

## Chapter-1

It is the delivery of computing services including servers, databases, networking, software, analytics and intelligent over the internet (cloud) to offer faster innovation, flexible resources and economic of scale.

- ex:-
1. Facebooks, gmail, cloud can be used for storage of files.
  2. Banking, financial services.
  3. Health care.
  4. Education.
  5. Government services.
  6. Big data analysis.
  7. Communication.
  8. Business process.

### \* Vision of Cloud computing:-

- (i) Cloud computing provide the facility to Provision virtual hardware, real time environment and services to a Person having money.
- (ii) The long term vision of a cloud computing is that it's services are traded as utility is an open market without technological and legal barriers.

## \* Characteristics of C.C :-

- (i) All demand self services
- (ii) Broad network access
- (iii) Resource Pooling
- (iv) Rapid elasticity
- (v) measured service

## \* Cloud Computing reference Model :-

- (i) This model is an abstract model that characterizes and standardize the function of a cloud computing environment by partitioning it into abstraction layers and cross-layer functions.
- (ii) This reference model groups the cloud computing functions and activities into five logical layers and three cross-layer functions.
- (iii) The five layers are physical layer, virtual layer, controls layer, service orchestration layer, and service layer.

Each of these layers specifies various types of entities that may exist in a cloud computing environment, such as computer systems, network devices, storage devices, virtualization

software, security mechanisms, control software, orchestration software, management software, and so on. It also describes the relationship among these entities.

## \* Layer & Reference model :-

- ① Physical layer (generates requests of layer 2,3)
- ② virtual layer (converts data into virtual data)
- ③ controls layer (controls all the process going on)
- ④ service orchestration layer (divides the work)
- ⑤ service layer

### Physical layer :-

- This is the ~~from~~ foundation layer of the cloud computing layer infrastructure.
- specifies entities that operate at this layer :-
  - ① computer systems
  - ② network devices
  - ③ storage devices
  - ④ operation environment
  - ⑤ protocols
  - ⑥ tools
  - ⑦ process

- Function of physical layer: Executes requests generated by the virtualization and control layer.

#### Virtual layer :-

- Deployed on the physical layer.
- Specifies entities that operate at this layer:
  - ① virtualization software, ② resource pools ③ virtual resources.

- Function of virtual layer: Abstracts physical resource and makes them appear as virtual resources (enables multitenant environment).
- Executes the request generated by control layer.

#### Control layer :-

- Deployed either on virtual layer or on physical layer.
- Specifies entities that operate at this layer:
  - ① ~~control~~ control software.
- Functions of control layer: Enables resources configuration, resource pool configurations and resource provisioning, executes requests generated by services layer, enforces resources and supports the services layer. Collaborates with the virtualization software and enables resource pooling and ~~creation~~ creating virtual resources, dynamic

ulation and optimizing utilization of resources.

#### Service orchestration layer :-

- Specifies the entities that operate at this layer:
  - ① orchestration software.
- Function of orchestration layer: Provides work-flows for executing automated tasks. Interacts with various entities to involve provisioning tasks.

#### Service layer

- ~~consumers~~ consumers interact and consume cloud resources via these layers.
- Specifies the entities that operate at this layer: service catalog and self-service portal.
- Functions of service layer: store information about the cloud resources in service catalog and presents them to the consumers, enables consumers to access and manage cloud resources via a self-service portal.

#### Cloud Computing environment

The cloud computing environment is all about I.T and what I.T needs different kinds of software and hardware, provide use on subscription based services offered both through the internet and real time.

## \* Cloud service requirements :-

The basic requirements of ~~the~~ cloud computing services are given below :-

- (i) Availability
  - (ii) Portability of data and applications
  - (iii) Data security
  - (iv) Manageability
  - (v) Elasticity
  - (vi) Features system
- (i) Availability :- The data over the cloud should be available to the users all the time 24x7 without any loss.
- (ii) Portability of data and application :- The data in the cloud should be portable which can be carried so easily and can be used at any place virtually.
- (iii) Data security :- The data in the cloud should be secure for all the time and the privacy of it should be maintained.
- (iv) manageability :- The data on use should be manageable and should come all over by one as per the user request.
- (v) Elasticity :- The data storage in the cloud computing should not be limited to anyone at any time it should be elastic.

