Module 1

Fundamentals - Principle of Virtualization

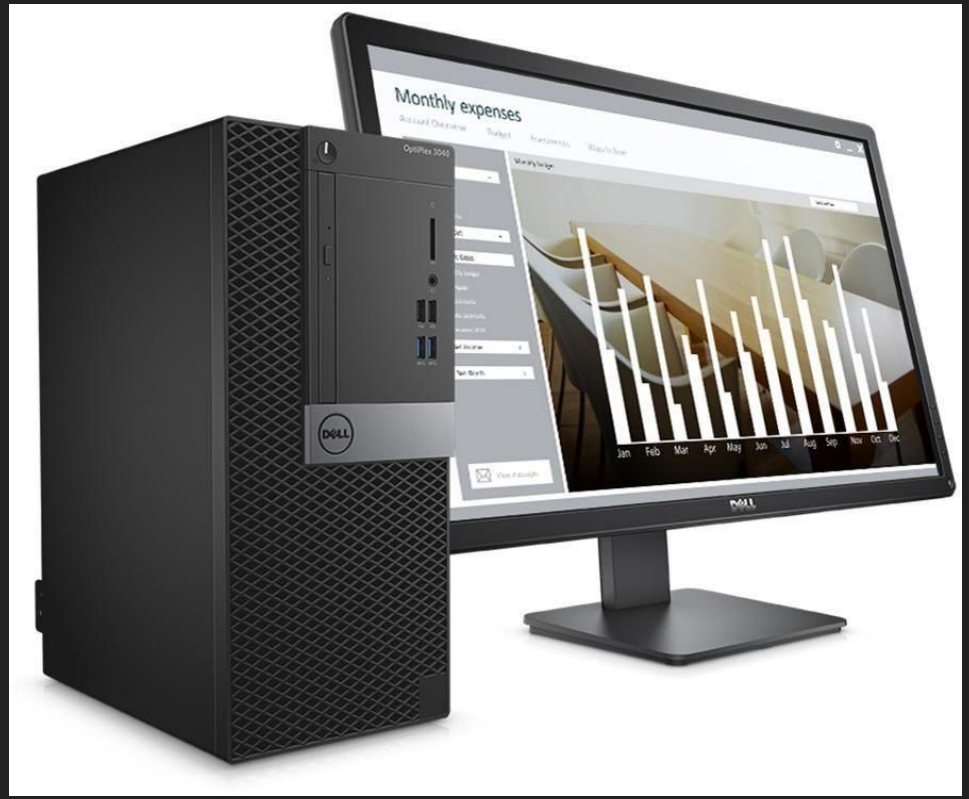
#Reference : VMware Docs.

Asst. Prof. Ashwini Mathur

Why the Concept of Virtualization Came ?

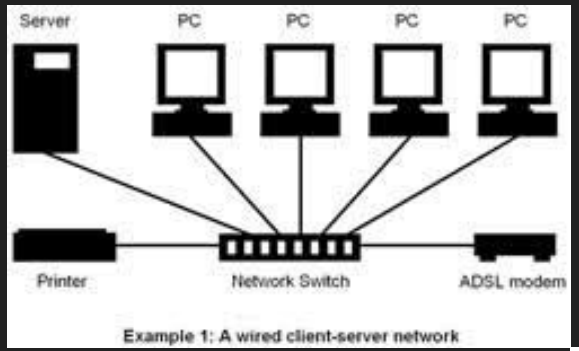
For that first we have to understand the hardware that we need to virtualize.

Devices to Guess ?



Display Size: 18.5" TFT Monitor; Processor: Intel Core i7; 8th Gen Processor Speed 3.2-3.9; Storage: 1TB HDD, 4GB RAM; Graphics: Intel; OS: UBUNTU;...

