What is Virtualization?

Virtualization refers to the creation of a virtual version of a computer system, operating system, network or storage device. It enables multiple operating systems to run on a single physical machine, allowing for greater efficiency and flexibility in managing and deploying resources.

Virtualization technology allows for the creation of virtual machines, which are essentially software-based emulations of a physical machine. Each virtual machine runs its own operating system and applications, but they share the resources of the physical host machine. This allows multiple operating systems and applications to coexist on a single physical server, which can reduce hardware costs, simplify management, and improve resource utilization.

Virtualization technology is widely used in data centers, cloud computing environments, and other enterprise computing environments. It can also be used on personal computers to run multiple operating systems or to isolate applications in a sandbox environment.

Virtualization can be defined as a process that enables the creation of a virtual version of a desktop, operating system, network resources, or server. Virtualization plays a key and dominant role in cloud computing.

This ensures that the physical delivery of the resource or an application is separated from the actual resource itself. It helps reduce the space or cost involved with the resource. This technique enables the end-user to run multiple desktop operating systems and applications simultaneously on the same hardware and software.

The process also ensures virtual emulation of products or services in the same machine, and it does not slow down or impact the system’s efficiency.

The invention of Virtualization was initiated during the era of mainframe usage, and as time evolved with progression in new-age technologies, Virtualization was achieved with the mean of specialized software.

Virtualization has a wide range of uses in different areas. Some common use cases include:

Server Consolidation: Virtualization allows multiple virtual servers to be created on a single physical server. This can reduce the number of physical servers required, which can save space, power, and cooling costs.

Development and Testing: Virtualization can be used to create isolated development and testing environments that are identical to production environments. This can help developers and testers to identify and fix issues before deploying changes to production environments.

Disaster Recovery: Virtualization can be used to create replicas of physical servers, which can be used as backups in case of a disaster. In the event of a disaster, the virtual machines can be quickly and easily started on another physical server, reducing downtime.

Cloud Computing: Virtualization is a key technology used in cloud computing. Cloud providers use virtualization to create multiple virtual servers on a single physical server, which allows them to offer flexible and scalable cloud services.

Desktop Virtualization: Virtualization can be used to create virtual desktops that are hosted on a central server. This can allow employees to access their desktops and applications from anywhere, on any device.

Overall, virtualization provides organizations with greater flexibility, efficiency, and cost savings in managing their computing resources.

Virtualization as a Concept of Cloud Computing

In cloud computing, Virtualization facilitates the creation of virtual machines and ensures the smooth functioning of multiple operating systems. It also helps create a virtual ecosystem for server operating systems and multiple storage devices, and it runs multiple operating systems.

Cloud Computing is identified as an application or service that involves a virtual ecosystem. Such an ecosystem could be of public or private nature. With Virtualization, the need to have a physical infrastructure is reduced. **The terms Cloud Computing and Virtualization are now being used interchangeably, and they are being unified quickly**.

Virtualization and Cloud Computing work hand in hand to ensure that you will get advanced and sophisticated levels of computing. It ensures that applications can be shared across multiple network threads of different enterprise and active users.

Cloud Computing delivers scalability, efficiency, and economic value. It offers streamlined workload management systems.

In simpler words, Cloud Computing in collaboration with Virtualization ensures that the modern-day enterprise gets a more cost-efficient way to run multiple operating systems using one dedicated resource.

