

- ubiquitous : anywhere/everywhere

Cloud computing : As per NIST, cc is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (network, server, storage, app and services) that can be rapidly provisioned and released with minimal management effort or service provider intellectual.

→ The cloud model is composed of 5 essential characteristic, 3 service models & 4 deployment models.

## Types of Cloud Computing

- \* public
- \* private
- \* hybrid
- \* community

## Types of Cloud Deployment model

- IaaS: Infrastructure as a service of data centers.  
    ↳ - private
- PaaS: Platform as a service      Eg: OS  
    ↳ - private
- SaaS: Software as a service.      Eg: Gmail.

(Virtualization is the key enabler for cloud comp)

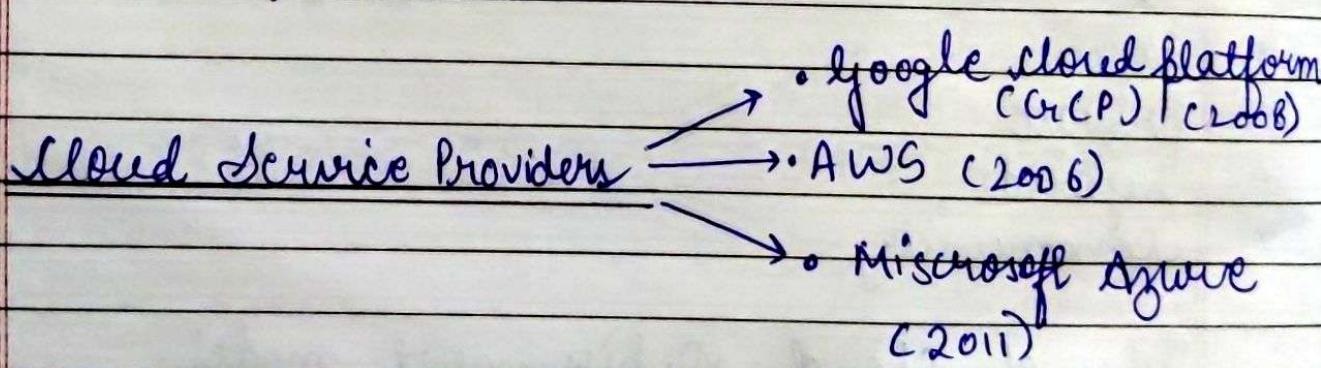


## Characteristics of Cloud Computing

- On Demand Self Service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

- API : Application programming interface
- BI : Business Intelligence

⇒ Cloud is basically a metaphor for internet i.e. it cannot be accessed or used without internet but it can be used in disrupted internet network.



- Rapid provisioning. → resources → user
- provisioning
- horizontal, emulated.
  - vertical
- [↑] come in system  
is required.

## # Advantages of CC.

- Ease of scalability .
- Reduced cost of hardware
- Convenient to use .
- Paying only for the resources the user required
- Availability of Utility software , API etc .
- Reduced cost of operation .
- Convenience / ease of utilization .
- Outsource IT management .
- Simplified management & upgrade .
- Low barrier to entry .
- Increased collaboration .
- Sustainability / carbon footprint reduction
- Automatic software update
- Backup & Disaster Recovery .
- Flexibility & mobility .

• ICT → Information  
& Communication  
Technology .

• IT → Information  
Technology .

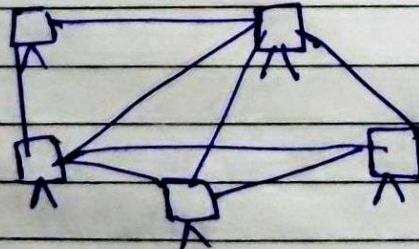
• LB → Load Balancer

## # Disadvantages .

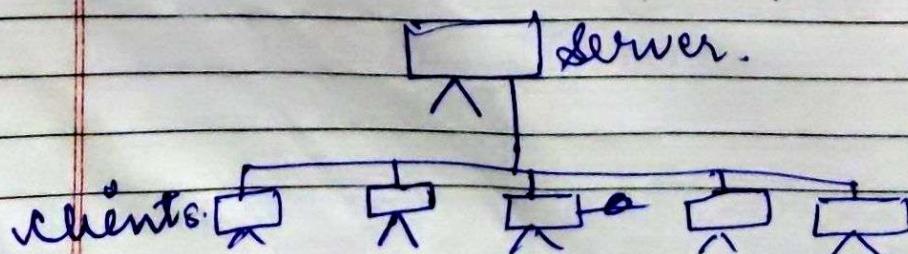
- Vendor lock-in .
- Network latency .
- Dependency on Internet .

## # History

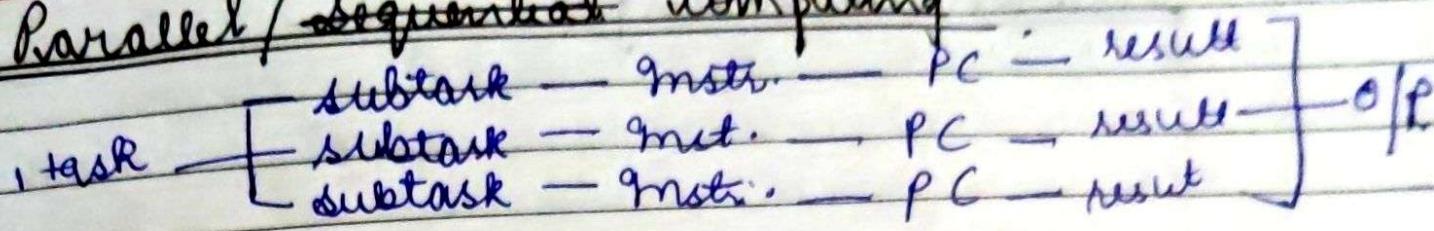
- Peer to peer computing : connecting different computers.  
(achieved peer to peer computing)  
(Arpanet) AWS for limit ↑ people
- 1950's — 1961 — 1969 — 1999 — 2002 — 2006 → E2S  
(super computer) (MIT) (John Melathy) (CUSA) ↓ (Salesforce) |  
AWS |- Rackspace & NASA came together  
OPENSTACK |- Peer to Peer computing. 2008  
(Tim Lee) (Google) |  
2009 |- (Azure) AWS → 2011 |- 2013 |



