

## **1. What Is Cloud Computing?**

Ans: Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable and reliable computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal consumer management effort or service provider interaction.

## **2. Advantages of Cloud Computing**

Ans:

- a) Less Costs
- b) 24 X 7 Availability and reliability
- c) Flexibility
- d) All over Functioning Cloud
- e) Automated Updates.
- f) Security

### **Disadvantages of Cloud Computing**

A list of the disadvantage of cloud computing is given below -

#### **1) Internet Connectivity**

#### **2) Vendor lock-in**

Vendor lock-in is the biggest disadvantage of cloud computing. Organizations may face problems when transferring their services from one vendor to another. As different vendors provide different platforms, that can cause difficulty moving from one cloud to another.

#### **3) Limited Control**

## **3. Cloud Computing Deployment Models/NIST Model/ Cloud Cube**

The cloud deployment model represents the exact category of cloud environment based on proprietorship, size, and access and also describes the nature and purpose of the cloud. Different Types of Cloud Computing Deployment Models.

The NIST model consist of 3 parts

## Essential Cloud Computing Characteristics:

- On-demand self-service: consumers can unilaterally provision computing capabilities as needed automatically without requiring human interaction with each service provider.
  - Broad network access: capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms.
  - Resources pooling: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand
  - Rapid elasticity: capabilities can be elastically provisioned and released to scale rapidly outward and inward commensurate with demand
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- Measured service: cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service.

Cloud Characteristic	Description	Application
<b>On-demand self-service</b>	For automatically providing a consumer with provisioning capabilities as needed.	Server, Time, Network and Storage
<b>Broad network access</b>	For heterogeneous thin or thick client platforms.	Smartphones, tablets, PCs, wide range of locations
<b>Resource pooling</b>	The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model.	Physical and virtual resources with dynamic provisioning
<b>Rapid elasticity</b>	Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward with demand.	Adding or removing nodes, servers, resource or instances

# Characteristics

- **On Demand Self Service**
  - Cloud Computing allows the users to use web services and resources on demand. One can logon to a website at any time and use them.
- **Broad Network Access**
  - Since cloud computing is completely web based, it can be accessed from anywhere and at any time.
- **Resource Pooling**
  - Cloud computing allows multiple tenants to share a pool of resources. One can share single physical instance of hardware, database and basic infrastructure.
- **Rapid Elasticity**
  - It is very easy to scale the resources vertically or horizontally at any time. Scaling of resources means the ability of resources to deal with increasing or decreasing demand.
  - The resources being used by customers at any given point of time are automatically monitored.
- **Measured Service**
  - In this service cloud provider controls and monitors all the aspects of cloud service. Resource optimization, billing, and capacity planning etc. depend on it.

There are four dimensions in the Cloud cube model.

- **Internal/External**

Internal/External is the most common form of the cloud. It describes the physical location of the data. It agrees with us whether the data exists inside or outside of your organization's limit. In this, the data that is stored by the help of private cloud deployment will be referred to as internal, and data outside the cloud will be referred to as external.
- **Proprietary/open**

The second dimension of cloud formation is proprietary/open. It defines the state of ownership of the cloud technology and interfaces. It also defines the level of incomparability while enabling data transportability between the system and forms of cloud.
- **De-parameterized /parameterized**

The Perimeterised and De-perimeterized dimension tells us whether you are operating inside your traditional mindset or outside it.

**Parameterized** dimension means, continuing to operate within the traditional it boundary, orphan signaled by network firewalls.

**De-perimeterized** dimension means the system perimeter is architected on the principles outlined in the Jericho forums commandments. In De-parameterized dimension, the data will be encapsulated with metadata and mechanisms, which will further help to protect the data and limit the inappropriate usage.

- **Insourced/outsourced dimension**

Insourced/outsourced is the fourth dimension of the cloud cube model. In the outsourced dimension, services are offered by the third party, and in the insourced dimension, the services are offered by the own staff.

- a) **Public Cloud:** Public Cloud provides a **shared platform** that is accessible to the **general public** through an Internet connection.

Examples: Amazon Elastic Compute Cloud (EC2), Microsoft Azure, IBM's Blue Cloud, Sun Cloud, and Google Cloud

Advantages: Low cost, saves time, quick and easy setup, scalable and reliable

Disadvantages: Low security , performance depends on speed connectivity, less customizable

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- b) **Private Cloud:** Private cloud is also known as an **internal cloud** or **corporate cloud**. Private cloud provides computing services to a **private internal network (within the organization)** and **selected users** instead of the general public

Examples: HP Data Centers, Microsoft, Elastra-private cloud, and Ubuntu

Advantages: More control over resources and hardware, Secure and privacy, Improved performance

Disadvantages: High cost, limited scalability, skilled people required

- c) **Hybrid Cloud:** Hybrid cloud is a combination of **public and private** clouds. The main aim to combine both the clouds is to create unified, automated, and well managed computing environment. **Non-critical activities** are performed by the **public cloud** and **critical activities** are performed by the **private cloud**.

Examples: The best hybrid cloud provider companies are **Amazon, Microsoft, Google, Cisco, and NetApp**.

Advantages: Flexible, secure, cost effective, risk management.

Disadvantages: Reliability depends on cloud service providers, infrastructure compatibility, Networking issues.

- d) **Community cloud:** Community cloud is a cloud infrastructure that allows systems and services to be accessible by a group of several organizations to share the information. It is owned, managed, and operated by one or more organizations in the community, a third party, or a combination of them.

Examples: Our government organization within India may share computing infrastructure in the cloud to manage data.

Advantages: Cost effective, flexible and scalable, sharing infrastructure

Disadvantages: Costly than public, not a good choice for every organization, fixed amount of data storage and bandwidth.

#### 4. Amazon Elastic Compute Cloud (Amazon EC2)

Ans: Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) Cloud. Using Amazon EC2 eliminates your need to invest in hardware up front, so you can develop and deploy applications faster.

Features provided by EC2:

- A) Various configurations of CPU, memory, storage, and networking capacity for your instances, known as *instance types*
- B) Secure login information for your instances using *key pairs* (AWS stores the public key, and you store the private key in a secure place)
- C) Storage volumes for temporary data that's deleted when you stop, hibernate, or terminate your instance, known as *instance store volumes*
- D) Static IPv4 addresses for dynamic cloud computing, known as *Elastic IP addresses*
- E) Metadata, known as *tags*, that you can create and assign to your Amazon EC2 resources

## 5. AWS Lambda

Ans: With Lambda, you can run code for virtually any type of application or backend service. All you need to do is supply your code in one of the languages that Lambda supports.

