

→ Definition :- gt

(i) Cloud :- cloud refers to servers that are accessed over the internet located remotely.

(ii) computing :- any activity that uses computer to manage process and communication information.

Cloud Computing :- gt is the on-demand availability of computer system resources and computing power without direct device active management by the user.

in short :- we store, manage & process data on remote server.

→ Service Provider :- (1) Google cloud.

(2) AWS (Amazon web services)

(3) Microsoft

(4) IBM cloud.

(5) Alibaba cloud etc.

→ Type of cloud :- (1) Public → Access to all

(2) Private. → Services accessible within an org.

(3) Hybrid. → Public + Private cloud feature

(4) Community :- Services accessible by a group of organization.

→ Properties / Characteristics of Cloud Computing :-

{ (1) On-demand Services.

(4) Rapid Elasticity

(2) Broad Network Availability. (5) measured Service.

(3) Resource Pooling

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→ Advantages of Cloud Computing:-

- Cost reduction.
- Security.
- Wide ~~secre~~ Reach.
- Reliability.
- Device independent.

Disadvantage:-

- N/W connection dependency - Internet mobile
- Lack of Support
- - Unable to access your Date before a month
- may not get all the feature - mean not all cloud service providers are same

→ Architecture of Cloud Computing:-

→ Evolution of Cloud Computing:-

- ① → 1950
Distributed computing
- ② → mainframe computing
- ③ → cluster Computing
- ④ → Grid Computing
- ⑤ → 2007
Cloud Computing

① Distributed Computing:-

Splitting of a business into different Sub-Services and distributing them on different w/c.i

Problem:- Requires all the Systems to be present at a same location.

(2) Mainframe Computing:- Highly Powerful and reliable machines designed to process very large amount of data quickly.

Problem:- Very Expensive

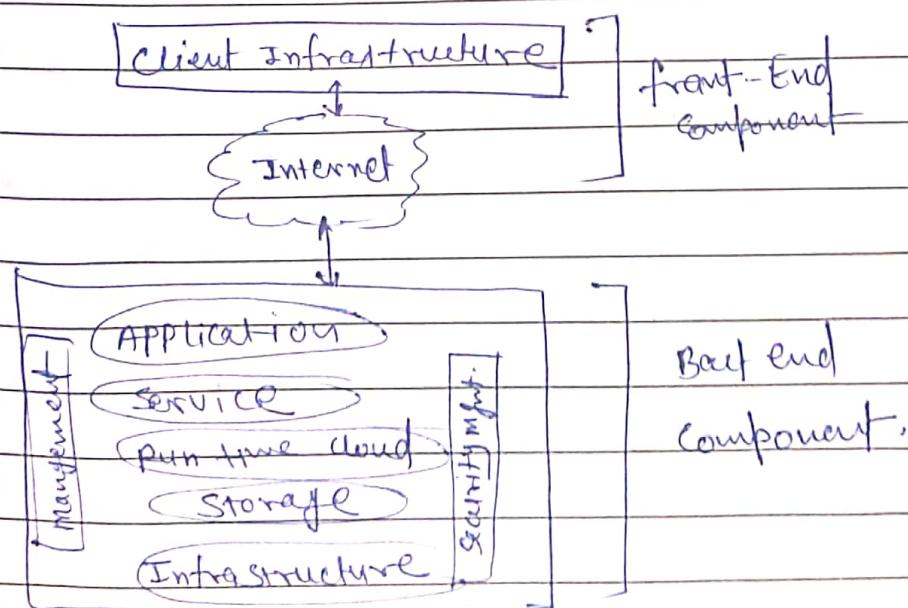
(3) Cluster Computing:- Multiple servers are grouped together to achieve the same business benefit and regarded as one computer.

Problem:- Problem related to geographical location still persists.

(4) Grid Computing:- Different systems are placed at entirely different location and connected by internet.

Cloud Computing refers to the successor of Grid Computing.

→ Components of Cloud Computing:-



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Front End :- It is used by the clients directly which consist of client side interface and application that are required to access the cloud computing platform. It includes - web server (which include chrome, firefox etc) and other device.

Back-End :- It is used by the service providers. It manages all the resources that are required to provide cloud computing service. It consists of huge amount of data, storage, security mechanism, services, traffic deployment model, application, traffic control mechanism, etc.

Deployment model of Cloud Computing :-

- (1) Public cloud model
- (2) Private cloud
- (3) Hybrid "
- (4) Community "

① Advantage and disadvantage of Deployment models —

(A) Public cloud model :-

Adv. :- ① Cost effective. DisAdv. :- ① less customization.

② location independent

② low security.

③ flexibility

(B) Private cloud model :-

Adv. :- ① more control /

② improve performance

③ Security & Privacy.

DisAdv. :- ① High cost

② Restricted area of operation

③ Limited scalability.

④ skilled people

(C) Hybrid-cloud model :-

Adv. :- ① flexible & secure

② cost effective.

③ security.

DisAdv. :- ① N/w issue,

② infrastructure compatibility.

(D) Community cloud model :-

Adv. - ① flexible and scalable

② secure.

③ sharable infrastructure

DisAdv. :- ① Sharing *

resources within organization

is little difficult.

② fixed amount of resources

resources are shared b/w members which reduce community mechanism.

Performance.

Service models of cloud-computing :-

- ① SaaS (Software as a Service)
- ② PaaS (Platform as a Service)
- ③ IaaS (Infrastructure as a Service)

① SaaS:- It is a software distribution model in which a third party service provider hosts the applications and make them available to the customer over the internet.
- Service is purchased on subscription basis.

② PaaS:- It is a cloud computing model in which cloud vendor provides development with a platform for building apps.

③ IaaS:- It is a cloud computing model that provides virtualized computing resources over the internet.

→ ① SaaS:- Resources managed - Business applications / web services etc.
Ex:- E-mail, Google drive, Facebook, YouTube etc.

② PaaS:- Resources managed:- development tools & data base, S/W framework etc.
Ex:- Microsoft Azure, Google App Engine etc.

③ IaaS:- Resources managed:- Virtual machine, server storage etc.
Ex:- AWS (Amazon Web Services).

