→ Cloud computing is a technology that lets you use & access computer resources like servers, storage, databases, networking, s/w and more over the internet.

→ The term cloud refers to a n/w or internet. Cloud can provide services over public and private n/w i.e., WAN, LAN or VPN.

→ Cloud computing is a internet based computing.

(*) History of Cloud Computing

Client Server Computing
↓
Distributed Computing
↓
Cloud computing

(*) Characteristics of cloud computing

(1.) **Agility**

It shares resources among users & works very fast.

(2.) **Maintenance**

Maintenance of cloud computing applications is easier, since they do not need to be installed on each user's computer.

(3) On-demand self-services
Does not require any human administrators, user themselves are able to monitor & manage computing resources.

(4) Low Cost
The cost will be reduced because to take the services of cloud computing, IT company need not to set its own infrastructure & pay as per usage of resources.

(5) Security
Cloud providers invest heavily in security measures to protect their users data.

(6) High availability & reliability
Availability of servers is high & more reliable, because chances of infrastructure failure are minimal.

(*) Applications of Cloud Computing in real-world.

- Online Data Storage
- Backup & Recovery
- Big Data Analysis
- Testing & Development
- E-commerce Application
- In education
- In Medical Fields

Page No.
Date:

(*) Advantages of Cloud Computing

(1.) **Cheaper**

Whatever cloud service model you choose, you only pay for the resources you actually use.

(2.) **Data loss prevention**

Cloud providers offer backup & disaster recovery features.

(3.) **Better Collaboration**

Cloud storage enables you to make data available anywhere you are, anytime you need it.

(4.) **Mobility**

Cloud computing allows us to easily access all cloud data via mobile.

(5.) **Data Security**

It offers many advanced features related to security & ensures that data is securely stored & handled.

(6.) **Unlimited storage capacity**

Cloud offers us a huge amount of storing capacity for storing our imp. data such as documents, images, audio in one place.

✳ Evolution of Cloud Computing

Distributed Computing (1950s)
↓
Mainframe Computing
↓
Cluster Computing
↓
Grid Computing
↓
Virtualization
↓
Web 2.0
↓
Service Orientation
↓
Utility Computing
↓
Cloud computing (2007)

→ Distributed Systems

- It is a composition of multiple independent system.
- The purpose of distributed systems is to share resources and also use them effectively & efficiently.
- Main problem with this system was that all the systems were required to be present at the same geoquaphical location.

→ Mainframe Computing

- Mainframes are high powerful & reliable computing machines.
- These are responsible for handling large data such as massive input - output operation
- These were very expensive.

→ Cluster Computing

- It is an alternative to mainframe computing.
- Each machine in a cluster was connected to each other by a n/w with high bandwidth.

→ Grid Computing

- In guid computing different systems were placed at entirely different geographical location & these all were connected via the internet.

→ 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.

- H/w virtualization is still one of the most common types of virtualization.

Date:

→ Web 2.0

- It is the interface through which the cloud computing services interact with the clients.
- Eg:- Google Maps, Facebook

