CLOUD COMPUTING UNIT-I INTRODUCTION

Definition:

It is a combination of two terms cloud and computing.

Meaning of Cloud:

The cloud refers to servers that are accessed over the internet, and the software and databases that run on those servers.

Computing:

Any activity that uses computers to manage, process and communicate information.

Definition of Cloud Computing:

Cloud-Computing is the on-demand availability of computer system resources (data storage especially) and computing power without direct active management by the user.

Properties of Cloud Computing:

* It is generally used to describe the data centres available to many users over the internet. (On-demand self service.).
* It is a combination of both hardware and software computing resources delivered as network service.
* Broad network access.
* Resource pooling

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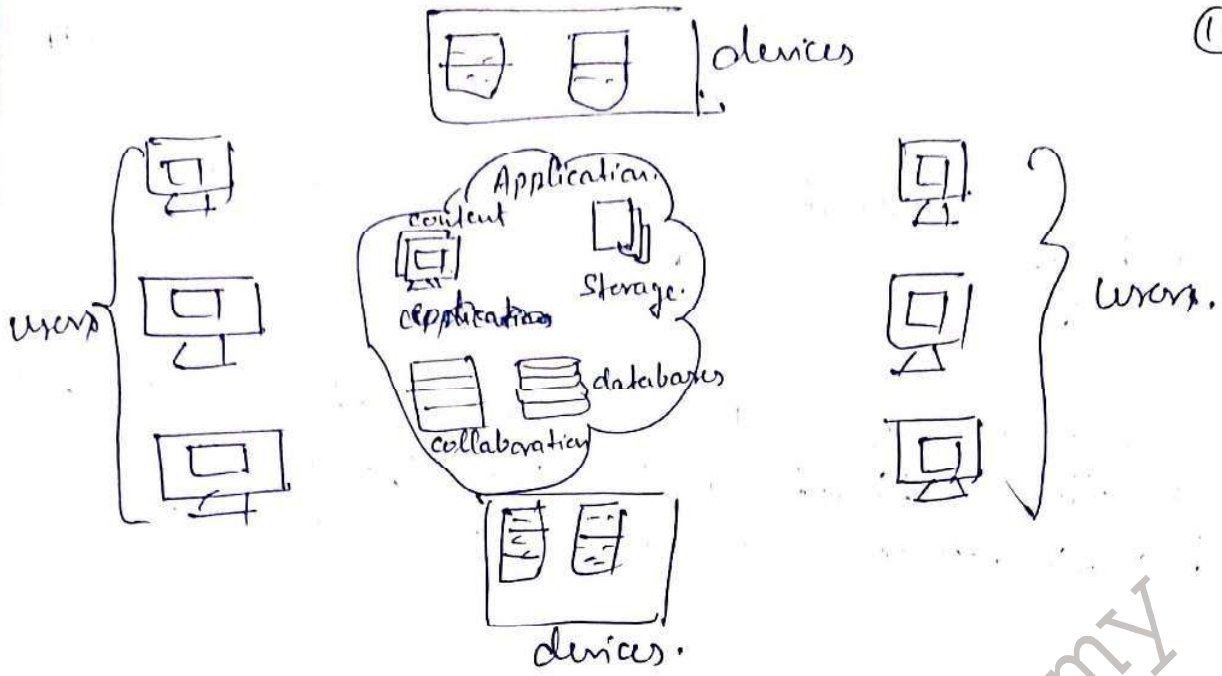

Advantages of Cloud Computing:

1) Cost Reduction
2) Security
3) Reliability
4) Improved performance
5) Instant Software Updates.
6) Universal document Access.
   ~~Devide~~ Device independance.

Disadvantages:-

1) Requires a constant Internet Connection.
2) Does not work well with low internet-connection.