(vi) Federated system :- The cloud computing system should be a federated system and user should not be limited to only one service it should be providing more and more services.

(vii) A federated system :- helps customers to move their data or applications across different cloud service providers, cloud services with providing customers security.

## \* cloud and dynamic infrastructure :-

(i) Service management :- This type of special facility or a functionality is provided to the cloud IT services by the cloud services providers. This facility includes visibility, automation and controls to delivering the first class IT service.

(ii) As-a-Service Management :- This is the assets or the property which is involved in providing the cloud services are getting managed.

(iii) Virtualization and Consolidation :- consolidation is an effort to reduce the cost of a technology by improving its operating efficiency and effectiveness. It means migrating from

large number of resources to fewer one, which is done by virtualization technology.

④ Information Infrastructure :- It helps the business organizations to achieve the following information compliance, availability of resource retention and security objectives.

⑤ Energy-Efficiency :- Here the IT infrastructure or organization sustainable. It means it is not likely to damage or affect any other things.

⑥ Security :- This cloud infrastructure is responsible for the risk management. Risk management refers to the risk involves in the services which are being provided by the cloud-service providers.

⑦ Resilience :- This infrastructure provides the feature of resilience means the services are resilient.

#### \* Cloud Adoption :-

Cloud adoption is a strategic move by organization of reducing cost, mitigating risk and achieving scalability of data base capability. In fact the depth

of adoption fields insights into the maturity of best practices, enterprise-ready cloud services availability.

#### \* Cloud application :-

A cloud application simply refers to any software application that is deployed in a cloud environment rather than being hosted on a local server or machine.

\* what is cloud architecture in cloud computing?

→ The cloud architecture refers to the various components in terms of database, software capabilities, application, etc. engineered to leverage the power of cloud resources to solve business problems. cloud architecture defines the components as well as the relationships between them.

The various components of cloud architecture are:

- On premise resources
- Cloud resource
- Software components and services
- Middleware

note:

Components of cloud computing architecture

- ① Client infrastructure
- ② Application
- ③ Service
- ④ Runtime cloud
- ⑤ Storage
- ⑥ Infrastructure
- ⑦ Management
- ⑧ Security

\* Types of clouds:

The type of cloud refers to the cloud services:

- ① Infrastructure as a service (IaaS)
- ② Platform as a service (PaaS)
- ③ Software as a service (SaaS)
- ④ Function as a service (FaaS)
- ⑤ Public cloud
- ⑥ Private cloud
- ⑦ Hybrid cloud
- ⑧ Community cloud

(i) Public cloud :-

\* Public clouds typically have massive amounts of available space, which translates into easy scalability.

→ A public cloud is often recommended for software development and collaborative projects.

→ example: Amazon, Microsoft, Google.

(ii) Private cloud :-

→ Private clouds usually reside behind a firewall and utilized by a single organization.

→ Authorized users can access, utilize, and store data in the private cloud from anywhere.

→ HP data centers, Microsoft are the example of Private cloud.

### (iii) Hybrid cloud :-

The combination of Public and private cloud is known as hybrid cloud.

### (iv) Community cloud :-

→ Community cloud computing refers to a shared cloud computing service environment that is targeted to a limited set of organizations or employees (such as banks or heads of trading firms).

→ U.S. based dedicated IBM soft layer cloud for federal agencies.

### \* Cloud Interoperability and Standards.

Cloud interoperability is the ability in which a customer's system communicate with a cloud service or the ability of one cloud service to communicate with other cloud services by sharing information to achieve predictable results according to a specified process.

### \* Cloud computing interoperability use cases:

1. Workload migration :- A workload that executes in one cloud provider can be uploaded to another cloud provider. Some standardization efforts that support this use cases are Amazon Machine Image (AMI), Open virtualization framework (OVF), and virtual hard disk (VHD).

2. Data migration :- Data that resides in one cloud provider can be moved to another cloud provider. A standardization effort that supports this use case is cloud data management Interface (CDMI). In addition, even though SOAP and REST are not data-specific standards, multiple cloud storage providers support data and storage management interfaces that use SOAP and REST.

3. User authentication :- A user who has established an identity with a cloud provider can use the same identity with another cloud provider. Standardization efforts that support this use cases

case are Amazon Web Services Identity Access management (AWS IAM), OpenID, and WS-Security.

