Unit - 1

History and Evolution of Cloud Computing

* The History of the Cloud

1960s — John McCarthy introduces mainframe timesharing

1969 — ARPANET by J.C.R. Licklider

1970 — Virtualization software launched

1997 — Cloud Computing is defined by Prof. Ramnath Chellappa

1999 — Sales force

2006 — Amazon launches Elastic Compute (EC2), Simple Storage Service (S3)

2013 — 18.5% ↑ (from 2012); £78bn worldwide Public Cloud Services Market*

2014 — 20% (from 2013); £103.8bn ↑ estimated global cloud spending**

* The Evolution Of Cloud Computing :

The basic concepts behind cloud computing have been part of the IT industry all along. Dust off an old mainframe concepts book and you will be surprised by the similarities to the computer industry as well.-

* Cloud computing overview -

Cloud computing means on demand delivery of IT resources via the internet with pay-as-you-go pricing. It provides a solution of IT infrastructure in low cost.

⇒ Working of Cloud Computing -

Cloud computing provides a simple way to access servers, storage, databases and a broad set of applications services over the internet. A Cloud services platform such as Amazon Web Services (AWS) owns and maintains the network-connected hardware required for these application services, while you provision and use what you need via a web application.

Good Write

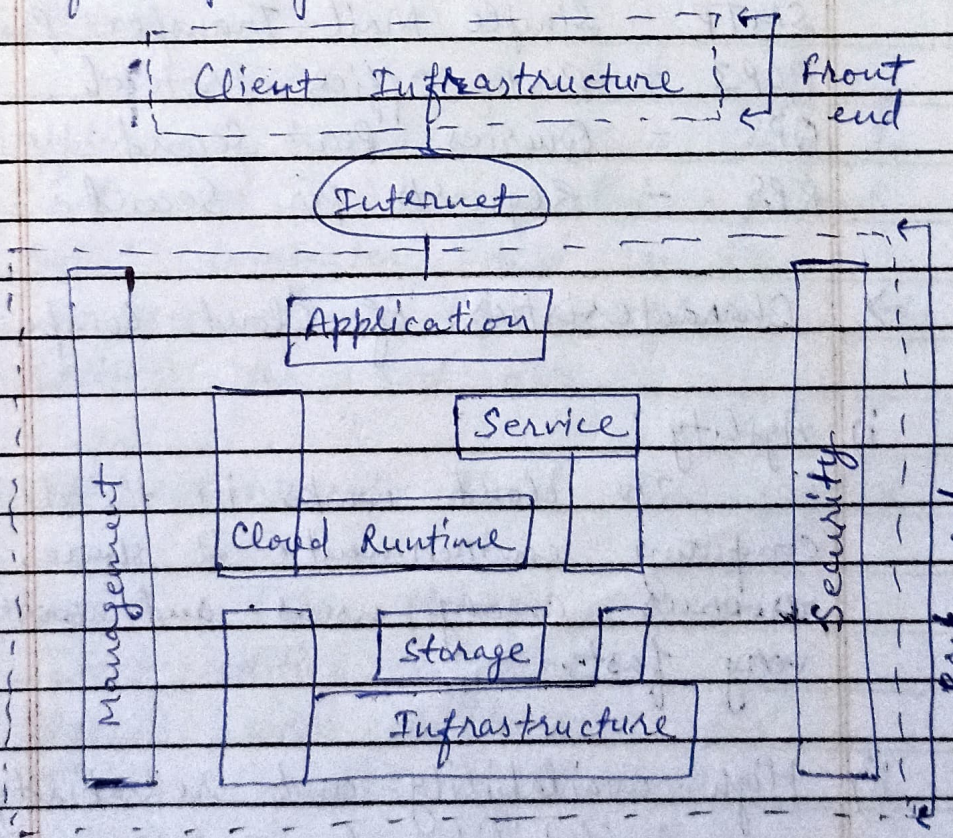
⇒ Cloud Computing Architecture -

We can divide it into two sections:

i) Front end
ii) Back end

i) The front end includes the client's computer (or computer network) and the application required for accessing the cloud computing system.

ii) The back end of the system are the various computers, servers and data storage systems that create the "cloud" of computing services.