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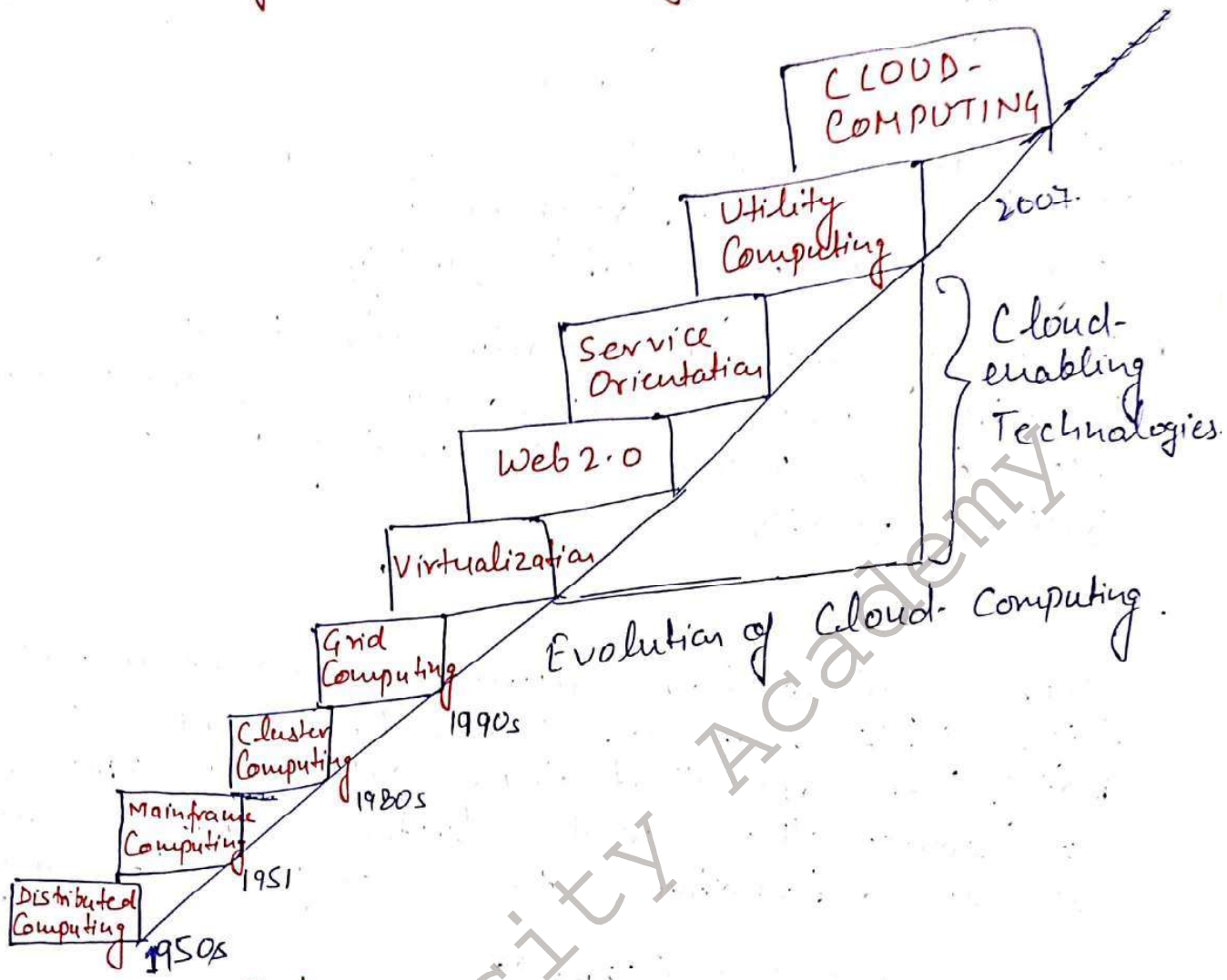
Evolution of Cloud - Computing :-



Evolution of Cloud- 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 system is to share resources and also use them effectively and efficiently.

Problem with Distributed Systems:-

The main problem with this system was that it requires all the systems to be present at the same geographical location. To solve this problem it led to three more types of

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computing — Mainframe Computing, cluster computing and grid computing.

Mainframe Computing :- (1951)

* Mainframes are highly powerful and reliable computing machines, designed to process very large amount of data quickly.
* These systems are widely used in the industries where a large number of transactions need to be processed as part of routine business practices.