Characteristics of Virtualization

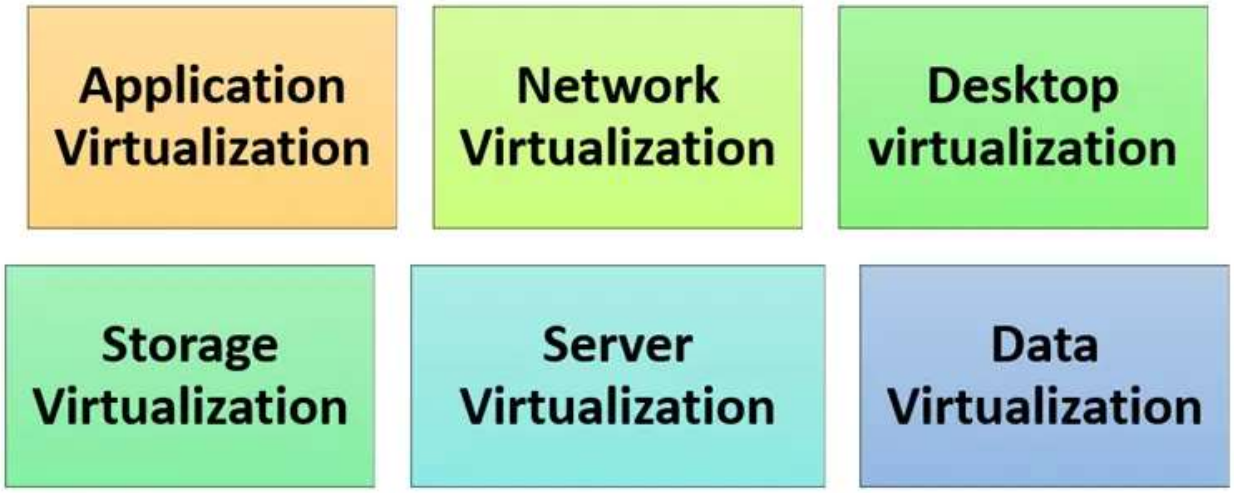
Virtualization offers several features or characteristics as listed below: –

- **Distribution of resources:** Virtualization and Cloud Computing technology ensure end-users develop a unique computing environment. It is achieved through the creation of one host machine. Through this host machine, the end-user can restrict the number of active users. By doing so, it facilitates easy of control. They can also be used to bring down power consumption.

- **Accessibility of server resources:** Virtualization delivers several unique features that ensure no need for physical servers. Such features ensure a boost to uptime, and there is less fault tolerance and availability of resources.
- **Resource Isolation:** Virtualization provides isolated virtual machines. Each virtual machine can have many guest users, and guest users could be either operating systems, devices, or applications.
  The virtual machine provides such guest users with an isolated virtual environment. This ensures that the sensitive information remains protected, and, at the same time, guest users remain inter-connected with one another.
- **Security and authenticity:** The virtualization systems ensure continuous uptime of systems, and it does automatic load balancing and ensures there is less disruption of services.
- **Aggregation:** Aggregation in Virtualization is achieved through cluster management software. This software ensures that the homogenous sets of computers or networks are connected and act as one unified resource.

Types of Virtualizations

There are many variants or types available under virtualization technology as listed below:



Types of Virtualizations

Application Virtualization

This can be defined as the type of Virtualization that enables the end-user of an application to have remote access.

This is achieved through a server. This server has all personal information and other applicable characteristics required to use the application.

The server is accessible through the internet, and it runs on a local workstation. With Application virtualization, an end-user can run two different versions of the same software or the same application.

Application virtualization is offered through packaged software or a hosted application.

Network Virtualization

This kind of virtualization can execute many virtual networks, and each has a separate control and data plan. It co-occurs on the top of a physical network, and it can be run by parties who are not aware of one another.

Network virtualization creates virtual networks, and it also maintains a provision of virtual networks.

Through network virtualization, logical switches, firewalls, routers, load balancers, and workload security management systems can be created.

Desktop Virtualization

This can be defined as the type of Virtualization that enables the operating system of end-users to be remotely stored on a server or data center. It enables the users to access their desktops remotely and do so by sitting in any geographical location. They can also use different machines to virtually access their desktops.

With desktop virtualization, an end-user can work on more than one operating systems basis the business need of that individual.

If the individual wants to work on an operating system other than the Window Operating System, he can use desktop virtualization. This provides the individual an opportunity to work on two different operating systems.

Therefore, desktop virtualization delivers a host of benefits. It delivers portability, user mobility, easy software management with patches and updates.