⇒ Affect of Cloud on Human Lives -

- Application became cheaper, easier to find and use.
- New application become easier to develop & create based on a standard modular part.
- Cloud will provide new social services by connecting through social networks.
- Lessen the usage of proprietary operating system in our daily computing.
- Connection to the cloud can be done whenever we want.

* Full Forms -

SMTP - Simple Mail Transfer Protocol
POP3 - Post Office Protocol.
QPS - Queries Per Second
RPS - Requests per Second

⇒ Characteristics of Cloud Computing :-

i) Agility :
The cloud works in the distributed computing environment. It shares resources among users and works very fast.

ii) High availability and reliability :
Availability of servers is high

and more reliable, because chances of infrastructure failure are minimal.

iii) High Scalability:
Means "on-demand" provisioning of cloud computing, multiple users and applications can work.

iv) Device and Location Independance:
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.

v) 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.

⇒ Applications of Cloud Computing:-

- Online File Storage
- Photo editing software
- Digital video software
- Twitter - related applications.
- Creating image - album

- Web applications for antivirus
- Word processing application
- Spreadsheets
- Presentation software.
- Finding a way on the map
- E-commerce software
- Miscellaneous applications.

⇒ Benefits of Cloud Computing -

1. Managed service contracts replaced with cloud service providers at less cost, less risk to consuming organization.

2. Organizations pay for the usage of cloud which is carefully monitored and measured.

3. Centralized compute resources, within the cloud provider, are managed by fewer personnel with heavy use of automation and consistent processes resulting in lower cost to the consumers

4. Consuming organizations do not need a sophisticated IT staff which is expensive, hard to find and keep - internal technical talent / personnel will either focus on mission critical core business services or leave / transition to work for a cloud provider. This

improves quality, maintainability, security and reduces cost to the consumer of cloud.

⇒ Challenges of Cloud Computing :-

- Not enough proven cloud providers at this time to truly give customers a wide selection of providers to choose from.

- Organizations have significant legacy computing resources (servers, data centers, and IT personnel) that will need to be transitioned or eliminated in order to achieve true cost savings and flexibility provided by cloud providers/services.

- Mission critical applications that are core to the business or the consuming organization must be transitioned to the cloud. This is neither quick nor easy and will take some time. Businesses need to evaluate whether their custom/legacy application is truly needed and worth the re-investment, or if an alternative already cloud-enabled service is a better fit in the long-term.

- Procurement and budgeting for cloud services is a challenge to some commercial and government organizations. Existing procurement policies may need to be adapted.

- Existing security, operations and other processes within consuming organization need to adapt to this new cloud computing model.

Unit - 2

Cloud Computing Service Models

- The most popular services of the cloud are that of either infrastructure, platforms, software, or storage.
- The most common cloud service is that one offering data storage disks and virtual servers, i.e. infrastructure. Examples of Infrastructure - as - a - Service (IaaS) companies are Amazon, Rackspace, Flexiscale.
- If the cloud offers a development platform, and this includes operating system, programming language execution environment, database and web server, the model is known as Platform - as - a - Service (PaaS). Examples of which are Google App Engine, Microsoft Azure, Salesforce. Operating system can be frequently upgraded and developed with PaaS, services can be obtained from diverse sources, and programming can be worked in teams (geographically distributed).
- Software - as - a - Service (SaaS), finally, means that users can access various software applications on a pay-per-use basis. As opposed to buying license programs, often very expensive. Examples of such services include widely used

GMail, or Google Docs.