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→ Future Scope of cloud computing :-

- (1) Better cloud Services
- (2) Security
- (3) modular SW development
- (4) market Growth.
- (5) Virtualization.

→ Issues Related to Cloud Computing:-

↳ Data issues → Data loss, Hacked.

Security issues

Energy related issues

Performance issues

Fault tolerance.

- Challenges / Issues :-
- ① Data loss. ② Hacked interface
 - ③ Data Breach (Hacking of data). MPT
 - ④ Vendor-lock-in - ⑤ Denial of Service (DOS) -
(Attack - flooding of service with so much traffic)
 - ⑥ Account Hijacking ⑦ misconfiguration.
 - ⑧ Accidental exposure of credential
 - ⑨ Cyber security attack. ⑩ Data privacy & Confidentiality.

→ Evaluation of the cloud's Business Impact and Economic.

- ① fast communication.
- ② Ease of Access.
- ③ Secure Collaboration.

Some other Important Point :-

- ① flexibility.
- ② Dedicated Employees (focused on job, Profit for "Business")
- ③ Cloud Services help in saving time money and also travelling.
- ④ Reduce IT Cost

IOT :- Internet of things is a technology that connects the things (ie. device) to the internet over wired or wireless connections.

Here the things refers to every smart device of today's age like - Computer, Smartphone, home appliances and vehicles etc.

- IOT allows people and things to be connected anywhere, any place with anything and anyone over any path/Network
- IOT is a phenomenon that connects the things to the internet over wired or wireless connection.

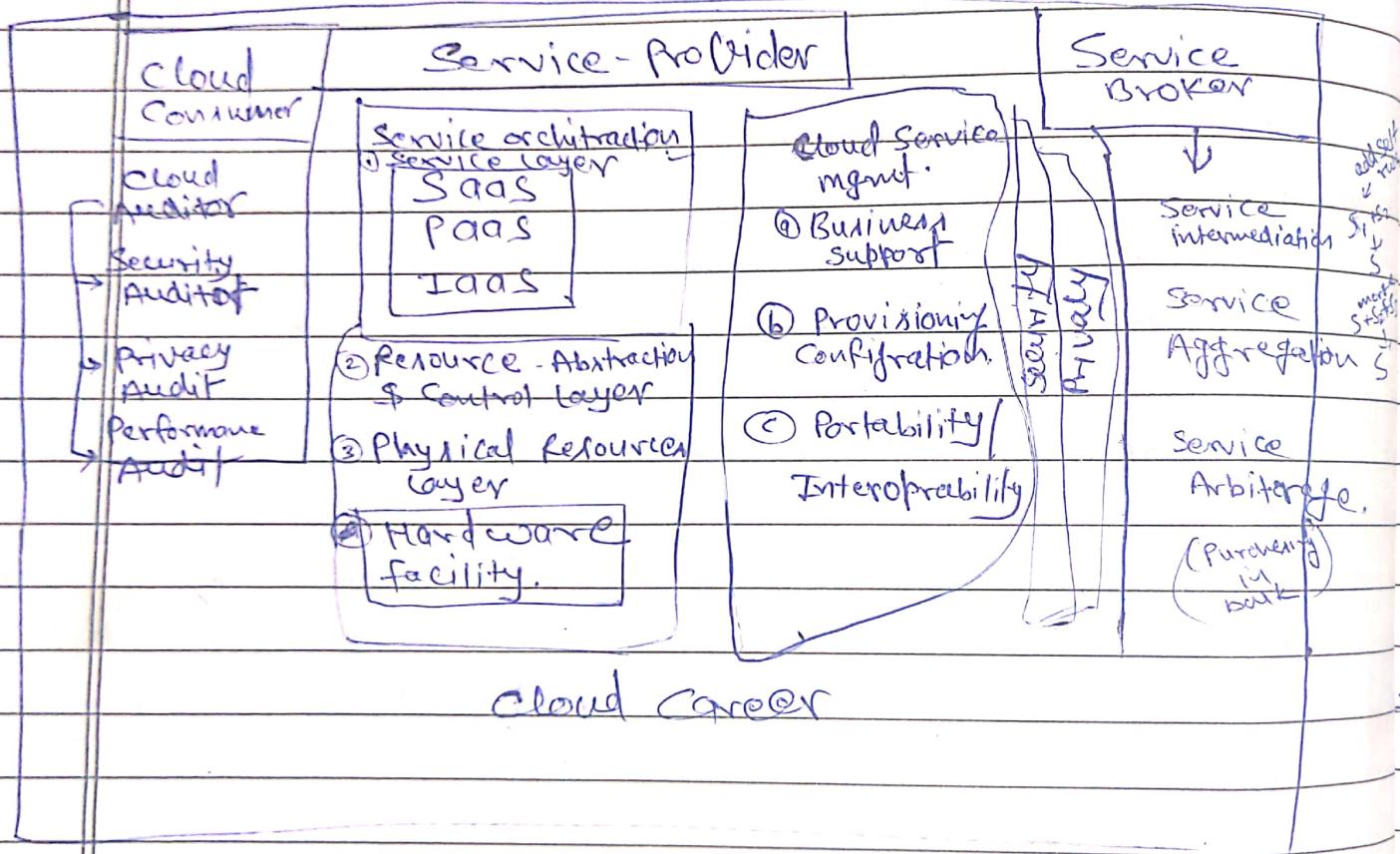
Enabling Technology for IOT :-

- ① RFID (Radio frequency identification)
- ② Sensors
- ③ Smart technology.
- ④ Software
- ⑤ Network connectivity.