Storage Virtualization

This type of Virtualization provides virtual storage systems that facilitate storage management.

It facilitates the management of storage effectively and through multiple sources accessed from a single repository. Storage virtualizations ensure consistent performance and smooth performance.

It also offers continuous updates and patches on advanced functions. It also helps cope with the changes that come up in the underlying storage equipment.

Server Virtualization

This kind of Virtualization ensures masking of servers. The main or the intended server is divided into many virtual servers. Such servers keep changing their identity numbers and processors to facilitate the masking process. This ensures that each server can run its own operating systems in complete isolation.

Data Virtualization

This can be defined as the type of Virtualization wherein data are sourced and collected from several sources and managed from a single location.

There is no technical knowledge from where such data is sourced and collected, stored, or formatted for such data.

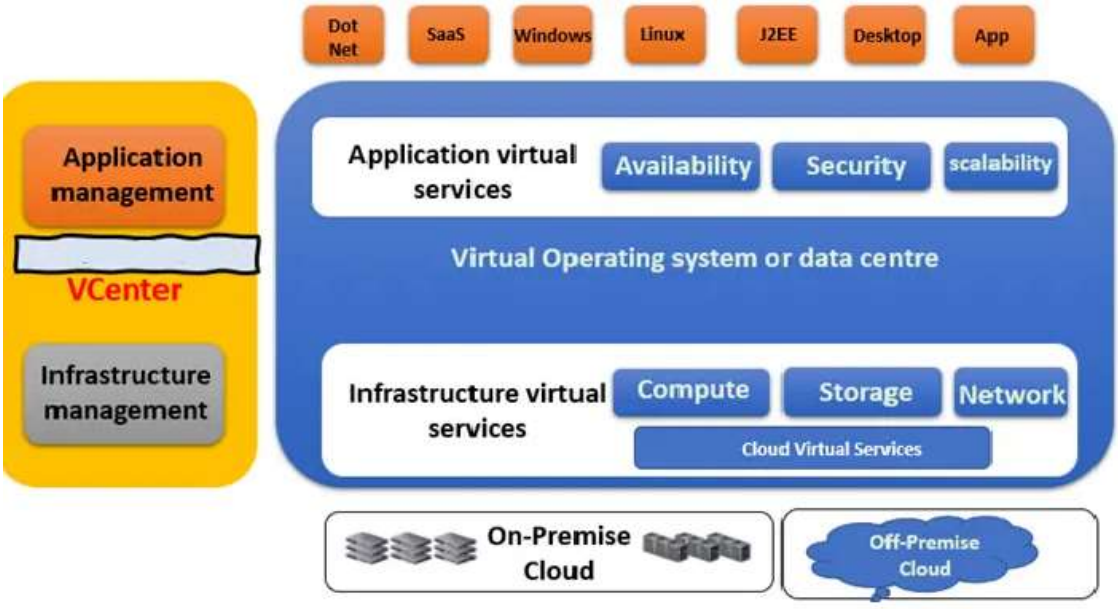
The data is arranged logically, and the interested parties and stakeholders then access the virtual view of such data. These are reports are also accessed by end-users on a remote basis.

The application of data virtualization ranges from data integration to business integration. They are also used for service-oriented architecture data services, and they help find organizational data.

Architecture of Virtualization

The architecture in Virtualization is defined as a model that describes Virtualization conceptually. Virtualization application in Cloud Computing is critical. In Cloud Computing, the end-users share the data on applications termed as the clouds. However, end users can share the entire IT infrastructure with Virtualization itself.

Here is the architecture of the Virtualization:



In the above image, Virtualization comprises virtual application and infrastructure virtual services.

The virtual application services help in application management, and the virtual infrastructure services can help in infrastructure management.

Both services are embedded into a virtual data center or an operating system. The virtual services can be used in any platforms and programming environment. The services can be accessed through an on-premise cloud or an off-premise cloud.

