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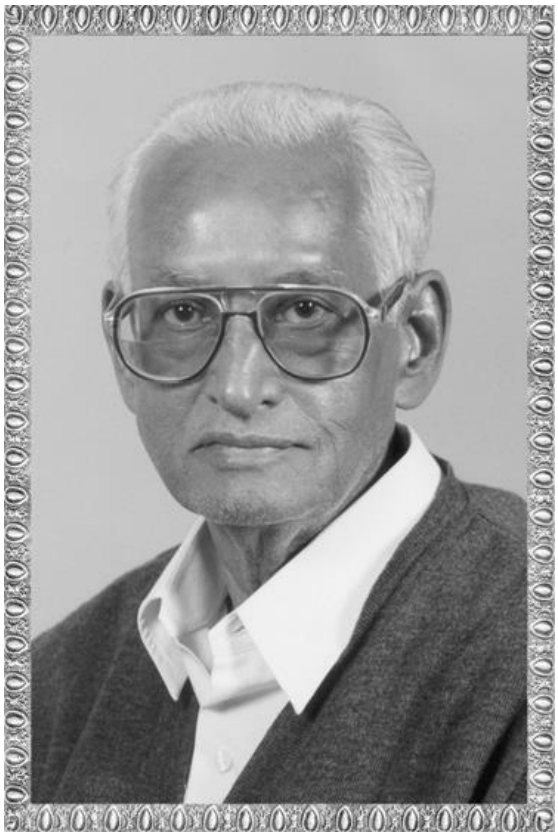

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M.Sc I.T. SEM-2 - Cloud Computing

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Virtualization

- 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 very important part of testing and cloud-based computing.

Virtualization objectives

- Virtualization is the backbone of Cloud Computing.
- Cloud Computing brings efficient benefits as well as makes it more convenient with the help of Virtualization, not only this, it also provides solutions for great challenges in the field of data security and privacy protection.
- Virtualization is the imitation of hardware within a software program.
- The role of multiple computers is allowed on a single computer.
- In a file or a web server, the usage of purchase, maintenance, depreciation, energy and floor space is double, but by creating virtual web or file server all of our objectives are fulfilled like the use of hardware resources to its maximum, flexibility, improvement in security, reduced cost.
- Efficient use of resources, increased security, portability, problem free testing, easier manageability, increased flexibility, fault isolation, rapid deployment are the benefits of virtualization.

Virtualization in Cloud Computing:

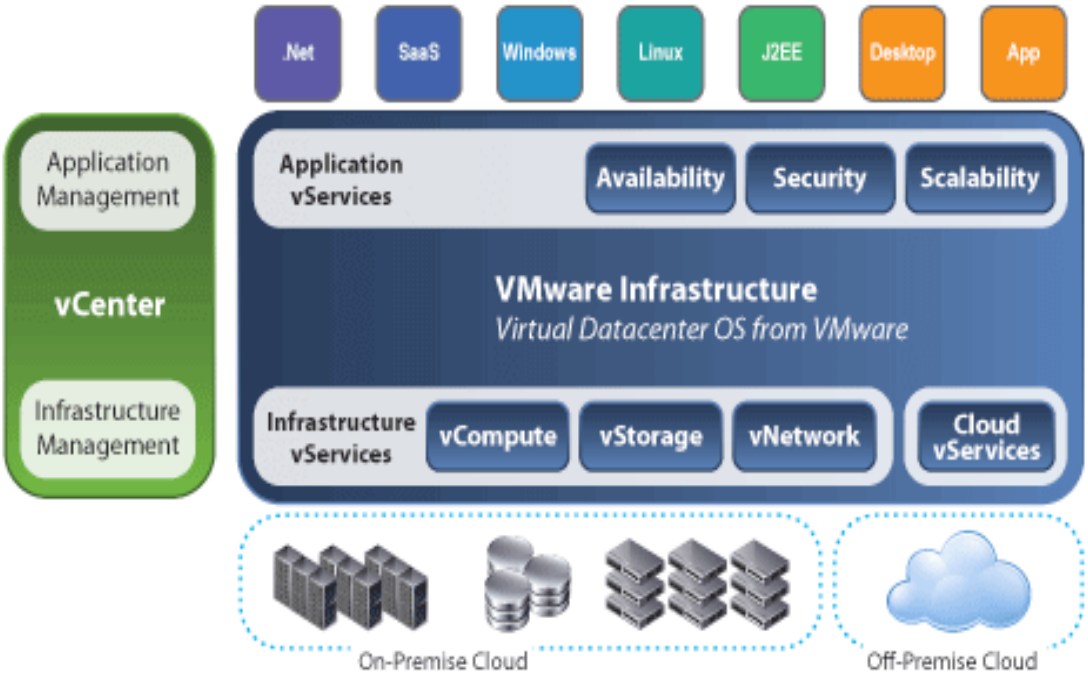
- For combining local and network resources data storage virtualization.
- For grouping physical storage devices into the single unit
- For reaching the high level of availability or improving availability using virtualization
- Improving performance using virtualization
- Using virtualization using stripping and caching
- Capacity improvement

