Assignment : 03

❖ Define Virtualization.

⇨ Virtualization is the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources".

⇨ In other words, Virtualization is a technique, which allows to share a single physical instance of a resource or an application among multiple customers and organizations. It does by assigning a logical name to a physical storage and providing a pointer to that physical resource when demanded.

➢ Types of Virtualization :-

1. Hardware Virtualization.
2. Operating system Virtualization.
3. Server Virtualization.
4. Storage Virtualization.

1) Hardware Virtualization :-

⇨ When the virtual machine software or virtual machine manager (VMM) is directly installed on the hardware system is known as hardware virtualization.

⇨ The main job of hypervisor is to control and monitoring the processor, memory and other hardware resources.

⇨ After virtualization of hardware system we can install different operating system on it and run different applications on those OS.

Usage :-

⇨ Hardware virtualization is mainly done for the server platforms, because controlling virtual machines is much easier than controlling a physical server.

2) Operating System Virtualization :-

⇨ When the virtual machine software or virtual machine manager (VMM) is installed on the Host operating system instead of directly on the hardware system is known as operating system virtualization.

Usage :-

⇨ Operating System Virtualization is mainly used for testing the applications on different platforms of OS.

3) Server Virtualization :-

⇨ When the virtual machine software or virtual machine manager (VMM) is directly installed on the Server system is known as server virtualization.

Usage :-

⇨ Server virtualization is done because a single physical server can be divided into multiple servers on the demand basis and for balancing the load.

4) Storage Virtualization :-

⇨ Storage virtualization is the process of grouping the physical storage from multiple network storage devices so that it looks like a single storage device.
⇨ Storage virtualization is also implemented by using software applications.

Usage :-

⇨ Storage virtualization is mainly done for back-up and recovery purposes.

❖ **Define Hypervisors.**

⇨ The hypervisor supports hardware-level virtualization on bare metal devices like CPU, memory, disk and network interfaces.

⇨ The hypervisor software sits directly between the physical hardware and its OS. This virtualization layer is referred to as either the VMM or the hypervisor.

⇨ The hypervisor provides hyper calls for the guest OSes and applications.

⇨ A hypervisor must be able to convert physical devices into virtual resources dedicated for the deployed VM to use. Depending on the functionality, a hypervisor can be a micro-kernel architecture or a monolithic hypervisor architecture.

⇨ A micro-kernel hypervisor includes only the basic and unchanging functions. The device drivers and other changeable components are outside the hypervisor. Eg. The Microsoft Hyper-V.

⇨ A monolithic hypervisor implements all the aforementioned functions, including those of the device drivers.

⇨ Therefore, the size of the hypervisor code of a micro-kernel hypervisor is smaller than that of a monolithic hypervisor.

⇨ Ex.VMware ESX for server virtualization.

➢ **Types of Hypervisors :-**

1) **TYPE-1 Hypervisor :-**

⇨ The hypervisor runs directly on the underlying host system. It is also known as a "Native Hypervisor" or "Bare metal hypervisor". It does not require any base server operating system. It has direct access to hardware resources. Examples of Type 1 hypervisors include VMware ESXi, Citrix XenServer, and Microsoft Hyper-V hypervisor.

Pros & Cons of Type-1 Hypervisor :-

⇨ **Pros :** Such kinds of hypervisors are very efficient because they have direct access to the physical hardware resources(like Cpu, Memory, Network, and

Physical storage). This causes the empowerment of the security because there is nothing any kind of the third party resource so that attacker couldn't compromise with anything.

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

2) TYPE-2 Hypervisor :-

⇨ A Host operating system runs on the underlying host system. It is also known as 'Hosted Hypervisor". Such kind of hypervisors doesn't run directly over the underlying hardware rather they run as an application in a Host system(physical machine). Basically, the software is installed on an operating system. Hypervisor asks the operating system to make hardware calls. An example of a Type 2 hypervisor includes VMware Player or Parallels Desktop. Hosted hypervisors are often found on endpoints like PCs. The type-2 hypervisor is very useful for engineers, and security analysts (for checking malware, or malicious source code and newly developed applications).

Pros & Cons of Type-2 Hypervisor :-

⇨ **Pros :** Such kind of hypervisors allows quick and easy access to a guest Operating System alongside the host machine running. These hypervisors usually come with additional useful features for guest machines. Such tools enhance the coordination between the host machine and the guest machine.

⇨ **Cons :** Here there is no direct access to the physical hardware resources so the efficiency of these hypervisors lags in performance as compared to the type-1 hypervisors, and potential security risks are also there an attacker can compromise the security weakness if there is access to the host operating system so he can also access the guest operating system.

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