Drawback :-

These systems have almost no downtime with high fault tolerence. The only drawback with mainframes are that these are very expensive. To reduce the cost, cluster computing came as an alternative to mainframe technology

Cluster Computing :- (1980s) :-

Cluster computing refers that many of the computers connected on a network and they perform like a single entity.

These were way cheaper than the mainframe systems, equally capable of high computations. Also new nodes could be easily added to the cluster if it was required.

Drawback :-

The problem of 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.

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Grid- Computing:-

In 1990s, the concept of grid- computing was introduced as a solution to cluster computing.

In grid-computing different systems were placed at entirely different locations and these all were connected via the internet.

Problem:-

Although it solved some problems but new problems emerged as the distance b/w the nodes increased.

The main problem which was encountered, was the low availability of high bandwidth connectivity and other h/w issues also arised.

Cloud - Computing:-

Cloud- computing is referred as "Succesor of grid- computing.

Virtualization:-

It refers to the process of creating a virtual layer over the h/w which allows the user to run multiple instances simultaneously on the h/w.

web 2.0:- It is the interface through which the cloud-computing services interact with the clients. It is because of web2.0 that we have interactive and dynamic web pages.

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Service Orientation :-

It acts as a reference model for Cloud-computing.

Two important concepts were introduced in this computing model.

(i) Quality of Service (QoS) ⇒ also includes SLA (service level agreement.

(ii) 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.

Hence these are the technologies (virtualization, web 2.0, service orientation & utility computing) which contributed to the making of cloud-computing.

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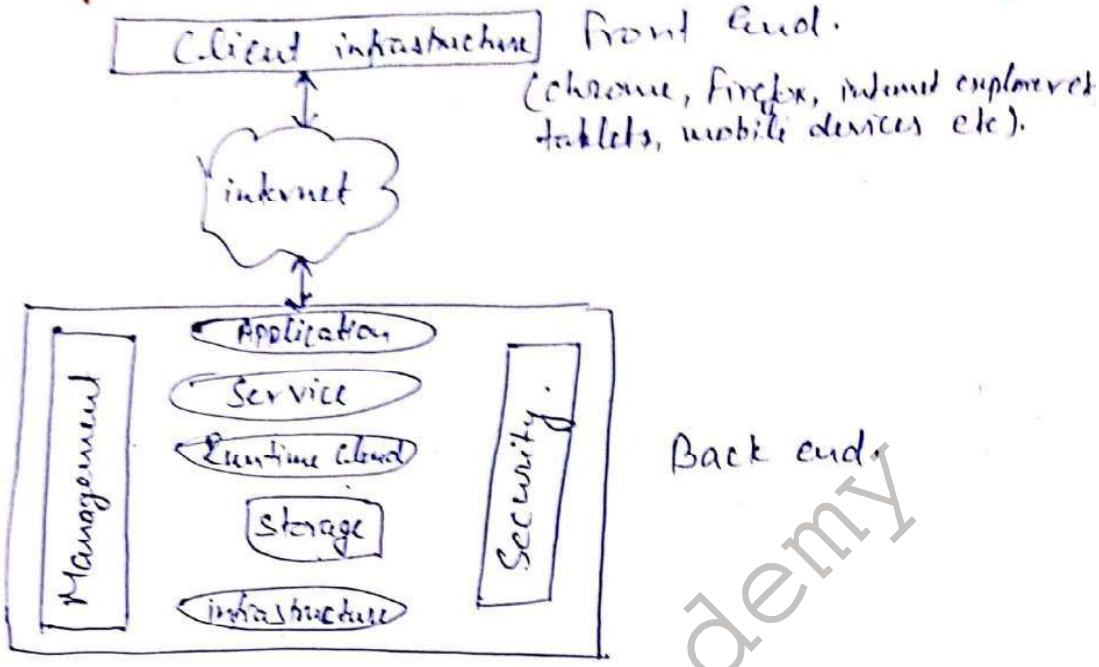
Components of Cloud Computing: / Architecture of Cloud Computing



Front End:

* Front end is used by clients.
* It consists of client-side interfaces and applications that are required to access the cloud computing platforms.
* It includes web servers (including chrome, Firefox, internet explorer etc) tablets and mobile devices.