Answer: Personal Desktops or Computers



Example 1: A wired client-server network

Answer: Switch Networking Device

Router : CISCO Series

Answer: Router Networking Device

Exos E 4U106 Modular Enterprise System

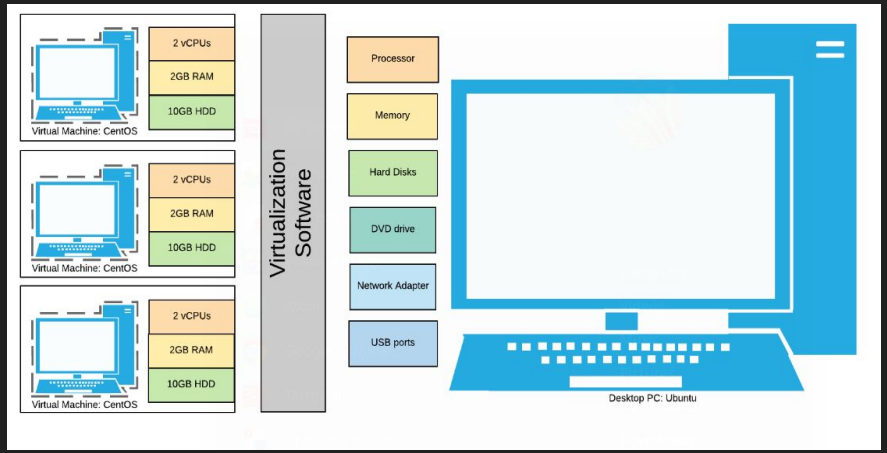
Answer: Storage Devices

https://youtu.be/RsZjjAqlpJ0?t=28 : Reference video of Blade Server

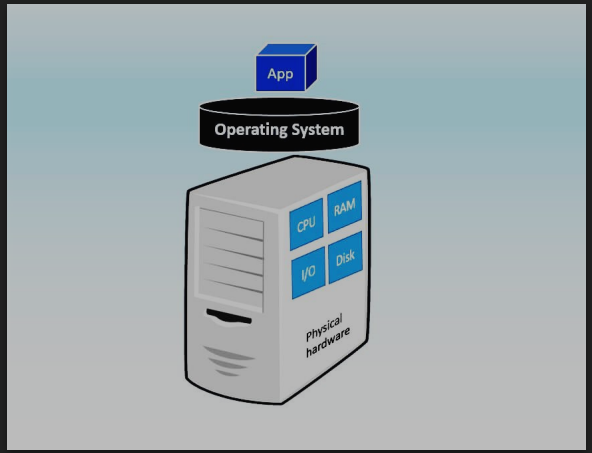
Answer: High End Servers

Data Center

What is Virtualization ??



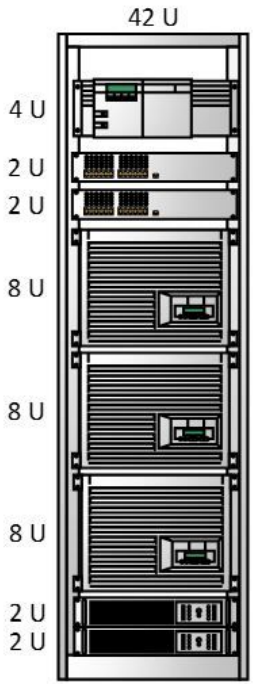
Virtualization Environment



Virtualization is the process of creating a software-based, or virtual, representation of something, such as virtual applications, servers, storage and networks.

It is the single most effective way to reduce IT expenses while boosting efficiency and agility for all size businesses. **[But HOW??]**

