# Descriptive Question Bank

1. **What is Cloud Computing? Explain essential characteristics of Cloud Computing**

Ans: Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.

It means that the computing resource or infrastructure—be it server hardware, storage, network, or application software—all available from the cloud vendor or provider’s site/premises, can be accessible over the Internet from any remote location and by any local computing device. In addition, the usage or accessibility is to cost only to the level of usage to the customers based on their needs and demands, also known as the pay-as-you-go or pay-as-per-use model. If the need is more, more quantum computing resources are made available (provisioning with elasticity) by the provider

Five Essential Characteristics

Diagram

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1. On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service’s provider.
2. Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and personal digital assistants [PDAs])
3. Elastic resource pooling: The provider’s computing resources are pooled to serve multiple consumers using a multitenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify the location at a higher level of abstraction (e.g., country, state, or data center). Examples of resources include storage, processing, memory, and network bandwidth.
4. Rapid elasticity: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.
5. 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 (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer of the utilized service.
6. **Explain in detail Infrastructure as a Service (IAAS) with an example**

Ans: IaaS changes the way that the compute, storage, and networking resources are consumed. In traditional data centers, the computing power is consumed by having physical access to the infrastructure. IaaS changes the computing from a physical infrastructure to a virtual infrastructure. IaaS provides virtual computing, storage, and network resources by abstracting the physical resources. Technology virtualization is used to provide the virtual resources. All the virtual resources are given to the virtual machines (VMs) that are configured by the service provider. The end users or IT architects will use the infrastructure resources in the form of VMs as shown in Figure

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* Generally, the IaaS services are provided from the service provider cloud data center.
* The end users can access the services from their devices through web command line interface (CLI) or application programming interfaces (APIs) provided by the service providers.
* Some of the popular IaaS providers include

Amazon Web Services (AWS)

Google Compute Engine

OpenStack

Eucalyptus.

Services provided by IaaS providers

* **Compute:** Computing as a Service includes virtual central processing units (CPUs) and virtual main memory for the VMs that are provisioned to the end users.
* **Storage:** STaaS provides back-end storage for the VM images. Some of the IaaS providers also provide the back end for storing files.
* **Network:** Network as a Service (NaaS) provides virtual networking components such as virtual router, switch, and bridge for the VMs.
* **Load balancers:** Load Balancing as a Service may provide load balancing capability at the infrastructure layer.

Characteristics of IaaS

* Web access to the resources
* Centralized management
* Elasticity and dynamic scaling
* Shared infrastructure
* Preconfigured VMs
* Metered services

Suitability of IaaS

* Unpredictable spikes in usage
* Limited capital investment
* Infrastructure on demand

Benefits provided by IaaS

* Pay-as-you-use model
* Reduced TCO
* Elastic resources
* Better resource utilization
* Supports Green IT

Drawbacks of IaaS

* Security issues
* Interoperability issues
* Performance issues

1. **Write short note on:** 
   1. **Hybrid Cloud**

Ans: A hybrid cloud is a cloud computing environment that uses a mix of on-premises, private cloud, and third-party, public cloud services with orchestration between these platforms. This typically involves a connection from an on-premises data center to a public cloud. The connection also can involve other private assets, including edge devices or other clouds.

A hybrid cloud model allows enterprises to deploy workloads in private IT environments or public clouds and move between them as computing needs and costs change. This gives a business greater flexibility, and more data deployment options. A hybrid cloud workload includes the network, hosting, and web service features of an application.

Hybrid cloud computing enables an enterprise to deploy its most sensitive workloads in an on-premises cloud and to host less-critical resources on a third-party public cloud provider. This approach allows organizations to get the best of both private and public cloud models.