Back-End:

* Back-end is used by the service provider.
* It manages all the resources that are required to provide cloud computing services.
* It consists of huge amount of data storage, security mechanism, virtual machines, deploying models, servers, traffic control mechanism etc.

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The various components can be given as

1) Client - Infrastructure :-

It is the front end component. It provides GUI (Graphical User Interface) to interact with cloud.

2) ~~Application~~

2) Internet :-

* It is the medium through which front end and back end can interact and communicate with each other.

3) Security :-

* It is an in-built back-end component of cloud - computing.
* It is decided by the cloud - service provider

4) Management :-

* It is used to manage components such as application, service, storage, infrastructure and other security issues in the cloud.
* It is used to establish coordination b/w all the components.

5) Infrastructure :-

It provides services on host level, application level and network level.

It includes both h/w and s/w components that are needed to support the cloud computing model.

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Storage:

It provides a huge amount of storage capacity in the cloud to store and manage data.

Runtime Cloud:

It provides the execution and runtime environment to virtual machines.

Services:

It totally depends upon the client requirement.

Cloud computing offers three types of services.

(i) Software as a Service (SaaS)
(ii) Plateform as a Service (PaaS)
(iii) Infrastructure as a service (IaaS).

Application:

It can be defined as any S/w or platform that client wants to access.

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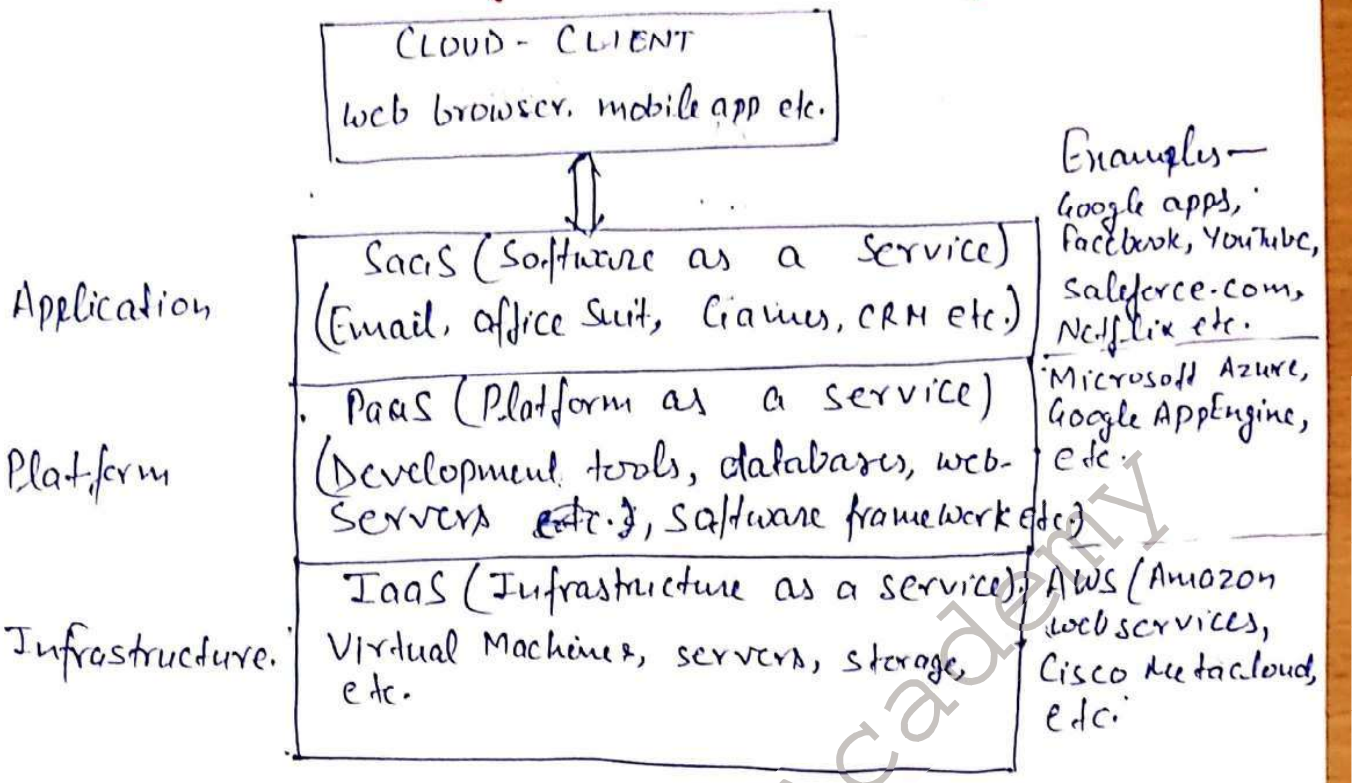
Service Models of Cloud-Computing:-



