Cloud Computing Important Questions and Solutions

1. **What is cloud? Describe the core technology on which cloud computing is built up.**

**Ans:**

**Cloud:**

Information and data is stored on physical or virtual servers, which are maintained and controlled by a cloud computing provider, such as Amazon and their AWS product. As a personal or business cloud computing user, you access your stored information on the 'cloud', via an Internet connection.

**The core technology on which cloud computing is built up:**

1. **Software as a Service (SaaS):**

SaaS is a form of cloud computing in which users can access software applications without needing to download, install, or store that software and its various components on their devices or hard drive. Most cloud computing software of this kind is subscription-based with an annual or monthly fee. In return, users get seamless solutions and features without needing hardware, being bogged down by installing updates, or other maintenance tasks.

When it was founded, Salesforce was one of the first cloud computing and SaaS companies. Its Sales Cloud, Marketing Cloud, and Service Cloud are all cloud-based software applications.

1. **Platform as a Service (PaaS):**

Platform as a Service (PaaS) is a cloud computing solution that provides developers with an easy-to-use platform to create their own software, web applications, or other programming projects. Businesses use PaaS to create proprietary apps and programs without the need for servers or special testing environments.

Salesforce has been in the PaaS market for over a decade and is the leader in enterprise PaaS. The Salesforce Platform gives companies the power to build apps and services with Heroku Enterprise, Private Spaces, Salesforce Lightning, and Trailhead. The platform’s versatility allows developers to write code in the language of their choice, and it integrates with other cloud computing products that use customer data, which allows companies to track an app’s performance.

1. **Infrastructure as a Service (IaaS):**

Infrastructure as a Service (IaaS) provides companies with access to servers, firewalls, virtual machines, storage, and other infrastructure. It’s ideal for companies that create highly specialized or unique proprietary applications, but don’t want to spend time or other resources buying, storing, setting up, or maintaining the necessary equipment. Instead, they access ready-to-use infrastructure over the internet.

1. **Discuss the origin of the cloud concept.**

**Ans:**

<http://whatiscloud.com/origins_and_influences/a_brief_history>

1. **How the cloud based software development can differ from the traditional one?**

**Ans:**

Cloud computing is far more abstract as a virtual hosting solution. Instead of being accessible via physical hardware, all servers, software and networks are hosted in the cloud, off premises. It’s a real-time virtual environment hosted between several different servers at the same time. So rather than investing money into purchasing physical servers in-house, you can rent the data storage space from cloud computing providers on a more cost effective pay-per-use basis.

The main differences between cloud hosting and traditional web hosting are:

### **Resilience and Elasticity**

The information and applications hosted in the cloud are evenly distributed across all the servers, which are connected to work as one. Therefore, if one server fails, no data is lost and downtime is avoided. The cloud also offers more storage space and server resources, including better computing power. This means your software and applications will perform faster.

Traditional IT systems are not so resilient and cannot guarantee a consistently high level of server performance. They have limited capacity and are susceptible to downtime, which can greatly hinder workplace productivity.

### **Flexibility and Scalability**

Cloud hosting offers an enhanced level of flexibility and scalability in comparison to traditional data centres. The on-demand virtual space of cloud computing has unlimited storage space and more server resources. Cloud servers can scale up or down depending on the level of traffic your website receives, and you will have full control to install any software as and when you need to. This provides more flexibility for your business to grow.

With traditional IT infrastructure, you can only use the resources that are already available to you. If you run out of storage space, the only solution is to purchase or rent another server.If you hire more employees, you will need to pay for additional software licences and have these manually uploaded on your office hardware. This can be a costly venture, especially if your business is growing quite rapidly.

### **Automation**

A key difference between cloud computing and traditional IT infrastructure is how they are managed. Cloud hosting is managed by the storage provider who takes care of all the necessary hardware, ensures security measures are in place, and keeps it running smoothly. Traditional data centres require heavy administration in-house, which can be costly and time consuming for your business. Fully trained IT personnel may be needed to ensure regular monitoring and maintenance of your servers – such as upgrades, configuration problems, threat protection and installations.