Features of lambda:

- a) **Concurrency and scaling controls**
- b) **Functions defined as container images**
- c) **Code signing**
- d) **Lambda extensions**
- e) **Database access**
- f) **File systems access**
- g) **Function blueprints**

## 6. Elastic Load Balancing

Ans: .ELB helps an IT team adjust capacity according to incoming application and network traffic. Users enable ELB within a single availability zone or across multiple availability zones to maintain consistent application performance. ELB offers enhanced features including:

- a) Detection of unhealthy Elastic Compute Cloud (EC2) instances.
- b) Optional public key authentication.
- c) Support for both IPv4 and IPv6

## 7. Amazon Simple Storage Service (Amazon S3)

Ans: Amazon S3 has a simple web services interface that you can use to store and retrieve any amount of data, at any time, from anywhere on the web. It gives any developer access to the same highly scalable, reliable, fast, inexpensive data storage infrastructure that Amazon uses to run its own global network of web sites  
Advantages: Storing data, creating buckets, downloading data, permissions.

## **8. Amazon Glacier**

Ans: Amazon S3 Glacier is a secure, durable, and extremely low-cost Amazon S3 storage class for data archiving and long-term backup. Amazon Glacier is another cloud storage service related to Amazon S3, but optimized for data archiving and long-term backup at extremely low cost. Amazon Glacier is suitable for “cold data,” which is data that is rarely accessed and for which a retrieval time of three to five hours is acceptable

## **9. Amazon Elastic Block Store (Amazon EBS)**

Ans: Amazon Elastic Block Store (EBS) is an easy to use, high-performance, block-storage service designed for use with Amazon Elastic Compute Cloud (EC2) for both throughput and transaction intensive workloads at any scale.

## **10. AWS Storage Gateway**

Ans: AWS Storage Gateway is a service connecting an on-premises software appliance with cloud-based storage to provide seamless and secure integration between an organization’s on-premises IT environment and the AWS storage infrastructure. The service supports industry-standard storage protocols that work with existing applications. It provides low-latency performance by maintaining a cache of frequently accessed data on-premises while securely storing all of your data encrypted in Amazon S3 or Amazon Glacier.

## **11. AWS Identity and Access Management (IAM)**

Ans: AWS Identity and Access Management (IAM) is a web service that helps you securely control access to AWS resources. You use IAM to control who is authenticated (signed in) and authorized (has permissions) to use resources.

Features of IAM: **Shared access to your AWS account**, **Granular permissions**(i.e different permissions to different people for different resources), **Secure access to AWS resources for applications that run on Amazon EC2**

## **12. AWS region, Availability Zones.**

Ans: Amazon EC2 is hosted in multiple locations worldwide. These locations are composed of Regions and Availability Zones. Each Region is a separate geographic area. Each Region has multiple, isolated locations known as Availability Zones. Amazon EC2 provides you the ability to place resources, such as instances, and data in multiple locations. AWS has 80 Availability Zones across 25 geographic regions, with plans to

launch 15 more Availability Zones and five more AWS Regions in Australia, India, Indonesia, Spain, and Switzerland

### 13. Common use cases for Amazon S3 storage include:

Ans: Backup and archive for on-premises or cloud data; Content, media, and software storage and distribution; Big data analytics; Static website hosting; Cloud-native mobile and Internet application hosting

14. **Amazon Glacier** is another cloud storage service related to Amazon S3, but optimized for data archiving and long-term backup at extremely low cost. Amazon Glacier is suitable for “cold data,” which is data that is rarely accessed and for which a retrieval time of three to five hours is acceptable.

### 15. Object Storage versus Traditional Block and File Storage

Ans:

Side-by-side comparison: Object vs. traditional storage			
	OBJECT STORAGE	FILE-BASED STORAGE	BLOCK-BASED STORAGE
Transaction units	Objects, that is, files with custom metadata	Files	Blocks
Supported type of update	No in-place update support; updates create new object versions	Supports in-place updates	Supports in-place updates
Protocols	REST and SOAP over HTTP	CIFS and NFS	SCSI, Fibre Channel, SATA
Metadata support	Support of custom metadata	Fixed file-system attributes	Fixed system attributes
Best suited for	Relatively static file data and as cloud storage	Shared file data	Transactional data and frequently changing data
Biggest strength	Scalability and distributed access	Simplified access and management of shared files	High performance
Limitations	Ill-suited for frequently changing transactional data; doesn't provide a sharing protocol with a locking mechanism	Difficult to extend beyond the data center	Difficult to extend beyond the data center

### 16. What is bucket?

Ans: A bucket is a container (web folder) for objects (files) stored in Amazon S3. Every Amazon S3 object is contained in a bucket.

Buckets serve several purposes:

- They organize the Amazon S3 namespace at the highest level.

- They identify the account responsible for storage and data transfer charges.
- They play a role in access control

## 17. Object URL:

Ans: Amazon S3 object can be addressed by a unique URL [formed using the web services endpoint, the bucket name, and the object key]. For example, with the URL: <http://mybucket.s3.amazonaws.com/exp.doc> mybucket is the S3 bucket name, and exp.doc is the key or filename.

18. **Amazon S3** offers a range of storage classes suitable for various use cases. explain...  
Know the use case for each of the Amazon S3 storage classes. Standard is for general purpose data that needs high durability, high performance, and low latency access. Standard- IA is for data that is less frequently accessed, but that needs the same performance and availability when accessed. RRS offers lower durability at lower cost for easily replicated data.
19. **Amazon Glacier** is for storing rarely accessed archival data at lowest cost, when three-to five hour retrieval time is acceptable.

## 20. Amazon S3 versioning

Ans: Versioning in Amazon S3 is a means of keeping multiple variants of an object in the same bucket. You can use the S3 Versioning feature to preserve, retrieve, and restore every version of every object stored in your buckets. With versioning you can recover more easily from both unintended user actions and application failures.

## 21. Instance Types

Ans: Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instance types comprise varying combinations of CPU, memory, storage, and networking capacity and give you the flexibility to choose the appropriate mix of resources for your applications. Each instance type includes one or more instance sizes, allowing you to scale your resources to the requirements of your target workload.

**General purpose:** provide a balance of compute, memory and networking resources, and can be used for a variety of diverse workloads.

**Compute Optimized:** ideal for compute bound applications that benefit from high performance processors.

**Memory optimized:** Memory optimized instances are designed to deliver fast performance for workloads that process large data sets in memory.

**Accelerated Computing:** uses hardware accelerators, or co-processors, to perform functions, such as floating point number calculations, graphics processing, or data pattern matching, more efficiently than is possible in software running on CPUs.

**Storage Optimized:** designed for workloads that require high, sequential read and write access to very large data sets on local storage.

## 22. Amazon Machine Images (AMIs)

Ans: An Amazon Machine Image (AMI) provides the information required to launch an instance. You must specify an AMI when you launch an instance. You can launch multiple instances from a single AMI when you need multiple instances with the same configuration. You can use different AMIs to launch instances when you need instances with different configurations.

23. **sources of AMIs:** Published by AWS, The AWS Marketplace, Generated from Existing Instances

Ans:



## 24. The Lifecycle of Instances

Ans: An Amazon EC2 instance transitions through different states from the moment you launch it through to its termination

**Pending:** The instance is preparing to enter the running state. An instance enters the pending state when it launches for the first time, or when it is started after being in the stopped state.