The core benefits of hybrid cloud include the following:

* Flexibility. Users work with various types of data in disparate environments and adjust their infrastructure. A company can build a hybrid cloud that works for its needs, using traditional systems as well as the latest cloud technology, without a full commitment to a vendor.
* Cost management. With a private cloud, organizations own and operate the data center infrastructure, which requires significant capital expense and fixed costs. Alternatively, the public cloud offers resources and services that are accounted as variable and operational expenses. Hybrid cloud users can choose to run workloads in whichever environment is more cost effective.
* Agility and scalability. Hybrid cloud offers more resource options via a public cloud provider vs. an organization's physical data center. This makes it easier to provision, deploy and scale resources to meet demand spikes
* Resiliency and interoperability. To increase resiliency, a business can run workloads redundantly in both private and public environments. Components of one workload can also run in both environments and interoperate.
* Compliance. Compliance restrictions on where data can reside mean organizations in highly regulated industries cannot move all workloads to the public cloud. With hybrid cloud, organizations can keep data in a private environment while operating workloads in the cloud, or they can operate workloads in a private data center and move data to and from the public cloud as needed. This allows companies to meet regulatory requirements and still benefit from the elasticity of the cloud.

Hybrid cloud solutions combine public cloud hosting from an IaaS (infrastructure-as-a-service) provider—like Amazon Web Services (AWS), Microsoft Azure, or Google Cloud Platform (GCP)—with an internal private cloud.

* 1. **Cloud application in healthcare**

Ans: To effectively address the needs of business and patients, tech-savvy healthcare professionals are turning towards cloud computing for all its benefits. Cloud computing, with its on-demand availability, internet-based services, and high-data availability, has transformed the entire healthcare domain and converted it into HealthTech.

1. Collaboration: Sharing facilitates collaboration. With cloud computing, the process of data sharing has become a lot easier and simpler. As healthcare information is meant to stay confidential, with the cloud, the data can be securely shared among all the relevant healthcare stakeholders like doctors, nurses, and caregivers that, too, in real-time.

Apart from sharing, they can also remotely access medical reports and records anytime, anywhere. Cloud has also facilitated remote conferencing, quick updates on healthcare developments, and patients’ conditions, which altogether make it a perfect companion for healthcare professionals.

2. Security: Healthcare data needs to stay confidential. The abundant data held by this domain makes it a focal point of attraction to the malicious actors, resulting in security and data breaches. The cloud network ensures safety as it has specific security tools that can inform you about suspicious attempts.

As cloud acts as a repository of data, cloud service providers like AWS or Azure are extra cautious in complying with the privacy standards like GDPR. These service providers resort to different safeguard mechanisms like network fireball, customer-controlled encryption, etc., which makes it the safest and most reliable option for data-related needs.

3. Cost: Cloud can hold an enormous amount of information at a very minimal cost. Cloud computing works on the pay-as-you-go and subscription model, which indicates you only must pay for those services which you are availing.

By shifting the IT budgets, cloud technology can reduce your in-house infrastructural costs and other operational costs to a great extent. It ultimately makes it even possible for smaller hospitals with a tight budget to adopt a cloud-based model.

4. Speed: Speed is a significant criterion before making decisions about selecting any technology. Cloud-based tools can update and upgrade their features at a commendable pace with minimal intervention, and you can get real-time updates as well on all the relevant information.

The benefits of cloud computing in healthcare include unmatched speed and faster access to information, which can overcome the stumbling blocks which the industry stakeholders and patients are encountering. This futuristic technology has also modified the scope of clinical research, and the cloud can facilitate clinical trial management and knowledge sharing.

5. Scalability and Flexibility: Healthcare organizations operate in a dynamic environment. Cloud facilitates technologies that are used in healthcare like electronic medical records, mobile apps, patient portals, devices with IoT, big data analytics. It provides hassle-free scalability and flexibility, which in turn improves the ultimate decision-making process.

Along with 24\*7 availability, healthcare providers drastically need to scale the data storage and network requirements as per the service demands. Cloud technology can increase or decrease these storage needs as per the need of healthcare professionals.

As cloud migration can completely disrupt your traditional methodologies of data handling, healthcare providers need to strategize the migration process well in advance. Cloud migration strategy not only reduces risks but also minimizes the chances of downtime, prevents information leaks, improves data handling, and strengthens security practices.

