KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY

Cloud Computing

3 Credit

School of Computer Engineering

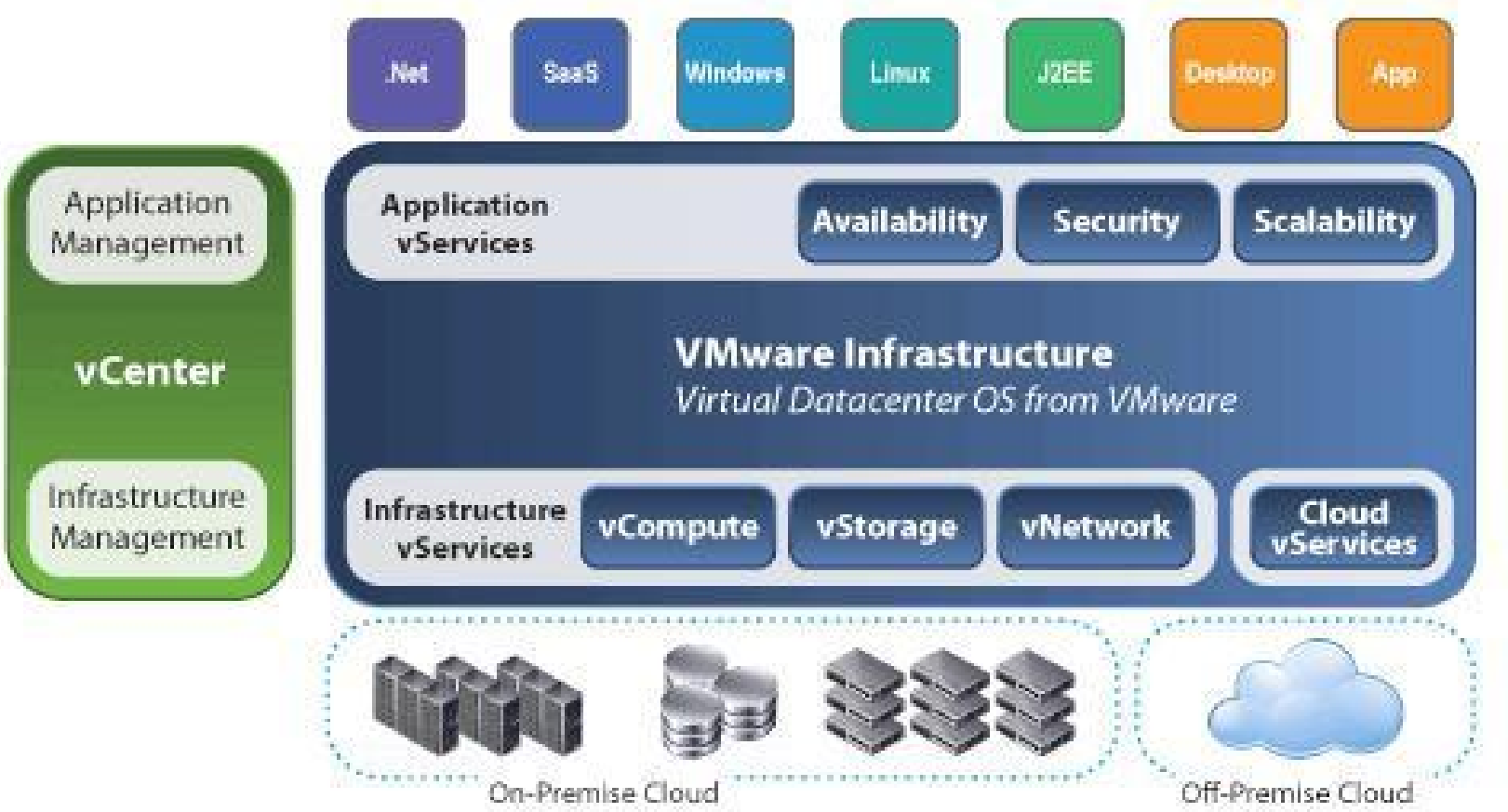
Unit-III

Virtualization

Virtualisation: Concept

- 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.
- Virtualization in cloud computing allows you to run multiple applications and OS on the same server, thereby providing for

Virtualization Architecture



With the help of Virtualization multiple operating systems and applications can run on same Machine and its same hardware at the same time increasing the utilization and flexibility of hardware.

The machine on which the virtual machine is going to be build is known as Host Machine and that virtual machine is referred as a Guest Machine.

Hypervisor

- The **hypervisor** is a firmware or low-level program that acts as a Virtual Machine Manager.
- Hypervisor is a form of virtualization software used in Cloud hosting to **divide and allocate the resources on various pieces of hardware**.The program which provide partitioning, isolation or abstraction is called virtualization hypervisor.
- Hypervisor is a hardware virtualization technique that allows multiple guest operating systems (OS) to run on a single host system at the same time. A hypervisor is sometimes also called a virtual machine manager(VMM).

Types of Hypervisors

- Type 1 hypervisors run directly on the system hardware. They are often referred to as a "native" or "bare metal" or "embedded" hypervisors in vendor literature. It dose not require any base server operating system.It has direct access to hardware resources

- Type 2 hypervisors run on a host operating system that provides virtualization services, such as I/O device and memory management. Basically a software installed on an operatingThey are often referred to as a "Hosted Architecture" hypervisors in vendor literature.