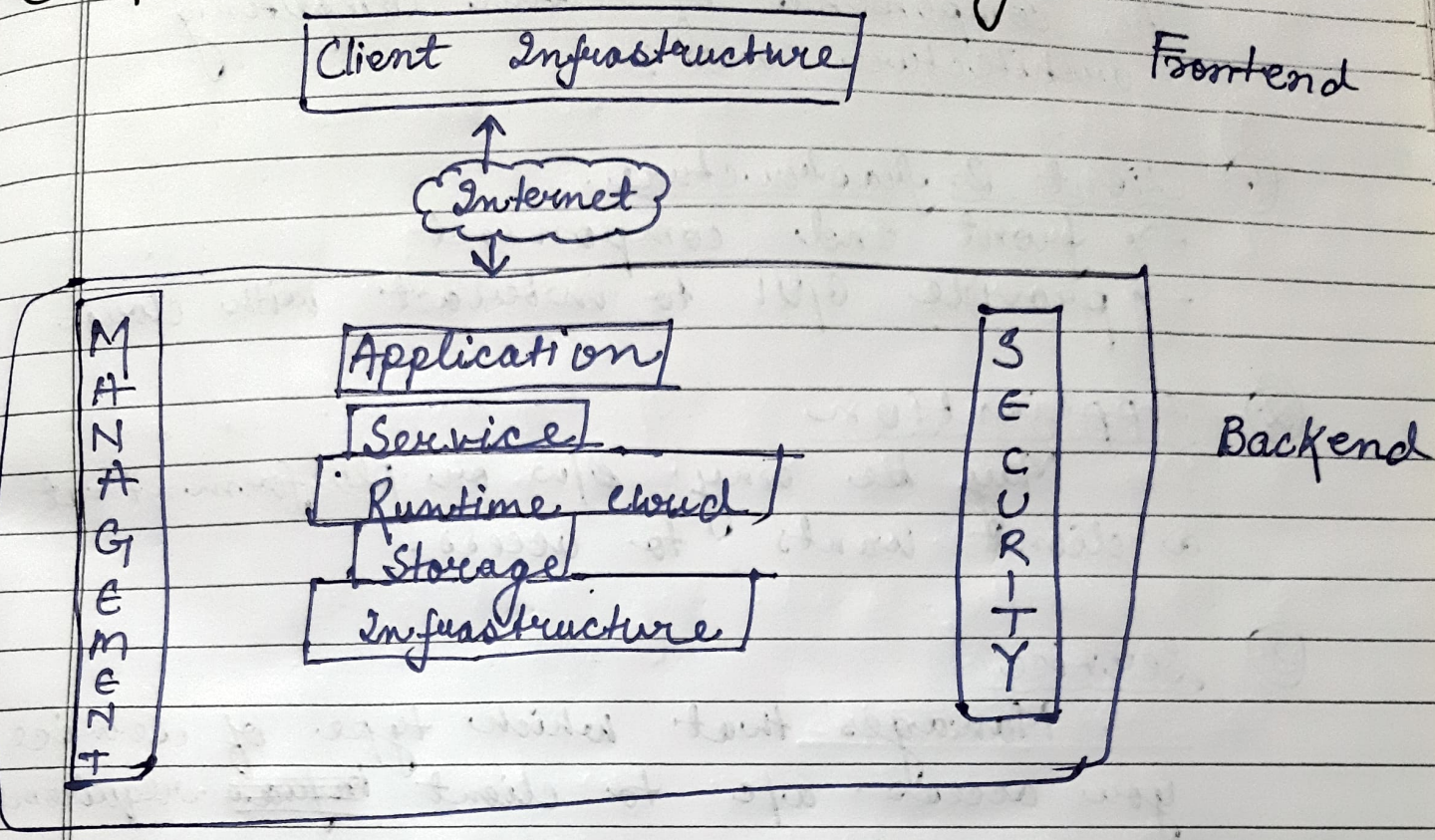
→ Service Orientation

- It acts as a reference model for cloud computing.
- It supports low cost, flexible and evolvable applications.

→ Utility computing

- It helps eliminate data redundancy as huge vol. of data are distributed across multiple servers or backend systems.

⊛ Architecture of Cloud Computing



→ It has 2 parts i.e frontend & backend

Frontend

* Used by client
* contains all the client side interfaces & applications that are required to access the cloud platforms.

Backend

* Used by service provider
* It manages all the resources that are req. to provide cloud computing services.
* It includes huge amt. of data storage, security mechanisms, virtual machines, deployment models servers, etc.

The components of cloud computing architecture are :-

1. **Client Infrastructure.**
   → front end component
   → provide GUI to interact with cloud

2. **Application**
   May be any s/w or platform that a client wants to access.

3. **Service**
   Manages that which type of service you access a/c to client requirement.

   CC offers :- SaaS, PaaS, IaaS

4. **Runtime cloud**
   Provides "execution & runtime environment to the virtual machines"

5. **Storage**
   One of the most imp. components.

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

6. **Infrastructure**

Cloud infrastructure includes h/w & s/w component such as "servers, storage, h/w devices, virtualization s/w & other resources needed for cloud computing model.

7. **Management**

Manages components like application, services, infrastructure

8. **Security**

Inbuilt backend component provides security mechanism in the backend.

9. **Internet**

Medium through which frontend & backend interacts.