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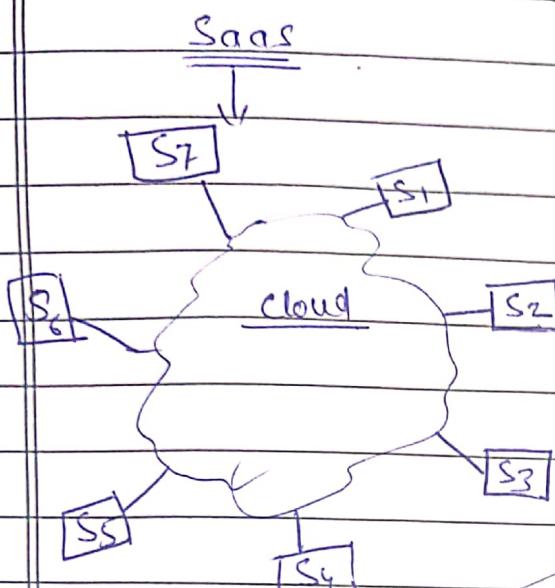
[This provide specific]

NIST (National Institute of Standards & Technology) cloud Computing architecture :-



SOA:- (Service oriented Architecture)

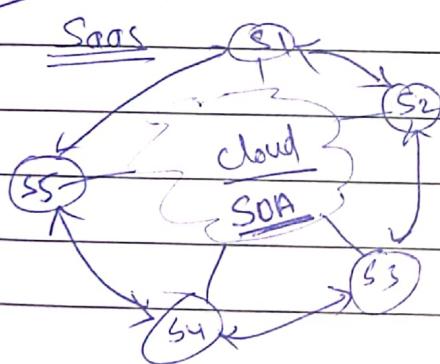
In cloud computing - There are variety of services which are provided to user.



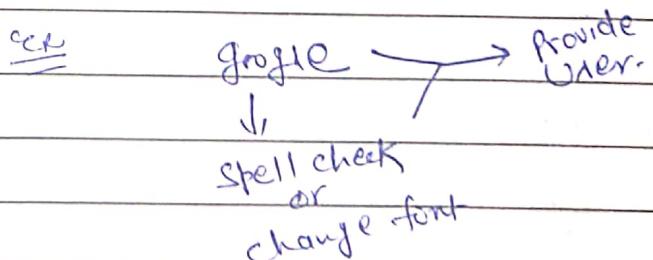
SaaS

In this architecture all services have independent and provide to user, and user can access directly.

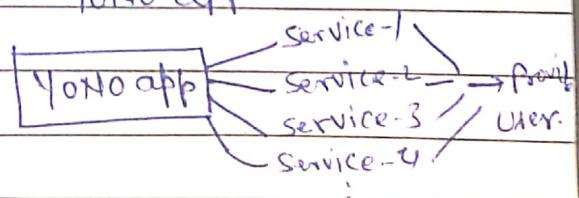
SOA:- SOA provide the platform or frame work in which different services can communicate to each other.



- ① Ex of SOA:- Google doc... if we want to prepare document then we add on diff. services.

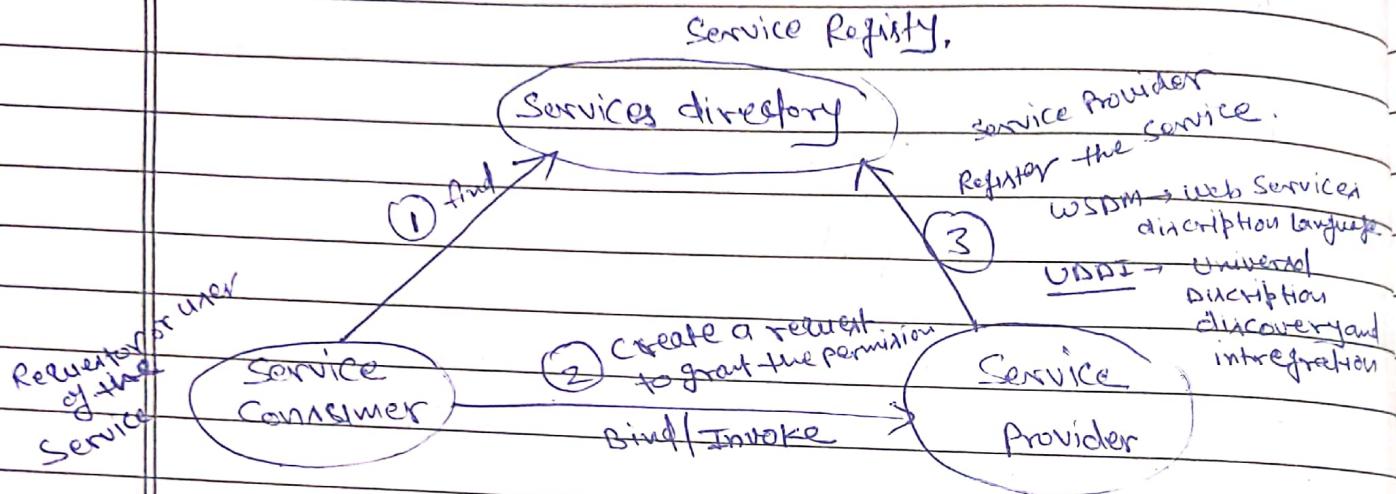


- ② In internet banking like SBI online → YONO app.



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SOA:- How to work request/ response in SOA