Hypervisor Design:

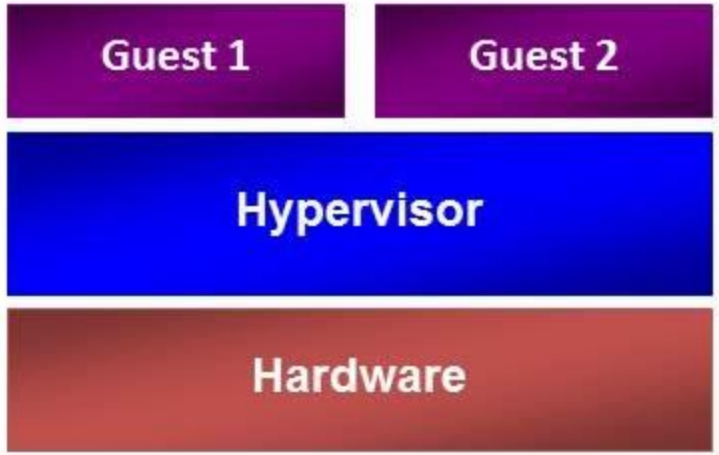
Two approaches

Type 2 Hypervisor

Examples:

- Virtual PC & Virtual Server
- VMware Workstation
- KVM

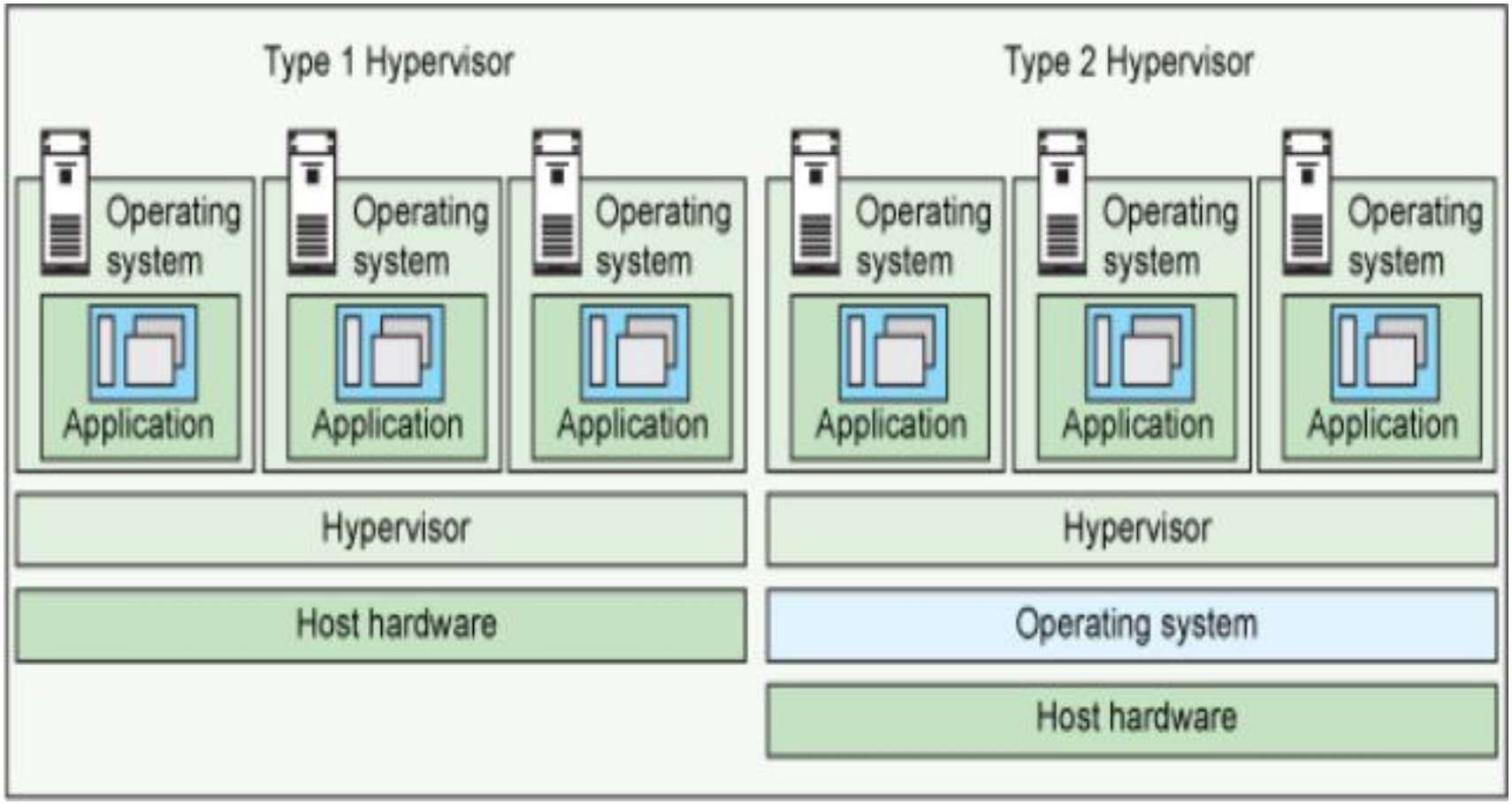
Type 1 Hypervisor



Examples:

- Hyper-V
- Xen
- VMware ESX

Hypervisors



Features of Type-1 and 2 Hypervisor

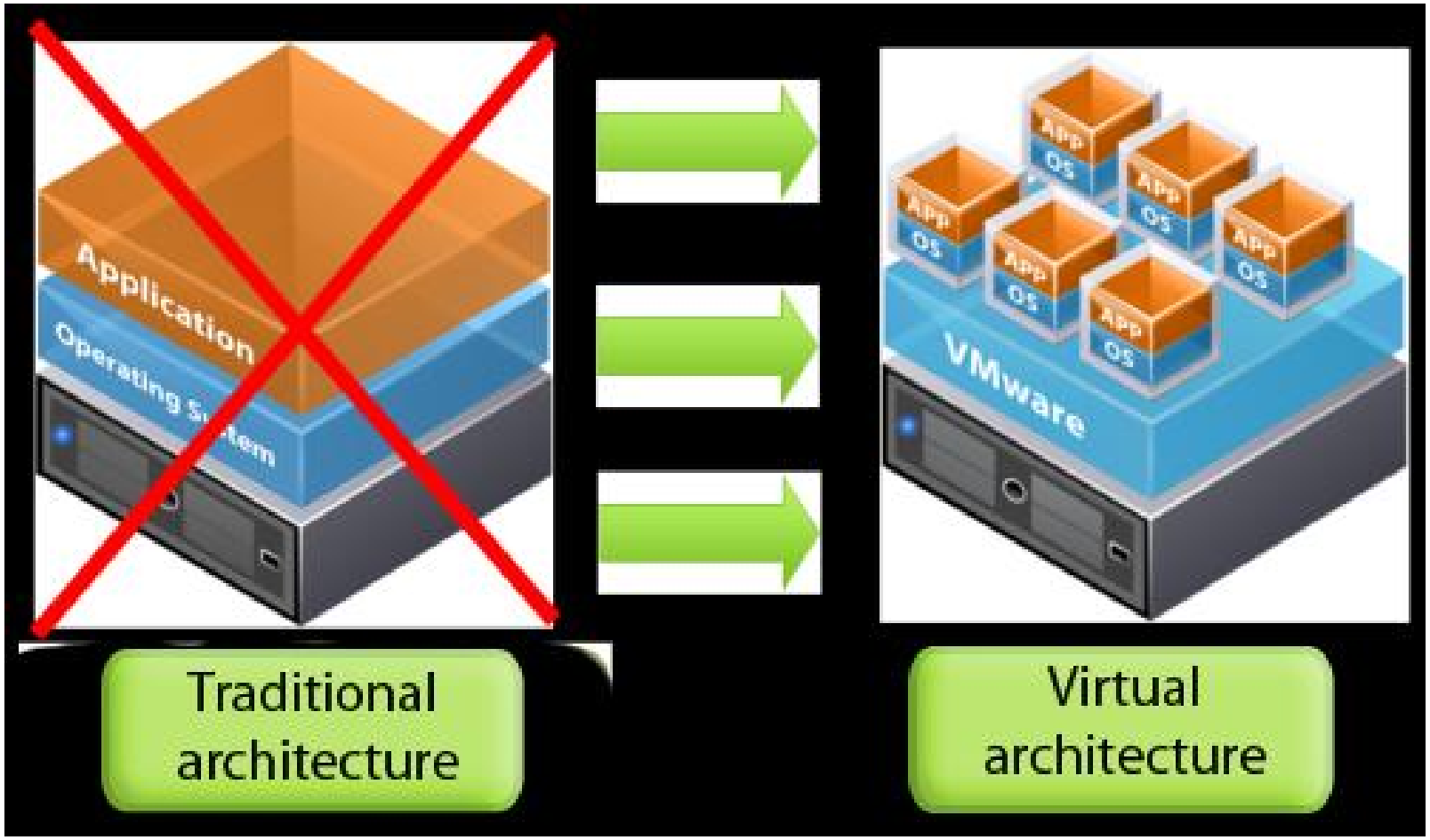
Type-1 Hypervisor:

- provides better performance
- provides greater flexibility
- Servers that run Type 1 hypervisors are often single-purpose servers that offer no other function.
- Type 1 hypervisors are production hypervisors or hypervisors that run VMs offering services to users.
- support hardware virtualization.

Type-2 Hypervisor:

- Less efficient
- Less flexible
- offer a series of different services.
- rarely used in production.
- perform software virtualization.

Virtualization



Types of Virtualization

- Hardware Virtualization
- Software Virtualization

- Memory Virtualization
- Storage Virtualization

- Data Virtualization
- Network Virtualization

- Desktop Virtualization

Hardware Virtualization

Hardware virtualization also known as server virtualization runs on the concept that an individual independent segment of hardware or a physical server, may be made up of multiple smaller segments of hardware or servers, essentially consolidating multiple physical servers into virtual servers that run on a single primary physical server.

Hardware Virtualization:

- Full Virtualization –
- The underlying hardware is fully simulated.
- Guest software does not require any modifications.
- Para-virtualization –
- The hardware is not simulated instead the guest software run their own isolated domains.
- Emulation Virtualization –
- The virtual machine simulates the hardware and becomes independent of it.

Full virtualization is a common and cost-effective type of virtualization, which is basically a method by which computer service requests are separated from the physical hardware that facilitates them. With full virtualization, operating systems and their hosted software are run on top of virtual hardware.