SaaS:
Software as a Service

Managed by vendor								
Applications	Runtime	Middleware	OS	Virtualization	Servers	Storage	Networking

PaaS:
Platform as a Service

Managed by vendor								
Applications	Runtime	Middleware	OS	Virtualization	Servers	Storage	Networking

IaaS:
Infrastructure as a Service

Managed by vendor								
Applications	Runtime	Middleware	OS	Virtualization	Servers	Storage	Networking

On Premise

Managed by You								
Applications	Runtime	Middleware	OS	Virtualization	Servers	Storage	Networking

Good Write

* Infrastructure

* Infrastructure As A Service / IaaS :-

IaaS is one of the layers of cloud computing platform wherein the customer organization outsources ~~via~~ its IT infrastructure such as servers, networking, processing, storage, virtual machines and other resources. Customers access these resources over internet i.e. cloud computing platform, on a pay-per-use model.

IaaS, earlier called Hardware As a Service (HaaS), is a cloud computing platform based model.

→ Major IaaS Vendors and Products :

There are many examples of IaaS vendors and products. AWS offers storage services such as Simple Storage Services (S3) and Glacier, as well as compute services, including its Elastic Compute Cloud (EC2). GCP offers storage and compute services through Google Compute Engine (GCE), as does Microsoft Azure.

⇒ Advantages of IaaS Cloud Computing Layer:

1) You can dynamically choose a CPU, memory and storage configuration as per your needs.
2) You easily access the vast computing power available on IaaS cloud platform.
3) You can eliminate the need of investment in rarely used IT ~~software~~ hardware.
4) IT infra will handled by the IaaS cloud computing platform vendors.

⇒ Disadvantages of IaaS Cloud Computing Layer:

1) There is a risk of IaaS cloud computing platform vendor by gaining the access to the organization data. But it can be avoided by opting for private cloud.
2) IaaS cloud computing platform model is dependent on internet availability.
3) It is also dependent on the availability of virtualization services.
4) IaaS cloud computing platform can limit the user privacy and customization options.

* Platform As A Service / PaaS :-

- PaaS cloud computing platform is a developer programming platform which is created for the programmer to develop, test, run and manage the applications.
- A developer is able to write the application as well as deploy it directly into this layer easily.
- PaaS extend and abstract the IaaS layer by removing the hassle of managing the individual virtual machine
- In PaaS cloud computing platform, back end scalability is handled by the cloud service provider and the end user does not have to worry about to manage the infrastructure.
- All the infrastructure to run the applications will be over the internet.

→ Leading PaaS Vendors:

Google App Engine supports distributed web applications using Java, Python, PHP and Go. Red Hat OpenShift is a PaaS offering for creating open source applications using a wide variety of languages, database and components.

⇒ Advantages of PaaS :-

1) Simplified Development
2) Lower risk
3) Prebuilt business functionality
4) Instant Community
5) Scalability

⇒ Disadvantages of PaaS :-

1) Vendor lock-in : One have to write the applications according to the platform provided by PaaS vendor so migration of an application to another PaaS vendor would be a problem.
2) Data Privacy : Corporate data whether it can be critical or not, will be private so if it is not located within the walls of the company there can be a risk in terms of privacy of data.
3) Integration with the rest of the systems applications : It may happen that some applications are local and some are in ~~loud~~ cloud. So there will be chances of increased complexity when we want to use data which in the cloud with the local data.

* Software As A Service (SaaS) :-

SaaS is defined as the software distribution model that is deployed on internet which applications are provided by cloud service provider. It is also known as "on-demand software" or "pay-as-you-go application".

In SaaS, the software & the applications associated with it are centrally located on the cloud servers and users can access them via a thin client connecting application i.e. using a web browser.

SaaS is a way to deliver software over the internet. Instead of installing and maintaining applications, users access them via the Web. There's no hardware to buy, and users just need an Internet connection.

⇒ Advantages of SaaS Cloud Computing layer:

1) SaaS is easy to buy: SaaS pricing is based on a monthly fee or annual fee, SaaS allows organizations to access business functionality at a low cost which is less than licensed applications.

2) Less hardware required for SaaS: The software is hosted remotely, so organizations don't need to invest in additional hardware.