SaaS (Software as a service):-

* It is also known as cloud application services. The service is purchased on a subscription basis.
* It is a software distribution model in which a third-party service provider hosts applications and makes them available to the customers over the internet.

Characteristics of SaaS:-

* Software managed from a central location.
* Web access to commercial softwares.
* Software delivered in a "one to many" model.
* User not required to handle software upgrades and patches.

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Platform as a Service (PaaS):

* It is a cloud computing model in which cloud vendors provides developers with a platform for building apps.

* The developers basically rent everything they need to build an application. & depending upon cloud provider for development tools (compiler, debugger etc), databases, infrastructure etc.

Characteristic:

* Provides a variety of services to assist with the development, testing and deployment of apps.

* Resources can be easily scaled up or down as business changes.

* Accessible to numerous users via the same development application.

IaaS: Infrastructure as a Service:

It is a form of cloud computing that provides virtualized computing resources over the internet (storage, memory, infrastructure etc)

Characteristic:

Shared infrastructure

web access to resources.

pay-as-per use.

On-demand scalability.

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Difference b/w SaaS, PaaS and IaaS:

SaaS	PaaS	IaaS
1- It provides web software and apps to complete business tasks as well as personal uses.	It provides virtual platforms and tools to create, test and deploy the apps.	It provides a virtual infrastructure in which resources are provided to the users but not physically.
2- It provides software as a service to the end users.	It provides runtime environments and deployment tools for applications.	It provides access to resources such as virtual machines, virtual storage etc.
3- It is used by the end users.	It is used by developers.	It is used by network architects.
4- It provides infrastructure + platform + software	PaaS provides Infrastructure + Platform.	IaaS provides only Infrastructure
5. ex: Cisco WebEx, Google apps, Dropbox, ZenDesk etc.	ex:- Force.com, Magento Commerce cloud, Openshift etc.	ex:- AWS, Rackspace, Cisco Metacloud.

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Underlying Principles of Parallel and distributed computing:

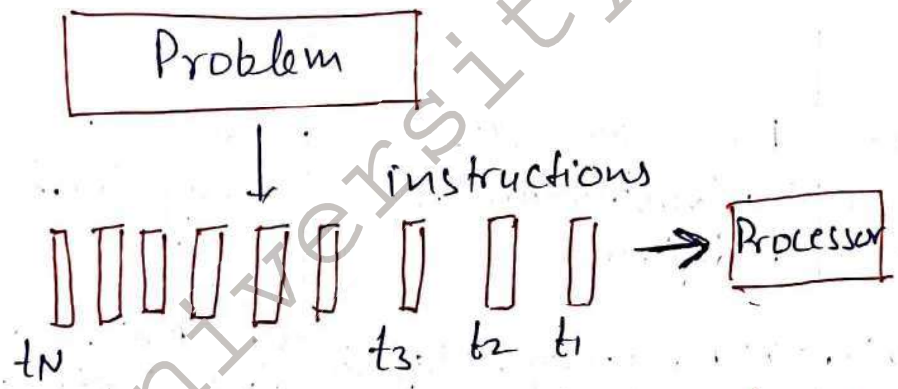
Before discussing parallel and distributed computing we need to discuss serial computation.

Serial Computation:

⇒ Initially S/w has been written for serial computations. i.e. to be run on a single computer having a single CPU.

⇒ In serial computation a problem is broken into a discrete series of instructions and instructions are executed one after another.

⇒ Only one instruction may execute at any moment in time.



Problem with Serial Computation:

⇒ Low transmission speed.