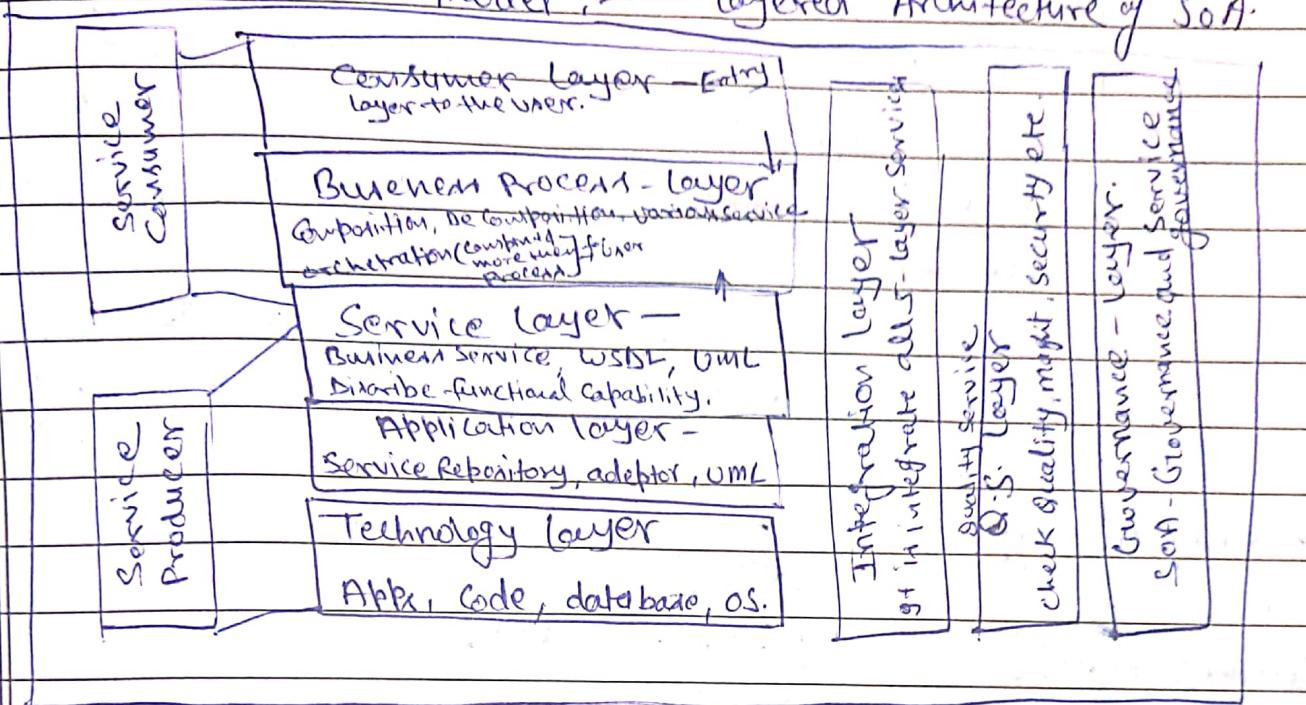


SOAP → Simple object access protocol.

Cex - There are two standard to register the services -
① WSDL ② UDDI.

(WS DL → common language format)
 (Web Service Description language)

SOA - Reference model :- layered Architecture of SOA.

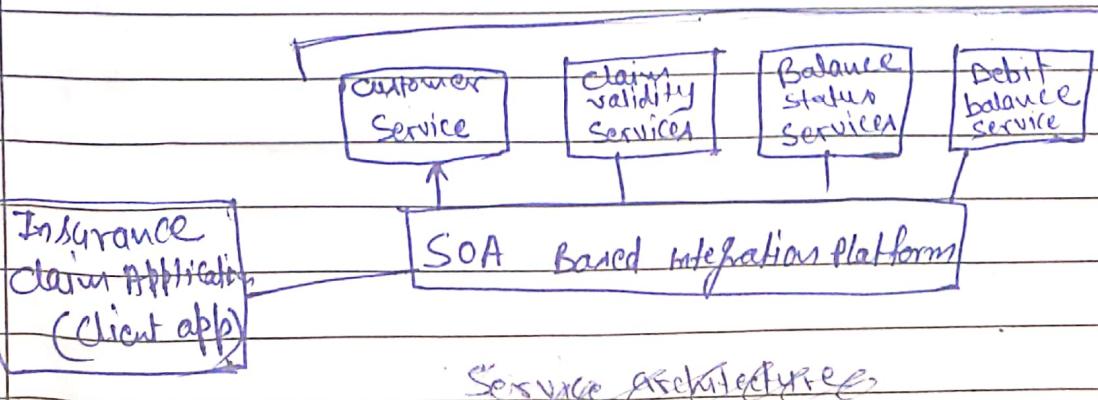


Repository → Store the Services at particular location.

Adaptor. — It work the forward the Service particular location

UML - Unified modeling language - Required the modeling of service
(means form it's service defn.)

- Application of SOA :-
- ① To manage a world of data
 - ② To manage work flow
 - ③ To consolidation Services
 - ④ To improve customer services
 - ⑤ For more effective partnership
 - ⑥ To trim cost etc.



Service architecture

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Web Services:- It is a collection of open protocols and standards used for exchanging data between application and system.

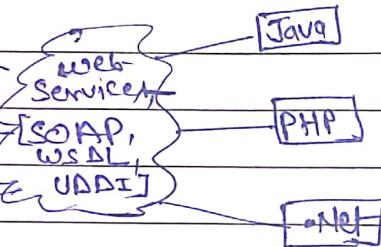
- It is a technology to communicate one programming with other.
- The web services can be searched for over the internet and can also be invoked accordingly.

S₁ → services

S₂ → design in Java

S₃ → design in .Net

S₄ → design in PHP



SOAP → Simple Object Access Protocol

WSDL → Web Services Description language

UDDI → Universal Description Discovery and integration

These are diff protocol & standards with the help of these standard & protocol communicate diff. services which is design in diff languages.

(1)

(2)

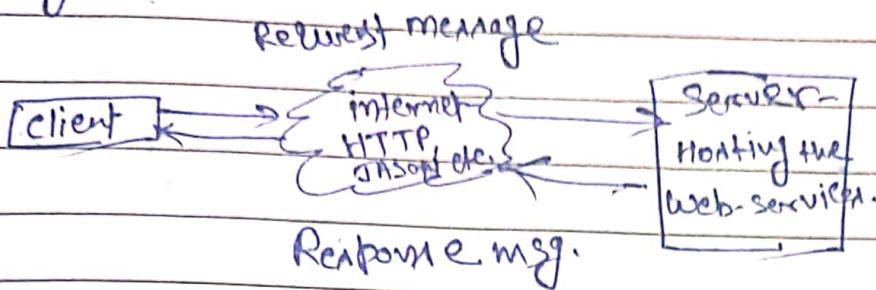
(3)

(4)

(5)

JavaScript object notation
standard text-based format for
representing structured data based on
JavaScript object syntax

Working of Web-Services:-



Set of protocols—
WSDL
UDDI
SOAP

Various steps in Request / Response :-

- ① Client would request (invoke) a series of Web Service call via request to Server (through-RPC)

RPC (Remote Procedure Call) — If one application want to communicate to another application then call some procedure these procedure call RPC.

