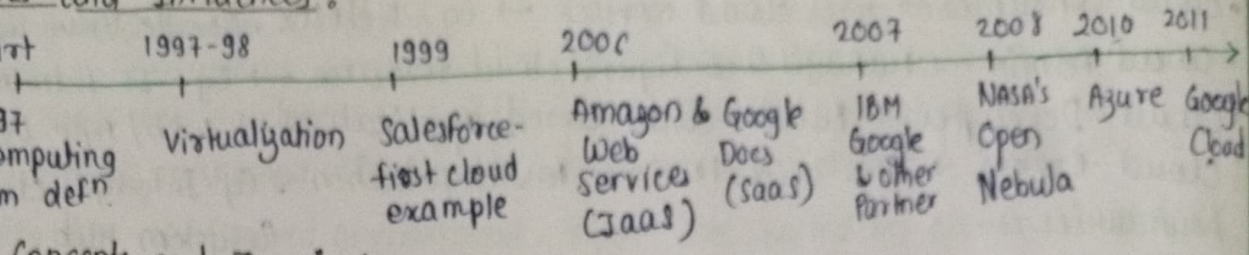
CC UNIT 1 FUNDAMENTALS OF CLOUD COMPUTING

Origins and Influences :-



Basic Concepts and Terminology :-

What is cloud computing? It is the delivery of computer services (like servers, storage, db, networking, etc) over the internet. Instead of maintaining physical hlw, users can access these services on-demand. Eg: Google Drive, Microsoft OneDrive, AWS, Netflix (runs on AWS)

Goals of CC?
- Quick Time to Value → consume resources.
- Reduced cost → pay for what you use.
- Infinite Scaling → assume resources is ∞ available.
- Maximum Availability → all time available & accessible.
- Rapid Innovation → new services & high performance by "updating".

Benefits :-

Advantages of CC:
- Cost effective → no need of expensive hlw.
- Scalability → increase / decrease resources as needed.
- Security → offers strong security measures.
- Automatic updates → updates automatically for better performance.
- Accessibility → access from anywhere with the internet.
- Low maintainance required → auto updates available.
- Pay for what you use

Characteristics of CC:
- On-demand self-service → can access cloud anytime without human interaction.
- Broad Access Network → available over the Internet from any device.
- Resource Pooling → multiple users share same cloud resources.
- Rapid Elasticity → Resource scale up / down as needed.
- Measured service → Pay only for what you use.

Risks and challenges :-

- Security Risks → hacking & malware threats → Soln: encryption & multi-factor authentication
- Downtime & Outrages → system fail → Soln: backup providers.
- Vendor Lock-in → hard to switch cloud providers → Soln: use multi-cloud strategies.
- Cost Management → Unexpected bills due to overuse → Soln: monitor usage & enable auto-scaling.
- Requires high speed of network connectivity.
- Lack of knowledge & Expertise.
- Performance challenges.

Roles & Boundaries :-

Roles :- Cloud Provider → provides cloud service (AWS, Azure) → Eg. AWS, Google Cloud.
- Cloud Consumer → uses cloud services → Eg. Netflix, Google Drive users.
- Cloud Admin → Manages & configures cloud resource → Eg. IT Administrator
- Cloud Developer → Builds cloud-based applications → Web/App Developer
- Cloud Broker → The middleman for negotiation → Eg. Infosys cloud Ecosystem Hub.

Boundaries :-

Organizational → Internal cloud policies & control → Eg. IT team managing cloud access.
Cloud provider → What the provider vs user controls → Eg AWS secure servers, user secures data.
Trust → who/what is trusted → Eg. Encrypting data before cloud upload.
Juridictional → legal boundaries → Eg. GDPR restricts EU data transfer

Cloud Delivery Models :- < Cloud service models → IaaS, Paas, SaaS
Cloud deployment models → Public, Private, Community, Hybrid.