Traditional Architecture - IT Organization



Router / Firewall

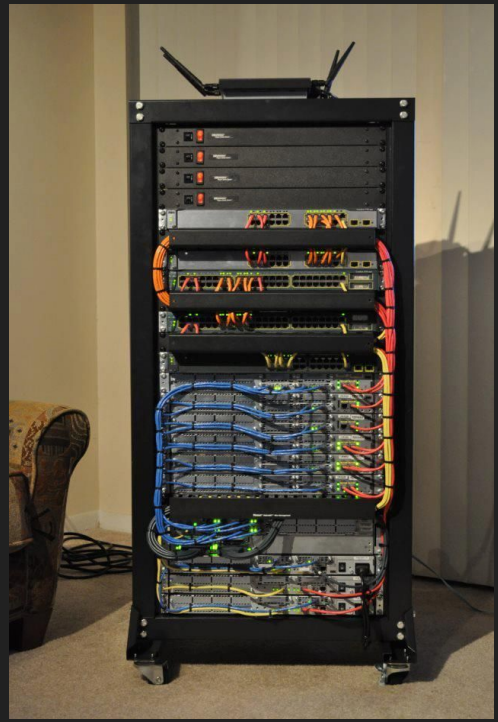
Switches

Web Server

Database Server

Email Server

Uninterruptible Power Supplies

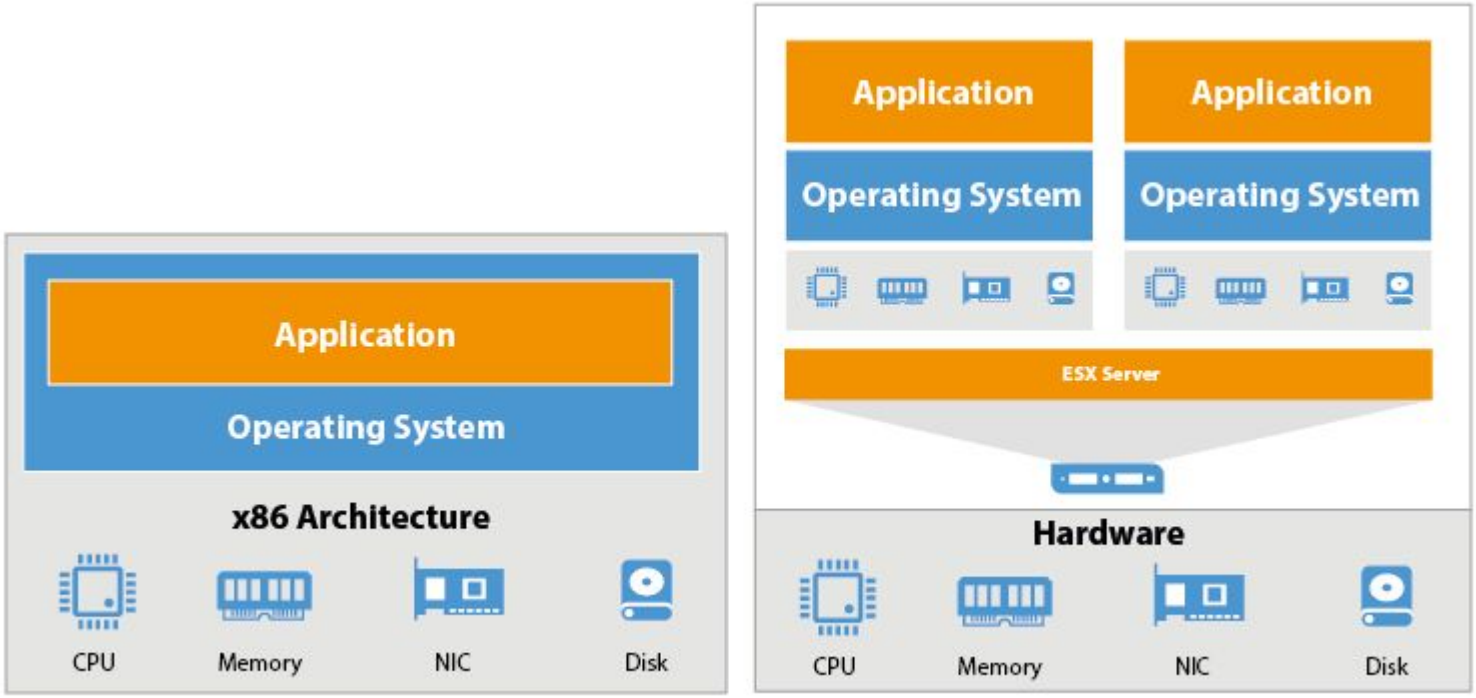


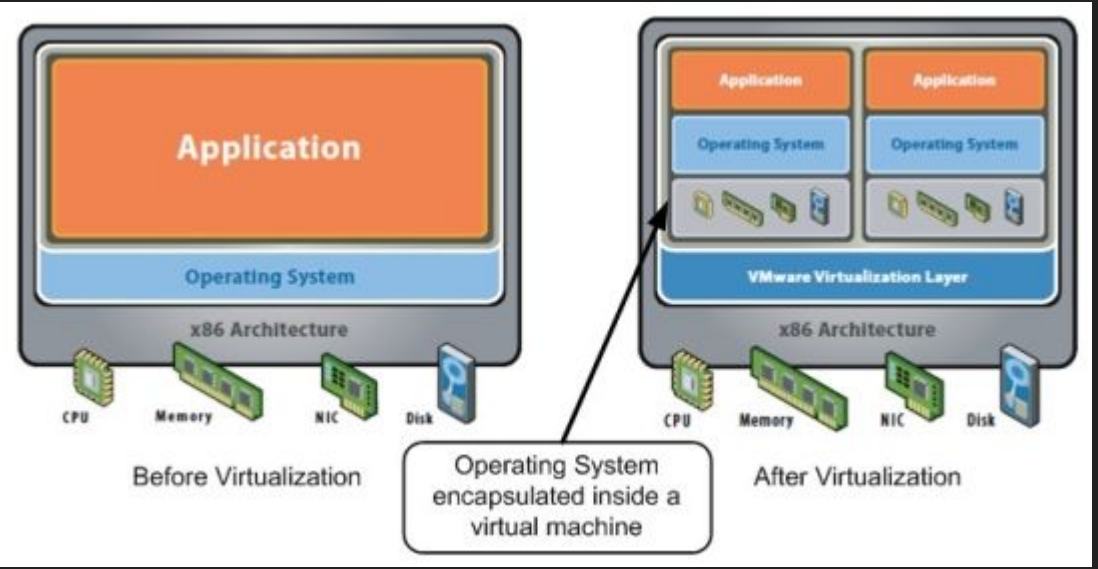
Fundamentals of virtualization

Virtualization is an abstraction layer that decouples the physical hardware from the operating system to deliver greater IT resource utilization and flexibility.

Virtualization allows multiple virtual machines, with heterogeneous operating systems (e.g., Windows 2003 Server and Linux) and applications to run in isolation, side-by-side on the same physical machine.

Physical Servers Vs Virtual Machines


Application
Operating System
x86 Architecture
CPU
Memory
NIC
Disk
Application
Application
Operating System
Operating System
ESX Server
Hardware
CPU
Memory
NIC
Disk


Application
Operating System
x86 Architecture
CPU
Memory
NIC
Disk
Before Virtualization
Application
Application
Operating System
Operating System
VMware Virtualization Layer
x86 Architecture
CPU
Memory
NIC
Disk
After Virtualization
Operating System encapsulated inside a virtual machine

Virtual Machine

A virtual machine is the representation of a physical machine by software. It has its own set of virtual hardware (e.g., RAM, CPU, NIC, hard disks, etc.) upon which an operating system and applications are loaded.

The operating system sees a consistent, normalized set of hardware regardless of the actual physical hardware components. VMware virtual machines contain advanced hardware features such as 64-bit computing and virtual symmetric multiprocessing.

In other words ..

Virtual Machines Explained

A virtual computer system is known as a “virtual machine” (VM): a tightly isolated software container with an operating system and application inside. Each self-contained VM is completely independent. Putting multiple VMs on a single computer enables several operating systems and applications to run on just one physical server, or “host.”