### **Running Costs**

Cloud computing is more cost effective than traditional IT infrastructure due to methods of payment for the data storage services. With cloud based services, you only pay for what is used – similarly to how you pay for utilities such as electricity. Furthermore, the decreased likelihood of downtime means improved workplace performance and increased profits in the long run.

With traditional IT infrastructure, you will need to purchase equipment and additional server space upfront to adapt to business growth. If this slows, you will end up paying for resources you don’t use. Furthermore, the value of physical servers decreases year on year, so the return on investment of investing money in traditional IT infrastructure is quite low.

### **Security**

Cloud computing is an external form of data storage and software delivery, which can make it seem less secure than local data hosting. Anyone with access to the server can view and use the stored data and applications in the cloud, wherever internet connection is available. Choosing a cloud service provider that is completely transparent in its hosting of cloud platforms and ensures optimum security measures are in place is crucial when transitioning to the cloud.

With traditional IT infrastructure, you are responsible for the protection of your data, and it is easier to ensure that only approved personnel can access stored applications and data. Physically connected to your local network, data centres can be managed by in-house IT departments on a round-the-clock basis, but a significant amount of time and money is needed to ensure the right security strategies are implemented and data recovery systems are in place.

1. **Explain what is the use of “EUCALYPTUS” in cloud computing.**

**Ans:**

Eucalyptus is an open source software platform for implementing Infrastructure as a Service ([IaaS](https://searchcloudcomputing.techtarget.com/definition/Infrastructure-as-a-Service-IaaS)) in a [private](https://searchcloudcomputing.techtarget.com/definition/private-cloud) or [hybrid cloud](https://searchcloudcomputing.techtarget.com/definition/hybrid-cloud) computing environment.

The Eucalyptus cloud platform pools together existing [virtualized](https://searchservervirtualization.techtarget.com/definition/virtualization) infrastructure to create cloud resources for infrastructure as a service, [network as a service](https://searchsdn.techtarget.com/definition/Network-as-a-Service-NaaS) and [storage as a service](https://searchstorage.techtarget.com/definition/Storage-as-a-Service-SaaS). The name Eucalyptus is an acronym for ***Elastic Utility Computing Architecture for Linking Your Programs To Useful Systems***.

Eucalyptus was founded out of a research project in the Computer Science Department at the University of California, Santa Barbara, and became a for-profit business called Eucalyptus Systems in 2009. Eucalyptus Systems announced a formal agreement with Amazon Web Services ([AWS](https://searchaws.techtarget.com/definition/Amazon-Web-Services)) in March 2012, allowing administrators to move instances between a Eucalyptus private cloud and the Amazon Elastic Compute Cloud ([EC2](https://searchaws.techtarget.com/definition/Amazon-Elastic-Compute-Cloud-Amazon-EC2)) to create a hybrid cloud. The partnership also allows Eucalyptus to work with Amazon’s product teams to develop unique AWS-compatible features.

Eucalyptus features include:

* Supports both Linux and Windows virtual machines ([VMs](https://searchservervirtualization.techtarget.com/definition/virtual-machine)).
* Application program interface- [(API)](https://searchmicroservices.techtarget.com/definition/application-program-interface-API) compatible with Amazon [EC2](https://searchaws.techtarget.com/definition/Amazon-Elastic-Compute-Cloud-Amazon-EC2) platform.
* Compatible with Amazon Web Services (AWS) and Simple Storage Service (S3).
* Works with multiple [hypervisors](https://searchservervirtualization.techtarget.com/definition/hypervisor) including [VMware](https://searchvmware.techtarget.com/definition/VMware), [Xen](https://searchservervirtualization.techtarget.com/definition/Xen) and KVM.
* Can be installed and deployed from source code or DEB and [RPM](https://searchdatacenter.techtarget.com/definition/RPM-Package-Manager-Red-hat-Package-Manager) packages.
* Internal processes communications are secured through [SOAP](https://searchmicroservices.techtarget.com/definition/SOAP-Simple-Object-Access-Protocol) and WS-Security.
* Multiple clusters can be virtualized as a single cloud.
* Administrative features such as user and group management and reports.