* 1. **Private Cloud**

Ans: According to the National Institute of Standards and Technology (NIST), private cloud can be defined as the cloud infrastructure that is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises. The private cloud in simple terms is the cloud environment created for a single organization. It is usually private to the organization but can be managed by the organization or any other third party. The private cloud is small as compared to other cloud models. Here, the cloud is deployed and maintained by the organizations itself

Characteristics

Certain characteristics of the private cloud are as follows:

* + - 1. Secure: The private cloud is secure. This is because usually the private cloud is deployed and managed by the organization itself, and hence there is least chance of data being leaked out of the cloud. In the case of outsourced cloud, the service provider may view the cloud (though governed by SLAs), but there is no other risk from anybody else as all the users belong to the same organization.
      2. Central control: The organization mostly has full control over the cloud as usually the private cloud is managed by the organization itself. Thus, when managed by the organization itself, there is no need for the organization to rely on anybody.
      3. Weak SLAs: Formal SLAs may or may not exist in a private cloud. But if they exist, they are weak as it is between the organization and the users of the same organization. Thus, high availability and good service may or may not be available. This depends on the organization that is controlling the cloud.

Suitability

* The organizations or enterprises that require a separate cloud for their personal or official use.
* The organizations or enterprises that have enough funds as managing and maintaining a cloud is a costly affair.
* The organizations or enterprises that consider data security to be important.
* The organizations that want autonomy and complete control over the cloud.
* The organizations that have a smaller number of users.
* The organizations that have prebuilt infrastructure for deploying the cloud and are ready for timely maintenance of the cloud for efficient functioning.
* Special care needs to be taken and resources should be available for troubleshooting

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Advantages of Private Cloud

Medium and large businesses typically chose a private cloud due to its protection, compliance, and scalability options. Other benefits include

* Fine-grained control over your infrastructure.
* Adapt better to the usage of resources as per demand.
* If your business has to comply with bespoke industry standard compliance, the private cloud allows you to easily ensure your systems are totally compliant.
* While you can scale to demand in a public cloud, the granularity of scale that the private cloud offers is of a significant benefit for some businesses.
* Large to very large businesses might want to maintain a private cloud then use a public infrastructure especially with a competitor on it or the infrastructure itself owned by a competitor.

Disadvantages of Private Cloud

* the associated cost. In general, private clouds are more expensive than public
* Operational efficiency in a private cloud is difficult to achieve. Underutilization is a major grouse in private clouds.
* Scaling up on hardware and real estate space would be a challenge in private clouds.

Private Cloud Companies in market

Hewlett Packard Enterprise (HPE)

VMware

Dell EMC

Oracle

IBM

Red Hat

1. **Explain in detail life cycle of cloud service.**

Ans: The input to the production of a cloud services are all the resources and assets that will compose the cloud service (i.e., in the form of hardware, software, manpower required from developer to the management level and cost). The outcome of the cloud services production is an acceptable and marketable cloud service, which will provide a measurable value to the business objectives and outcomes. The sets of inputs are transformed to derive the outcome by using the cloud service life cycle. The cloud service life cycle consists of five phases as shown in Figure 25.3 and Table 25.1 summarizes each of the phase in cloud service life cycle. At the core of the cloud service life cycle is service strategy, which is the fundamental phase in defining the service principles. The main core of the cloud Service life cycle is the key principle that all services must provide measurable value to business objectives and outcomes, which is reinforced in ITIL service management as its primary focus. Service design, transition, and operation are the revolving life-cycle stages and are anchored by continual service improvement. This life cycle revolves through the continuous service improvement process to provide performance measurement at each individual phase and a feedback for improvement. This has become crucial as IT organizations are increasingly forced to operate as businesses to demonstrate a clear return on investment and equate service performance with business value to the IT’s internal customers. The necessity of specialization and coordination in the life-cycle approach has been made available via feedback and control between the functions and processes across the life-cycle phases. The cloud service life-cycle approach mimics reality of most organizations where effective management requires uses of multiple control perspectives.

Diagram

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1. What is Virtualization. Explain taxonomy/opportunities of virtualization

Ans: Virtualization uses software to create an abstraction layer over computer hardware that allows the hardware elements of a single computer—processors, memory, storage and more—to be divided into multiple virtual computers, commonly called virtual machines (VMs).