A thin layer of software called a “hypervisor” decouples the virtual machines from the host and dynamically allocates computing resources to each virtual machine as needed.

Perception for current trending technology

Though virtualization has become the new normal for businesses of all sizes, physical server infrastructures are still quite widespread.

Do you think that the companies using traditional, physical server networks are wasting money?

#Reference :
blob:https://www.vmware.com/356ea069-8829-4054-8de6-694c6038bede

Benefits of Virtualization

Virtualization can increase IT agility, flexibility and scalability while creating significant cost savings. Greater workload mobility, increased performance and availability of resources, automated operations –

they’re all benefits of virtualization that make IT simpler to manage and less costly to own and operate. Additional benefits include:

- Reduced capital and operating costs.
- Minimized or eliminated downtime.
- Increased IT productivity, efficiency, agility and responsiveness.
- Faster provisioning of applications and resources.
- Greater business continuity and disaster recovery.
- Simplified data center management.
- Availability of a true Software-Defined Data Center..

Virtualization

Due to the limitations of x86 servers, many IT organizations must deploy multiple servers, each operating at a fraction of their capacity, to keep pace with today's high storage and processing demands. The result: huge inefficiencies and excessive operating costs.

Virtualization relies on software to simulate hardware functionality and create a virtual computer system. This enables IT organizations to run more than one virtual system – and multiple operating systems and applications – on a single server.