- A central computer hosting an application to multiple users, preventing the need for installing software repeatedly on every system **is virtualization in Cloud Computing**.
- The data from different hard drives, USB drives, and databases are merged into one location increasing its accessibility and security.

- The creation of virtual hardware, software, or an operating system or a storage or network device is virtualization in cloud computing.
- In IT virtual changes occur more rapidly than in a physical environment.

How does virtualization work in cloud computing?

- Virtualization plays a very **important role** in the cloud computing technology, normally in the cloud computing, users share the data present in the clouds like application etc, but actually with the help of virtualization users shares the Infrastructure.
- **The main usage** of Virtualization Technology is to provide the applications with the standard versions to their cloud users, suppose if the next version of that application is released, then cloud provider has to provide the latest version to their cloud users and practically it is possible because it is more expensive.
- To overcome this problem we use basically virtualization technology, By using virtualization, all severs and the software application which are required by other cloud providers are maintained by the third party people, and the cloud providers has to pay the money on monthly or annual basis.

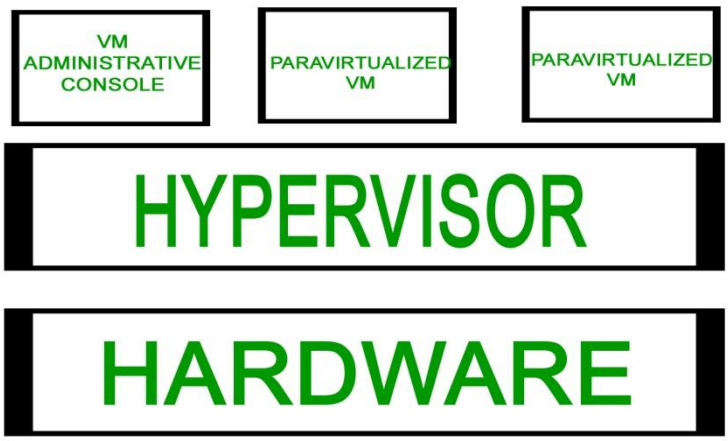


Virtual servers introduction

- Server Virtualization is the partitioning of a physical server into number of small virtual servers, each running its own operating system.
- These operating systems are known as **guest operating systems**. These are running on another operating system known as **host operating system**.
- Each guest running in this manner is unaware of any other guests running on the same host.
- Different virtualization techniques are employed to achieve this transparency.

Types of Server virtualization :

1. **Hypervisor –**
   - A Hypervisor or VMM(virtual machine monitor) is a layer that exits between the operating system and hardware.
   - It provides the necessary services and features for the smooth running of multiple operating systems.
   - It identifies traps, responds to privileged CPU instructions and handles queuing, dispatching and returning the hardware requests. A host operating system also runs on top of the hypervisor to administer and manage the virtaul machines.
2. **Para Virtualization –**
   - It is based on Hypervisor.
   - Much of the emulation and trapping overhead in software implemented virtualisation is handled in this model.
   - The guest operating system is modified and recompiled before installation into the virtual machine.
   - Due to the modification in the Guest operating system, performance is enhanced as the modified guest operating system communicates directly with the hypervisor and emulation overhead is removed.
   - Example : Xen primarily uses Para virtualisation, where a customised Linux environment is used to supportb the administrative environment known as domain 0.