**Running:** The instance is running and ready for use.

**Stopping:** The instance is preparing to be stopped or stop-hibernated.

**Shutting-down:** The instance is preparing to be terminated.

**Terminated:** The instance has been permanently deleted and cannot be started.

## 25. On-Demand Instances

Ans: With On-Demand Instances, you pay for compute capacity by the second with no long-term commitments. You have full control over its lifecycle—you decide when to launch, stop, hibernate, start, reboot, or terminate it

## 26. Reserved Instances

Ans: EC2 RIs provide a discounted hourly rate and an optional capacity reservation for EC2 instances. AWS Billing automatically applies your RI's discounted rate when attributes of EC2 instance usage match attributes of an active RI

## 27. Spot Instances

Ans: A Spot Instance is an unused EC2 instance that is available for less than the On-Demand price. Because Spot Instances enable you to request unused EC2 instances at steep discounts, you can lower your Amazon EC2 costs significantly. The hourly price for a Spot Instance is called a Spot price

## 28. Instance store Lifetime

Ans: The data in an instance store persists only during the lifetime of its associated instance. If an instance reboots (intentionally or unintentionally), data in the instance store persists. However, data in the instance store is lost under any of the following circumstances:

- The underlying disk drive fails
- The instance stops
- The instance hibernates
- The instance terminates

Therefore, do not rely on instance store for valuable, long-term data. Instead, use more durable data storage, such as Amazon S3, Amazon EBS, or Amazon EFS.

## 29. Amazon VPC

Ans: The address range of the Amazon VPC cannot be changed after the Amazon VPC is created. An Amazon VPC address range may be as large as /16 (65,536 available

addresses) or as small as /28 (16 available addresses) and should not overlap any other network with which they are to be connected.

### 30. purpose of a Subnet

Ans: **Subnetwork or subnet** is a logical subdivision of an IP network. The practice of dividing a network into two or more networks is called subnetting. AWS provides two features that you can use to increase security in your VPC: *security groups* and *network ACLs*. Security groups control inbound and outbound traffic for your instances, and network ACLs control inbound and outbound traffic for your subnets

### 31. purpose of a route table

Ans: A **route table** contains a set of rules, called **routes**, that are **used** to determine where network traffic from your subnet or gateway is directed. To **put** it simply, a **route table** tells network packets which way they need to go to get to their destination.

### 32. purpose of a Internet Gateway (IGW)

Ans: An internet gateway is a horizontally scaled, redundant, and highly available VPC component that allows communication between your VPC and the internet. An internet gateway serves two purposes: to provide a target in your VPC route tables for internet-routable traffic, and to perform network address translation (NAT) for instances that have been assigned public IPv4 addresses.

### 33. Security Group

Ans: A security group is a virtual stateful firewall that controls inbound and outbound network traffic to AWS resources and Amazon EC2 instances. All Amazon EC2 instances must be launched into a security group. You can create up to 500 security groups for each Amazon VPC. You can add up to 50 inbound and 50 outbound rules to each security group. You can specify separate rules for inbound and outbound traffic.

### 34. Access control list (ACL)

Ans: A network access control list (ACL) is another layer of security that acts as a stateless firewall on a subnet level. A network ACL is a numbered list of rules that AWS evaluates in order, starting with the lowest numbered rule, to determine whether traffic is allowed in or out of any subnet associated with the network ACL.

### 35. Comparison of Security Groups and Network ACLs

Security Group	Network ACL
Operates at the instance level (first layer of defense)	Operates at the subnet level (second layer of defense)
Supports allow rules only	Supports allow rules and deny rules
Stateful: Return traffic is automatically allowed, regardless of any rules	Stateless: Return traffic must be explicitly allowed by rules.

AWS evaluates all rules before deciding whether to allow traffic	AWS processes rules in number order when deciding whether to allow traffic.
Applied selectively to individual instances	Automatically applied to all instances in the associated subnets; this is a backup layer of defense, so you don't have to rely on someone specifying the security group.

### 36. NAT

Ans: You can now use Network Address Translation (NAT) Gateway in the AWS GovCloud (US) Region. NAT Gateway is a highly available AWS managed service that makes it easy to connect to the Internet from instances within a private subnet in an Amazon Virtual Private Cloud (Amazon VPC). Previously, you needed to launch a NAT instance to enable NAT for instances in a private subnet.

### 37. Listeners

Ans: Before you start using Elastic Load Balancing, you must configure one or more *listeners* for your Classic Load Balancer. A listener is a process that checks for connection requests. It is configured with a protocol and a port for front-end (client to load balancer) connections, and a protocol and a port for back-end (load balancer to back-end instance) connections

### 38. IAM

Ans: IAM is a powerful service that allows you to control how people and programs are allowed to manipulate your AWS infrastructure.

### 39. IAM Principals:

Ans: The first IAM concept to understand is principals. A principal is an IAM entity that is allowed to interact with AWS resources. A principal can be permanent or temporary, and it can represent a human or an application. There are three types of principals: root users, IAM users, and roles/temporary security tokens.

**Root user:** The **root user** is created when the **AWS account** is created. The credentials of the **account** owner allow full **access** to all resources in the **account**.

**IAM user:** Refer Q40

**roles/temporary security tokens:** To request temporary security credentials, you can use AWS Security Token Service (AWS STS) operations in the AWS API. These include operations to create and provide trusted users with temporary security credentials that can control access to your AWS resources.

### 40. IAM Users

Ans: An AWS Identity and Access Management (IAM) *user* is an entity that you create in AWS to represent the person or application that uses it to interact with AWS. A user in AWS consists of a name and credentials. An IAM user with administrator permissions is not the same thing as the AWS account root user

## 41. Policy:

Ans: A policy is a JSON document that fully defines a set of permissions to access and manipulate AWS resources.

Types of policy:

A] **Permissions policies:** You can attach permissions policies to a resource in AWS to define the permissions for that object.

a) **Identity-based policies** – When you attach a managed or inline policy to an IAM user, group, or role, the policy defines the permissions for that entity.

b) **Resource-based policies** – When you attach a JSON policy document to a resource, you define the permissions for that resource. The service must support resource-based policies.

c) **Access control lists (ACLs)** – When you attach an ACL to a resource, you define a list of principals with permission to access that resource. The resource must support ACLs.

B] **Permissions boundaries** – You can use policies to define the permissions boundary for an entity (user or role). A permissions boundary controls the maximum permissions that an entity can have.

a) **Organizations** – You can use an AWS Organizations service control policy (SCP) to apply a permissions boundary to an AWS Organizations organization or organizational unit (OU).

b) **IAM users or roles** – You can use a managed policy for a user or role's permissions boundary.

## 42. IAM JSON policy elements:

Ans: The Effect element is required and specifies whether the statement results in an allow or an explicit deny. Valid values for Effect are Allow and Deny.

43. **Service**—For what service does this permission apply? Most AWS Cloud services support granting access through IAM, including IAM itself.

44. **Resource**—The resource value specifies the specific AWS infrastructure for which this permission applies. This is specified as an Amazon Resource Name (ARN). The format for an ARN varies slightly between services, but the basic format is: "arn:aws:service:region:account-id:[resourcetype:]resource"

45. **User Policy**—These policies exist only in the context of the user to which they are attached. In the console, a user policy is entered into the user interface on the IAM user page.
46. **Managed Policies**—These policies are created in the Policies tab on the IAM page and exist independently of any individual user.