Cloud Service models :-

Infrastructure as a Service (IaaS) :-
- Provides virtualized computing resource over the internet. Includes servers, storage & networking, allowing users to install & manage their own OS, db & appln. OR.
Provides basic compute resources such as VM, storage & networking over the internet on a pay-as-you-go basis.
- Users get access ~~on~~ to on-demand computing power without owning physical h/w.
- scalability is max.
- Advantages : Cost-Effective → no need to invest on h/w.
Scalable → Resources can be increased/decreased on demand.
Flexible → supports different os, software & applications.
Backups → Data is stored across multiple locations.
- Disadvantages : Costly → cost is high
Requires management
Security concerns.
- Application : Hosting websites & applications, Data storage & backup, Running VM's.
- Examples : AWS EC2, Google Compute Engine, MS Azure VM's.
- User manages → OS, apps & data
Provider manages → h/w & virtulization.
- Customization → High.
- Used By → organizations
Used for → Building data centre

Platform as a Service (PaaS):-

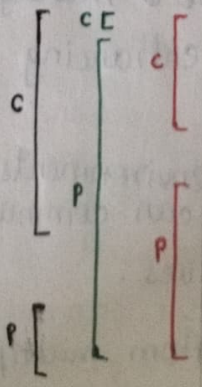
- Provides software appl^n over internet, eliminating need for to. Offers a platform with runtime environments, db, & tools for developers to build appl^n without managing infrastructure.
- Provides pre-configured environment for developers; incl OS, middleware & tools.
  The cloud provider manages everything except application code.
- Advantages :-
  - faster deployment process.
  - No need to managing infrastructure.
  - Automatic scaling based on traffic.
  - Maximizes availability
  - Low cost of development.
- Disadvantages :-
  - Limited customization.
  - Vendor lock-in is issue.
  - Security concerns as data is stored with provider.
- Applications :- Developing & deploying web apps API management. Db & Analytics solutions.
- Examples :- Google App Engine, AWS Elastic Beanstalk, MS Azure App service
- User Manages → apps
  Provider manages → OS, runtime, infrastructure
- Customization - Moderate
- Used By → Developers
  Used for → Application Development

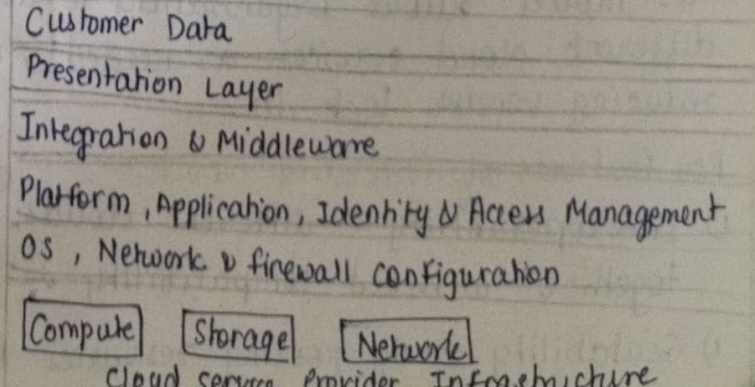
Software as a Service (SaaS):-

- Provides software application over internet, eliminating need for local (administrator) installation & maintainance. User access application via web browsers or dedicated clients.
- Appl^n are hosted by cloud provider & access via web browser. Users don't need to worry about maintainance, updates or security.
- Advantages :-
  - ~~faster development~~ No installation required.
  - Cost-effective → no maintainance.
  - Access from anywhere, anytime.
  - Low cost.
  - Immediate consumption.
- Disadvantages :-
  - Internet dependent
  - less control over s/w features
  - Data privacy concerns.
- Applications :- Email & communication tools, office productivity apps, Cloud storage.
- Example :- Gmail, Google Drive, MS 365, Zoom.
- User manages → nothing, just access s/w
  Provider manages → everything
- Customization → Low
- Used By → End Users
  Used for → Application consumption

- Iaas
- Saas
- Paas

C → customer's responsibility
P → Producer's responsibility





Cloud Deployment Models :—

Public Cloud
- Services are hosted & managed by third-party providers & made available to the public over the internet.
- Ownership → Third-party (AWS, MS, Google)
- Accessable to all.
- Cost is low
- Security is low
- Customization is limited
- Scalability → High
- Best for: Startups, individuals, general business.
- Adv: Cost-effective, Easy to scale, No maintainance.
  Disadv: Security risks, less control over data.
- Eg: AWS, Google cloud, MS Azure.

Private Cloud
- Cloud infrastructure is dedicated to a single organization, offering better security and control.
- Ownership → Single Organization
- Access Restricted to one organization.
- Cost is high
- Security is High
- Customization is highly
- Medium (scale)
- Best for large enterprises, banks, govt. agencies.
- Adv: High security, Customizable, Better performance
  Disadv:- Expensive, set up & maintain, Limited scalability
- Eg: VMware, OpenStack, MS Azure Stack.

Hybrid Cloud
A combination of public & private clouds that allows data & appln to move betn them.
- Ownership → Combination of both
- mix of public & private.
- Cost is medium
- Security is medium
- Customization depends on usage.
- High (scale)
- Business needing both flexibility & security
- Adv:- Balances cost & security, Backup & Recovery
  Disadv:- complex to manage, Requires strong, network connection.
- Eg: AWS Outpost, Google Anthos, Azure Hybrid Cloud.