(*) Service provider by C.C

(A) SaaS (s/w as a service)

* It is a way of delivering services & applications over the internet.
* Maintainance of s/w & h/w done by the vendor
* We did not to install the s/w in our machine.
* Generally used by end users

⇒ **CHARACTERISTICS**

(i) It makes the s/w available over internet.
(ii) Cost effective (pay as per use)
(iii) s/w are automatically upgraded.
(iv) works on shared model
(i.e one s/w is used by multiple clients)

⇒ **BENEFITS**

(i) Accesible anytime anywhere
(ii) Paltform independence to the user
(iii) Reduced time (we can use appl. directly from browser)

eg:- Dropbox, Office 365, Google Drive

⇒ Low performance (disadvantages)

It is a service where 3rd party provides both s/w & h/w tools to the cloud computing.

Page No.
Date:

(B) PaaS (Platform as a service)

* It provides a platform & environment (i.e runtime envi.) to allow developers to build applications & services over the internet.

* Developers use it.

⇒ CHARACTERISTICS

(i) Services are hosted in the cloud & accessed by users via web browser.

(ii) No control over the infrastructure. We will interact with the UI only

⇒ BENEFITS

(i) Cost effective (pay as per use)
(ii) S/w management (i.e updates & all) managed by the provider.

(ii) It manages applications development phases in the cloud very efficiently.

⇒ Disadvantages

Data is not secure

(c) IaaS (Infrastructure as a service)

* It is a service which delivering computing infrastructure as on demand services.
* It allows dynamic scaling & resources are distributed as a service.
* It generally includes multiple user on a single piece of h/w.
* It totally depends upon the customer to choose its resource wisely as per need.

⇒ **ADVANTAGES**

(i) Cloud provides the architecture.
(ii) It is easy to expand & saves lot of money.
(iii) Enhanced scalability & quite flexible.

⇒ **DISADVANTAGES**

(i) Security issue
(ii) Services & n/w delay are quite a issue is IaaS.

Date:

Q. Explain different cloud services providers & its market overview.

Cloud service providers (CSP) offers various services such as SaaS, PaaS, IaaS, o/w s, mobile applications & infrastructure in the cloud.

CSP companies :-

(1) AWS (Amazon Web Services)

- It is a secure cloud service platform provided by Amazon.
- It offers various services such as database storage, content delivery, simple email and other functionality to increase the organization's growth.
- AWS is cost-effective as it works on a pay as you go pricing.
- It offers various security services such as data encryption, logging, identity & access control and penetration testing.
- It provides various flexible storage options.

② Microsoft Azure

- Also known as Windows Azure.
- It supports various operating systems, databases, programming languages, frameworks that allows IT professionals to easily build, deploy & manage applications through a worldwide n/w.
- It provides scalable, flexible & cost effective.
- It allows developers to quickly manage the applications & websites.
- It offers a Content Delivery System (CDS) for delivering the images, videos, audios & applications.
- 24/7 cooperative team paying attention to their customers.
A free trial version of Microsoft Azure is available for 30 days.

Page No.
Date:

(3) Google Cloud

- Google cloud platform is a product of Google.
- Google cloud has a firm grip over the banking & finance sector.
- Google Cloud platforms is available in 22 regions, 61 zones & 200+ countries.
- GCP offers the cheapest cloud services in the market.
- Easy migration of data without touching any codes.

(4) IBM Cloud

- Developed by IBM.
- It offers IaaS, SaaS & PaaS services via public, private, hybrid & multi-cloud models.
- Users can manage their application in many coding languages such as Java, Python, PHP, etc.
- Cost depend on usage but free in its lite mode.
- Services offered by IBM cloud are security, database, AI, IOT, Mobile, Private cloud & VMware.

5. Oracle Cloud

- This platform is offered by the Oracle corporation.
- Oracle has approximately 4,30,000 huge no. of clients around the world.
- The best thing about this cloud services provider is its [CHATBOT] option which can help customers 24/7 whenever they face difficulties.
- Payment a/c to the usage.
- Secure & better visibility to the user.
- Oracle offers IaaS, PaaS & SaaS in different enterprise to help in workload & securing data.