## 47. What is an ARN, what are its parts

Ans: Amazon Resource Names (ARNs) uniquely identify AWS resources. We require an ARN when you need to specify a resource unambiguously across all of AWS, such as in IAM policies, Amazon Relational Database Service (Amazon RDS) tags, and API calls. The parts of ARN are: “arn:partition:service:region:account-id:resource-id

partition: in which the resource is located

service: The service namespace that identifies the AWS product. For example, s3 for Amazon S3

region: The Region code. For example, us-east-2 for US East (Ohio).

account-id: The ID of the AWS account that owns the resource, without the hyphens

resource-id: The resource identifier. This part of the ARN can be the name or ID of the resource or a resource path.

## 48. What is virtualization?

Ans: Virtualization is the process of creating a virtual version of something like computer hardware which involves using specialized software to create a virtual version of a computing resource rather than the actual version of the same resource.

**Host Machine:** Machine on which the virtual version is built.

**Virtual Machine(Guest machine):** The virtual version created

Advantages:

1. More flexible and efficient allocation of resources.
2. Enhance development productivity.
3. It lowers the cost of IT infrastructure.

## 49. How a Virtual Machine Works

Ans:

Step1: Access is given to the host machine and virtual machine by the software called a hypervisor.

Step2: Hypervisor acts as a link between hardware and virtual environment which distributes the hardware components like CPU usage, memory allotments to the virtual environment.

**50. Hypervisor Types:** Hypervisor acts as a link between hardware and virtual environment which distributes the hardware components like CPU usage, memory allotments to the virtual environment.

**Function of hypervisor:** It is used to create and manage multiple VM instances on a host machine.

Ans:

TYPE 1 HYPERVISOR	TYPE 2 HYPERVISOR
A hypervisor that runs directly on the host's hardware to control the hardware and to manage guest operating systems	A hypervisor that runs on a conventional operating system just as other computer programs do
Called a native or Bare Metal Hypervisor	Called a Host OS Hypervisor
Runs directly on the host's hardware	Runs on an operating system similar to other computer programs
Examples: AntsleOs, Xen, XCP-ng, Microsoft Hyper V, VMware ESX/ESXi, Oracle VM Server for x86	Examples: VMware Workstation, VMware Player, VirtualBox, Parallel Desktop for Mac

### Pros & Cons of Type-1 Hypervisor:

**Pros:** Such kind of hypervisors are very efficient because they have direct access to the physical hardware resources (like Cpu, Memory, Network, Physical storage).

**Cons:** One problem with Type-1 hypervisor is that they usually need a dedicated separate machine to perform its operation and to instruct different VMs and control the host hardware resources.

### Pros & Cons of Type-2 Hypervisor:

**Pros:** Such kind of hypervisors allows quick and easy access to a guest Operating System alongside the host machine running.

**Cons:** Here there is no direct access to the physical hardware resources so the efficiency of these hypervisors lags in performance as compared to the type-1 hypervisors.

## 51. Types of Virtualization:

Ans:

**1) Hardware Virtualization:** When the virtual machine software or virtual machine manager (VMM) is directly installed on the hardware system is known as hardware virtualization.

Here are the three types of hardware virtualization:

- **Full Virtualization:** In full virtualization, the underlying hardware is completely simulated. Guest software does not require any modification to run.
- **Emulation Virtualization:** In Emulation, the virtual machine simulates the hardware and hence becomes independent of it.
- **Paravirtualization:** In Paravirtualization, the hardware is not simulated. The guest software runs their own isolated domains.

**2) Software Virtualization:** Software Virtualization is capable of abstracting the software installation procedure and creating virtual software installation.

Here are the three types of software virtualization

- **Application virtualization:** It is the abstraction of individual applications from the underlying operating system.
- **Desktop virtualization:** It is a concept in which desktop environments can be centrally provided and accessed via a network.
- **Operating system virtualization:** These concepts use native kernel functions of unix operating systems.

**3) Network Virtualization:** In computing, network virtualization is the process of combining hardware and software network resources and network functionality into a single a virtual network.

**4) Desktop Virtualization:** Desktop virtualization is technology that lets users simulate a workstation load to access a desktop from a connected device remotely or locally

**5) Storage Virtualization:** Storage virtualization helps the storage administrator to backup, archive and recover data more efficiently, in less amount of time by masking the actual complexity of SAN (Storage Area Network).

**6) Server Virtualization:** It is the division of a physical server into several virtual servers and this division is mainly done to improvise the utility of server resources.

## **52. Difference between paravirtualization and full virtualization**

Ans:



FULL VIRTUALIZATION	PARAVIRTUALIZATION
A common and cost effective type of virtualization in which computer service requests are separated from the physical hardware that facilitates them	An enhancement of virtualization technology in which a guest OS is recompiled prior to installation inside a virtual machine
Allows the guest operating systems to execute independently	Allows guest operating systems to communicate with the hypervisor
Guest operating system issues hardware calls to access hardware	Guest operating system directly communicate with the hypervisor using drivers
Lower Performance	Higher Performance

## 53. The Importance of Virtualization

- Virtualization abstracts compute resources
- Virtualization enables rapid scaling of resources
- Cloud computing can exist without Virtualization, although it will be inefficient and difficult
- Cloud computing makes notion of Pay for what you use, infinite availability
- These notions are practical only if we have flexibility as well as efficiency in the back end
- This efficiency is readily available in Virtualized Environments as well as Machines

## 53. Citrix Xen, architecture

A Xen virtual environment consist of several items that work together to deliver the virtualization environment a customer is looking to deploy:

- **Xen Hypervisor:** The Xen hypervisor is the basic abstraction layer of software that sits directly on the hardware below any operating systems. It is responsible for CPU scheduling and memory partitioning of the various virtual machines running on the hardware device. It controls the execution of virtual machines as they share the common processing environment. It has no knowledge of networking, external storage devices, video, or any other common I/O functions found on a computing system.



- **Domain 0:** The guest OS, which has control ability, is called Domain 0. Domain 0, a modified Linux kernel, is a unique virtual machine running on the Xen hypervisor that has special rights to access physical I/O resources as well as interact with the other virtual machines (Domain U: PV and HVM Guests) running on the system. All Xen virtualization environments require Domain 0 to be running before any other virtual machines can be started.
  
- **Domain U Guest (Dom U):** The guest OS, which does not have control ability, is called Domain U. Domain U guests have no direct access to physical hardware on the machine and are often referred to as unprivileged.
  - **PV Guest:** All paravirtualized virtual machines running on a Xen hypervisor are referred to as Domain U PV Guests and are modified Linux operating systems, Solaris, FreeBSD, and other UNIX operating systems. A Domain U PV Guest contains two drivers for network and disk access, PV Network Driver and PV Block Driver.
  - **HVM Guest:** All fully virtualized machines running on a Xen hypervisor are referred to as Domain U HVM Guests and run standard Windows or any other unchanged operating system. A Domain U HVM Guest does not have the PV drivers located within the virtual machine; instead a special daemon is started for each HVM Guest in Domain 0, Qemu-dm. Qemu-dm supports the Domain U HVM Guest for networking and disk access requests.