Version 3.3, which became generally available in June 2013, adds the following features:

* [Auto Scaling](https://searchcloudapplications.techtarget.com/definition/autoscaling): Allows application developers to scale Eucalyptus resources up or down based on policies defined using Amazon EC2-compatible APIs and tools
* [Elastic Load Balancing](https://searchaws.techtarget.com/definition/elastic-load-balancing): AWS-compatible service that provides greater [fault tolerance](https://searchdisasterrecovery.techtarget.com/definition/fault-tolerant) for applications
* CloudWatch: An AWS-compatible service that allows users to collect metrics, set alarms, identify trends, and take action to ensure applications run smoothly
* Resource Tagging: Fine-grained reporting for [showback](https://searchservervirtualization.techtarget.com/definition/IT-showback) and [chargeback](https://whatis.techtarget.com/definition/IT-chargeback-system) scenarios; allows IT/ [DevOps](https://searchitoperations.techtarget.com/definition/DevOps) to build reports that show cloud utilization by application, department or user
* Expanded Instance Types: Expanded set of instance types to more closely align to those available in Amazon EC2. Was 5 before, now up to 15 instance types.
* Maintenance Mode: Allows for [replication](https://searchsqlserver.techtarget.com/definition/replication) of a virtual machine’s hard drive, evacuation of the server node and provides a maintenance window.

1. **At the phase of cloud planing, it is necessary to make a detailed investigation on customer position and to analyze the problems and risks in cloud application both at present and in future. Therefore we need to consider practicable planning phase to ensure that customer can use cloud computing successfully to reach their business goal. What are the practicable planning phases that we need to consider?**

**Ans:**

In cloud computing, the business requirements are mandatory to consider before deploying applications to cloud.

**Following are the things to consider while planning:**

* Data Security and privacy requirement
* Budget requirements
* Data backup, training
* Type of cloud i.e public, private or hybrid
* Dashboard and reporting requirements
* Client access requirements
* Data export requirements

To achieve these, well-compiled planning is required.

Phases of Planning

**Following are the phases to migrate the entire business to cloud.**

1) Strategy phase

2) Planning phase

3) Deployment phase

**1) Strategy phase**

In strategy phase, examine the strategy problems faced by the customer.

**Following are the two steps to accomplish this analysis:**

i) Cloud Computing Value Proposition

ii) Cloud Computing Strategy Planning

**i) Cloud Computing Value Proposition**

In this, examine the factors affecting the customers while applying the cloud computing mode. Target the key problems they want to solve.

**The key factors are:**

* IT management simplification
* Operation and maintenance cost reduction
* Business mode innovation
* Low cost of outsourcing the hosting service
* High service quality of hosting service outsourced
* The above factors helps in decision making for future development.

**ii) Cloud Computing Strategy Planning**

A strategy document is created as per the conditions experienced by the customer when using Cloud computing.

**2) Planning Phase**

In planning phase, analysis of problems and risks in Cloud computing is conducted. It ensures that the cloud is successfully meeting the customer's business goals.

**Following are the steps involved in Planning phase:**

* Business Architecture Development
* IT Architecture Development
* Requirements on Quality of Service Development
* Transformation Plan development

**3) Deployment phase**

Deployment phase focuses on the above two phases i.e strategy and planning phase.

**It includes following two phases:**

i) Selecting Cloud Computing provider

ii) Maintenance and Technical Service

1. **In cloud who actually has the access on the data or the hardware where the data is stored on? Does the provider have a right or ability to access or use data?**

**Ans:**

**What can my cloud provider do with my data:**

Lack of specificity regarding cloud vendors' rights to use customer data presents a significant risk in the majority of cloud services agreements.