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**Hardware-assisted virtualization.**

* This term refers to a scenario in which the hardware provides architectural support for building a virtual machine manager able to run a guest operating system in complete isolation. Eg: Products such as VMware Virtual Platform, introduced in 1999 by VMware,

**Full virtualization**

* Full virtualization refers to the ability to run a program, most likely an operating system, directly on top of a virtual machine and without any modification, as though it were run on the raw hardware
* The principal advantage of full virtualization is complete isolation, which leads to enhanced security, ease of emulation of different architectures, and coexistence of different systems on the same platform
* A key challenge is the interception of privileged instructions such as I/O instructions

**Paravirtualization**

* This is a not-transparent virtualization solution that allows implementing thin virtual machine managers.
* Paravirtualization techniques expose a software interface to the virtual machine that is slightly modified from the host and, therefore, guests need to be modified.
* The aim of paravirtualization is to provide the capability to demand the execution of performance-critical operations directly on the host, thus preventing performance losses that would otherwise be experienced in managed execution

**Partial virtualization**

* Partial virtualization provides a partial emulation of the underlying hardware, thus not allowing the complete execution of the guest operating system in complete isolation.
* Partial virtualization allows many applications to run transparently, but not all the features of the operating system can be supported, as happens with full virtualization.
* An example of partial virtualization is address space virtualization used in time-sharing systems;

**Operating system-level virtualization**

* Operating system-level virtualization offers the opportunity to create different and separated execution environments for applications that are managed concurrently. This virtualization technique can be considered an evolution of the chroot mechanism in Unix systems. Operating system-level virtualization aims to provide separated and multiple execution containers for running applications. This technique is an efficient solution for server consolidation scenarios in which multiple application servers share the same technology: operating system, application server framework, and other components.
* Examples of operating system-level virtualizations are FreeBSD Jails, IBM Logical Partition (LPAR), SolarisZones and Containers, Parallels Virtuozzo Containers, OpenVZ, iCore Virtual Accounts, Free Virtual Private Server (FreeVPS), and others

**Programming language-level virtualization**

* Programming language-level virtualization is mostly used to achieve ease of deployment of applications, managed execution, and portability across different platforms and operating systems. It consists of a virtual machine executing the byte code of a program, which is the result of the compilation process.
* The main advantage of programming-level virtual machines, also called process virtual machines, is the ability to provide a uniform execution environment across different platforms
* Programming language-level virtualization is mostly used to achieve ease of deployment of applications, managed execution, and portability across different platforms and operating systems. It consists of a virtual machine executing the byte code of a program, which is the result of the compilation process.
* Security is another advantage of managed programming languages; by filtering the I/O operations, the process virtual machine can easily support sandboxing of applications

**Application-level virtualization**

* Application-level virtualization is a technique allowing applications to be run in runtime environments that do not natively support all the features required by such applications.
* In this case, one of the following strategies can be implemented:
  + Interpretation- every source instruction is interpreted by an emulator
  + Binary translation- every source instruction is converted to native instructions with equivalent functions
* Application virtualization is a good solution in the case of missing libraries in the host operating system. Another advantage is that in this case the virtual machine manager is much lighter
* Compared to programming-level virtualization, which works across all the applications developed for that virtual machine, application-level virtualization works for a specific environment
* One of the most popular solutions implementing application virtualization is Wine, which is a software application allowing Unix-like operating systems to execute programs written for the Microsoft Windows platform

**Storage virtualization**

Storage virtualization is a system administration practice that allows decoupling the physical organization of the hardware from its logical representation. Using this technique, users do not have to be worried about the specific location of their data, which can be identified using a logical path

**Network virtualization**

Network virtualization combines hardware appliances and specific software for the creation and management of a virtual network. Network virtualization can aggregate different physical networks into a single logical network (external network virtualization) or provide network-like functionality to an operating system partition (internal network virtualization)

**Desktop virtualization**

Desktop virtualization abstracts the desktop environment available on a personal computer to provide access to it using a client/server approach. Desktop virtualization provides the same outcome of hardware virtualization but serves a different purpose. desktop virtualization strictly refers to the ability to remotely access a desktop environment, generally the desktop environment is stored in a remote server or a data centre that provides a high-availability infrastructure and ensures the accessibility and persistence of the data