## 54. Memory in a Virtual Machine.

Virtual memory is a feature of an operating system that enables a computer to be able to compensate for shortages of physical memory by transferring pages of data from random access memory to disk storage. This process is done temporarily and is designed to work as a combination of RAM and space on the hard disk.

## 55. Steps to create VM in oracle virtualbox

### START:

1. Open VirtualBox.
2. Click "New"
3. Fill out form. Name: Kali Linux. Type: Linux. ...
4. Allocate a Minimum of "2048" MB of Memory (equal to 2 GiB)
5. Use "Create a virtual hard disk now" for the Hard disk.
6. Use "VDI" to create a virtual hard disk.
7. Choose "Dynamically allocated"
8. Allocate at Minimum 8 GB (recommended 10 or more)
9. Click "Start" (green arrow)

10. Load the ISO
11. Click the “Folder” icon.
12. Use the keyboard arrows to select “Install”. Hit Enter.

## 57. Role of a Hypervisor :

Hypervisors support the creation and management of virtual machines (VMs) by abstracting a computer’s software from its hardware. Hypervisors make virtualization possible by translating requests between the physical and virtual resources

## 58. Ring architecture, Intel x86 protection rings.

The ordered protection domains are referred to as **Protection Rings** which help in improving fault tolerance and provide Computer Security.

### Use of Protection Ring :

Use of Protection Rings provides logical space for the levels of permissions and execution. Two important uses of Protection Rings are :

1. Improving Fault Tolerance
2. Provide Computer Security

### Levels of Protection Ring :

There are basically 4 levels ranging from 0 which is the most privileged to 3 which is least privileged. Most Operating Systems use level 0 as the kernel or executive and use level 3 for application programs. A resource that is accessible to level n is also accessible to levels 0 to n and the privilege levels are rings.

### Modes of Protection Ring :

1. **Supervisor Mode** :  
Supervisor Mode is an execution mode in some of processors which allows execution of all instructions including privileged instructions. It also gives access to different address space, to memory management hardware, and to other peripherals. Usually, Operating System runs in this mode.
2. **Hypervisor Mode** :  
Modern CPUs offer x86 virtualization instructions for hypervisor to control “Ring 0” hardware access. In order to help virtualization, VT and Pacifica insert new privilege level below “Ring 0” and Both these add nine new “machine code” instructions that only work on Ring –1 and intended to be used by hypervisor
- **Features of Protection Ring :**
  - Protection Ring follows hierarchy.
  - Protection Ring provides layered architecture.
  - Protection Ring provides Computer Security.
  - Protection Ring provides good Fault Tolerance.

## 59. Virtualization opportunities.

## 60. Virtualization at the Instruction Set Architecture Level

Instruction set virtualization is a processor virtualization technique that enables emulation of the instruction set of one processor on a different processor. It allows the running or emulating of the instruction set architectures of different processors among each other – delivered as a virtualization layer.

## 61. Virtualization at the Hardware Abstraction Layer

**Virtualization at the HAL** exploits the similarity in architectures of the guest and host platforms to cut down the interpretation latency. **Virtualization** technique helps map the **virtual** resources to physical resources and use the native **hardware** for computations in the VM.

## 62. Memory ballooning, deduplication

### Memory Ballooning

Memory ballooning is a memory management feature used in most virtualization platforms which allows a host system to artificially enlarge its pool of memory by taking advantage

### Deduplication

Data deduplication technique allows the cloud users to manage their cloud storage space effectively by avoiding storage of repeated data and saving bandwidth.

## 63. The NIST model-all layers

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interactive.” NIST provides the following definitions of the essential characteristics and service and deployment models for cloud computing. Essential Cloud Computing Characteristics:

- On-demand self-service: consumers can unilaterally provision computing capabilities as needed automatically without requiring human interaction with each service provider.
- Broad network access: capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms.
- Resources pooling: The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand
- Rapid elasticity: capabilities can be elastically provisioned and released to scale rapidly outward and inward commensurate with demand.
- Measured service: cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service.

### Service Models

- Software as a Service (SaaS)

- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

## Deployment Models

- Private cloud
- Community cloud
- Public cloud
- Hybrid cloud

## 67. The Cloud Cube Model-all dimensions

The Cloud cube model helps to classify the cloud-based network on the four-dimensional factor. The main motive of the cloud model is to secure and protect the cloud network. The cloud model supports choosing cloud creation for the security association. It also helps IT managers, organizations, and business leaders by offering a safe and protected network. Security is an essential aspect for cloud users, and most of the cloud providers understand it. The customer should also take care of that; the selected cloud formation fulfills the regulatory and location needs. They also need one thing in their mind that if cloud providers stop offering the services, where else they can move.

There are three service models which consist:

- SaaS
- PaaS
- IaaS

There are four deployment models also.

- Public cloud
- Private cloud
- Community cloud
- Hybrid cloud

The models are flexible, user-friendly, and offer many benefits to cloud users.

There are four dimensions in the Cloud cube model.

- Internal/External  
Internal/External is the most common form of the cloud. It describes the physical location of the data. It agrees with us whether the data exists inside or outside of your organization's limit. In this, the data that is stored by the help of private cloud deployment will be referred to as internal, and data outside the cloud will be referred to as external.
- Proprietary/open  
The second dimension of cloud formation is proprietary/open. It defines the state of ownership of the cloud technology and interfaces. It also defines the level of incomparability while enabling data transportability between the system and forms of cloud.
- De-parameterized /parameterized  
The Perimeterised and De-perimeterized dimension tells us whether you are operating inside your traditional mindset or outside it.

**Parameterized** dimension means, continuing to operate within the traditional it boundary, orphan signaled by network firewalls.

**De-perimeterized** dimension means the system perimeter is architected on the principles outlined in the Jericho forums commandments. In De-parameterized dimension, the data will be encapsulated with metadata and mechanisms, which will further help to protect the data and limit the inappropriate usage.

- Insourced/outsourced dimension  
Insourced/outsourced is the fourth dimension of the cloud cube model. In the outsourced dimension, services are offered by the third party, and in the insourced dimension, the services are offered by the own staff.

## 68. Service models

**The service models are categorized into three basic models:**

### 1) Software-as-a-Service (SaaS)

- SaaS is known as '**On-Demand Software**'.
- It is a software distribution model. In this model, the applications are hosted by a cloud service provider and publicized to the customers over internet.
- The companies like Google, Microsoft provide their applications as a service to the end users.

#### **Advantages of SaaS**

- SaaS is easy to buy
- SaaS needed less hardware,
- Less maintenance cost

#### **Disadvantages of SaaS**

- SaaS applications are totally dependent on Internet connection.
- It is difficult to switch amongst the SaaS vendors.

### 2) Platform-as-a-Service (PaaS)

- PaaS is a programming platform for developers, generated for the programmers to create, test, run and manage the applications.
- Google Apps Engine(GAE), Windows Azure, Salesforce.com are the examples of PaaS.