4. Workload management - custom tools developed for cloud workload management can be used to manage multiple cloud resources from different vendors. Even though most environments provide a form of management console or command-line tools, they also provide APIs based on REST or SOAP.

\* Role of standards in cloud computing environment -



## Ch-3

(3.1) What is cloud scalability in cloud computing?  
→ cloud scalability in cloud computing refers to the ability to increase or decrease IT resource as needed to meet changing demand.

3.2 Fault tolerance in cloud computing?  
→ Fault tolerance refers to the ability of a system (computer, network, cloud clusters, etc) to continue operating without interruption when one or more of its components fail.

3.3 cloud solutions?  
→ A cloud based solution refers to on-demand services, computer networks, storage, applications or resources accessed via the internet and through another providers shared cloud computing.

3.4 cloud ecosystem:-  
A cloud ecosystem is a complex system of independent components that all work together to enable cloud services.

### 3.5 Cloud Business Process Management:

cloud business process management is usually a platform as a service solution that lets you create work flows and optimise them, without having to install a single Mb of software on your office hardware. you can use these cloud-based software solutions to streamline and optimise everyday business activities.

### 3.6 Portability and Interoperability:

Interoperability means the ability of two cloud systems to talk to another, i.e. to exchange message and information in a way that both can understand.

### 3.7 Cloud Service Management:

cloud service management and operations entails all the activities that an organization does to plan, design, deliver, operate, and control the IT and cloud service that it offers to customers. service management includes the operational aspects of

your applications and services.

### 3.8 Cloud Offerings:

cloud offerings is the delivery of computing services - including server, storage, database, networking, software, analytics and integrating over the internet ("the cloud") to offer faster innovation, flexible resources and economics of scale.

### 3.9 Testing under control:

Stress: This test is used to determine the ability of application to maintain a certain level of effectiveness beyond breaking point.

Load: Load testing of an application involves creation of heavy user traffic, and measuring its response. There is also a need to tune the performance of any application to meet certain standards.

#### Performance:

finding out thresholds, bottlenecks & limitation is a part of

Performance under a particular workload is necessary.