Community Cloud
A cloud shared by multiple organizations with similar requirements, such as healthcare or government institutions
- Ownership - multiple organization with shared interests.
- Access restricted to a specific community.
- Cost is medium.
- security is medium
- Customization is medium.
- Medium (scale)
- Organization in same industry (healthcare, education)
- Adv:- cost-sharing, collaboration
  Disadv:- Limited Scalability, Management Issues.
- Eg: Govt cloud services, healthcare data-sharing platforms.

Federated Cloud / Intercloud :—

Cloud federation :- refers to integration of multiple cloud computing environments from different providers to create a unified, seamless computing environment.

- This model allows organizations to use & manage resources across different cloud services as needed, enhancing flexibility & reducing vendor lock-in.

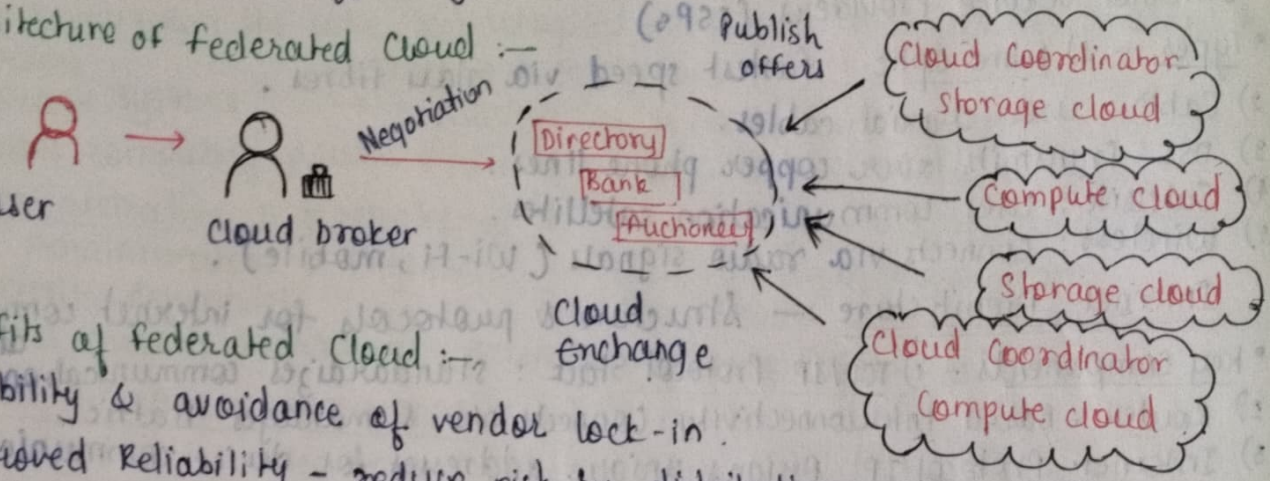
Key features of federated Cloud :— environments

1) Interoperability → different clouds can communicate & work together without compatibility issues.
2) Scalability → By pooling resources from multiple providers

3) Redundancy & Resilience → Distributes resource across multiple providers, minimize risk of downtime due to failures in a single cloud environment.

4) Resource optimization → allows optimal use of resources by balancing workloads across different cloud providers, leading to better performance & cost-efficiency.

Architecture of federated cloud :-

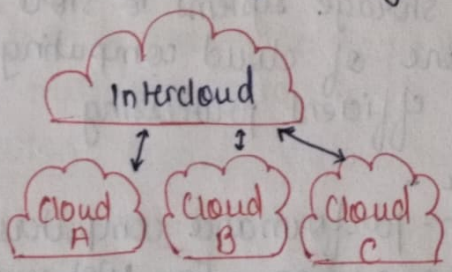


Benefits of federated cloud :-

- Flexibility & avoidance of vendor lock-in.
- Improved Reliability - reduce risk by distributing across multiple providers
- Enhanced Security & compilance - Healthcare Banking

Intercloud :-

Concept of 'cloud federation', emphasizing the interconnection betn different cloud environments.
Used in scenerios where you want to balance load betn 2 providers instead of concentrating everything on one cloud provider.



Pg 1

Cloud Hosting :- To host websites, apps & database
↳ providing service to

Advantages :- Cost saving
Scalable
Flexible
High Performance & Speed
Automatic updates
Security & Backups