## 2. Client Server Computing.



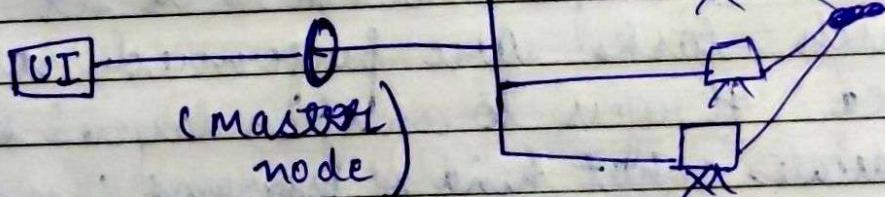
### 3. Parallel / sequential computing



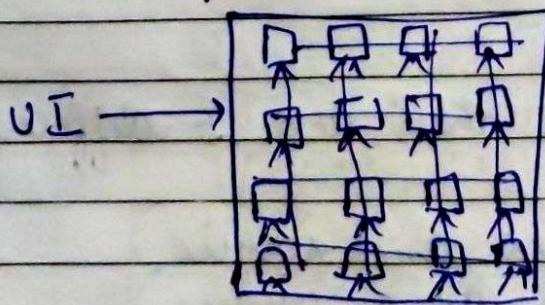
### Sequential computing

→ E2S (AWS) 1 task — instruction — PC — result

### 4. Distributed grid computing



### 5. Grid computing



(Should have similar resources)

(Homogeneous resources)

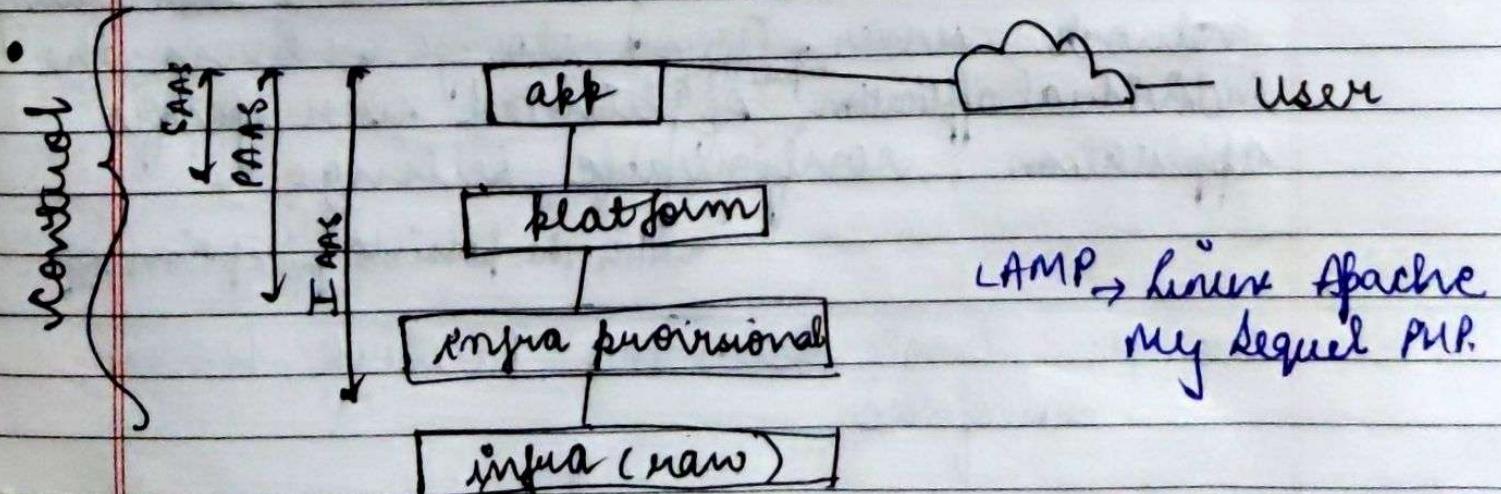
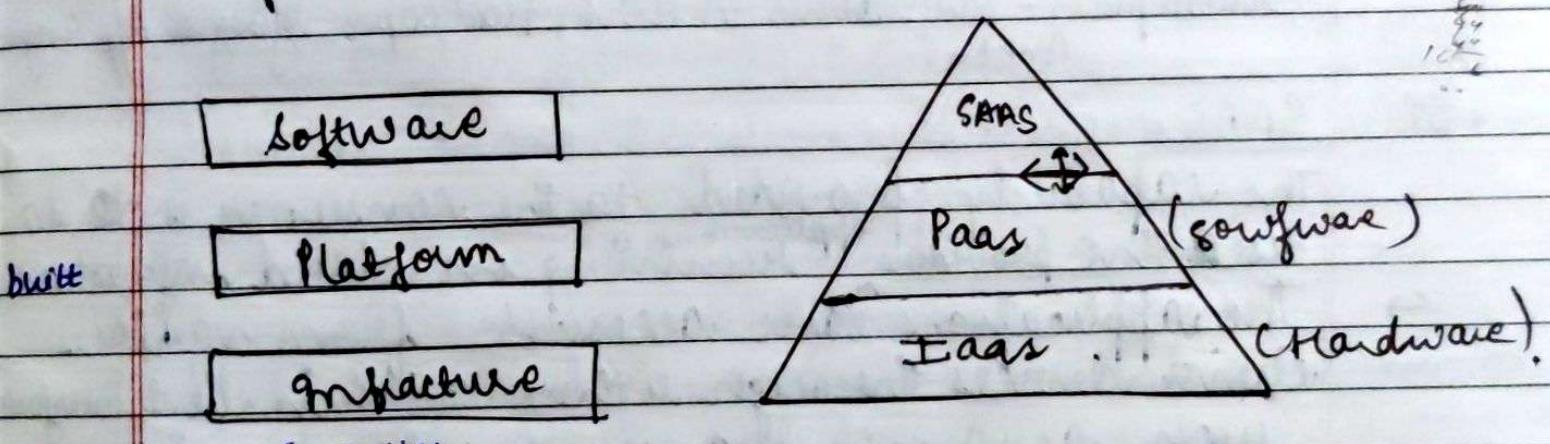
## 6. Cloud computing