#### **Advantages of PaaS**

- PaaS is easier to develop..
- In PaaS, developer only requires a PC and an Internet connection to start building applications.

#### **Disadvantages of PaaS**

- One developer can write the applications as per the platform provided by PaaS vendor hence moving the application to another PaaS vendor is a problem.

### 3) Infrastructure-as-a-Service (IaaS)

Infrastructure As A Service (IAAS) is a means of delivering computing infrastructure as on-demand services.

IaaS is a way to deliver a cloud computing infrastructure like server, storage, network and operating system.

#### **Advantages of IaaS**

- In IaaS, user can dynamically choose a CPU, memory storage configuration according to need.
- Users can easily access the vast computing power available on IaaS Cloud platform.

#### **Disadvantages of IaaS**

- IaaS cloud computing platform model is dependent on availability of Internet and virtualization services.

## **69. Cloud Components**

Components of Cloud Computing Architecture

There are the following components of cloud computing architecture -

### 1. Client Infrastructure

Client Infrastructure is a Front end component. It provides GUI (Graphical User Interface) to interact with the cloud.

### 2. Application

The application may be any software or platform that a client wants to access.

### 3. Service

A Cloud Services manages that which type of service you access according to the client's requirement.

Cloud computing offers the following three type of services:

i. Software as a Service (SaaS) – It is also known as cloud application services. Mostly, SaaS applications run directly through the web browser means we do not require to download and install these applications. Some important example of SaaS is given below –

Example: Google Apps, Salesforce Dropbox, Slack, Hubspot, Cisco WebEx.

ii. Platform as a Service (PaaS) – It is also known as cloud platform services. It is quite similar to SaaS, but the difference is that PaaS provides a platform for software creation, but using SaaS, we can access software over the internet without the need of any platform.

Example: Windows Azure, Force.com, Magento Commerce Cloud, OpenShift.

iii. Infrastructure as a Service (IaaS) – It is also known as cloud infrastructure services. It is responsible for managing applications data, middleware, and runtime environments.

Example: Amazon Web Services (AWS) EC2, Google Compute Engine (GCE), Cisco Metapod.

#### 4. Runtime Cloud

Runtime Cloud provides the execution and runtime environment to the virtual machines.

#### 5. Storage

Storage is one of the most important components of cloud computing. It provides a huge amount of storage capacity in the cloud to store and manage data.

#### 6. Infrastructure

It provides services on the host level, application level, and network level. Cloud infrastructure includes hardware and software components such as servers, storage, network devices, virtualization software, and other storage resources that are needed to support the cloud computing model.

#### 7. Management

Management is used to manage components such as application, service, runtime cloud, storage, infrastructure, and other security issues in the backend and establish coordination between them.

#### 8. Security

Security is an in-built back end component of cloud computing. It implements a security mechanism in the back end.

#### 9. Internet

The Internet is medium through which front end and back end can interact and communicate with each other.

## 70. Grid Computing

**Grid Computing** can be defined as a network of computers working together to perform a task that would rather be difficult for a single machine.

### **Working:**

A Grid computing network mainly consists of these three types of machines

1. **Control** **Node:**  
A computer, usually a server or a group of servers which administers the whole network and keeps the account of the resources in the network pool.
2. **Provider:**  
The computer which contributes it's resources in the network resource pool.
3. **User:**  
The computer that uses the resources on the network.

### Advantages of Grid Computing

1. Tasks can be performed parallely accross various physical locations and the users don't have to pay for it(with money).

## 71. SPI Framework- Software-Platform-Infrastructure (SPI) model.

A commonly agreed upon framework for describing cloud computing services goes by the acronym "SPI." This acronym stands for the three major services provided through the cloud: software-as-a-service (SaaS), platform-as-a-service (Paas), and infrastructure-as-a-service (Iaas).

## 72. Scaling-horizontal vs vertical

**Horizontal Scaling** is the act of changing the number of nodes in a computing system without changing the size of any individual node.

**Vertical Scaling** is increasing the size **and** computing power of a single instance or node without increasing the number of nodes or instances.

Horizontal Scaling	Vertical Scaling
Add more instances as demand increases	Add more CPU and/or RAM to existing instances as demand increases
No downtime required to scale up or down	Requires a restart to scale up or down
Automatic using services such as AWS Auto-Scaling	Would require scripting or automation tools to automate
Unlimited scalability	Scalability limited by maximum instance size

## 73. What is backup

Cloud backup, also referred to as cloud computer backup, refers to the backing up of data to a remote cloud-based server.



Cloud backup is a type of service through which cloud computing resources and infrastructure are used to create, edit, manage and restore data, services or application backup. This is done remotely over the internet.

#### Advantages of Cloud Backup

Stores your data on an external server, Ability to access your file via the internet, It is highly affordable, Reduces maintenance cost.

#### Disadvantages of Cloud Backup

Requires high internet connectivity, Data is stored on a third-party server, Determine the bandwidth allowance.

## 74. Storage vs backup

Backups and Cloud storage at a glance		
Features	Online Backup	Cloud Storage
Storage Space	Unlimited	Limited
Backup Type	Automatic and scheduled backups	Mostly manual backups only
Security	Strong	Weaker
Free versions	Free trials available (time limited)	Free subscriptions available (space and features limited)
Sync and Share options	Limited or non-existent	Well-developed
Number of devices	Limited (1 - 5)	Unlimited

## 75. Cloud backup types

There are mainly three types of backup: full, differential, and incremental.

### Full Backup

A full backup is the most complete type of backup where you clone all the selected data. This includes files, folders, SaaS applications, hard drives and more. The highlight of a full backup is the minimal time it requires to restore data. However, since as everything is backed up in one go, it takes longer to backup compared to other types of backup.

### Differential Backup

A differential backup straddles the line between a full and an incremental backup. This type of backup involves backing up data that was created or changed since the last full backup. To put it simply, a full backup is done initially, and then subsequent backups are run to include all the changes made to the files and folders.

### Incremental Backup

The first backup in an incremental backup is a full backup. The succeeding backups will only store changes that were made to the previous backup. Businesses have more flexibility in spinning these types of backups as often as they want, with only the most recent changes stored.

Ghost is an example of software that supplies this type of backup.

- Point-in-time (PIT) backups or snapshots: The data is backed up, and then every so often changes are amended to the backup creating what is referred to as an incremental backup. This type of backup lets you restore your data to a point in time and saves multiple copies of any file that has been changed. At least 10 to 30 copies of previous versions of files should be saved.