Take a moment from your day and pull out the last three or four cloud services agreements your company has entered into. Now, highlight the provisions in those agreements that specifically define how the vendor may use your data. You may be very surprised at the results. Some of the agreements may not even include language clearly defining what the vendor can and, more importantly, cannot do with your data. Likely, however, what you will see is language that grants the vendor broad rights to use your data for purposes other than simply performing the services for your company’s benefit.

Lack of specificity regarding the vendor’s rights to use customer data presents a significant risk in the majority of cloud services agreements. The following discusses two of the most critical issues presented by this risk and potential solutions:

## **Lack of definition regarding data usage rights**

Many cloud agreements are silent as to limits on the vendor’s use of customer data. Some may say the vendor will use the data to provide the services. All too frequently, however, the agreements grant the vendor vague rights to use customer data for purposes other than providing the services (e.g., to improve the services, to enhance functionality, or, cryptically, to create new products and services).

We recommend always wording data usage in terms of an express license along the following lines:

*During the term of this Agreement, Customer grants Vendor a non-transferable, non-exclusive, terminable at-will license to use the Customer Data solely for purposes of performing the Services for Customer’s benefit*.

There are several advantages to approaching data use with a license of this kind. First, it makes clear the license is non-transferable (i.e., it cannot be assigned to a third party without the customer’s consent). Second, it is “terminable at-will.” This means the customer can revoke the license at any time. For example, if the data contains highly confidential information (e.g., consumer information or trade secrets), the customer may want to the right to revoke the license if the vendor suffers an attack on its security that could place data at risk. All too often, cloud agreements are written such that the customer cannot readily terminate or suspend access to their data. The inclusion of this right is important for protection. Finally, the license makes clear the vendor has one, and only one, right to use the data: solely for purposes of performing the services *for the customer’s benefit*. Any other use would constitute a breach of contract.

## **Extremely broad and undefined “aggregated data” rights**

Most cloud agreements include the right for the vendor to use aggregated data. While this may be entirely acceptable to many customers, the problem is that the term “aggregated” is seldom defined or, at best, it includes a vague reference to not identifying the customer. If aggregated data rights are to be granted, the contract should make clear the aggregated data will not be identifiable to or capable of re-identification to any entity or individual. If the customer’s data contains regulated information of individuals (e.g., healthcare data or financial data), then there are specific legal standards for de-identification and aggregation the vendor must follow. If applicable, the contract should specifically require the vendor to de-identify and aggregate the data in compliance with those laws.

In addition to making clear what aggregated data is, we also recommend customers disclaim all liability for that data. That is, the contract should state that the customer is making no warranties with regard to use of its data in connection with data aggregation and that all such use is entirely as-is, without warranties of any kind.

Finally, consider including language that places all liability and risk of using aggregated data, including failure to properly de-identify the data, on the vendor.

In negotiating future cloud agreements, customers should bear these issues in mind and, where relevant, insist on revisions to provide greater specificity and protection. In a perfect world, cloud providers should have these issues addressed in their form agreements. Unfortunately, the world of cloud computing is not perfect.

1. Cc

**Ans:**

1. **Write the difference between SaaS and PaaS.**

**Ans:**

**SaaS –**

SaaS is the most popular and known form of cloud service for consumers. Some of the popular SaaS products are Salesforce, Google Apps, NetFlix, WebEx, GotoMeeting and DropBox.