- ② The data which is transferred b/w client and server is in form of XML. (extensible markup language)

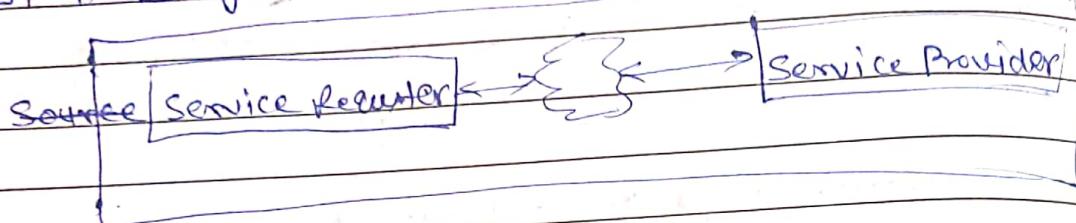
- ③ Web Services use SOAP (Simple Object Access Protocol) for sending the XML data b/w application

- ④ Different standards like HTTP, TCP/IP, SMTP can be used for sending the messages over the internet.

- ⑤ The data which is sent from the Web Service to the application is called SOAP message which is actually an XML document

SOAP (Simple Object Access Protocol) → ① It is used for Access Web Services

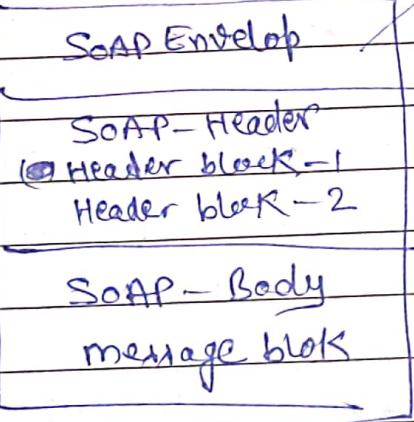
② It is designed in XML.



SOAP Building Block

- ① Identify XML document as Soap message → used to Encapsulate all the details in Soap message.
- ② Contains header information → like authentication credential which is used by calling application.
- ③ It contains call and request response information

Contain the actual data which to be send b/w web Services.



Cloud Storage - It is a service model in which data is transmitted and stored on remote storage system where it is maintained, managed, backed up and made available to the user over internet.

- Cloud storage is based on virtualized infrastructure with accessible interface.
- With the help of RESTful API user can retrieve and access data from storage.

Advantages:-

- ① Pay for what's used.
- ② Utility billing.
- ③ Global availability.
- ④ Easy to use.
- ⑤ Recovery, security, accessibility.

Disadvantages:-

- ① Back-up may be slower (depend on internet speed)
- ② Higher internet utilization.
- ③ Privacy concerns.

→ Storage as a Service:- It is cloud business model in which a company rents its storage area infrastructure to another company or individual to store data.

Storage provider provides the client with SW required to access their stored data.

Advantages:-

- ① Cost saving.
- ② Collaboration.
- ③ Security.
- ④ Automation.
- ⑤ Accessibility.
- ⑥ Share.
- ⑦ Data protection, etc.

Cloud Storage Providers :-

- (1) Amazon S3 (Simple Storage Service) → It provide diff storage area for ^{click}
- (2) icloud → any organization want to store our data like - faculty data, Student data, organization data.
- (3) OneDrive → It is provide storage device can access any place
- (4) Google drive, etc.

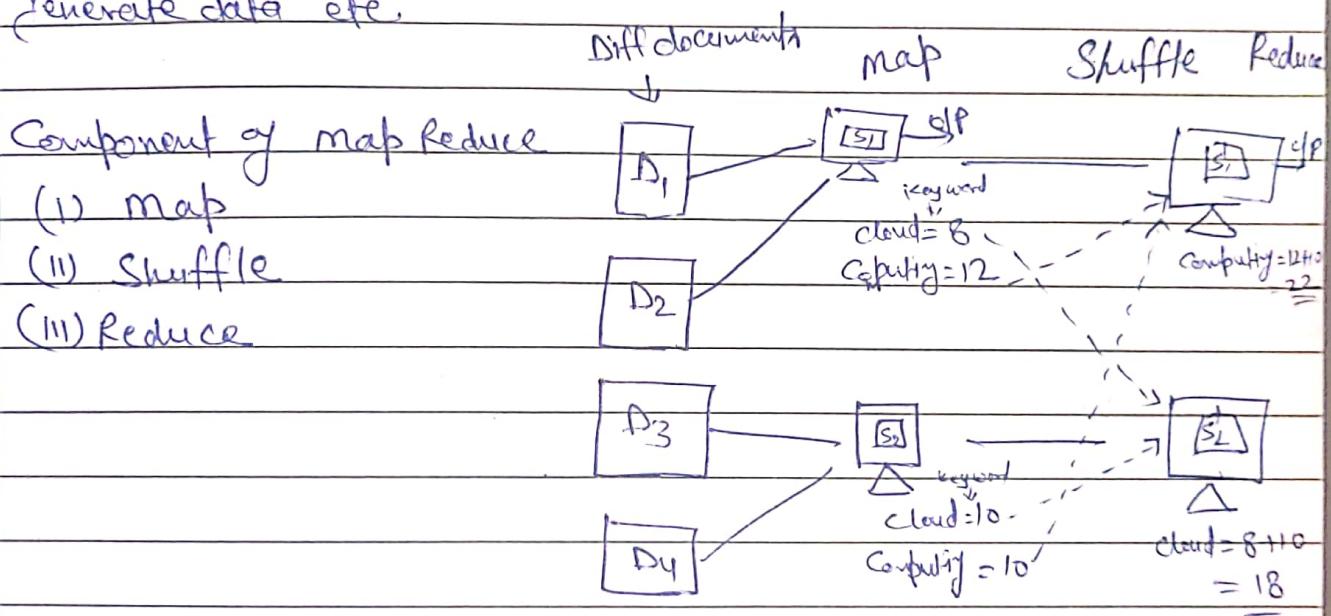
→ Amazon S3 → This storage Service will allow you to ~~store~~ store and retrieve data in any amount from anywhere.