⇒ Limits to miniaturization

⇒ Only one instruction at a time can executes so it is a time taking process.

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Requirements of Parallel Processing :- (To solve problems of serial computing.) (1-14)

⇒ Save time and/or money.

⇒ Solve larger/more complex problems.

⇒ Provides concurrency.

⇒ Takes advantages of non-local resources.

⇒ Makes better use of underlying parallel hardware.

Parallel - Computing :-

Parallel computing involves the concurrent computation or simultaneous execution of processes or threads at the same time.

Basically it consists of —

⇒ Decomposition of a problem into discrete parts that can be solved concurrently.

⇒ Decomposition of each parts into series of instructions.

⇒ Distributing the parts as tasks which are worked on by multiple processors simultaneously

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⇒ Coordinating work and communications of those processors or cores.

(1.15)

Distributed Computing:

In distributed computing we have multiple autonomous computers which seems to the user a single system.

In distributed systems there is no shared memory and computers communicate with each other through message passing.

In distributed computing a single task is divided among different computers.

Difference b/w Parallel and Distributed Computing:

Parallel Computing	Distributed Computing
① Many operations are performed simultaneously	System components are located at different locations.
② Single computer is required	Uses multiple computers.
③ Multiple processors performs multiple operations.	Multiple computers performs multiple oprns.
④ It may have shared or distributed memory.	It have only distributed memory.

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(5) Processors communicates with each other through bus.	Computers communicates with each other through message passing.
(6) Improves the system performance.	Improves system scalability, fault tolerance, and resource sharing capabilities.
7) Ex:- weather forecasting, movie special effects etc.	Telecommunication networks, aircraft control systems etc.

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Deployment Models of CLOUD-COMPUTING

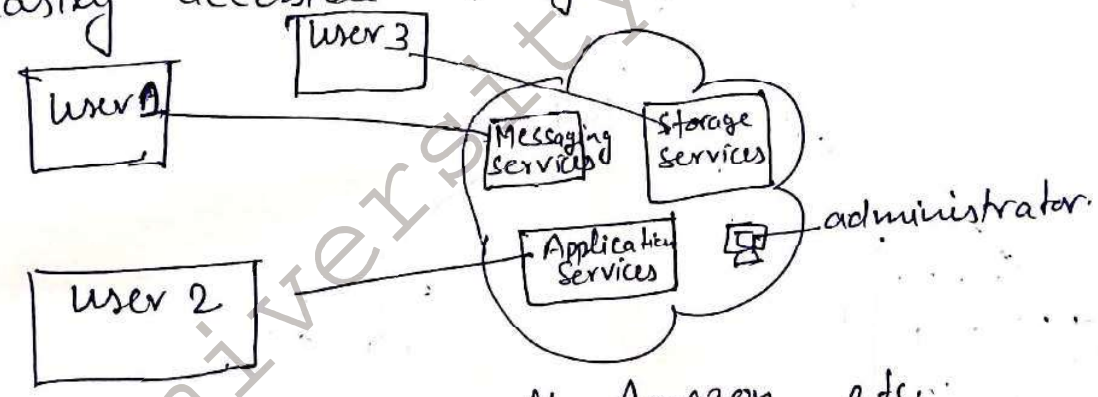
↳ In its general terms deployment is the process of making software available and ready for use.

4 types of deployment models are available in cloud.

1) Public Cloud
2) Private Cloud
3) Hybrid Cloud
4) Community Cloud

1) Public Cloud Model :

* It allows systems and services to be easily accessible to general public.



Example: Google, Microsoft, Amazon etc.

Advantages:

* Flexible
* Low Cost
* Place independence

Disadvantages

* Less secure.
* Less customization.

Examples: Google Cloud, IBM's Blue Cloud, Sun cloud etc.

