

The SOA keep secret the implementation details of the subsystems.
It allows interaction of new channels with customers, partners and suppliers.
It authorizes the companies to select software or hardware of their choice as it acts as platform independence.

There are two major roles within Service-oriented Architecture:

Service provider: The service provider is the maintainer of the service and the organization that makes available one or more services for others to use. To advertise services, the provider can publish them in a registry, together with a service contract that specifies the nature of the service, how to use it, the requirements for the service, and the fees charged.

Service consumer: The service consumer can locate the service metadata in the registry and develop the required client components to bind and use the service.



Similarities between Cloud Computing and SOA:
Reuse – The idea of reuse is inherent both in Cloud Computing and SOA.
As needed basis – In Cloud Computing, the services are provided to the users on-demand and as needed. SOA is similar to this since the system-to-system services are on-demand and as needed as well.
Network Dependency – Cloud Computing and SOA both require an available and reliable network. If a network does not exist then the cloud services provided over the Internet would not be possible. Similarly, if a network does not exist then the communications between systems would not be possible. Thus, both Cloud Computing and SOA are dependent on a network.

Cloud Contracts – In Cloud Computing, contracts entail the mutual agreement between an organization and cloud service providers. In cloud contracts, there is a cloud service provider and a cloud service consumer (the organization). In the case of SOA, contracts are important and can be either external (e.g., Yahoo! Pipes) and/or internal (e.g., organizational system integration). In SOA contracts, there are service producer(s) and service consumer(s) that are conceptually similar to cloud contracts.

Differences between Cloud Computing and SOA:

Despite the similarities between Cloud Computing and SOA, they are not the same.

Following are some of the differences between them:

Outcome vs. Technology – In Cloud Computing, we are paying for the outcome but in SOA we are paying for technology.

External vs. External and/or Internal Point-of-View – In Cloud Computing, the services that organizations get are from external organization but in SOA these services can be either from external organizations (e.g., Yahoo! Pipes) and/or internally (e.g., system-to-system integration between two or more systems).

IaaS, PaaS, SaaS vs. Software Components – In Cloud Computing, the services provided can go up and down the stack but in SOA the services are software components.

Virtualization

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.

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:

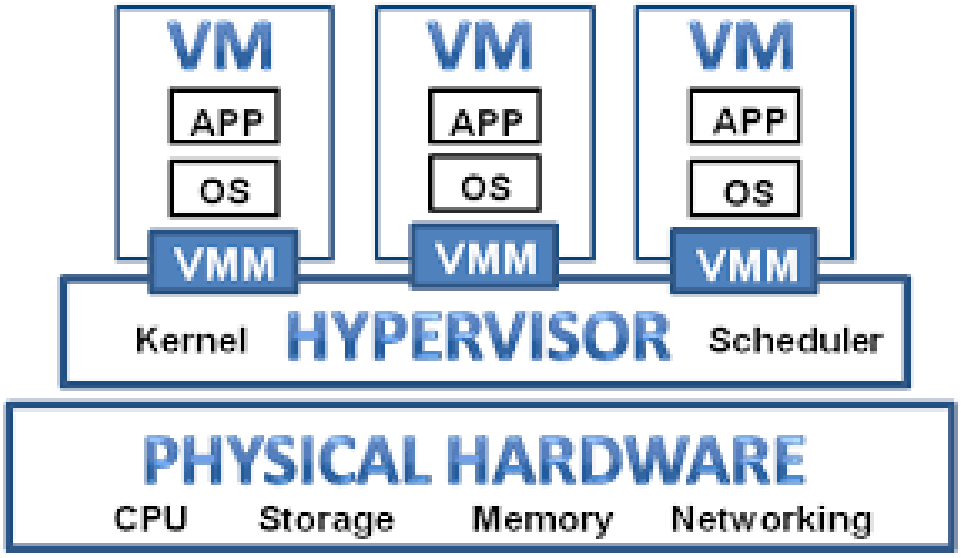
When the virtual machine software or virtual machine manager (VMM) is directly installed on the Server system is known as server virtualization.

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.



A hypervisor, also known as a virtual machine monitor or VMM, is software that creates and runs virtual machines (VMs). A hypervisor allows one host computer to support multiple guest VMs by virtually sharing its resources, such as memory and processing.