**SaaS Characteristics:**

* Software is hosted on a remote server and is always accessible through a web browser over Internet
* Application is managed from a central location
* Application users don’t need to worry about hardware, software updates and patches
* Any integration with the third party applications are done through APIs

**SaaS Suitability**

* Applications where the demands spike or reduce significantly – For example: taxation software has high demand during tax filing season, hotel reservations see a spike during holiday season and so on
* Applications which have demand for web as well as mobile access – For example: Sales management software, CRM systems
* Short term projects which require collaboration – the pay-as-you-go model makes it convenient to quickly setup and use
* Start-up businesses which want to quickly launch ecommerce sites without worrying about server configurations and software updates

**PaaS –**

PaaS is the similar to SaaS in many ways. Instead of delivering the software over the web, PaaSoffers a platform for the creation of software (which is then delivered over the web).Developers work on PaaS platform and concentrate on software application building without having to worry about software updates, operating systems, load balancing, storage, or other details related to infrastructure.

**PaaS Characteristics:**

* Built on top of virtualization technology – you can demand for resources as per your need and scale up/ down as per the requirement
* Provides varying services to facilitate development, testing, deployment and hosting of software applications in integrated development environment
* Multiple users can utilize the same development application
* Integrated web services and databases
* Billing and subscription is managed by tools

**PaaS Suitability**

* When multiple developers are working on the development or when external parties are involved in the development process, PaaS is a great option to bring in the speed and flexibility to the development process
* For organizations following Agile Methodology for software development, PaaSeases the difficulties associated with rapid development and iteration of application
* When you wish to spread your Capital Investment – by providing the underlying solid infrastructure, PaaS model reduces the organization’s overhead costs
* Large organizations who want to customize applications

1. **Explain Virtualization technology.**

**Ans:**

Virtualization is the creation of virtual servers, infrastructures, devices and computing resources. A great example of how it works in your daily life is the separation of your hard drive into different parts. While you may have only one hard drive, your system sees it as two, three or more different and separate segments. Similarly, this technology has been used for a long time. It started as the ability to run multiple operating systems on one hardware set and now it a vital part of testing and cloud-based computing.

Virtualization is a large umbrella of technologies and concepts that are meant to provide an abstract environment—whether virtual hardware or an operating system—to run applications. The term virtualization is often synonymous with hardware virtualization, which plays a fundamental role in efficiently delivering Infrastructure-as-a-Service (IaaS) solutions for cloud computing. In fact, virtualization technologies have a long trail in the history of computer science and have been available in many flavors by providing virtual environments at the operating system level, the programming language level, and the application level. Moreover, virtualization technologies provide a virtual environment for not only executing applications but also for storage, memory, and networking.

1. **What are the features of managed execution?**

**Ans:**

Virtualization of the execution environment not only allows increased security, but a wider range of features also can be implemented. In particular, sharing, aggregation, emulation, and isolation are the most relevant features (see Figure).

• **Sharing**. Virtualization allows the creation of a separate computing environments within the same host. In this way it is possible to fully exploit the capabilities of a powerful guest, which would otherwise be underutilized. As we will see in later chapters, sharing is a particularly important feature in virtualized data centers, where this basic feature is used to reduce the number of active servers and limit power consumption.

• **Aggregation**. Not only is it possible to share physical resource among several guests, but virtualization also allows aggregation, which is the opposite process. A group of separate hosts can be tied together and represented to guests as a single virtual host. This function is naturally implemented in middleware for distributed computing, with a classical example represented by cluster management software, which harnesses the physical resources of a homogeneous group of machines and represents them as a single resource.

• **Emulation**. Guest programs are executed within an environment that is controlled by the virtualization layer, which ultimately is a program. This allows for controlling and tuning the environment that is exposed to guests. For instance, a completely different environment with respect to the host can be emulated, thus allowing the execution of guest programs requiring specific characteristics that are not present in the physical host. This feature becomes very useful for testing purposes, where a specific guest has to be validated against different platforms or architectures and the wide range of options is

not easily accessible during development. Again, hardware virtualization solutions are able to provide virtual hardware and emulate a particular kind of device such as Small Computer System Interface (SCSI) devices for file I/O, without the hosting machine having such hardware installed. Old and legacy software that does not meet the requirements of current systems can be run on emulated hardware without any need to change the code. This is possible either by emulating the required hardware architecture or within a specific operating system sandbox, such as the MS-DOS mode in Windows 95/98. Another example of emulation is an arcade-game emulator that allows us to play arcade games on a normal personal computer.