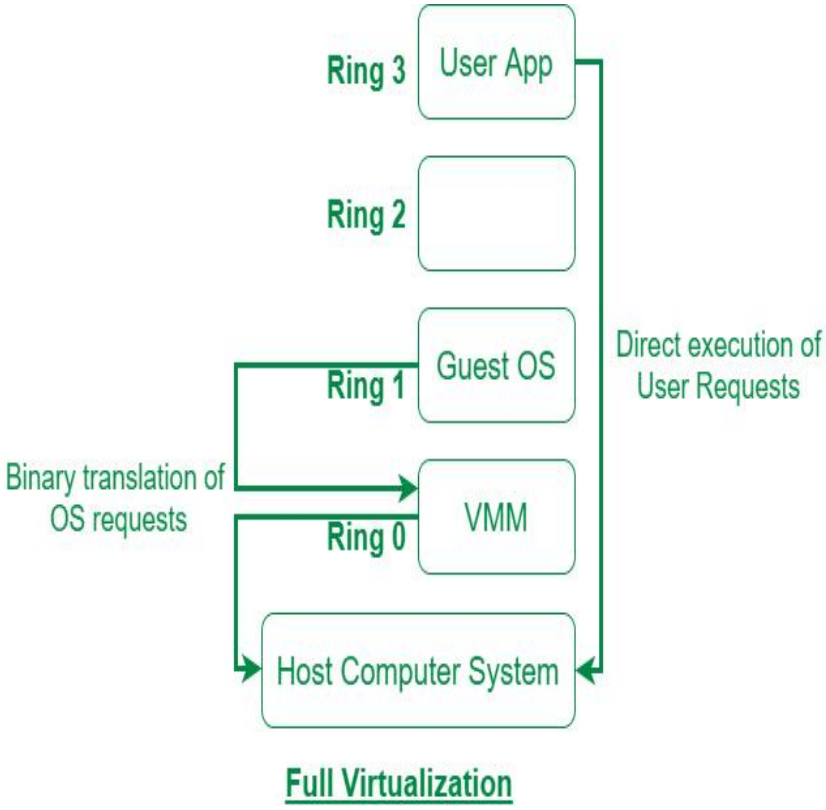
It differs from other forms of virtualization (like paravirtualization and hardware-assisted virtualization) in its total isolation of guest operating systems from their hosts.

Full virtualization

Full virtualization is fulfilled by the use of both binary translation and direct execution.

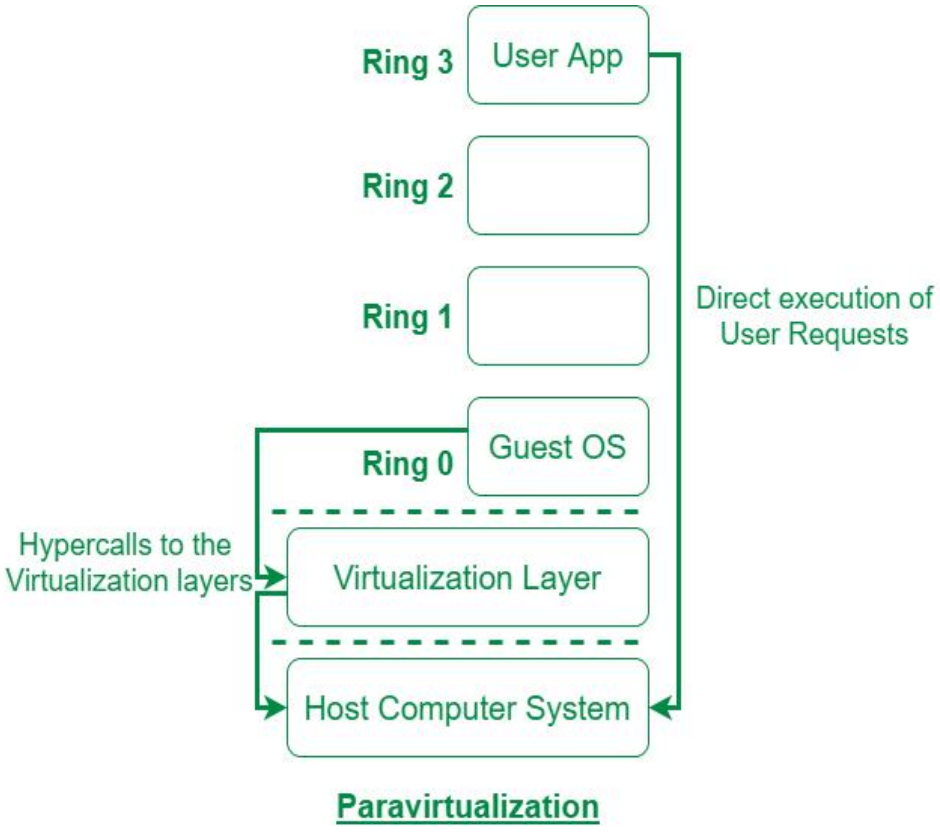
In full virtualization, guest OS is completely isolated by the virtual machine from the virtualization layer and hardware.

Microsoft and Parallels systems are examples of



Full Virtualization

Para-virtualization



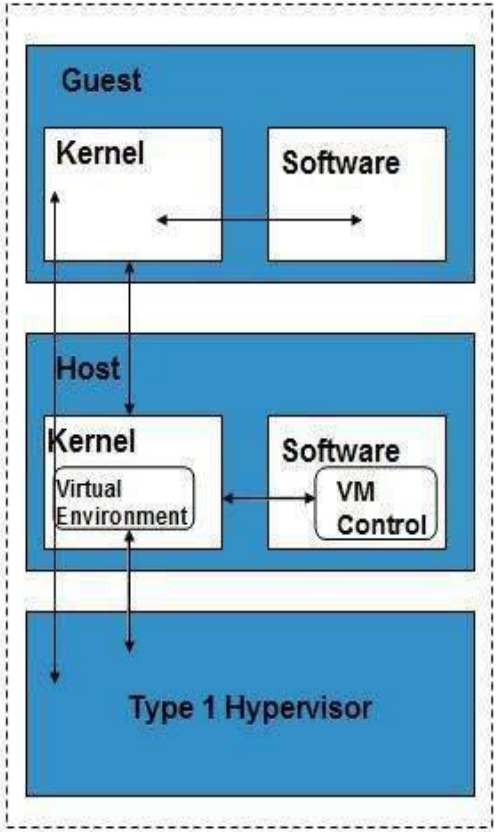
Paravirtualization

Paravirtualization is the category of CPU virtualization which uses hypercalls for operations to handle instructions at compile time.