- # model: A model is an informative representation of an object, person or system. These are representations that can aid in defining, analyzing & communicating a set of concepts.
- # architecture: It is a set of rules & methods that describe the functionality, organisation & implementation of computer systems.
- # framework: A framework is a set structure in which tasks are performed or completed. It refers to an often layered structure that indicates what kind of programs can or should be built & how they would connect to each other.
  - Cloud models
  - Service
  - deployment.
- Service model.  
As per as NIST there are 3 different models for cloud
  - IaaS ( Infrastructure as a service )
  - PaaS ( Platform as a service )
  - SaaS ( Software as a service ).

## IaaS

The capability provided to the consumer is to provision storage, processing, network & other fundamental computing resources where the consumer ~~is~~ is able to deploy & run arbitrary <sup>software</sup> which can execute operating system & applications.

The consumer does not manage or control the ~~underlined~~ <sup>inf</sup> cloud infrastructure but has control over OS, storage and deployed applications, & possibly limited control of selected networking components.



## • PaaS

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer related or acquired application created using programming languages, libraries, tools & services supported by the provider

- The consumer does not manage or control the underlying cloud infrastructure including network, server, OS or storage, but has control over the deployed application possibly configuration settings for the application hosting application environment

Example :- Windows Azure, Hadoop, Google App Engine, Ameka.

## • SaaS

The capability provided to the consumer is to use the providers <sup>applications</sup> running on cloud infrastructure.

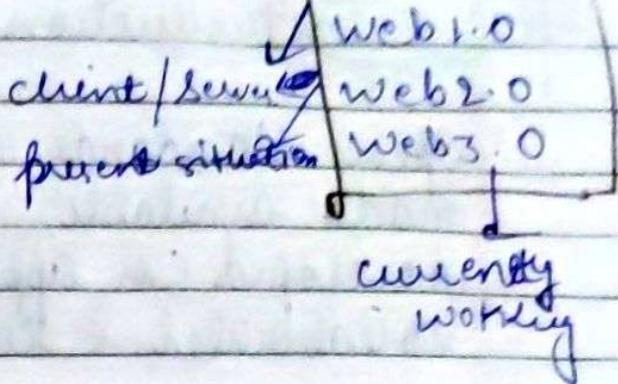
- The applications are accessible from various client devices through either a thin client interface such as a web browser or a program interface

- The consumer does not manage or control the underlying cloud infrastructure including network, server, OS or storage or even the individual application <sup>capabilities</sup> of limited user specific application, configurable settings

with the possible exception of

example:- Google Documents, Facebook, Flickr, Salesforce.

- AWS
- GCP
- Azure
- IBM Blue Mix
- Apache Cloud Stack
- Rackspace
- Open Cloud
- Open Nebula



- AWS :: Elastic Compute Cloud (EC2)
  - Simple Storage Service (S3)
- GCP : App Engine SDK
  - ↳ Blog / CMS : WordPress | CDN, Debugger
  - ↳ Database / Big Data : Firestore, elasticsearch, cassandra
  - ↳ Networking : RabbitMQ
  - ↳ Web Server : Nginx
  - ↳ Logging & Monitoring : Grafana, Prometheus
  - ↳ Analytics : Apache Spark
- Microsoft Azure : Microsoft Azure SQL database, Cosmos DB, Kubernetes, Azure Stream Analytics, Windows Azure.

## # Introduction to Open Standard

Open standards are those standards that are made available to the general public & are developed (or approved) & maintained via a collaborative & consensus driven process.

Open standards facilitates interoperability and data exchanged <sup>among</sup> different products or services which are intended for wide-spread adoption.

## # Elements belonging to open standards include :-

- Collaborative process (Voluntary, market driven, transparent consensus).
- Open for use to all interested parties.
- Quality & level level of detail.
- Publicly available.
- Maintenance & support.

## Closed standards

Cloud Service +  
Consumer

Hybrid Cloud  
Integration

Consumer  
In-house IT

CLOUD SERVICE

enabling 23rd party  
services, partners  
across all ecosystems.

common cloud management

Cloud  
service  
provider

Software-as-a-service  
Platform-as-a-service,  
Infrastructure-as-a-service

new, new,  
old, old

Security

- Identify & access management
- Security infrastructure against threat
- Security infrastructure, protect data & information
- Discover, categorize, extract
- Information systems acquisition, new & old
- Cloud governance

consumability

T N F R A S T R U C T U R E

Resiliency

Resiliency

- Resiliency Policy management
- Resiliency Policy management
- Resiliency Policy management
- Availability & continuity management
- Resiliency management

A. co to IBM

Honeypot

Futpo

## ↳ Data Security • EBS. (AWS).

### → Identity & access management.

I AM module. (WWW → what, why, who)

for eg:- Google security.