• **Isolation**. Virtualization allows providing guests—whether they are operating systems, applications, or other entities—with a completely separate environment, in which they are executed. The guest program performs its activity by interacting with an abstraction layer, which provides access to the underlying resources. Isolation brings several benefits; for example, it allows multiple guests to run on the same host without interfering with each other. Second, it provides a separation between the host and the guest. The virtual machine can filter the activity of the guest and prevent harmful operations against the host.

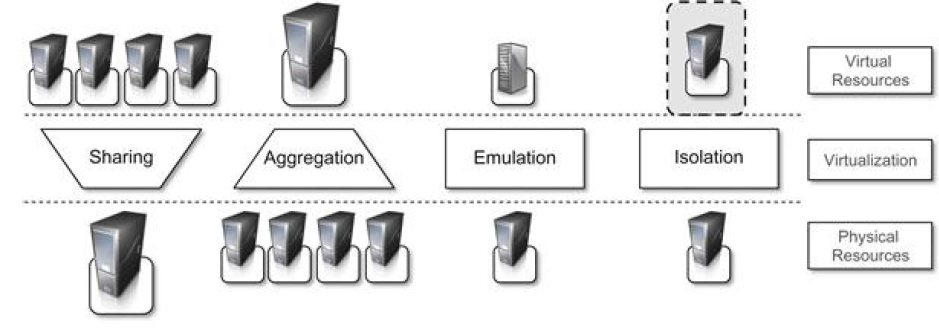


Fig 1: Functions enabled by managed execution

1. **Describe different types of hardware virtualization techniques.**

**Ans**

Hardware-level virtualization is a virtualization technique that provides an abstract execution environment in terms of computer hardware on top of which a guest operating system can be run. In this model, the guest is represented by the operating system, the host by the physical computer hardware, the virtual machine by its emulation, and the virtual machine manager by the hypervisor (see Figure). The hypervisor is generally a program or a combination of software and hardware that allows the abstraction of the underlying physical hardware.

Hardware-level virtualization is also called system virtualization, since it provides ISA to virtual machines, which is the representation of the hardware interface of a system. This is to differentiate it from process virtual machines, which expose ABI to virtual machines.

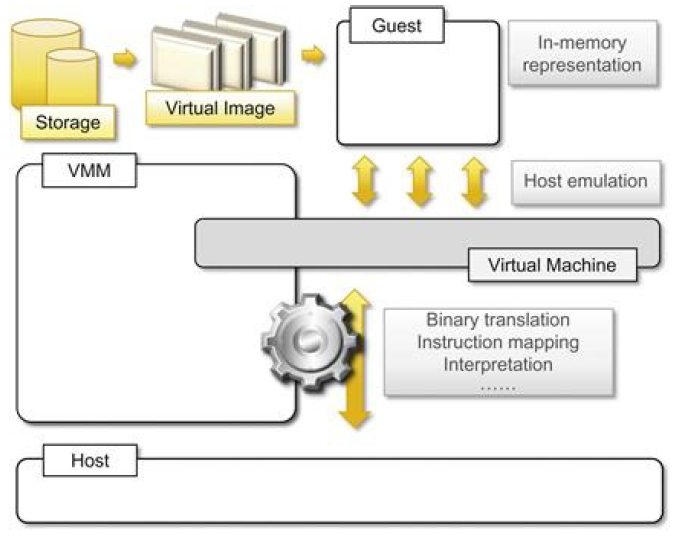


Fig 2: A hardware virtualization reference model.

The most popular virtualization techniques are:

**1. Full Virtualization:** This technique fully virtualizes the main physical server to support applications and software to operate in a much similar way on virtualized divisions. This creates an environment as if it is working on a unique server. Full virtualization technique enables the administrators to run unchanged and entirely virtualized operating system.