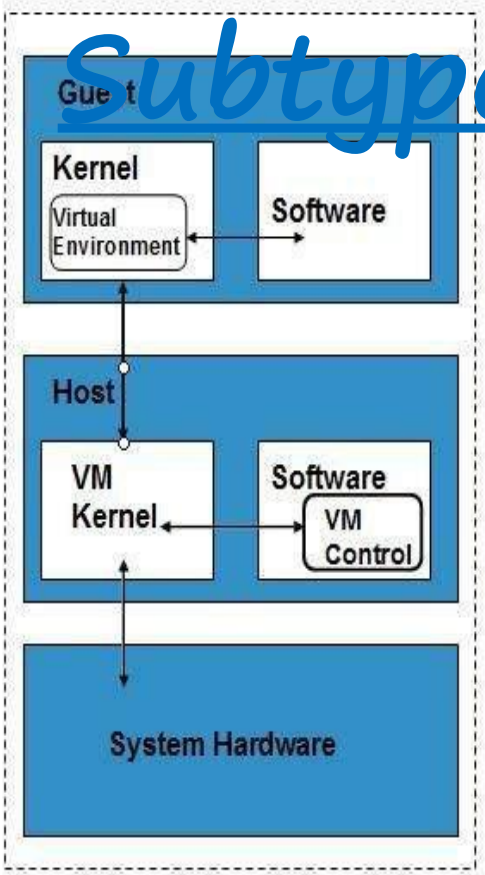
In paravirtualization, guest OS is not completely isolated but it is partially isolated by the virtual machine from the virtualization layer and hardware.

VMware and Xen are some examples of paravirtualization..

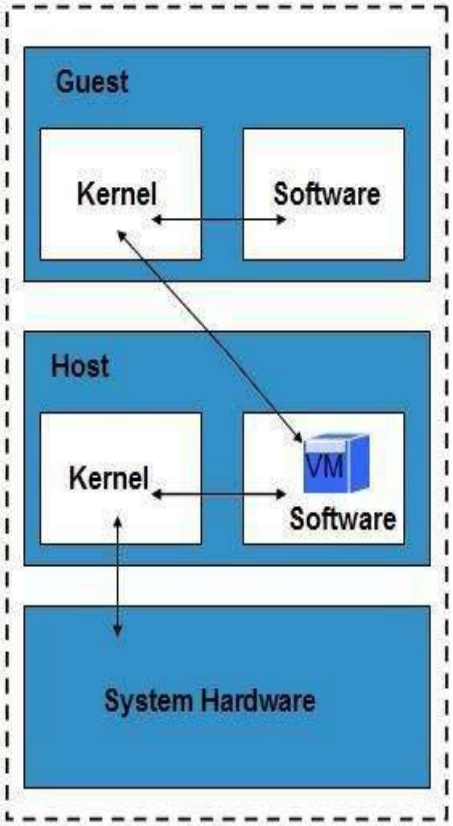
Hardware Virtualization: Subtypes



Full Virtualization



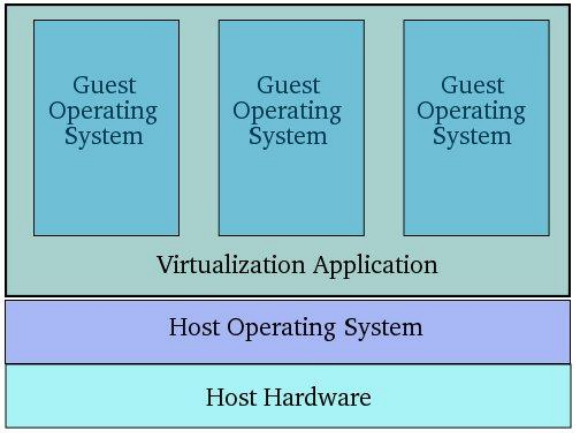
Para Virtualization



Emulation

Software Virtualization

- Software Virtualization involves the creation and operation of multiple virtual environments on the host machine.
- It is used to enable a complete computer system in order to allow the guest operating system to run.
- For instance, letting LINUX OS to run as a guest that is natively using a Microsoft Windows OS.