→ Physical security

→ Software security  
(handled by I AM)

### → Discover, categories, protect Data & Information Access

(compliance)

### → Cloud governance.

+  
to relay or  
follow.

## # AWS Elastic Block Store (EBS)

It is Amazon's block-level storage solution used with the EC<sub>2</sub> cloud service to store persistent data.

This means that data is kept on the AWS EBS servers even when the EC<sub>2</sub> instances are shut down.

### → (EC<sub>2</sub>) → Elastic Compute Cloud

EBS provides raw block-level storage that can be attached to EC<sub>2</sub> instances and is used by Amazon Relational Database Service.  
(IAAS).

- Cloud SQL: Platform as a Service (PaaS) service provided by GCP.

Used to manage Relational Database (can be used with SQL server & MySQL).

Features: Fully Managed, Integrated, Reliable, Easy to Migrate.

### WORKING:

- (I) Take service details (e.g. Type of DB)
- (II) Create a Cloud SQL instance as destination
- (III) Connects to the source instance.
- (IV) Test & promote the instance as primary Cloud SQL database.

→ A fully Managed database as a service based on MySQL PostgreSQL.

Cloud SQL makes it easy to setup, maintain, manage & administer RDBMS on cloud.

### features:

- (I) Option of using MySQL/PostgreSQL in the cloud
- (II) Backup & Patches are automatic.
- (III) Replica's are simple to create.
- (IV) Pay per use Model is adopted.
- (V) Option of scaling small & scaling up is added.
- (VI) Data is encrypted in transit & at rest.

- (vii) Firewall configuration for granting access.
- (viii) Horizontal scaling with read only replicas.
- (ix) Access control through native database security.
- (x) Familiar database with native tools.
- (xi) For existing on premises, Database migration.
- (xii) For common RDBMS work loads.

Q1. Why do we say Cloud SQL is an integrated service?  
we can access Cloud SQL instances from just about any application.  
easily connect from App engine, Compute engine,  
& your own workstations.

## Impact of Networks on Cloud

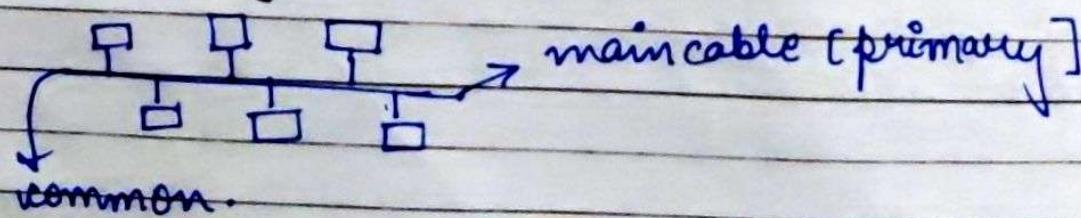
- Network: It's a connection of different computers.
- A computer network consists of two or more computers that are connected by cable (wired) or wifi (wireless), with the purpose of transmitting, exchanging or sharing data as well as resources.
- A computer network is primarily defined by the protocol it uses to communicate, the physical arrangement of its components, how it controls the traffic & the purpose of the networking.

### Topologies

- Different types of topologies.

- Star
- Ring
- Bus
- Mesh

### Bus topology

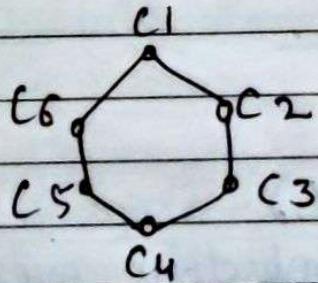


A bus network topology is the one where every network node is directly connected to the main

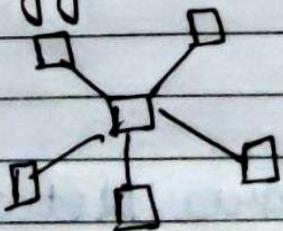
2. cable. If any of the node fail it will not affect another system. But if the main cable fail it will lead to the collapse in the network.

## 2. Ring topology:

Nodes are connected in a loop in such a way that every node has exactly two neighbours. Adjacent pairs are connected directly, non-adjacent pairs are connected indirectly through nodes. If any one node fails the entire network collapses.



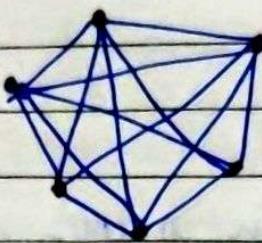
## 3. Star topology



In a star topology the computers are connected to a central hub. A multi point connection is present. A failure of central hub it leads to the collapse of the network whereas failure of a particular node, leads to the effect rest of the network does not.

#### 4. Mesh topology.

A mesh topology is defined by the overlapping connection b/w diff nodes.



- fault proof / resilient

Disadvantage : cost → sol : partial mesh topology

### # Types of Network.

#### 1. LAN

(Local Area Network.)

A Lan connects computers over a relatively short network allowing them to share data.

Typically LAN are privately owned & managed. Eg: A company has its own LAN (library)

#### 2. WLAN

(Wireless Local Area Network.)

It is just like LAN but the connections b/w devices are made wirelessly. (wi-fi)

#### 3. WAN

(Wide Area network)

A WAN connects computers over a geographically

wide area. (region to region & continent to continent). Eg: Internet

#### 4. MAN

(Metropolitan Area Network)

MAN are larger than LAN but smaller than WAN.