There are three other types of backup systems:

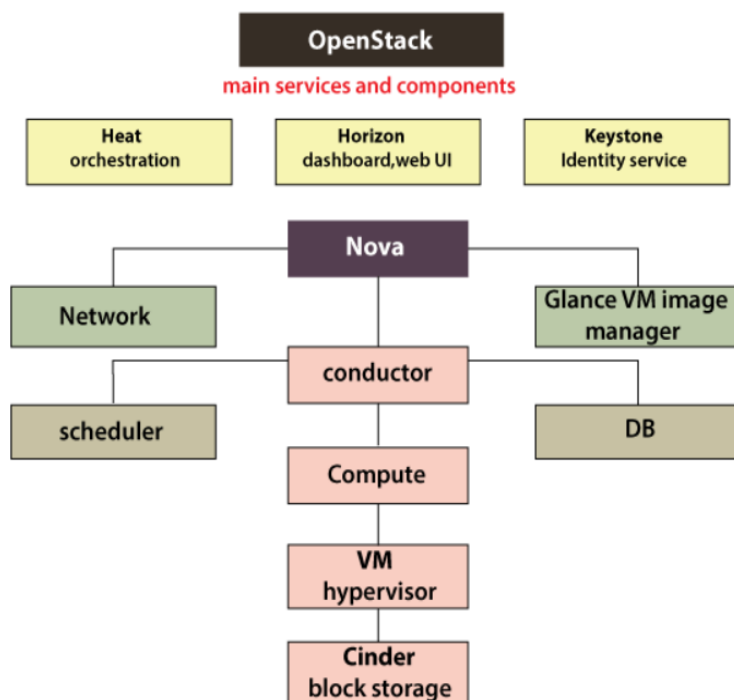
- Reverse Delta backup: A reverse delta backup creates a full backup first and then periodically synchronizes the full copy with the live version. The older versions of files that have been changed are archived so that a historical record of the backup exists. Among the software that uses this system is Apple's Time Machine and the RDIFF-BACKUP utility.
- Continuous Data Protection (CDP) or mirroring: The goal of this type of backup system is to create a cloned copy of your current data or drive. A cloud storage system contains a certain built-in latency, so unless the original data set is quiescent, the mirror lags behind the original in concurrency.
- Open file backup: Some applications such as database systems and messaging systems are mission critical and cannot be shut down before being backed up. An open file backup analyzes the transactions that are in progress, compares them to the file(s) at the start of the backup and the file(s) at the end of the backup, and

- Open file backup: Some applications such as database systems and messaging systems are mission critical and cannot be shut down before being backed up. An open file backup analyzes the transactions that are in progress, compares them to the file(s) at the start of the backup and the file(s) at the end of the backup, and

creates a backup that represents a complete file as it would exist at the time the backup started after all the transactions have been processed. This is a difficult proposition, and open file backup systems are expensive and highly customized to a particular application such as SQL Server or Exchange.

## 76. Open stack cloud

OpenStack is an open-standard and free platform for cloud computing. Mostly, it is deployed as IaaS (Infrastructure-as-a-Service) in both private and public clouds where various virtual servers and other types of resources are available for users. This platform combines unrelated components that networking resources, storage resources, multi-vendor hardware processing tools, and control diverse throughout the data center. Various users manage it by the command-line tools, RESTful web services, and web-based dashboard.



## **77. Code names**

## **78. Explain Application delivery over web browser to explore SaaS Environment.**

## **79.What are Security service provided by Amazon web services.**

AWS provides **services** that help you protect your data, accounts, **and** workloads from unauthorized access. AWS data protection **services** provide encryption **and** key management **and** threat detection that continuously monitors **and** protects your accounts **and** workloads.

## **80.What are AWS**

Amazon web service is an online platform that provides scalable and cost-effective cloud computing solutions. AWS is a broadly adopted cloud platform that offers several on-demand operations like compute power, database storage, content delivery, etc., to help corporates scale and grow.

## **81.Why API's is used in cloud services?**

## **82.What is the usage of virtualization platform in implementing cloud?**

Cloud computing runs on the concept of virtualization. It allows the creation of an intelligent abstraction layer over the need to procure and maintain the underlying hardware and software.

Server virtualization allows the different operating systems like Windows or Linux to share the same hardware and enables moving operating systems between different hardware even when the applications are in use.

Storage virtualization builds an abstract layer between the storage that is used to store the applications that are in use. This enables the users to use different storage systems as they want rather than be restricted to only one vendor.

Virtualization offers many benefits like no investment on shipping or storing. The vendors provide for backup and archiving. The data and applications are replicated offsite which aids in business continuity and recovery of any lost data. Virtualization removes the risks of losing components like tapes, external devices etc. or purchasing and maintaining hardware.

## **82.What are some large cloud providers and databases?**

## **83. Paravirtualization**

Paravirtualization is the category of CPU virtualization which uses hypercalls for operations to handle instructions at compile time. In paravirtualization, guest OS is not completely isolated but it is partially isolated by the virtual machine from the virtualization layer and hardware. VMware and Xen are some examples of paravirtualization.

**Advantages :**Paravirtualization advantages include easier backups, fast migrations, improved system utilization, server consolidation, power conservation and so on.

There are significant **disadvantages** to consider. Although the technology promises performance gains, those gains are often erratic and difficult to predict.

## **84. Cloud Storage:**

Cloud Storage is a service where data is remotely maintained, managed, and backed up. The service allows the users to store files online, so that they can access them from any location via the Internet.

**Advantages of Cloud Storage:** Usability, Bandwidth, Accessibility, Disaster Recovery, Cost Savings

**Disadvantages of cloud storage:**

**Accessibility:** If you have no internet connection, you have no access to your data.

**Software:** If you want to be able to manipulate your files locally through multiple devices, you'll need to download the service on all devices.

**Bandwidth:** Several cloud storage services have a specific bandwidth allowance.

## **85: Big tables**

**Cloud Bigtable** is a sparsely populated table that can scale to billions of rows and thousands of columns, enabling you to store terabytes or even petabytes of data.

## **86. Open stack features**

<b>Features</b>	<b>Benefits</b>
Leverages commodity hardware	No lock-in, lower price/GB.
HDD/node failure agnostic	Self-healing, reliable, data redundancy protects from failures.
Unlimited storage	Large and flat namespace, highly scalable read/write access, able to serve content directly from storage system.
Multi-dimensional scalability	Scale-out architecture: Scale vertically and horizontally-distributed storage. Backs up and archives large amounts of data with linear performance.
Account/container/object structure	No nesting, not a traditional file system: Optimized for scale, it scales to multiple petabytes and billions of objects.
Built-in replication 3X + data redundancy (compared with 2X on RAID)	A configurable number of accounts, containers and object copies for high availability.
Easily add capacity (unlike RAID resize)	Elastic data scaling with ease.
No central database	Higher performance, no bottlenecks.
RAID not required	Handle many small, random reads and writes efficiently.
Built-in management utilities	Account management: Create, add, verify, and delete users; Container management: Upload, download, and verify; Monitoring: Capacity, host, network, log trawling, and cluster health.
Drive auditing	Detect drive failures preempting data corruption.

## 87. What is mobile cloud computing?

MCC stands for Mobile Cloud Computing which is defined as a combination of mobile computing, cloud computing, and wireless network that come up together purpose such as rich computational resources to mobile users, network operators, as well as to cloud computing providers. Mobile Cloud Computing is meant to make it possible for rich mobile applications to be executed on a different number of mobile devices.