**Application server virtualization**

Application server virtualization abstracts a collection of application servers that provide the same services as a single virtual application server by using load-balancing strategies and providing a high-availability infrastructure for the services hosted in the application server

# Multiple Choice Question Bank

1. Geographic distribution of data across a cloud provider’s network is a problem for many enterprises because it:
2. Breaks compliance regulations
3. Adds latency
4. Raises security concerns
5. Makes data recovery harder

1. This is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.
2. Platform as a Service (PaaS)
3. Infrastructure as a Service (IaaS)
4. Software as a Service (SaaS).
5. Database as a Service (DaaS).

1. Which of the following is not PaaS in cloud environment?
2. Database servers
3. OS and applications software’s
4. Virtual Machines
5. Web server

1. Services to support database management system in any cloud-based system should be part of \_\_\_\_\_\_
2. SaaS
3. IaaS
4. PaaS
5. EaaS
6. IaaS provides\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. VM, Virtual storage, virtual infrastructure
8. VM, OS, Applications
9. Operating environment with applications
10. Physical machines with network

1. Which one of the following is disadvantage of CC?
2. QoS cannot be guaranteed
3. Cloud applications suffer from inherent latency
4. CC applications are not reliable
5. Utilization is poor

1. Which one of the following business types is least suitable for deploying on cloud?
2. Web content delivery services
3. CRM applications
4. Data analytics and computation
5. Billing application
6. Which of the following is not a possible parameter of SLA in Cloud?
7. Availability of service
8. Response time or latency
9. Electricity cost
10. Warranty of service

1. A low-level program that provides system resources to VMs is called\_\_\_\_\_\_\_\_\_\_\_
2. Guest OS
3. Hypervisor
4. Host OS
5. VM Box

1. \_\_\_\_computing refers to applications and services that run on a distributed network using virtualized resources.
2. Distributed
3. Parallel
4. Cloud
5. Grid

1. Which of the following statement is wrong?
2. The vendor is responsible for all the operational aspects of the service.
3. The customer is responsible only for his interaction with the platform.
4. Google’s App Engine platform is PaaS offering.
5. SaaS require specific application to be accessed globally over the internet.

1. In which one of the following, a strategy record or Document is created respectively to the events, conditions a user may face while applying cloud computing mode.
2. Cloud Computing Value Proposition
3. Cloud Computing Strategy Planning
4. Planning Phase
5. Business Architecture Development

1. What facet of cloud computing helps to guard against downtime and determines costs?
2. Service-level agreements
3. Application programming interfaces
4. Virtual private networks
5. Bandwidth fees

1. \_\_\_\_\_\_\_ as a Service is a cloud computing infrastructure that creates a development environment upon which applications may be build
2. Infrastructure
3. Service
4. Platform
5. Environment

1. SaaS supports multiple users and provides a shared data model through \_\_\_\_\_\_\_\_model.
2. single tenancy
3. multi-tenancy
4. multiple instance
5. shared tenancy

1. Which of the following virtualization has the main benefits like user mobility, portability, and easy management of software installation, updates, and patches?
2. Application virtualization
3. Network virtualization
4. Desktop virtualization
5. Storage virtualization
6. \_\_\_\_\_\_\_\_\_\_\_\_refers to the ability to run a program, most likely an operating system, directly on top of a virtual machine and without any modification, as though it were run on the raw hardware
   1. Para virtualization
   2. Full virtualization
   3. Partial Virtualization
   4. hardware assisted virtualization

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_virtualization is also called system virtualization
2. Desktop
3. Hardware-level
4. Operating system
5. Application

1. In \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_phase of cloud service lifecycle, all management knowledge required for a certain type of cloud service is captured in a service template.
   1. Production
   2. Subscription and instantiation
   3. offering
   4. definition

1. Which one of the following is an example of application-level virtualization?
   1. Xen
   2. VMware
   3. Wine
   4. Microsoft Hyper-V