3) Low Maintenance required for SaaS:
Software as a Service removes the necessity of installation, set-up and ofte daily upkeep and maintenance for organizations.

4) No special software or hardware versions required: All users will have the same version of software and typically access it through the web browser.

⇒ Disadvantages of SaaS Cloud Computing Layer:

1) Security: Actually data is stored in cloud, so security may be an issue for some users. However, cloud computing is not more secure than in-house deployment.

2) Latency issue: Because the data and applicatio are stored in cloud at a variable distance from the end user, so there is a possibility that there may be more latency while interacting with the application than a local deployment.

3) Total dependency on Internet: Without internet connection, most SaaS applications are not usable.

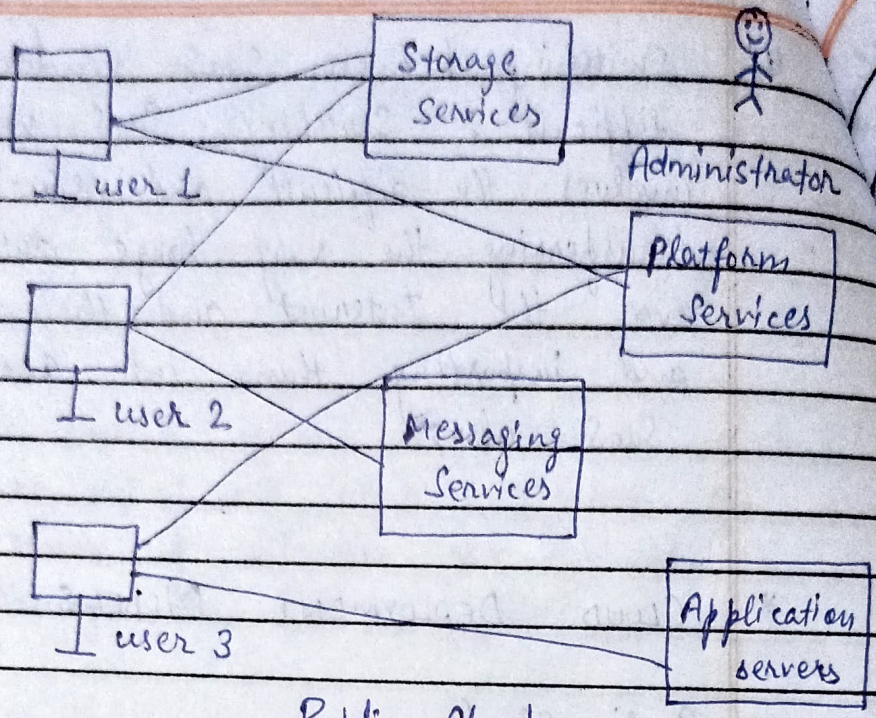
4) Switching between SaaS vendors is difficult : Switching SaaS vendors involves the difficult and slow task of transferring the very large data files over the Internet and then converting and importing them into another SaaS also.

* CLOUD DEPLOYMENT MODELS

- Public Cloud
- Private Cloud
- Hybrid Cloud
- Community Cloud

1) Public Cloud -

Public Cloud is a type of cloud hosting that allows the accessibility of systems & its services to its clients / users easily.
Some of the examples of those companies which provide public cloud facilities are : IBM , Google , Amazon , Microsoft etc.
This cloud service is open for use. This type of cloud computing is a true specimen of cloud hosting where the service providers render services to various clients.



Public Cloud

⇒ Advantages of Public cloud Model :

1) Low cost : Public cloud is having low cost as compared to private or hybrid cloud, because it shares same resources with large number of consumers.

2) Reliable : Public cloud provides large number of resources from different locations, if any of the resource fail, public cloud can employ another one.

3) Flexible : It is very easy to integrate public cloud with private cloud and hence it gives flexible approach to consumers.

4) Location Independent : It ensures the

independency of location, because public cloud services are delivered through Internet.