Eg:  $\frac{1}{\text{Crew}}$ , connected to other branches.  
LAN

#### 5. PAN

(Personal Area Network)

Eg:- To mobile hotspot.

#### 6. VAN      Private

(Virtual Area Network)

Eg: (forms a tunnel).

Access data withholding, secure

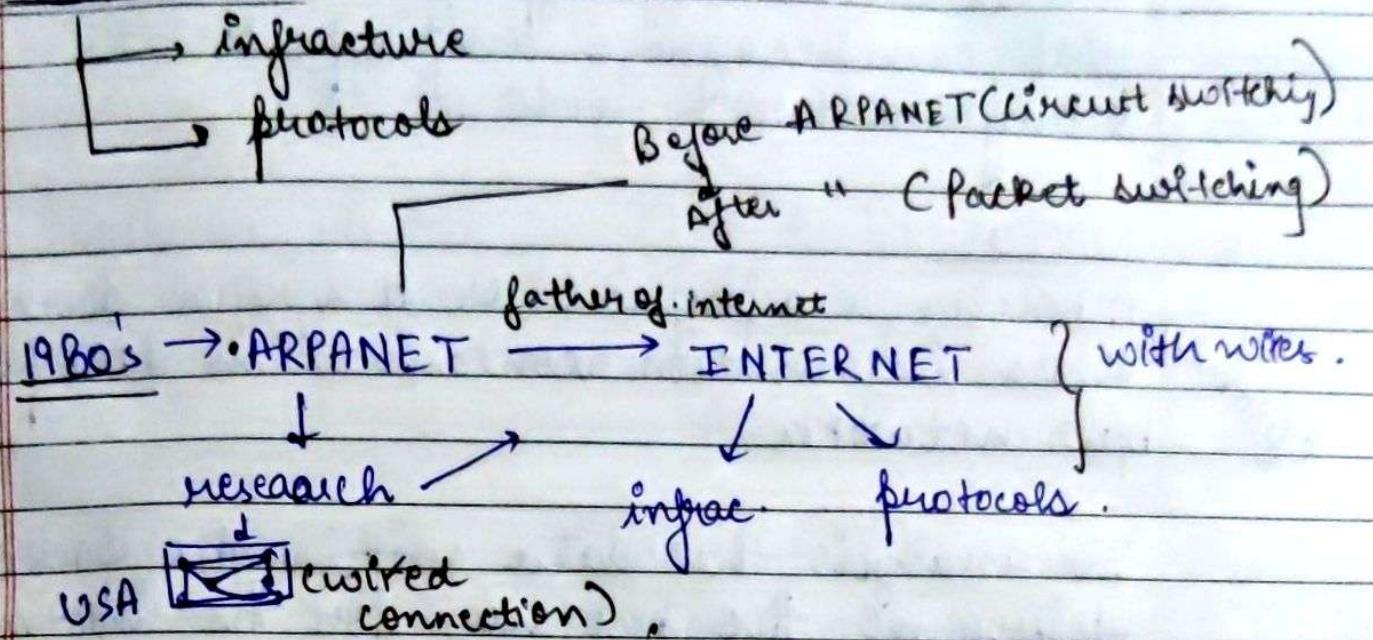
(changes IP) → for e.g. Talking to someone from  
other continent.

→ A VPN is a secure point to point connection b/w two network endpoints. A VPN establishes an encrypted channel that keeps a user's identity and access credentials, as well as any data transferred, inaccessible to hackers.

30/9/2021

Date \_\_\_\_\_  
Page \_\_\_\_\_

## Internet



## IP ADDRESS

An IP is a unique number which is assigned to every device connected to a network that uses INTERNET protocols (IP) for communication. It includes a header that comprises of the address of the sending device & the IP address of the destination device.

## NODE

A node is a connection point inside a network that can receive, send, create or store data. Each node requires you to provide some kind of identification in order to receive access to the network.

In most of the cases this identification is provided by an IP address.

A few eg. of nodes can include :- computers, printers, modems, bridges & switches.

A node can be any type of network device that can recognize any type of any network node.

- Router

(global)

A Router is a physical or a virtual device that sends information contained in data packets b/w networks.

It analyzes the data within the packets to determine the best way for the information to reach its ultimate destination.

- Switch

(local)

A switch is a device that connects other devices & manages node to node communication within a network, insuring that the data packets reach the ultimate destination.

While a router sends information b/w networks, a switch sends information b/w nodes in a single network.

→ When discussing about network, switching refers to how data is transferred b/w devices in a network.

Two main types of switching include:-  
→ Circuit switching  
→ Packet switching.

- Port

A port identifies a specific connection b/w network devices. & each port is identified by a number.

Computer / device use port number to determine which application, service, process should receive specific messages.

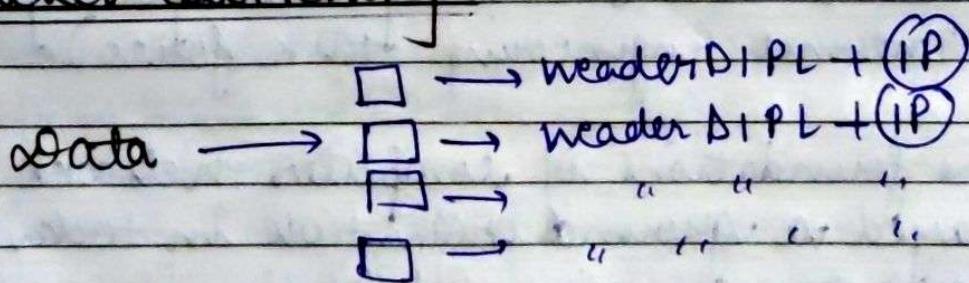
## I

- ISPs / NSPs provides the infrastructure that allows the transmission of packets of data/information over the internet.