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2) Private Cloud Model :- (Internal Cloud)

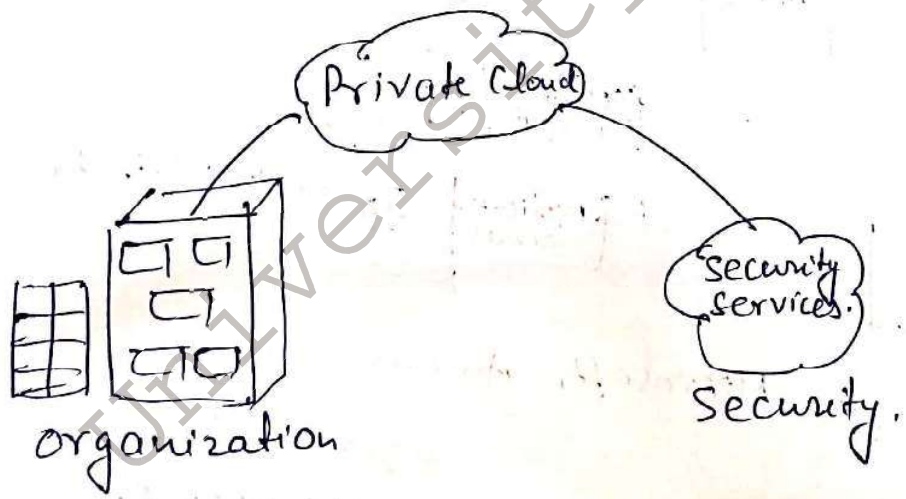
* It allows systems and services to be accessible within an organization.
* However, it may be managed internally by the organization itself or by third party.

Advantages :-

* Highly Private and secured.
* Control oriented.

Disadvantages :-

* Costly.
* Restriction
* Pricing is inflexible i.e. purchasing new hardware for upgradation is more costly.
* restricted area of operation.
* Limited area of operation.



Examples :- HP data Centres, Microsoft, Elastra- private cloud etc.

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3) Hybrid Cloud:

* It is a combination of public and private clouds.

Hybrid cloud = public cloud + private cloud.

* In hybrid cloud, non critical activities are performed by public cloud and critical activities are performed by the private cloud.

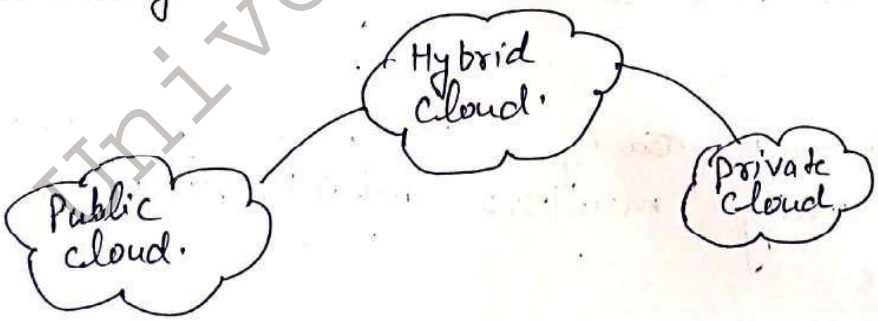
* A hybrid cloud is an infrastructure that includes links between one cloud managed by user and at least one cloud managed by a third party (public cloud).

Advantages:

* Flexible and Secure
* Cost-effective
* Security.
* Risk-management.

Disadvantages

* Network - issues
* Infrastructure compatibility required.



Examples: Amazon, Microsoft, Google, Cisco and NetApp are the various hybrid cloud provider companies.

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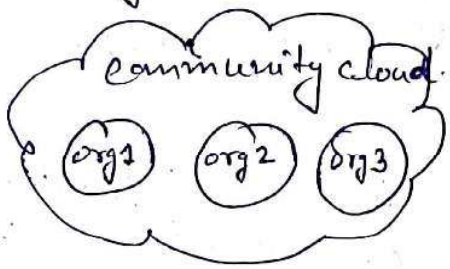
4) Community Cloud:

* It is a cloud infrastructure that allows systems and services to be accessible by a group of several organizations to share the information.

* It is owned, managed and operated by one or more organizations in the community, a third party or a combination of them.



Advantages:

* Cost-effective
* Flexible and scalable.
* Security
* Sharing infrastructure

Disadvantages:

* Sharing resources within organization is little difficult.
* Fixed amount of resources are shared b/w community members which reduces performance.

Example: V.S based dedicated IBM SoftLayer cloud for federal agencies.

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