**Advantages:**

* Full virtualization technique grants the potential to combine existing systems on to the newer ones with increased efficiency and a well-organized hardware.
* This amazing methodology contributes effectively to trim down the operating costs engaged in repairing and enhancing older systems.
* The less competent systems can be power-packed with this technique, while reducing the physical space and augmenting the overall performance of the company.

2. **Virtual machines:** Virtual machines are popularly known as VMs, imitate certain factual or illusory hardware requiring the valid resources from the host, which is nothing but the actual machine operating the VMs. A virtual machines monitor (VMM) is used in certain cases where the CPU directives need extra privileges and may not be employed in user space.

**Advantages:**

* This methodology benefits numerous system emulators who use it for running a random guest operating system without altering the guest OS.
* VMMs are used to examine the performed code and facilitate its secure running. For such varied benefits it is widely used by Microsoft Virtual Server, QEMU, Parallels, VirtualBox and many other VMware products.

3. **Para-Virtualization:** This methodology clearly runsmodified versions of operating systems. Only the software and programs are carried out in a precise manner to work for their exclusive websites without executing any kind of hardware simulation. Using this technique, the guest is very well aware of its environment as the para-virtualized OS is altered to be alert about its virtualization.

**Advantages:**

* It enhances the performance notably by decreasing the number of VMM calls and prevents the needless use of privileged instructions.
* It allows running many operating systems on a single server.
* This method is considered as the most advantageous one as it augments the performance per server without the operating cost of a host operating system.

4. **Operating System level Virtualization:** Operating system level virtualization is specially intended to grant the necessary security and separation to run manifold applications and replicas of the same operating system on the same server. Isolating, segregating and providing a safe environment enables the easy running and sharing of machines of numerous applications operating on a single server. This technique is used by Linux-VServer, FreeBSD Jails, OpenVZ, Solaris Zones and Virtuozzo.

**Advantages:**

* When compared with all the above mentioned techniques, OS level virtualization is considered to give the best performance and measurability.
* This technique is easy to control and comparatively uncomplicated to manage as everything can be administered from the host system.

Virtualization has become a widespread concept in the today's world of information technology. Decisive and influential designers can do all the wonders required for optimizing the performance of virtualized systems while steadily focusing on your business needs.

**5. 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. This technique was originally introduced in the IBM System/370. At present, examples of hardware-assisted virtualization are the extensions to the x86-64 bit architecture introduced with Intel VT (formerly known as Vanderpool) and AMD V (formerly known as Pacifica). These extensions, which differ between the two vendors, are meant to reduce the performance penalties experienced by emulating x86 hardware with hypervisors. Before the introduction of hardware-assisted virtualization, software emulation of x86 hardware was significantly costly from the performance point of view. The reason for this is that by design the x86 architecture did not meet the formal requirements introduced by Popek and Goldberg, and early products were using binary translation to trap some sensitive instructions and provide an emulated version. Products such as VMware Virtual Platform, introduced in 1999 by VMware, which pioneered the field of x86 virtualization, were based on this technique. After 2006, Intel and AMD introduced processor extensions, and a wide range of virtualization solutions took advantage of them: Kernel-based Virtual Machine (KVM), VirtualBox, Xen, VMware, Hyper-V, Sun xVM, Parallels, and others.

**6. 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; this allows multiple applications and users to run concurrently in a separate memory space, but they still share the same hardware resources (disk, processor, and network). Historically, partial virtualization has been an important milestone for achieving full virtualization, and it was implemented on the experimental IBM M44/44X. Address space virtualization is a common feature of contemporary operating systems.