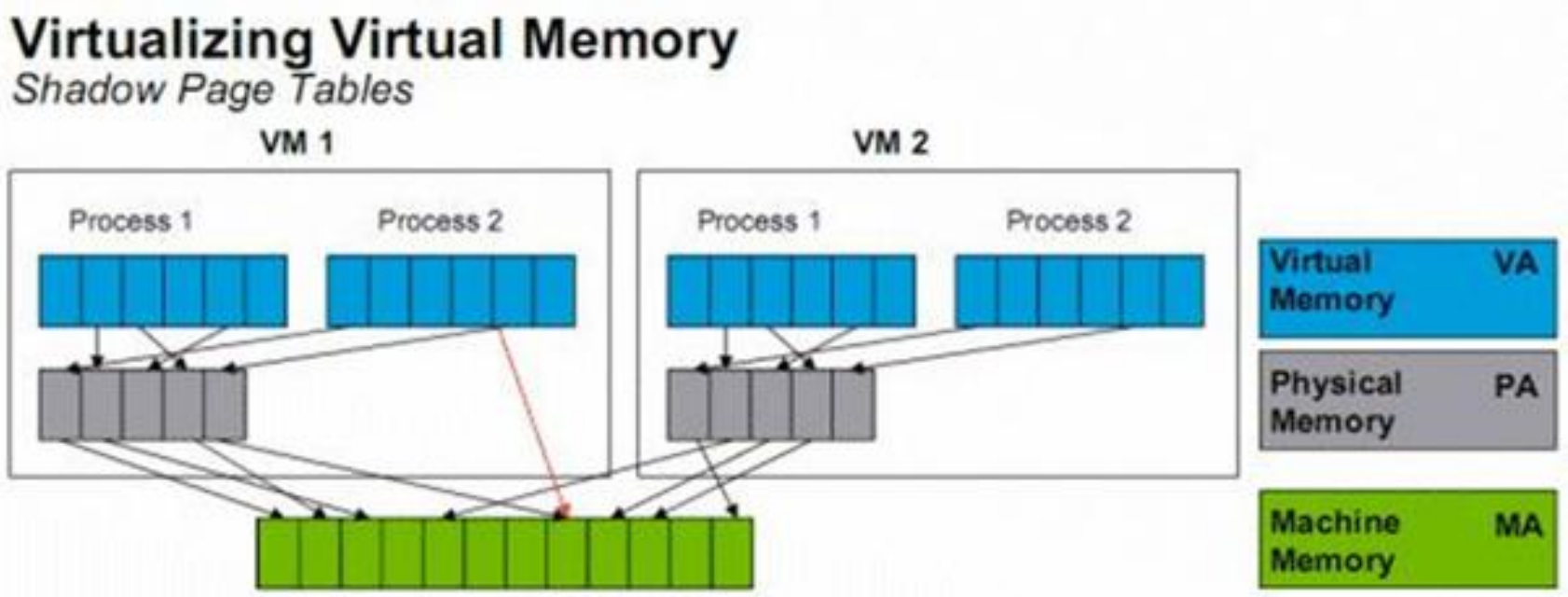


Software Virtualization :Subtypes

- Operating System Virtualization –
  hosting multiple OS on the native OS
- Application Virtualization –
  hosting individual applications in a virtual environment separate from the native OS
- Service Virtualization –
  hosting specific services related to a particular application.

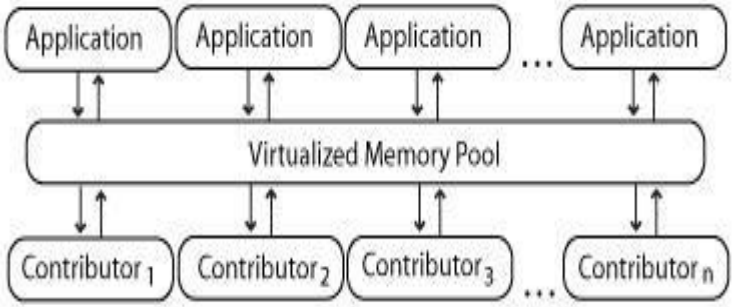
Memory Virtualization

- Physical memory across different servers is aggregated into a single virtualized memory pool.
- It provides the benefit of an enlarged contiguous working memory.
- For instance, as some OS such as Microsoft Windows OS allows a portion of your storage disk to serve as an ex

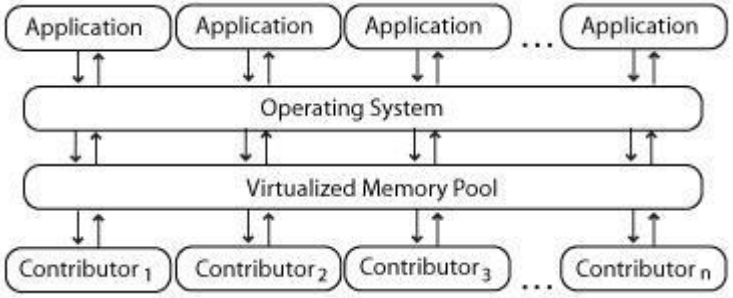


Memory Virtualization: Subtypes

- Application-level control – Applications access the memory pool directly.



- Operating system level control – Access to the memory pool is provided through an operating s



Storage Virtualization

- Multiple physical storage devices are grouped together, which then appear as a single storage device.

- This provides various advantages such as homogenization of storage across storage devices of multiple capacity and speeds, reduced downtime, load balancing and better optimization of performance and speed.

- Partitioning your hard drive into

Storage Virtualization: Subtypes

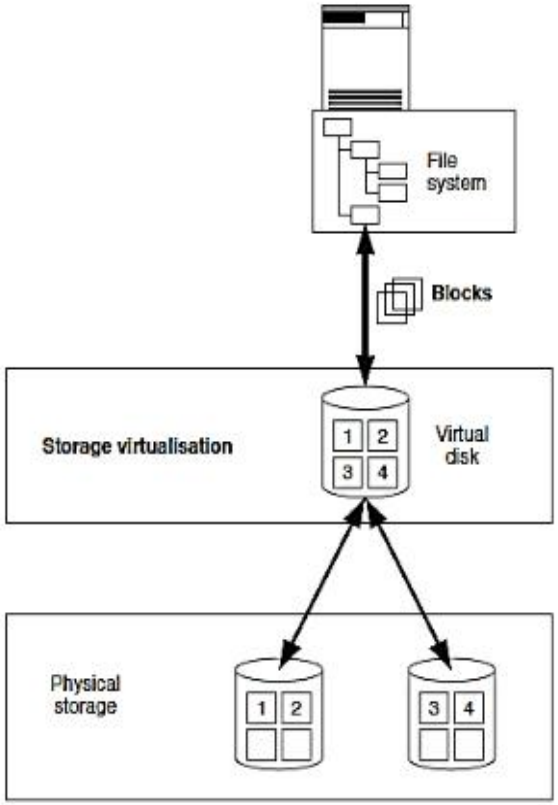


Figure 5.12 In virtualisation on block level the virtualisation entity provides the virtual storage to the servers in the form of a virtual disk.

1. Block Virtualization – Virtualisation on block level means that storage capacity is made available to the operating system or the applications in the form of virtual disks.