- It can be used by any sized business and by any industry
- It is useful for ~~storage~~ storing the data of websites, mobile applications, IOT devices, enterprise application, backup and big data analytics.

Cloud Technology :- ① Map Reduce ② Hadoop etc.

① Map Reduce :- (Data Processing Tool) -

This algorithm divide the task into small task or parts and assign them to many computer, and collects the results from them which when integrated generate data etc.



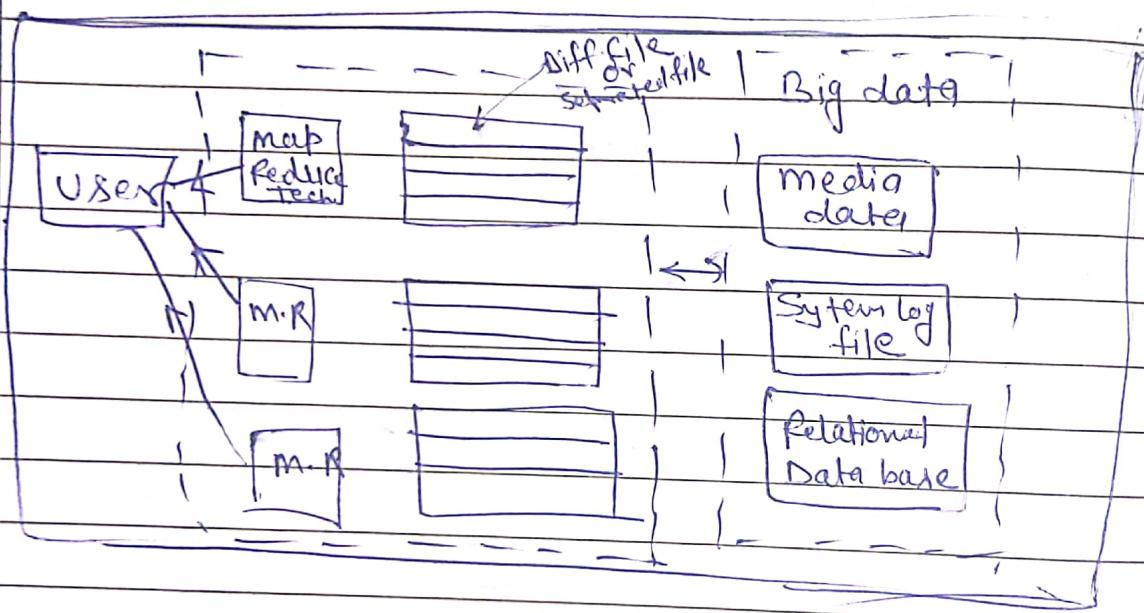
- ① firstly diff document allocate in single Computer ex D1 & D2
Allocate S1 and D3 & D4 Allocate S2
- ② in map phase ~~one~~ phase is categorize the document in diff keyword like cloud keyword repeat = 8 time or Computing = 12 time
- ③ in Shuffle phase common keyword allocate in single computer
- ④ in Reduce phase Count total reward like S1 have Computing keyword = 22 etc.

HADOOP :- It is developed by apache.

It is an open source Java based framework used for storing and processing big data in distributed environment.

Ex. → Facebook, Twitter, Stock exchange etc

Hadoop framework:

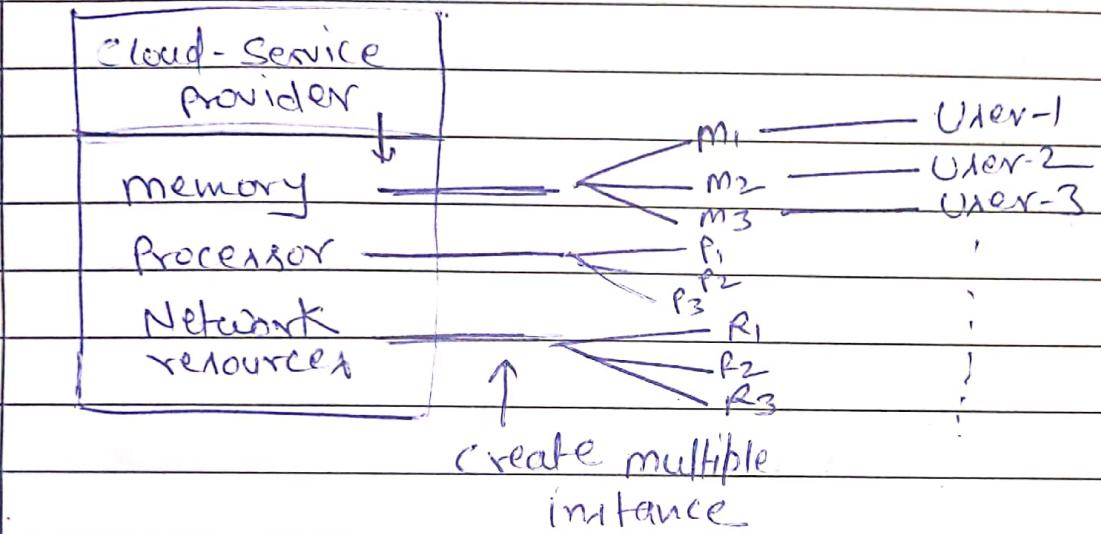


Benefits of Hadoop:-

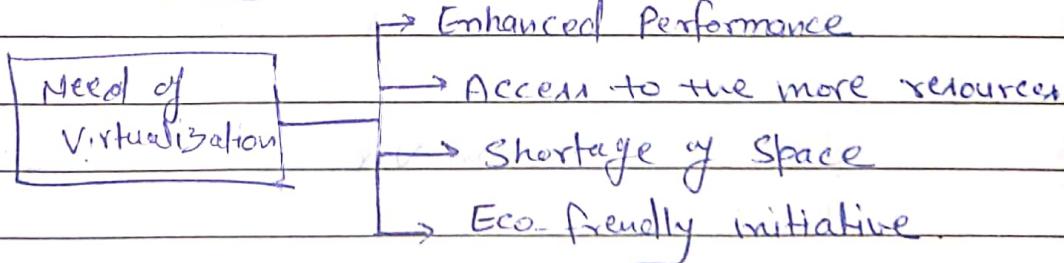
- ① Resilience → replication of data store many node
- ② Scalability :— It means operate data (large data) in distributed environment.
- ③ Low cost :— Because it is open source so no any registration charge
- ④ Speed :— fast as compare to relational algo.
- ⑤ Data diversity :— It means it store & process Structured data, Unstructured data or semi structured data.