Functional (cloud testing) :-

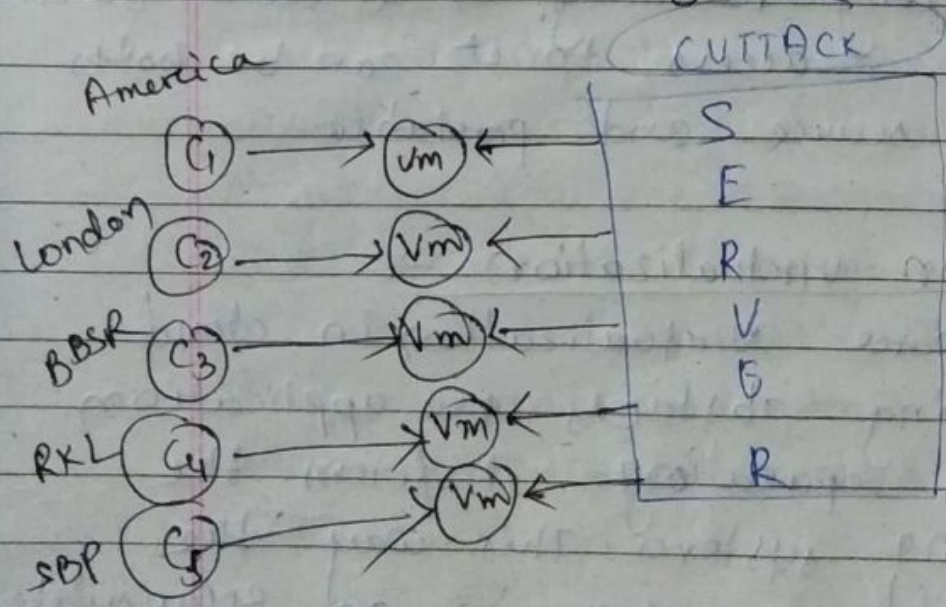
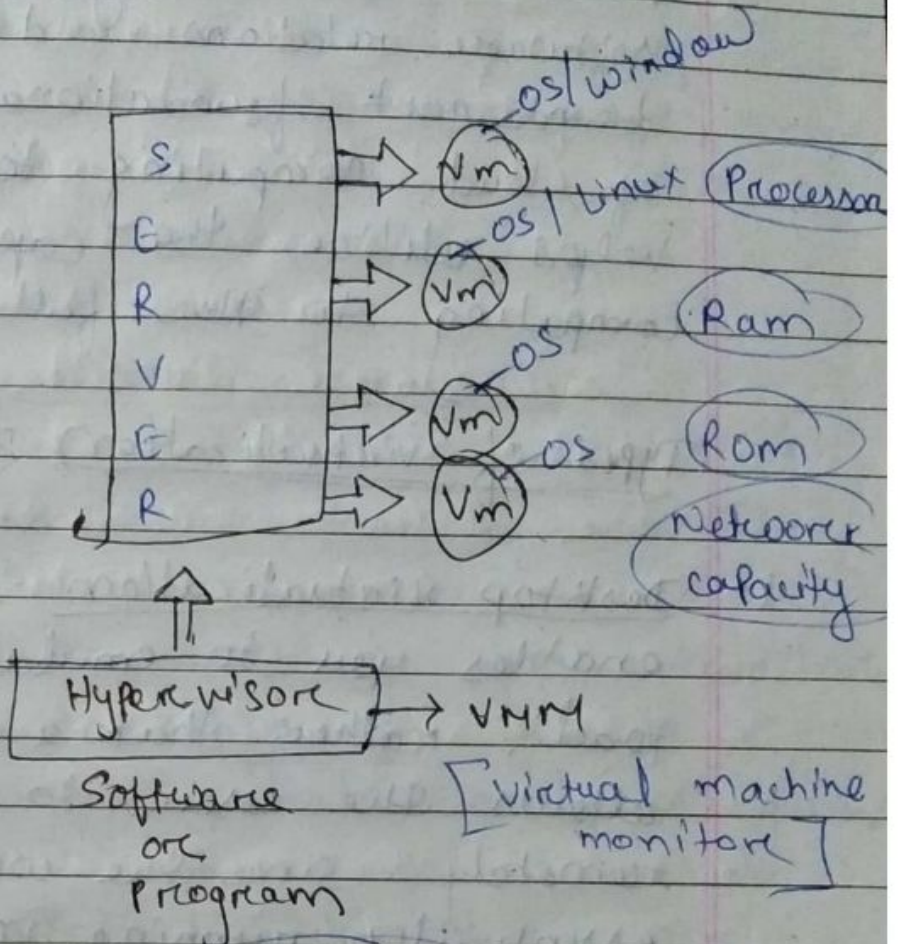
It is of both internet and non-internet applications can be performed using cloud testing.

Compatibility :- using cloud environment instance of different operating systems can be created on demand making compatibility testing effortless.

Browser Performance :- To verify application support for various browser types and performance in each type can be accomplished with ease.

Latency :- Cloud testing is utilized to measure the latency between the action and the corresponding response for any application after deploying it on cloud.

SIL Virtualization



virtualisation is the creation of virtual servers, infrastructures, devices and computing resources.

virtualization changes the hardware-software relations and is one of the fundamental foundational elements of cloud computing technology that helps utilize the capabilities of cloud computing to the full.

Types of virtualization :-

1. Desktop virtualization :- This model enables you to emulate a workstation load, rather than a server. This allows the users to access the desktop remotely. Since the workstation is essentially running in a data center server, access to it can be both more secure and portable.

2. Application virtualization :- Software virtualization in cloud computing abstracts the application layer, separating it from the operating system. This way the application can run in an encapsulated form without being dependant upon the operating system underneath.

3. Server virtualization :-

This technique is the making of server resources. It simulates physical servers by changing their identity, numbers, processors and operating system.

4. Network virtualization :-

Network virtualization in cloud computing is a method of combining the available resources in a network by splitting up the available bandwidth into different channels, each being separate and distinguished.

5. Storage virtualization :-

Using this technique gives the user an ability to pool the hardware storage space from several interconnected storage devices into a simulated single storage device that is managed from one single command console.