5) High Scalability: Cloud resources are available as per the demand from the pool of resources that means they can be scaled up or down according to the requirement.

⇒ Disadvantages of Public Cloud Model:

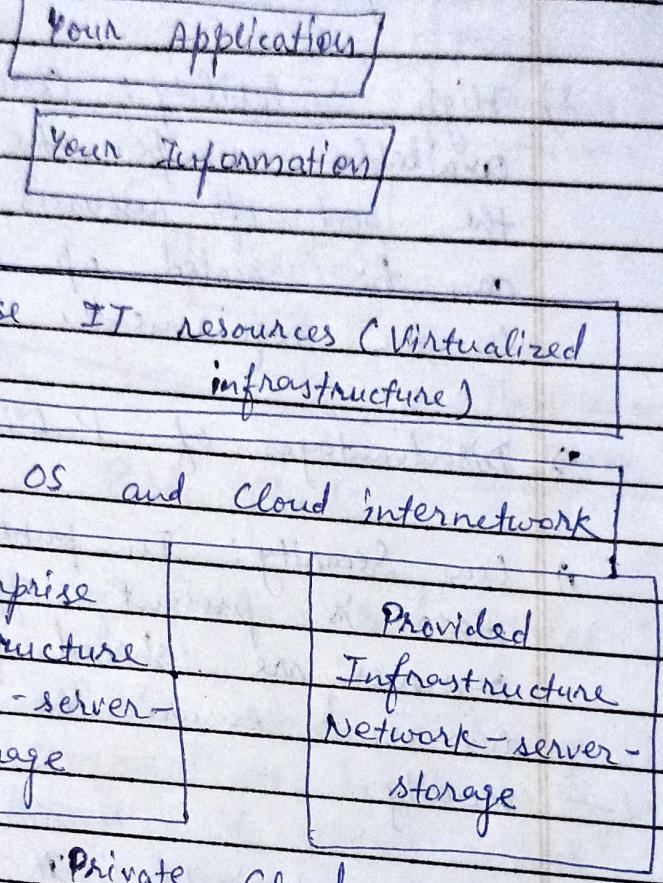
1) Low Security: In public cloud model, data is present off-site and resources are shared publicly. Hence it does not ensure the high level security.

2) Less customizable: It is less customizable than private cloud.

2) ★ PRIVATE CLOUD -

Private Cloud is also termed as 'Internet Cloud', which allows the accessibility of systems and services within a specific boundary or organization. The Cloud platform is implemented on a cloud-based secure environment that is guarded by advanced firewalls under the

surveillance of IT department that belongs to a particular organization.



Private Cloud

⇒ Advantages of Private Cloud Model -

1) Highly private and secured
2) Control Oriented.

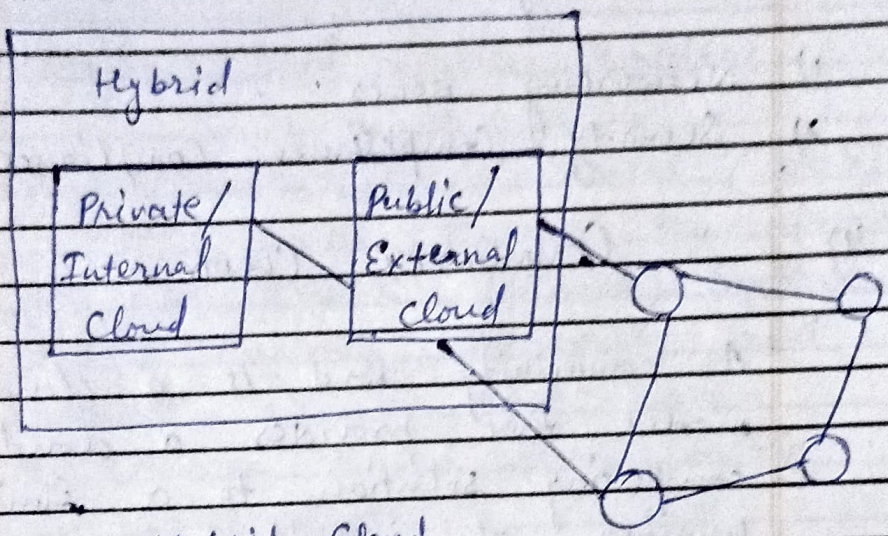
⇒ Disadvantages -

1) Restriction
2) More Cost
3) Inflexible price.
4) Less scability.