### **Benefits of Mobile Cloud Computing**

1. Mobile Cloud Computing Saves Business money.
2. Because of the portability which makes their work easy and efficient.
3. Cloud consumers explore more features on their mobile phones.
4. Developers reach greater markets through mobile cloud web services.
5. More network providers can join up in this field.

### **Challenges of Mobile Cloud Computing**

1. Low bandwidth
2. Security and Privacy
3. Service Availability
4. Alteration of Networks
5. Limited Energy source

## **88. Where open file backup is used?**

## **89. What is virtualization layer?**

The virtualization Layer is an additional abstraction layer between network and storage hardware, computing, and the application running on it. ... A machine with a virtualization layer can create other (virtual) machines, where you can install additional operating systems.

## **90. What is cloud?**

The cloud" refers to servers that are accessed over the Internet, and the software and databases that run on those servers.

## **91. Daas**

**Desktop as a Service (DaaS)** is a cloud computing offering where a service provider delivers virtual desktops to end users over the Internet, licensed with a per-user subscription

### **Advantages of Desktop as a Service**

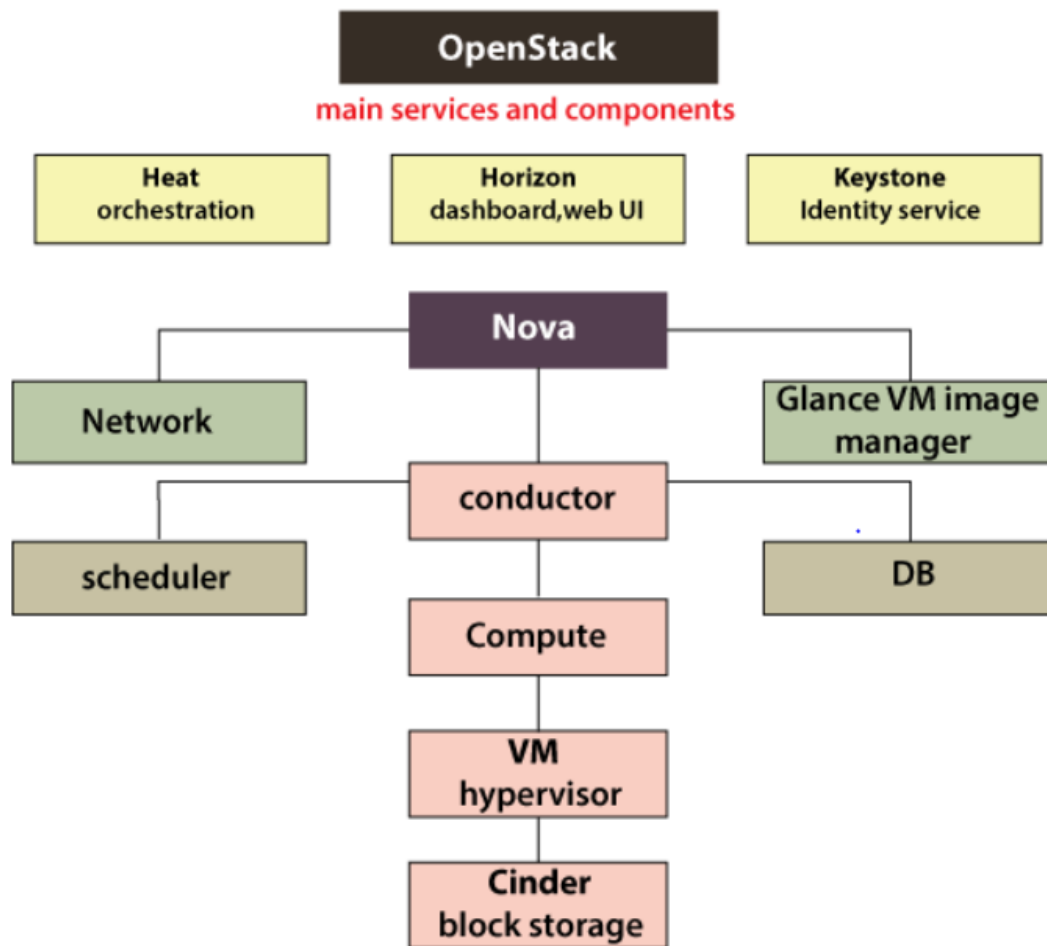
- Faster deployment and decommissioning of active end users
- Reduced downtime for IT support
- Cost savings
- Increased device flexibility
- Enhanced security

## 92. Utility computing

**Utility computing** is a model in which **computing** resources are provided to the customer based on specific demand.

## 93. Open stack

Open stack is an open standard and free platform, it is deployed as IaaS in both public and private. This platform combines interrelated components like storage resources, networking resources, multivendor hardware processing tools and control diverse throughout the data center.



**compute (Nova):** project of open stack that facilitates the way for provisioning compute instances, it supports building bare metal servers and vm

**Image Service (Glance):** The glance service (image) project offers a service in which users can discover and upload data assets.

**Dashboard (Horizon):** Horizon is a canonical implementation of Dashboard of OpenStack which offers the web-based UI to various OpenStack services such as Keystone, Swift, Nova, etc. Dashboard shifts with a few central dashboards like a "Settings Dashboard", a "System Dashboard", and a "User Dashboard".

**Identity Service (Keystone):** Keystone is a service of OpenStack that offers shared multi-tenant authorization, service discovery, and API client authentication by implementing Identity API of OpenStack.



**Neutron(Networking):** it handles every networking issues for vni( virtual networking infrastructure) and various authorization layer factors of pni(Physical networking infrastructure). It includes services like vpn and firewall

**Cinder(Block storage):**provides volume to nova vm, containers and ironic bare metal host. This block storage system handles detaching, attaching, replication, creation, and snapshot management of many block devices to the servers.

**Heat(Orchestration):** Heat can be expressed as a service for orchestrating more than one fusion cloud application with templates by CloudFormation adaptable Query API and OpenStack-native REST API.

**Swift** is an eventually consistent and distributed blob/object-store. The object store project of OpenStack is called Swift and it provides software for cloud storage so that we can retrieve and store a large amount of data along with a general API.

## 94. RestFULL Web Services

REST stands for REpresentational State Transfer

REST is an architectural style not a protocol.

### Advantages

**Fast:** RESTful Web Services are fast because there is no strict specification like SOAP. It consumes less bandwidth and resource.

**Language and Platform independent:** RESTful web services can be written in any programming language and executed in any platform.

**Can use SOAP:** RESTful web services can use SOAP web services as the implementation.

**Permits different data format:** RESTful web service permits different data format such as Plain Text, HTML, XML and JSON.

## 95. Soap

# SOAP Web Services

SOAP stands for Simple Object Access Protocol. It is a XML-based protocol for accessing web services.

# Advantages of Soap Web Services

**WS Security:** SOAP defines its own security known as WS Security.

**Language and Platform independent:** SOAP web services can be written in any programming language and platform.

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# Disadvantages of Soap Web Services

**Slow:** SOAP uses XML format that must be parsed to be read. It defines many standards that must be followed by SOAP applications. So it is slow and consumes more bandwidth and resource.