### (a) Desktop as a service :-

Desktop as a service is a cloud computing offering where a service provider delivers virtual desktops to end users over the internet, licensed with a per-user subscription. Cloud service providers may also handle security and applications for the desktop, or users may manage these service aspects individually.

### \* 5 Benefits of virtualization in a cloud environment

- Protection from system failures.
- Technology is always at the risk of crashing down at the wrong time.
- Hands-free transfer of data. you can easily
- you can ~~ea~~ transfer data from physical storage to a virtual server and vice versa.
- Security and security.
- Smoother IT operations.
- Cost-effective strategy.

### • Server virtualization

Server virtualization is the process of dividing a physical server into multiple unique and isolated, virtual servers - servers by

means of a software application. Each virtual server can run its own operating system independently.

### Key benefits of server virtualization

- Higher server ability
- Cheaper operating costs
- Eliminate server complexity
- Increased application performance
- Deploy workload quicker

### \* VSAN :-

A virtual storage area network is a logical partition in a physical storage area network (SAN). VSANs enable traffic to be isolated within specific portions of a storage area network, so if a problem occurs in one logical partition, it can be handled with a minimum of disruption to the rest of the network.

### • VLAN :-

VLAN is a network technology used to logically separate large broadcast domains using layer 2 devices.

(ii) VLANs allow network administrators to group hosts together even if the hosts are not

directly connected to the same network switch.

- (iii) VLANs allow network administrators to automatically limit access to a specified group of users by dividing workstation into different isolated LAN segments.
- (iv) when users move their workstations, administrators don't need to reconfigure the network or change VLAN groups.

# Ch-6 Cloud Security

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

## Cloud security fundamentals:

For the security folks, cloud security is depending the Confidentiality (C), integrity (I) and availability (A) of enterprise assets (data, application, infrastructure), using ~~at~~ cloud services, from an outside or inside ~~the~~ threat.

## Cloud - Security services

1. Identity and access management
2. Data loss prevention
3. web security
4. E-mail security
5. Security assessments
6. Intrusion management
7. security information and event management
8. Encryption
9. Business continuity and disaster ~~recovery~~ recovery
10. network security.

## Design Principles:-

1. Data in transit protection
2. effect protection and regulation
3. Separation between user
4. Governance - framework
5. operational security
6. Personal security



7. Supply chain security
8. secure user management
9. identity authentication
10. external interface protection
11. secure service administration
12. secure use of service
13. user data which is transacting

- (a) In the first phase, the controller determines optimal forwarding path to route the flow from source to destination.
- (b) In the second phase, the controller selects optimal switch in the selected path for each match rule.

### Secure cloud software requirements

Combine passwords with other authentication systems for sensitive areas. Enforce password management best practices. Regularly perform vulnerability scans and security audits, and patch known vulnerabilities. Ensure your cloud data is encrypted at rest and in transit.

### Policy implementation:-

1. Secure cloud accounts and create groups.
2. Check for free security upgrades.
3. Restrict infrastructure access via firewalls.
4. ~~For~~ Tether the cloud.
5. Replace passwords with keys.

### Cloud computing security challenges

Data breaches: consequences of a data breach may include.

Ch-7

## Cloud computing security architecture

### Architectural considerations:-

- (1) Misconfiguration and inadequate change control.
- (2) Lack of cloud security architecture and strategy.
- (3) Insufficient identity, credentials, access and key management.
- (4) Account hijacking.
- (5) Insider threat.
- (6) Insecure interfaces and APIs.
- (7) Used weak control plane.

Cloud Computing Security Architecture

\* Virtual Private cloud (VPC) :-

It is a secure, isolated private cloud hosted within a public cloud. VPC customer can run code, store data, host websites, and do anything else they could do in an ordinary private cloud, but the private cloud is hosted remotely by a public cloud provider.

\* Public Key :-

To access various cloud-based services securely, we can use public key. The public key can be publicly disclosed and is used for encrypting the message, while the private key must be kept private and is used to decrypt the message.

\* Encryption key management :-

Encryption key management is administering the full lifecycle of cryptographic keys. This includes: generating, using, storing, archiving and deleting of keys, protection of the encryption key includes limiting access to the keys physically, logically

and through user/role access.

\* Digital certificate :-

A digital certificate is an electronic "password" that allows a person, organization to exchange data securely over the Internet using the public key infrastructure. Digital certificate is also known as a public key certificate or identity certificate.