Computer Networks are used to connect nodes, like computer, router, node using fiber optics or wireless signals.

# Networks works on the foundation of infrastructure & protocols which define how the communication will be established.

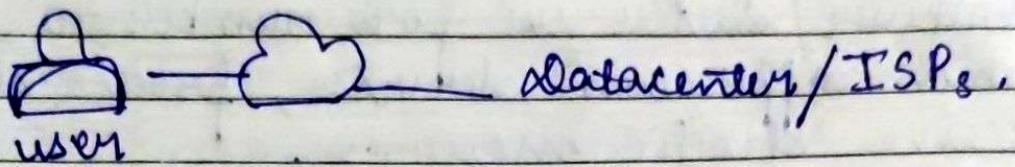
## # Packet switching



IMP's : Interface Message process.

Acc. to Cloud.

(Since we need to identify network)  
Virtual Router)



- ARPANET is considered as the fathers of today's internet. It was primarily used to connect mainframes belonging to universities & research facilities across USA.  
Before ARPANET, circuit switching was used by ARPANET pioneered the concept of packet switches. Data was divided into packets where each packet had a unique header (NCP's header) → this later became the foundation for TCP/IP protocol.
- In 1985 TCP IP was standardised & these protocols are currently managed by IETF (Internet Engineering Task force).
- The foundations of computer network have played a ground breaking role in today's cloud computing applications. All of the physical device infrastructure can be virtually created & managed.  
This opens a broad pathway for possible applications.

# Some of the networking services provided by Cloud Service Providers.

- AWS

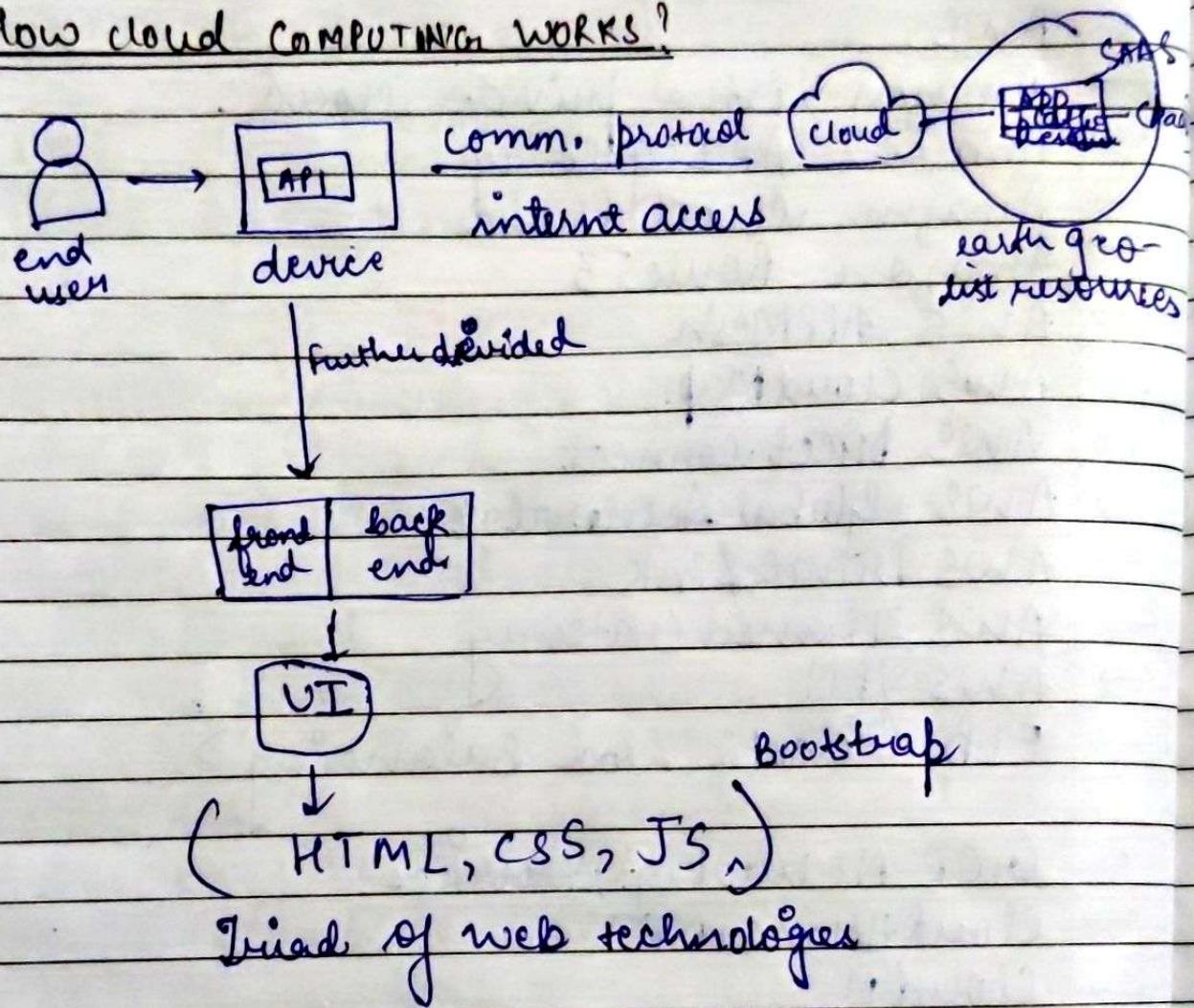
- ↪ Amazon Virtual private cloud .
- ↪ Amazon's API gateways
- ↪ Amazon Cloud Front
- ↪ Amazon Route53
- ↪ AWS APP Mesh
- ↪ AWS Cloud Map.
- ↪ AWS Direct Connect
- ↪ AWS Global Accelerator
- ↪ AWS PrivateLink .
- ↪ AWS Transit Gateway
- ↪ AWS VPN
- ↪ ELB (Elastic Load Balancing) ↴