Storage Virtualization: Subtypes

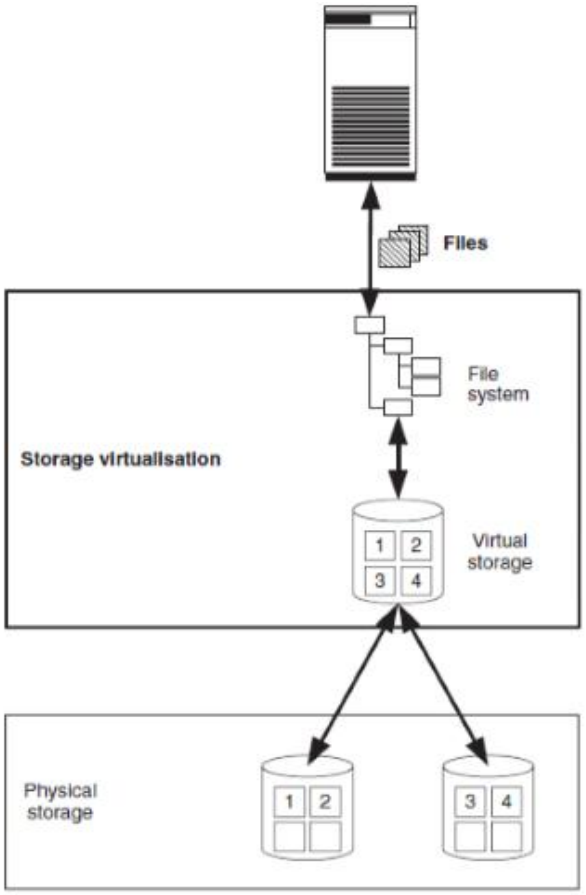


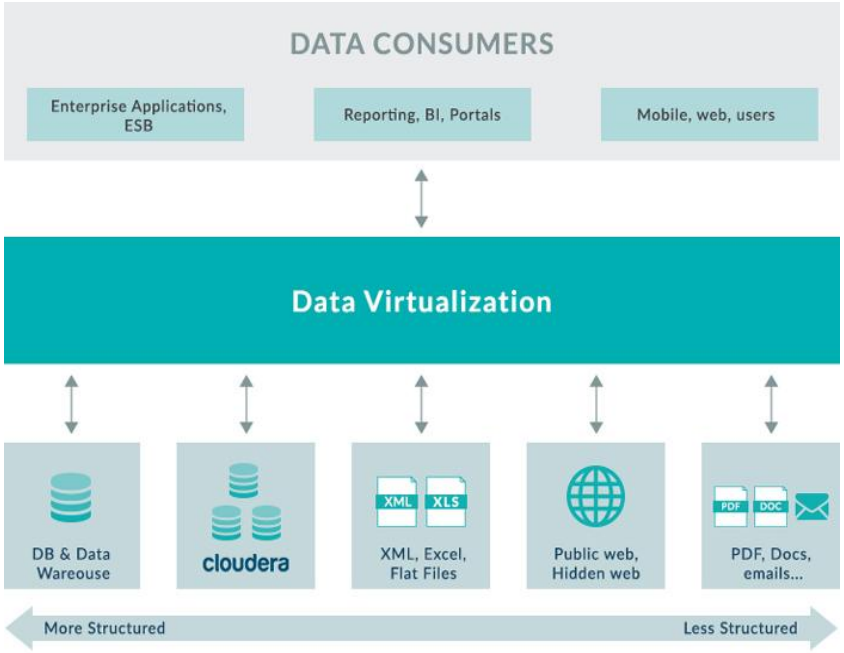
Figure 5.13 In virtualisation on file level the virtualisation entity provides the virtual storage to the servers in the form of files and directories.

2. File Virtualization

Virtualisation on file level means that the virtualisation entity provides virtual storage to the operating systems or applications in the form of files and directories

Data Virtualization

- It lets us to easily manipulate data, as the data is presented as an abstract layer completely independent of data structure and database systems.
- Decreases data input and