\* Implementing identity management :-

Identity management's primary goal in cloud computing is managing personal identity information so that access to computer resources, applications, data, and services is controlled properly. Identity management is the one area of IT security that offers genuine benefits beyond reducing the risks of security breaches. Identity management is a term that refers to the information system being used within the enterprise.

\* What is autonomic security in cloud computing ?

→ Autonomic computing is a computer's ability to manage itself automatically through adaptive technologies that further computing capabilities and cut down on the time required by computer professionals to resolve system difficulties and other maintenance such as software updates.



Market Based Management of clouds

\* what is cloud Federation stacks?

→ cloud Federation is the practice of interconnecting the cloud computing environments of two or more service Providers for the purpose of load balancing traffic and accommodating spikes in demand. First it allows Providers to earn revenue from computing resources that would otherwise be idle or underutilized.

\* what is Third party cloud service :

→ A cloud service Provider is a third party company offering a cloud based platform, infrastructure, application or storage services. Much like a homeowner would pay for a utility such as electricity or gas, companies typically have to pay only for the amount of cloud services they use, as business demands require.

example of third party cloud service:

→ Creatio.  
slack

Google cloud  
Microsoft 365  
Workplace by O365  
Adobe creative cloud

### \* What is cloud federation?

→ cloud federation, also known as federated cloud is the deployment and management of several external and internal cloud computing services to match business needs. It is a multi-national cloud system that integrates private, community, and public clouds into scalable computing platforms. Federated cloud is created by connecting the cloud environment of different cloud providers using a common standard.

### \* cloud information security vendors:

Cloud vendors put a priority on keeping their cloud solutions secure. They offer security monitoring and management services to their clients

and implement protocols that protect data and prevent unauthorized access.

### \* Top cloud security vendors:

- lacertix
- McAfee
- Palo Alto networks
- qualys
- symantec
- Tenable
- Trend Micro
- VMware

## Hadoop

\* What is Hadoop?

→ Hadoop is an open source framework that is used to efficiently store and process large datasets ranging in size from gigabytes to Petabytes of data. Instead of using one large computer to store and process the data, Hadoop allows clustering multiple computers to analyze massive datasets in parallel more quickly.

\* Data source of Hadoop?

→ Hadoop is an open source, Java based framework used for storing and processing big data. The data is stored on inexpensive commodity  
Ex: ~~Military~~, ~~biomedical~~, ~~Environment~~, ~~Industry~~, ~~consumer good~~, ~~Agriculture~~, ~~smart office management~~

Servers that run as clusters. Its distributed file system enables concurrent processing and fault tolerance.

\* What is Hadoop in data analytics?

→ Hadoop is an open-source software framework that provides for processing of large data sets across clusters of computers using simple programming models. Hadoop is designed to scale up from single servers to thousands of nodes.

## Cloud management and virtualization Tech

### Virtualization architecture :-

A virtualization architecture is a conceptual model specifying the overall structure, logical components and interrelationships of the elements involved in delivering a virtual, rather than physical, version of something such as an operating system (OS), a server, or storage device or network resources.

### Data centre :-

A data center houses ~~or~~ servers and/or data storage for an organization. A data center can be a single server or complex with hundreds of servers on racks.

Companies (like Amazon or Microsoft) that offer public cloud computing services have data centers that they then make available to other organizations.

### Resilience :-

Resilience is the ability of a server, network, storage system, or an entire data center, to recover quickly and continue operating even when there has been an equipment failure, power outage

or other disruption when one server in the cluster fails, another node takes over with its redundant workloads.

Agility :- In a cloud computing context agility often refers to the ability to rapidly develop, test and launch applications that drive business growth in a constantly changing IT environment.

Storage :- cloud storage is a cloud computing model that stores data on the internet through a cloud computing provider who manages and operates data storage as a service. It's delivered on demand with just-in-time capacity and costs, and eliminates ~~the~~ buying and managing your own data storage infrastructure.

Provisioning :- cloud provisioning software refers to the use of tools (orchestration, automation, and provisioning software) to automatically control the installation, configuration and management of cloud computing services.



It helps enterprises make better decisions  
for their cloud computing resources.