- GCP Networking Services

- ↪ Cloud Armor NAT
- ↪ Cloud M.
- ↪ Cloud CDN
- ↪ Cloud DNS
- ↪ Cloud Load balancing
- ↪ Network Service Mesh
- ↪ Hybrid connectivity
- ↪ Network Telemetry
- ↪ Network Connectivity Center
- ↪ Network
- ↪ Network Intelligence Center .

## # Web Development &amp; UI with/in cloud computing

→ How cloud computing works?



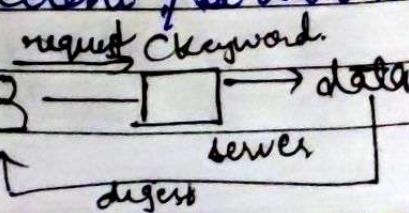
## # 1990's → web / internet

- WWW use cases:

→ 1990's - 2003<sub>ts</sub>  
(web 1.0)

Primary use case was reading.

(accessing / reading) → client / server model.



federated authentication

→ 2005 - 2015 / 18

(Web 2.0)

Reading & writing  
cloud, data etc, are available).  
(Hoggs)

- Dropbox.
- synchronization.
- in one device
- uses AWS S3.

→ 2018 - 2020 onwards. (Web 3.0)

Intelligent web. / (Cognitive Web).

- (premium)
- ai

- Web 1.0 : is considered as the first stage in the evolution of web dev. During the early phase of web dev, the info / data were serviced to the end users via a master / server. The end users are termed as client & the master is termed as server. The server held a collection of web pages. whenever the client requested, the info was served via server. The primary relationship b/w the client & the server was read-only.

T

- Web 2.0 : In the 2<sup>nd</sup> stage of web dev, the read-only mode was evolved into "read-write mode". The end users in web 2.0 became the source of data this led to the emergence of industry giants based on social media / healthcare / education & other areas .

In the last decade a growing adoption of internet by end users towards the web is observed leading to a growing interest - business market opportunities .

UI → user interface → GUI

UX → user experience → CLT

Data  
Page

- Web 3.0: Currently we are amidst the web 3.0 stage of evolution. The emerging app. such as targeted user marketing, targeted grouping of individuals based on interests, dark web financial app, etc.

## # Web 1.0 characteristics

1. static pages
2. content is served via client server architecture (server file system).
3. Pages are built using CGI (common gateway interface or server side includes (SSI)).
4. frames, tables, tags, were used to position & fetch the data from the server.

## # CLI / GUI

web dev. & UI go hand in hand. The term UI refers to the node of communication b/w the user & the computational b/w device. UI's can be accessed in 2 nodes in cloud computing CLI & GUI.

The term user experience refers to the quality of experience witnessed by the end user.

## → Difference b/w UI & UX

The difference b/w User Interface & User Experience is that UI refers to the aesthetic elements by which people interact with a product, while UX is about the experience a user has with a product or service. So UI focuses on visual

elements such as typography, colors, menu bars while UX focuses on the user & their journey through the product.

- User experience is determined by how easy or difficult it is to interact with the user interface elements that UI designers have created.

## # Web 2.0

It refers to the world wide websites which specifically highlights user generated content, usability & interoperability for end users.

Web 2.0 is also called as participatory social web. The web browser technology are used in web 2.0. It also includes AJAX & Java script frameworks.

## # Five Major features of Web 2.0

1. Free sorting of information, retrieval as well as for classification of applications.
2. Dynamic content i.e. response to user input.
3. Developed APIs to allow & self usage and complex analysis on data.
4. Web access needs a wide variety of end users as compared to the traditional internet users.

- Web 2.0 Applications tend to interact much more to the end user. The end user is not only the user of the app. but also the contributor of the app.