Virtualisation:

- It is a process of creating virtual version of something like - storage, N/W, Resources etc.
 It is a technique which allows to share single physical instance of a resource among multiple customers or organizations.

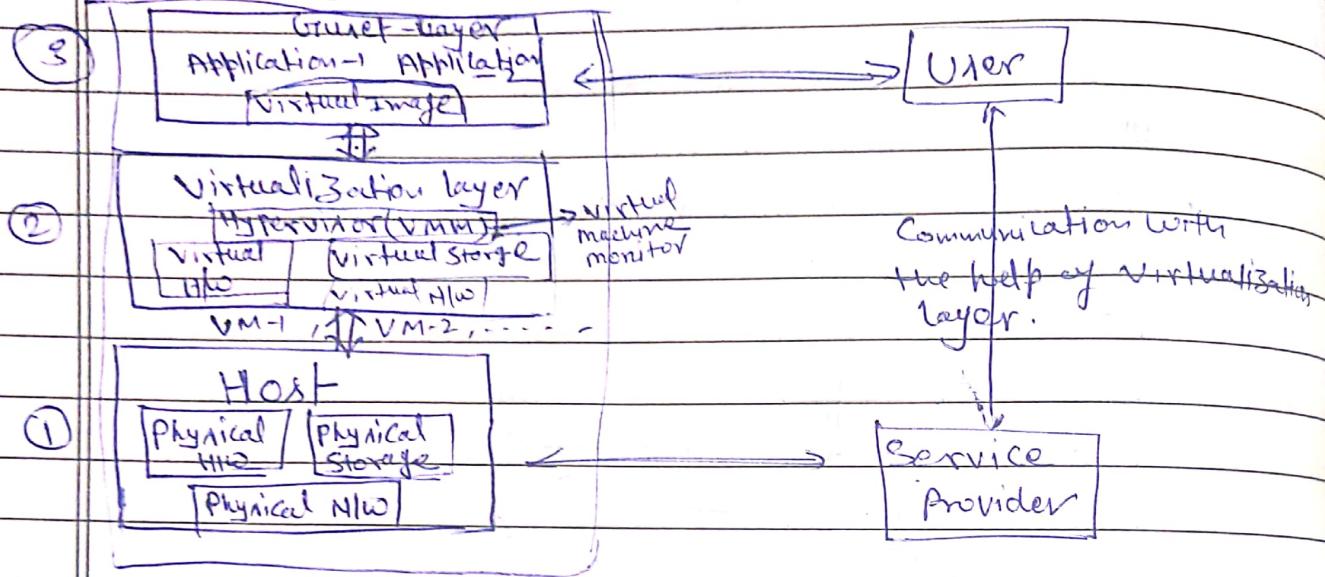


[Like - Hypervisor] → It is a SW or Prog. which creates multiple instances. *

Need of Virtualisation:-Advantages:-

- ① Economical
- ② flexible operation.
- ③ Security.
- ④ Eliminated the risk of system failure
- ⑤ flexible transfer of data.

Virtualization Reference model:-



Host :- It represents the actual environment where the Guest is supposed to be managed.

Guest :- It represents the system components that interact with Virtualization layer rather than the Host.

Hypervisor :- It is also known as virtual machine monitor and it is a SW that creates and runs virtual machine.

Type of Virtualization:-

⑦ Desktop virtualization

→ It allows the user to access his desktop from any device and location.

⑥ Data virtualization

→ Retrieve data from multiple sources without knowing types and locations.
Ex: E-commerce website, web portals etc.

⑤ S/W - virtualization.

→ It provides the availability to main computer to run and create one or more virtual environments.

④ memory - virtualization

→ physical memory across different servers are aggregated into single virtualized memory pool.

③ Storage - Virtualization

Block and file

→ multiple physical storage devices are grouped together which then appear as a single device.

② N/w - Virtualization.

Internal and external.

→ Available resources on different networks are combined to consolidate multiple physical networks.
Ex: virtual LAN (VLAN)

① H/w - Virtualization

full, para, partial

→ multiple physical servers consolidated into one virtual server and providing services.

Ex: ~~microsoft Hypervisor~~
microsoft Hyper-V and Xen.

Levels of Virtualization:-

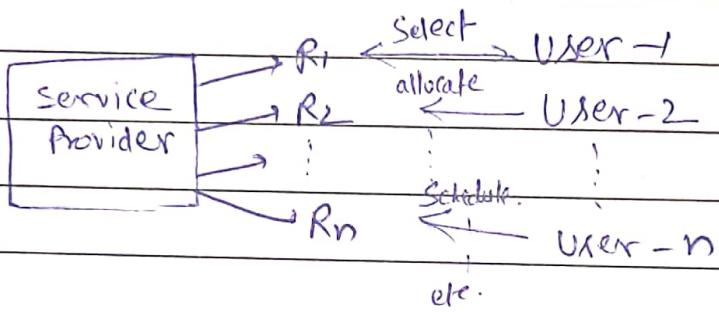


- ① Instruction Set Architecture level.
- ② H/w abstraction layer Level.
- ③ O/S System Level
- ④ Library Level.
- ⑤ Application Level.