(*) Cloud deployment Model

(1.) Public Cloud (Single User)

- The public cloud makes it possible for anybody to access systems & services.
- It may be less secure as it is open to everyone.
- This form of cc is an excellent example of cloud hosting in which service providers supply services to a variety of customers.
- Eg:- Google App Engine

⇒ **Advantages**

1. No setup cost
2. Minimal Investmest (it is a pay per use service)
3. No maintenance (work is done by service provider)

⇒ **Disadvantages**

1. Less Secure
2. Low customization (accessed by many public)

② Private Cloud

- It's a one-on-one environment for a single user (customer)
- There is no need to share your h/w with anyone else.
- It is also called the internal cloud.

⇒ **Advantages**

1. Better Control
2. Data Security & Privacy
3. Supports Legacy Systems

⇒ **Disadvantages**

1. Less scalable
2. Costly (as they provide personalized facilities)

③ Hybrid Cloud

- It is a combination of public & private clouds.
- The main aim to combine these cloud is to create a unified, automated & well-managed computing environment.
- Mainly, a hybrid cloud is used in finance, healthcare & Universities.
- Best companies provider are Google, Cisco & Amazon.

⇒ Advantages

① Security (because critical activities are performed by the private)

② Flexible & secure
↳ because of public
↳ because of private

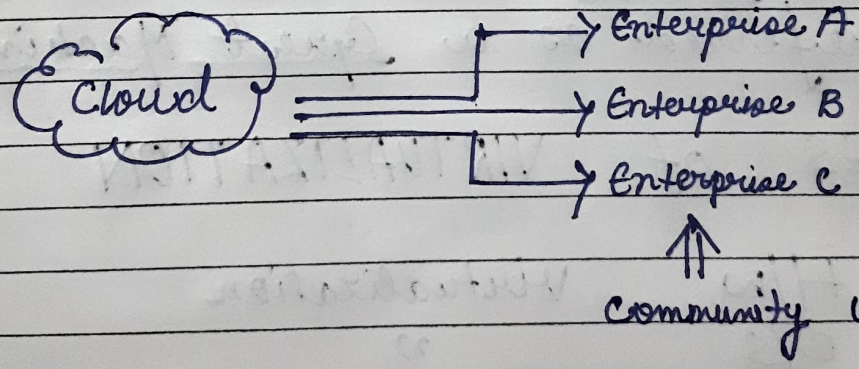
③ Risk Management (provides an excellent way for companies to manage risk)

⇒ Disadvantages

① Networking Issues (complex because of private & public cloud)
② Infrastructure Compatibility
③ Reliability.

④ Community Cloud

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



⇒ Advantages

① Security
② Cost effective
③ Flexible & Scalable

⇒ Disadvantages

① It is costly than the public cl
② Slow adoption to data.
③ Not a good choice for every organization.

Q. What is the role of virtualization in CC ?

Virtualization plays a very important role in the cloud computing technology, normally in the cloud computing, users share the data present in the clouds like application etc but actually with the help of virtualization users shares the Infrastructure.

→ Virtualization means running multiple O/S on a single machine but sharing all the H/W resources.

⇒ 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. H/W virtualization
2. O/S "
3. Server "
4. Storage "

Date:

Q. Case study related to cloud computing deployment.

The case study of Airbnb, a popular online marketplace for lodging & travel experiences.

→ Airbnb has adopted a hybrid cloud deployment model, which means they use a comb- of public & private cloud services.

→ Reasons for Hybrid cloud :-
1. Scalability
2. Data Privacy & Security
3. Cost optimization

→ Implementation :-
Airbnb's hybrid cloud approach involves using AWS for scalable resources during peak demand periods. This gives them the flexibility to balance the advantages of public & private clouds based on their specific needs.

→ Benefits :-
1. Cost Efficiency
2. Data Control
3. Scalability

→ Challenges :-

① Complexity (Managing both public & private can introduce complexity)

② Skill Sets (Teams need in managing both public & private cloud environments which may require additional training & resources)

→ Conclusion :-

Airbnb's hybrid cloud deployment model allows them to the benefits of both public & private cloud services, optimizing their infrastructure to meet the unique demands of their business while maintaining data security & cost efficiency.