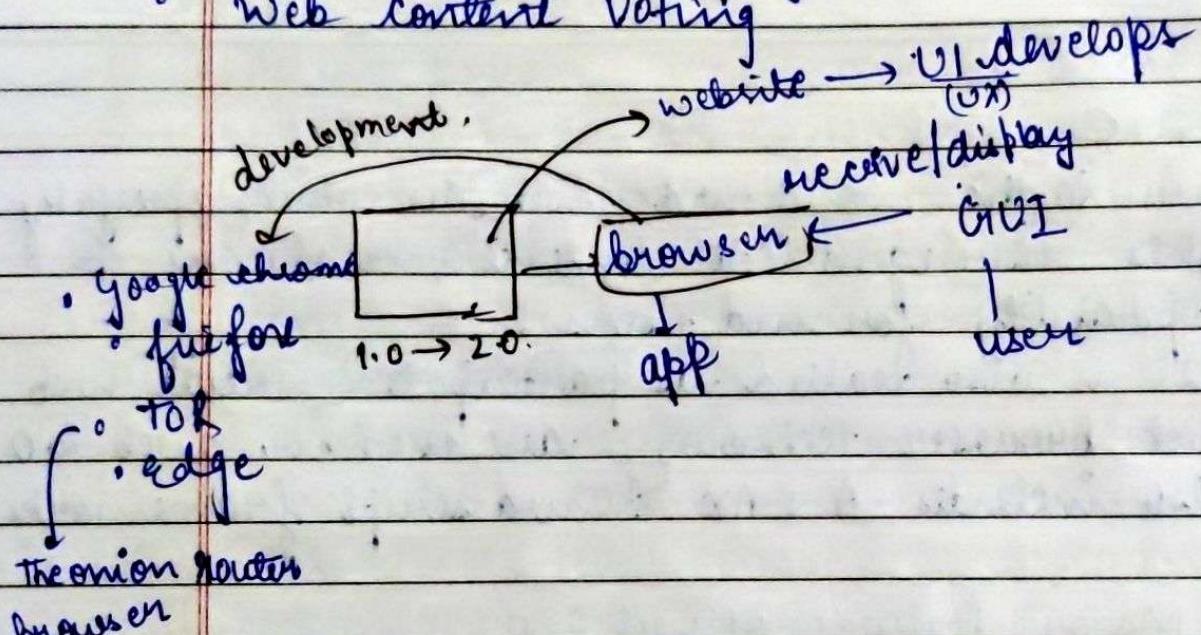
information

• Semantic Web week.



# Some Web 2.0 websites include.

- Blogging websites
- Broadcasts,
- Social Networking
- RSS feeds
- Social Media
- Financial add campaign
- Web content Voting



# Web 3.0

It is called as a semantic web. Web 3.0 offers artificially intelligent machine conception as a pose to the ~~human~~ newer understanding present in. Web 2.0.

# Features :

- Semantic web : It improves the web technologies in
- It demand to create, share & connect the content through search & analysis based on the capability to comprehend the meaning of word rather than keyword/number.

- Artificial Intelligence : AI combined with NLP (Natural Language Processing) can be used to distinguish information like humans to produce faster & more relevant results.
- 3D graphics & (3D museums, 3D Music, Computer games, E-commerce, geospatial data).
- Connectivity (2G, 3G, 4G, 5G, 6G).
- Ubiquity (everywhere present).

# Difference b/w Web 1.0, 2.0 & 3.0

Web 1.0

Web 2.0

Web 3.0

• Mostly read only	• Read & write (heavy)	• Portable & personal
• Company focus	• Community focus	• Individual focus
• Homepages	• Blogs / Wiki's	• Live Stream.
• Content is owned	• Content is shared	• Content is consolidated
• Web forms	• Web application	• Smart app
• Directories	• Tagging	• User behaviour
• Page views	• Cost per click	• User engagement
• Banner advertisements	• Interactive adv.	• Behavioural adv.

- HTML

- XML, RSS

- RDF's

## # UI & UX

UI is anything a user may interact with to use a digital product or service. This includes sound, lights & other devices. everything such as

1970's → Command Line Interface

1980's → first GUI was developed by Xerox

1990's → Apple Computer released the Macintosh personal computer with a point & click mouse

This shift in technology meant that anyone can use a computer as no coding was required.

This marks the <sup>onset</sup> concept of personal computer revolution.



The need of UI designer revolutionised the GUI.

UI designers worked not just on computer interfaces but also on mobile phones, AR / VR (Augmented Reality / Virtual Reality), invisible / screenless interfaces (Zero UI) including voice, gesture & light.

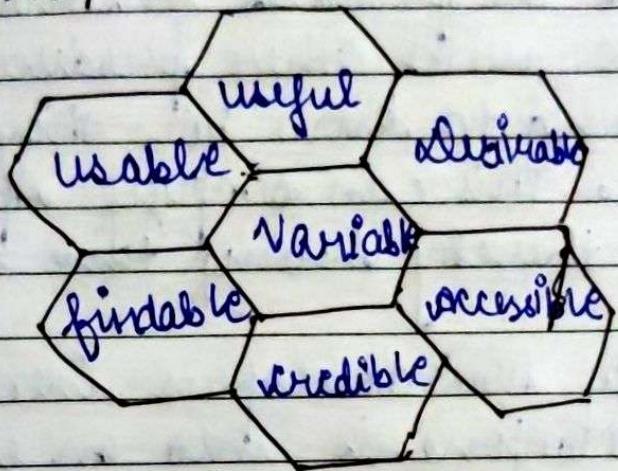
- Cognitive scientists, Don Norman is credited with coining the term user experience in 1990's

## USER EXPERIENCE :

- User experience encompasses all with aspects of the end user interaction with the company's services & the products.

API

### • USABILITY CONE BY PETER MORE



- UX designers work closely with UI designers, UX researchers, marketers and product teams to understand their users through research & experiments. They use the insights gained to continuously iterate to improve experiences based on both qualitative & quantitative user research.

→ The figure demonstrate usability cone by peter Moreville.

- RESTful API (representational state transfer)
- Simple object access protocol.

## # API

API stands for application programming interface which is set of definitions and protocols for building & integrating application software.

API's allows the products or services to communicate with other products & services without having to know how they are implemented. This can simplify application development thereby saving time & money.

API's simplify how developers integrate new applications components into an existing architecture.

In short API's allows to you to open access to your resources by maintaining security & control.

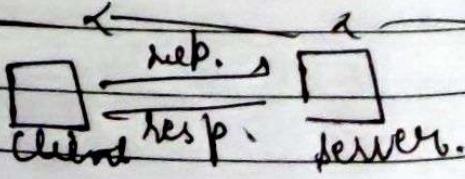
## # REST for API's.

(Representational State Transfer)

Architectural style

- Rest is a set of architectural constraints (not a protocol or standard).
- API developers can implement Rest in many diff ways.

Create  
Read  
Update  
Delete



- Coupling & Cohesion



- Virtualization is the key enabler for cloud computing.
- Concept of Virtualization was brought by paper L. Goldberg in 1968.