Virtualization services are delivered to cloud users by third-party individuals. The cloud users, in return, have to pay third-party individuals with an applicable monthly or annual fee.

This fee is paid to compensate the third parties to provide cloud services to end-users, and they also provide different versions of applications as requested by the end cloud users.

Virtualization is generally achieved through the hypervisor. A hypervisor enables the separation of operating systems with the underlying hardware. It enables the host machine to run many virtual machines simultaneously and share the same physical computer resources. There are two methods through which virtualization architecture is achieved described below:

- **Type one: The first hypervisor type is termed** a bare-metal hypervisor. They directly run over the top of the hardware of the host system. They deliver effective resource management and ensure the high availability of resources. It delivers direct access to the hardware system, ensuring better scalability, performance, and stability.
- **Type two: The second hypervisor type is** the hosted hypervisor. This is installed on the host operating system, and the virtual operating

system runs directly above the hypervisor. It is the kind of system that eases and simplifies system configuration.

It additionally simplifies management tasks. The presence of the host operating system at times limits the performance of the virtualization-enabled system, and it even generates security flaws or risks.

Advantages of Virtualization

Here are some Pros/Benefits of Virtualization:

- Virtualization offers several benefits, such as it helps in cost reduction and boosting productivity towards the development process.
- It does away with the need to have a highly complex IT infrastructure.
- It facilitates remote access to resources and ensures that it promotes faster scalability.
- It is highly flexible, and it allows the users to execute multiple desktops operating systems on one standard machine.
- It removes the risks involved in terms of system failures, and it also boosts flexible data transfer between different virtual servers.
- The working process in Virtualization is highly streamlined and agile, which ensures that the users work and operate most economically.

Disadvantages of Virtualization

The disadvantages of Virtualization are very much limited in nature. Here are the cons/disadvantages of Virtualization:

- The transition of the existing hardware setup to a virtualized setup requires an extensive time investment, and hence this can be regarded as a time-intensive process.
- There is a lack of availability of skilled resources that helps in terms of transition of existing or actual setup to virtual setup.

- Since there is a limitation in terms of having less skilled resources, the implementation of Virtualization calls for high-cost implementations.
- If the transition process is not handled meticulously, it also poses a security risk to sensitive data.

Role of Virtualization in Cloud Computing

In Virtualization, a sensible or proper name is aligned with the physical server. The pointers are then directed towards that physical server, which is done on demand. Virtualization facilitates the execution of applications that are homogenous.

It also provides a virtual and isolated networking, storage, and memory area environment. The Virtualization is achieved through a host machine and guest machine. A host machine can be defined as the machine on which a virtual machine is developed, and the virtual machine so developed is termed as a guest machine.

Hardware virtualization plays a critical role by delivering infrastructure as a service solution most efficiently and effectively under a Cloud Computing process.

This type of Virtualization ensures portability. The guest machine is packaged as a virtual instance of an image, and such virtual images can be removed easily as and when the need arises.

Important Terminologies of Virtualization

There are a few essential technologies in Virtualization, which are defined as follows: –

- **Virtual machine:** A virtual machine can be defined as the computer of a virtual type that operates beneath a hypervisor.
- **Hypervisor:** This can be defined as the operating system that runs on actual hardware. A virtual counterpart of the operating system is a

subpart that executes or emulates the virtual process. They are defined as Domain 0 or Dom0.

- **Container:** These can be defined as virtual machines of lightweight nature that are a subset of the same operating system instance or the hypervisor. They are a collection of processes that executes along with corresponding namespace or identifiers of process.
- **Virtual network:** This is defined as the network being separated logically and is present inside the servers. Such networks can be expanded across multiple servers.
- **Virtualization software:** This type of software helps deploy Virtualization on the computer device.

Summary

- Virtualization helps create virtual versions of desktops, servers, operating systems, and applications.
- Virtualization comprises the host machine and virtual machine.
- Each virtualization system comprises of hypervisor, container, and virtual network.
- Virtualization offers scalability efficiency and helps in effective resource management.