Advantages:

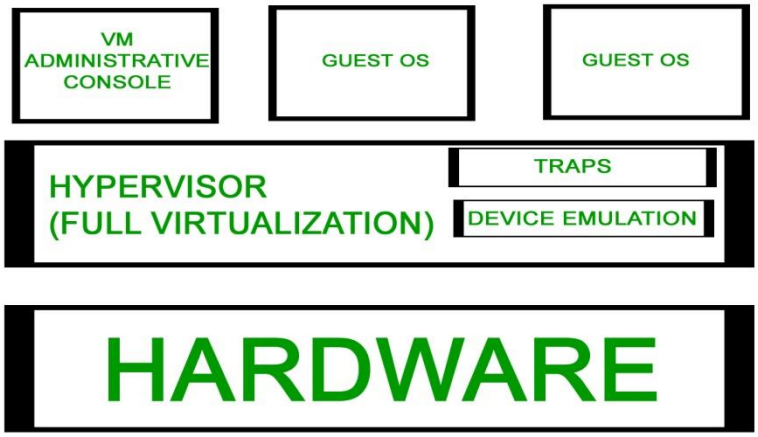
- Easier
- Enhanced Performance
- No emulation overhead

Limitations:

- Requires modification to guest operating system

3. **Full Virtualization –**
   - It is very much similar to Para virtualisation.
   - It can emulate the underlying hardware when necessary.

- The hypervisor traps the machine operations used by the operating system to perform I/O or modify the system status.
- After trapping, these operations are emulated in software and the status codes are returned very much consistent with what the real hardware would deliver.
- This is why unmodified operating system is able to run on top of the hypervisor.
- Example : VMWare ESX server uses this method. A customised Linux version known as Service Console is used as the administrative operating system. It is not as fast as Para virtualisation.



Advantages:

- No modification to Guest operating system required.

Limitations:

- Complex
- Slower due to emulation
- Installation of new device driver difficult.

4. **Hardware Assisted Virtualization –**

- It is similar to Full Virtualisation and Para virtualisation in terms of operation except that it requires hardware support.
- Much of the hypervisor overhead due to trapping and emulating I/O operations and status instructions executed within a guest OS is dealt by relying on the hardware extensions of the x86 architecture.
- Unmodified OS can be run as the hardware support for virtualisation would be used to handle hardware access requests, privileged and protected operations and to communicate with the virtual machine.
- Examples : AMD – V Pacifica and Intel VT Vanderpool provides hardware support for virtualisation.

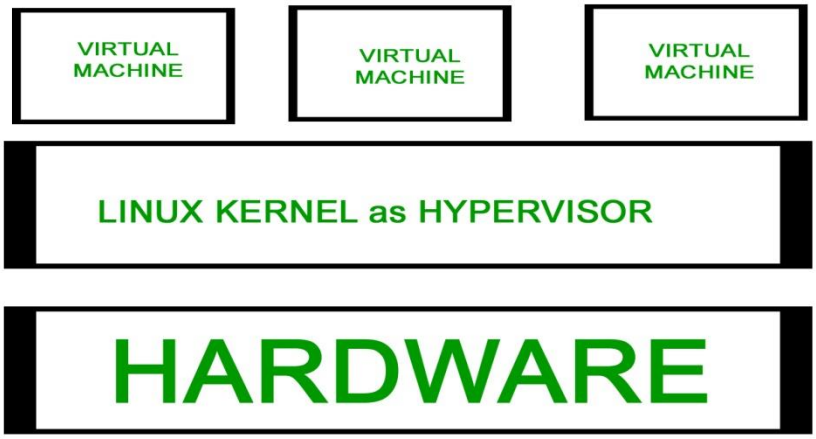
Advantages:

- No modification to guest operating system required.
- Very less hypervisor overhead

Limitations:

- Hardware support Required

5. **Kernel level Virtualization –**
   - Instead of using a hypervisor, it runs a separate version of the Linux kernel and sees the associated virtual machine as a user – space process on the physical host.
   - This makes it easy to run multiple virtual machines on a single host.
   - A device driver is used for communication between the main Linux kernel and the virtual machine.
   - Processor support is required for virtualisation(Intel VT or AMD – v).
   - A slightly modified QEMU process is used as the display and execution containers for the virtual machines.
   - In many ways, kernel level virtualization is a specialised form of server virtualization.
   - Examples: User – Mode Linux(UML) and Kernel Virtual Machine(KVM)



Advantages:

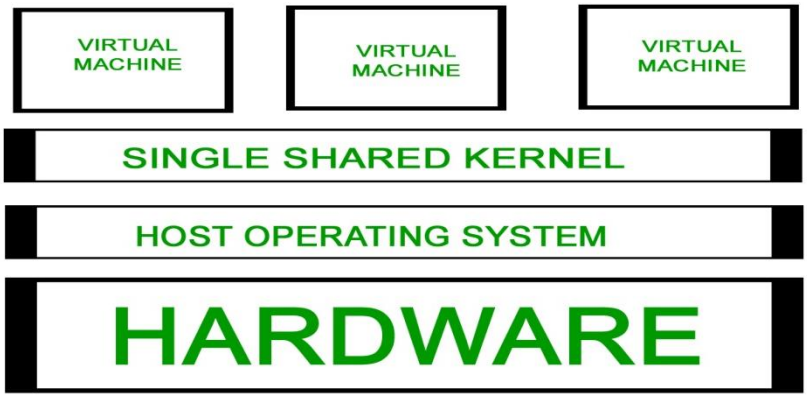
- No special administrative software required.
- Very less overhead

Limitations:

- Hardware Support Required

6. **System Level or OS Virtualization –**
   - Runs multiple but logically distinct environments on a single instance of operating system kernel.
   - Also called shared kernel approach as all virtual machines share a common kernel of host operating system.
   - Based on change root concept “chroot”.chroot starts during boot up.
   - The kernel uses root filesystems to load drivers and perform other early stage system initialisation tasks.
   - It then switches to another root filesystem using chroot command to mount an on -disk file system as its final root filesystem, and continue system initialization and configuration within that file system.
   - The chroot mechanism of system level virtualisation is an extension of this concept.

- It enables the system to start virtual servers with their own set of processes which execute relative to their own filesystem root directories.
- The main difference between system level and server virtualisation is wether different operating systems can be run on different virtual systems.
- If all virtual servers must share the same copy of operating system it is system level virtualisation and if different servers can have different operating systems it is server virtualisation.
- Examples: FreeVPS, Linux Vserver and OpenVZ are some examples.



Advantages:

- Significantly light weight than complete machines(including a kernel)
- Can host many more virtual servers
- Enhanced Security and isolation

Limitations:

- Kernel or driver problem can take down all virtual servers.

Virtual Servers

Hyper V

- Hyper-V is Microsoft's hardware virtualization product.
- It lets you create and run a software version of a computer, called a *virtual machine*.
- Each virtual machine acts like a complete computer, running an operating system and programs.
- When you need computing resources, virtual machines give you more flexibility, help save time and money, and are a more efficient way to use hardware than just running one operating system on physical hardware.
- Hyper-V runs each virtual machine in its own isolated space, which means you can run more than one virtual machine on the same hardware at the same time.

Hyper-V can help you:

- Establish or expand a private cloud environment.
- Use your hardware more effectively.
- Improve business continuity.
- Establish or expand a virtual desktop infrastructure (VDI).

- Make development and test more efficient.

VMware

- VMware offers its VMware Server, a free entry-level hosted virtualization product for Linux and Windows servers.
- The product is available for download at www.vmware.com/products/server/.
- "Virtualization and VMware have become mainstream in the past year, and many customers have deployed thousands of VMware server environments across their enterprises.
- With VMware Server, we are ensuring that every company interested in, considering or evaluating server virtualization for the first time has access to the industryleading
- virtualization technology," said Diane Greene, VMware president.
- "VMware Server makes it easy and compelling for companies new to virtualization to take the first steptoward enterprise-wide virtual infrastructure."

Features

VMware Server, the successor to VMware GSX Server, enables users to quickly provision new server capacity by partitioning a physical server into multiple virtual machines, bringing the powerful benefits of virtualization to every server.

VMware Server is feature-packed with the following market-leading capabilities:

- Support for any standard x86 hardware
- Support for a wide variety of Linux and Windows host operating systems, including 64-bit operating systems
- Support for a wide variety of Linux, NetWare, Solaris x86, and Windows guest operating systems, including 64-bit operating systems
- Support for Virtual SMP, enabling a single virtual machine to span multiple physical processors
- Quick and easy, wizard-driven installation similar to any desktop software
- Quick and easy virtual machine creation with a virtual machine wizard
- Virtual machine monitoring and management with an intuitive, user-friendly remote console