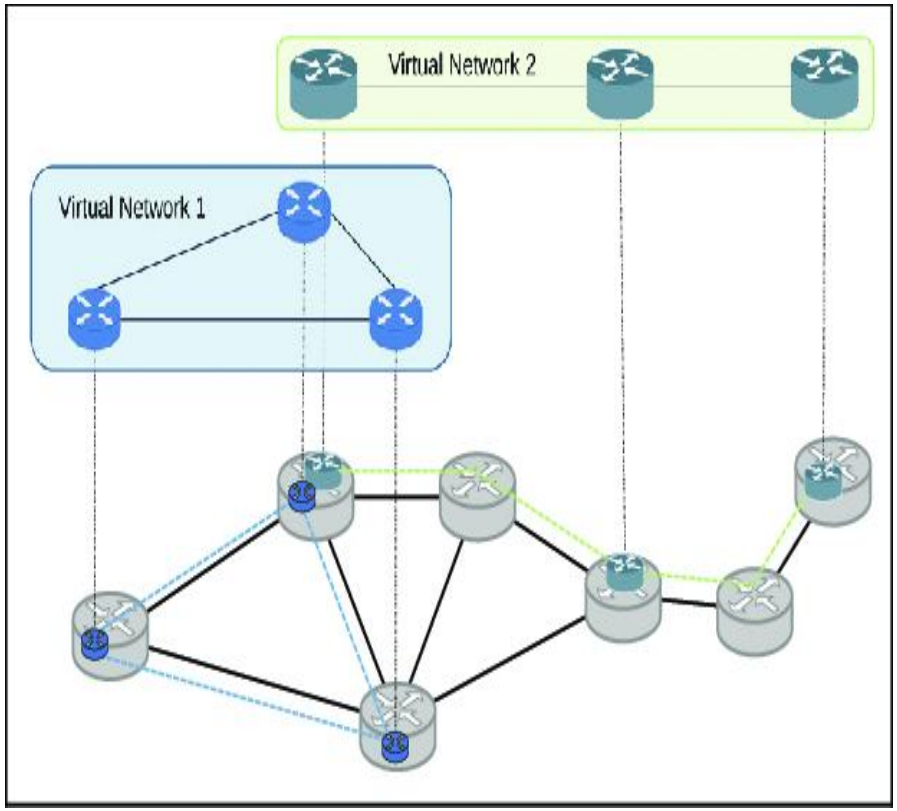
Network Virtualization

- In network virtualization, multiple sub-networks can be created on the same physical network, which may or may not is authorized to communicate with each other.
- This enables restriction of file movement across networks and enhances security, and allows better monitoring and identification of data usage.
- It also increases reliability as a disruption in one network doesn't affect

Network Virtualization :Subtypes

- Internal network:

Enables a single system to function like a network



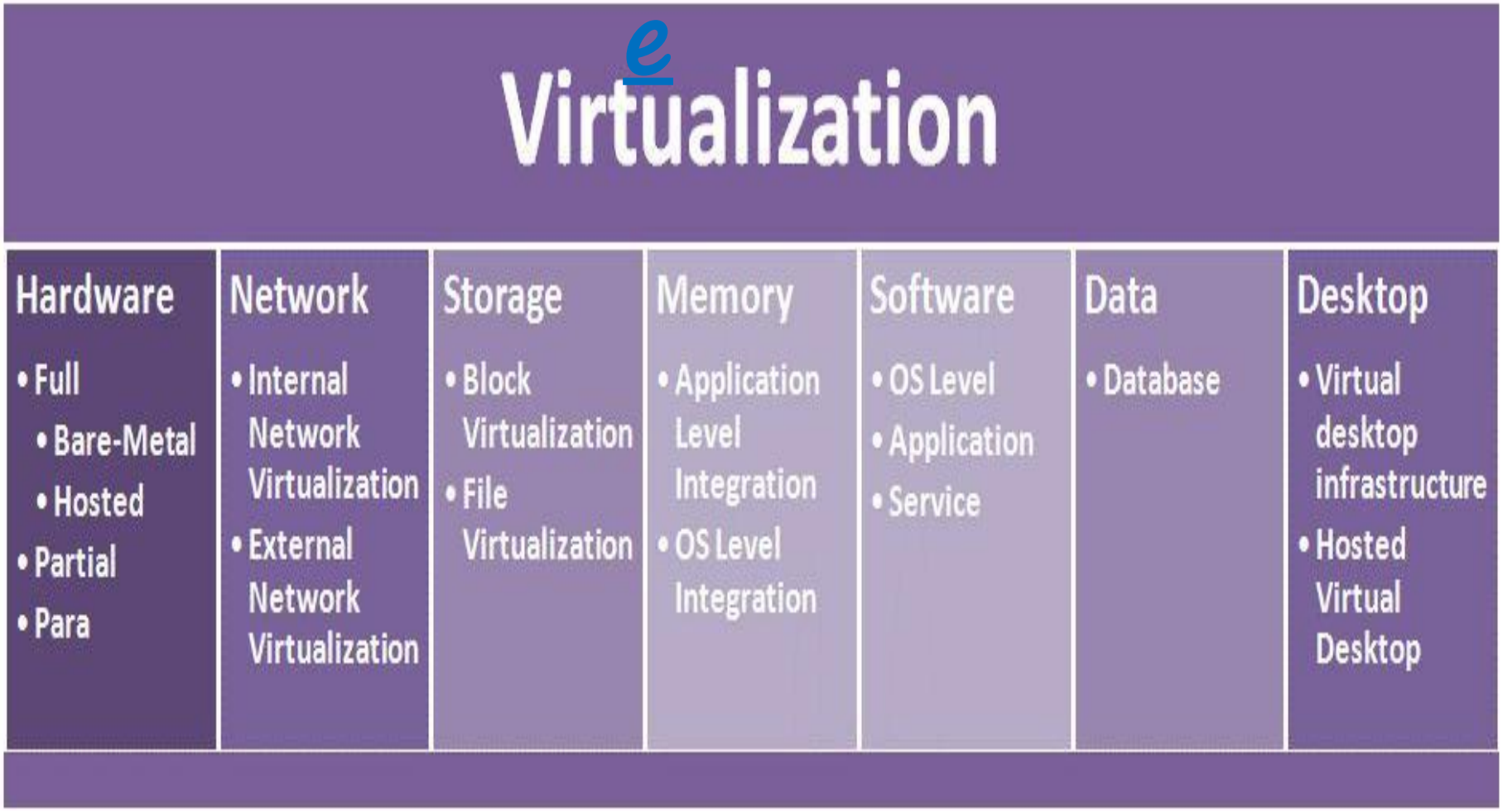
- External network:

Consolidation of multiple networks into a single one, or

Desktop Virtualization

- This is perhaps the most common form of virtualization for any regular IT employee.
- The user's desktop is stored on a remote server, allowing the user to access his desktop from any device or location.
- Employees can work conveniently from the comfort of their home. Since the data transfer takes place over secure protocols, any risk of data theft is minimized.

Types of Virtualization: At a Glance



Benefits of Virtualization

- Easily outsource your hardware and eliminate any energy costs associated with its operation.
- the efficiency, security and cost advantages.
- Run operating systems where thephysical hardware is unavailable.
- Easier to create new machines, backup machines, etc.
- Software testing using "clean" installs of operating systems and software
- Emulate more machines than are physically available.
- Timeshare lightly loaded systems on one host.
- Easy migration of virtual machines (shutdown