Good Write

3) HYBRID CLOUD :

Hybrid Cloud is often another Cloud computing type, which is integrated, i.e. it can be a combination of two or more cloud servers, i.e. private, public or community combined as one architecture, but remain individual entities.



Hybrid Cloud

⇒ Hybrid Cloud models can be implemented in a number of ways :

- Separate cloud providers team up to provide both private and public services as integrated service.
- Individual cloud providers offer as complete hybrid package.
- Organizations who manage their private clouds themselves sign up to a public cloud service, which they then

integrate into their infrastructure.

⇒ Advantages -

1) Scalable
2) Flexible and secure
3) Cost effective

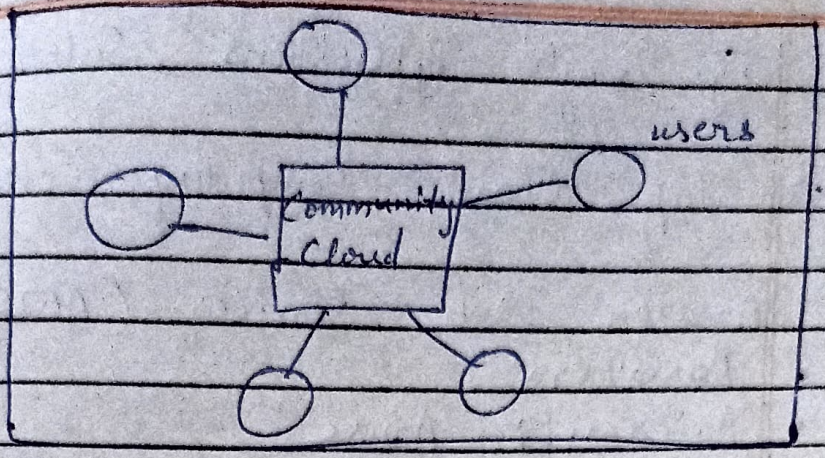
⇒ Disadvantages -

1) Networking issues
2) Security / ~~Compliance~~ Compliance

4) COMMUNITY CLOUD -

A community cloud is a cloud service model that provides a cloud computing solution to a limited number of individual or organizations that is governed, managed and secured commonly by all the participating organizations ~~or~~ or a third party managed service provider.

Community clouds are a recent variation on the private model that provide a complete cloud solution for specific business communities. Businesses share infrastructure provided by the CSP for software and development tools that are designed to meet community needs.



Community Cloud

* Major Cloud Service Providers :

1) Infrastructure as a Service (IaaS) -
This service provides the Infrastructure like Server, Operating Systems, Virtual Machines, Networks, and Storage etc on rent basis.
Eg: Amazon Web Service (AWS), Microsoft Azure.

2) Platform as a Service (PaaS) -
This service is used in developing, testing and maintaining of software. PaaS is same as IaaS but also provides the additional tools like DBMS, BI services etc.
Eg: Apprenda, Red Hat Open Shift.

3) Software as a Service (SaaS) -
This service makes the users connect to the applications through the Internet on a subscription basis.

Eg: Google Applications, Sales force.

⇒ Top Cloud Computing Companies -

- Amazon Web Services (AWS)
- Kanatera
- Microsoft Azure
- Google A Cloud Platform
- Adobe
- VMware
- IBM cloud
- Rack space
- Red Hat
- Sales force
- Oracle Cloud
- SAP
- Verizon Cloud
- Navisite
- Dropbox
- Egnyte