1. **What are the benefits of virtualizations?**

**Ans:**

1. Efficient use of resources
2. Portability
3. Self-containment
4. Managed execution
5. Isolation
6. Reduced capital and operating costs.
7. Minimized or eliminated downtime.
8. Increased IT productivity, efficiency, agility and responsiveness.
9. Faster provisioning of applications and resources.
10. Greater business continuity and disaster recovery.
11. Simplified data center management.
12. Availability of a true Software-Defined Data Center
13. **Speedy Recovery Time:** In the event of a system failure or disaster virtualization allows for faster recovery of IT resources which provides for improved business continuity and revenue. The older infrastructures are incapable of recovering within a few hours and in most cases, companies experience a much longer downtime which results in revenue loss.
14. **Better Scalability:** Virtualized environments are designed to be scalable which allows for more flexibility when it comes to company growth. Instead of purchasing additional infrastructure components, new applications and upgrades can easily be implemented with virtualization.
15. **Cost and Space Savings:** Saving on the costs of IT infrastructure is a reality when you switch to virtualization. The cost savings also extends to reduced energy consumption and IT personnel while reducing the amount of space that is required to house an IT environment.
16. **Better Return on Investment:** In addition to reducing the costs of maintaining an older infrastructure, companies can increase their ROI by ensuring business continuity following a disaster and preventing revenue loss.
17. **Faster Server Provisioning and Deployment:** Server virtualization enables system provisioning and deployment within minutes, allowing you to clone an existing virtual machine without the hours and costs normally spent installing a new physical server. Companies with virtual environments already look back and cringe at the grueling process of filling out a purchase order, waiting for the server to arrive and then waiting hours for the operating system and applications to finish installing. Time and cost add up substantially, not to mention the growing number of racks and cables you would have to purchase to accommodate for the increasing number of physical servers. Datacenter virtualization is most certainly necessary for most businesses to keep up with the explosion of data resources needed to keep pace with competitors.
18. **Greatly Improved Disaster Recovery:** Perhaps the greatest benefit of server virtualization is the capability to move a virtual machine from one server to another quickly and safely. Backing up critical data is done quickly and effectively because your company can effortlessly create a replication site. Most enterprise virtualization platforms contain software that helps automate the failover during a disaster. The software also allows you to test a disaster recovery failover—think of it as your data center’s own fire escape plan. If a data center disaster occurs, your infrastructure is already set up to take appropriate measures for a swift and safe recovery. Try achieving that with arrays of physical servers—now that’s a real disaster.
19. **Increased Productivity:** Having fewer physical servers means there are less of them to maintain and manage. As discussed in benefit #2, applications that used to take days or weeks to provision are now done in minutes. This leaves your IT staff more time to spend on more productive tasks such as driving new business initiatives, cutting expenses and raising revenue.
20. **Describe the logical components of hypervisors.**

**Ans:**

A fundamental element of hardware virtualization is the hypervisor, or virtual machine manager (VMM). It recreates a hardware environment in which guest operating systems are installed. There are two major types of hypervisor: Type I and Type II.

• **Type I** hypervisors run directly **on top of the hardware**. Therefore, they take the place of the operating systems and interact directly with the ISA interface exposed by the underlying hardware, and they emulate this interface in order to allow the management of guest operating systems. This type of hypervisor is also called a native virtual machine since it runs natively on hardware.

• **Type II** hypervisors **require the support of an operating system** to provide virtualization services. This means that they are programs managed by the operating system, which interact with it through the ABI and emulate the ISA of virtual hardware for guest operating systems. This type of hypervisor is also called a hosted virtual machine since it is hosted within an operating system.

**Logical components of Hypervisors:**

1. Network Bridging vs. Network Address Translation (NAT)

2. Memory Compression

3. Hypervisor Disk Swapping

4. Resource Overcommitting

5. Kernel Samepage Merging / Transparent Page Sharing

6. SSD Support

1. Cc
2. Cc
3. Cc
4. Cc
5. Cc
6. Cc
7. Cc
8. Cc
9. Cc
10. Cc
11. Cc
12. Cc
13. Cc
14. Cc
15. Cc
16. Cc
17. Cc
18. Cc
19. Cc
20. Cc
21. Cc
22. Cc
23. Cc
24. Cc
25. Cc
26. Cc
27. Cc