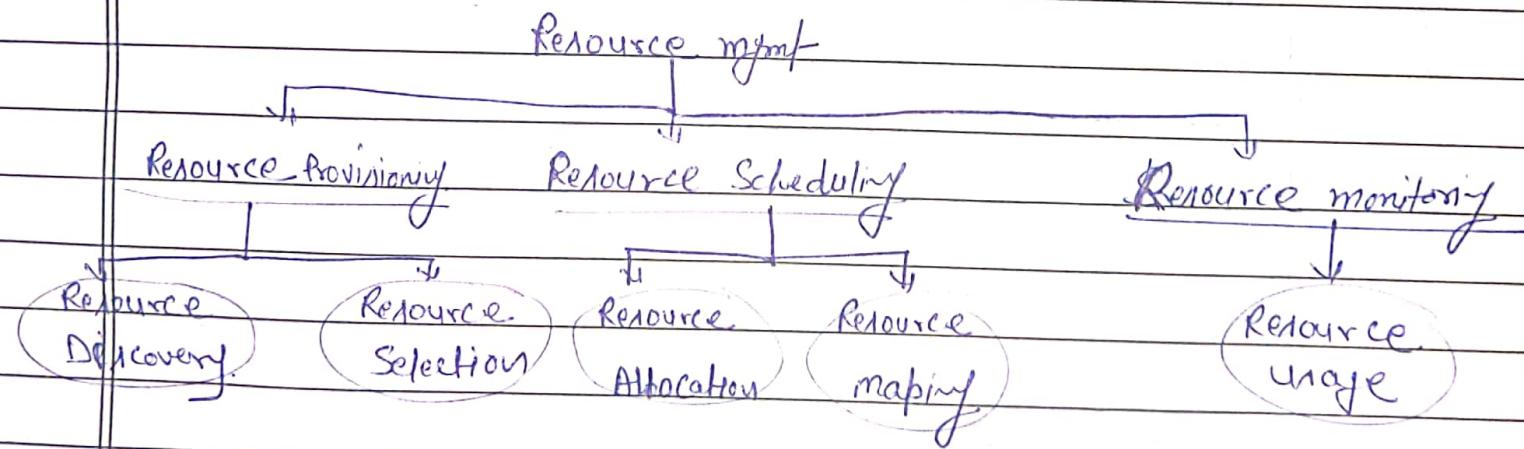
Unit-4 Resource management & Security in cloud

→ Inter-cloud - Resource management.

These services are built to perform resource discovery, match, select, composition, negotiate, Schedule and monitor operation.



Taxonomy of inter-cloud - Resource management:-



Global Exchange of cloud-Resources:-

Cloud-Security in cloud:-

Cloud-Security consist of:-

- (1) Set of Policies : — Service Provider $\xrightarrow{\text{Policy}}$ User.
- (2) Controls : —
- (3) Procedures : —
- (4) Technology : —

Definition of Cloud Security : - That way together to protect cloud based system data & infrastructure.

→ Services delivery depends upon the individual cloud service provider or the cloud security solution.

Challenges / Issues:-

- (1) Data Loss → if client store the data on the cloud then these data must be secured otherwise the may be loss.
- (2) Hacked interface and API : —

- (3) Data Breach → (Hacking of data)

Bandar-Lock-in : —

(5) Denial of Service (DoS):-

in this attack - flooding of service with so much traffic.

(6) Account Hijack.

(7) misconfiguration:-

(8) Accidental Exposure of credential

(9) Cybersecurity Attack.

(10) Data Privacy & Confidentiality.

(11) → Categories of cloud-computing security:-

(A) Security categories

Cloud
computing
Security

(B) Security in Service delivery models.

→ Security issues in SaaS
" " " Paas.
" " " Iaas.

(1) Security issues faced by providers

(2) Security issues faced by consumers

(C) Security - Threats -

like - Computer virus.
Spyware threats.
Installation of programs without user consent.

(D) Security Dimensions

① Security Domain → users, workstations and devices
Computers, Database server;
and infrastructure

② Security Risk → loss of privacy.
Anecdotal data.

Virtual-machine security in cloud-computing:-

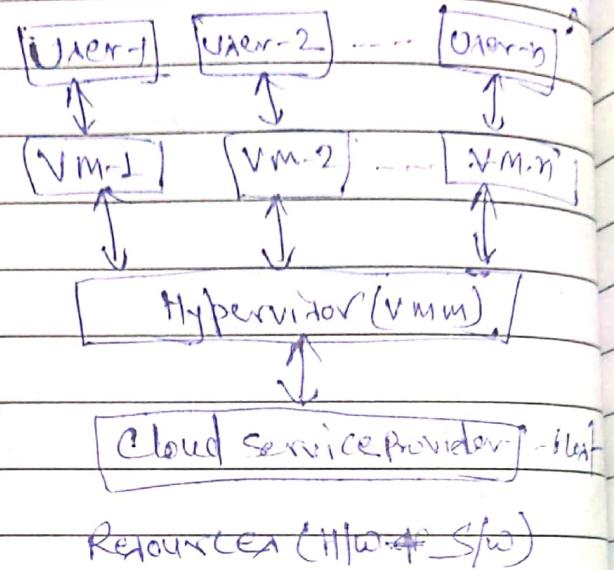
- Hypervisor - security.

V-M identity security

V-M Server security.

Security host resources

Virtualisation SW security.



IAM - Security mechanism:-

IAM (Identity and access management) :- Implements all

Role & and access privileges of individual user.

- IAM is also define different circumstances in which user is granted these privilege.

- Components of IAM : -
- ① Authentication → Validation of individual user
 - Username + Password.
 - digital signature
 - Bio-metrica.
- ② Authorization : - deal with access control.
 - Ex User $\rightarrow R_1$ (Authorised)
 - Ex User $\rightarrow R_2$ (Not Authorised)
- ③ User management : - (management work perform by admin)
 - Ex ① creating new user.
 - ② adding user to required access group
 - ③ maintaining password policies.

④ Credential management :- Establishing identities and access control rules for users.

IAM standards:-

- ① LDAP (Lightweight Directory Access Protocol) - Providing access to user.
- ② MFA (Multi-factor Authentication) :- Together with username ~~and~~ password required for authentication of user system.
- ③ Risk-based Authentication :- dynamic adjustment of user requirements.
- ④ Single-Sign-on :- multiple system can be accessed with single credentials.
- ⑤ User behaviour analytics :- examining the pattern of user behaviour.