The resulting benefits include economies of scale and greater efficiency.

How Virtualization works ?

Traditional Architecture

- Single operating system
- Single application

Virtual Architecture

- Virtualize many VMs using VMware Hypervisor

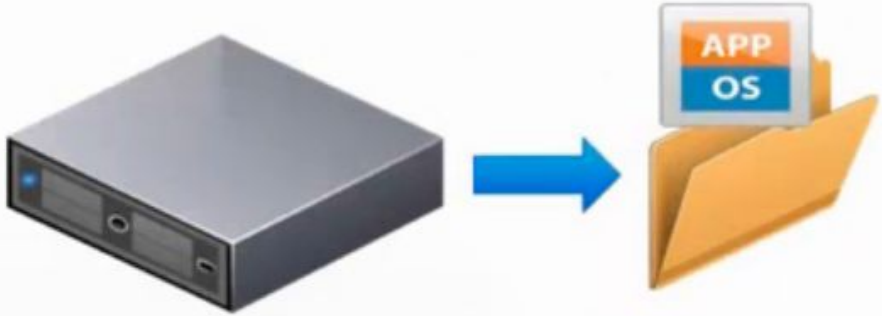
Key Properties of Virtual Machine

Partitioning

1. Run multiple operating systems on one physical machine.
2. Divide system resources between virtual machines.

Isolation

1. Provide fault and security isolation at the hardware level.
2. Preserve performance with advanced resource controls.



Encapsulation

1. Save the entire state of a virtual machine to files.
2. Move and copy virtual machines as easily as moving and copying files.

Hardware Independence

1. Provision or migrate any virtual machine to any physical server.

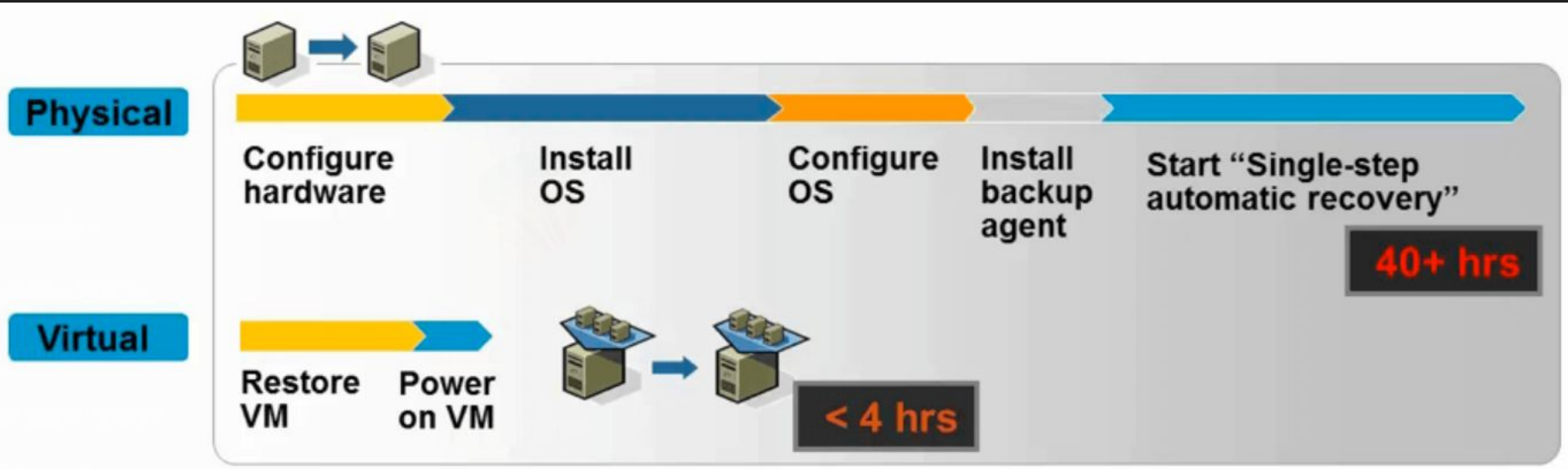
Key Benefits :

Consolidation - One-time event that moves existing applications onto a fewer number of servers

Containment - An ongoing effort to virtualize new applications and manage growth of existing ones

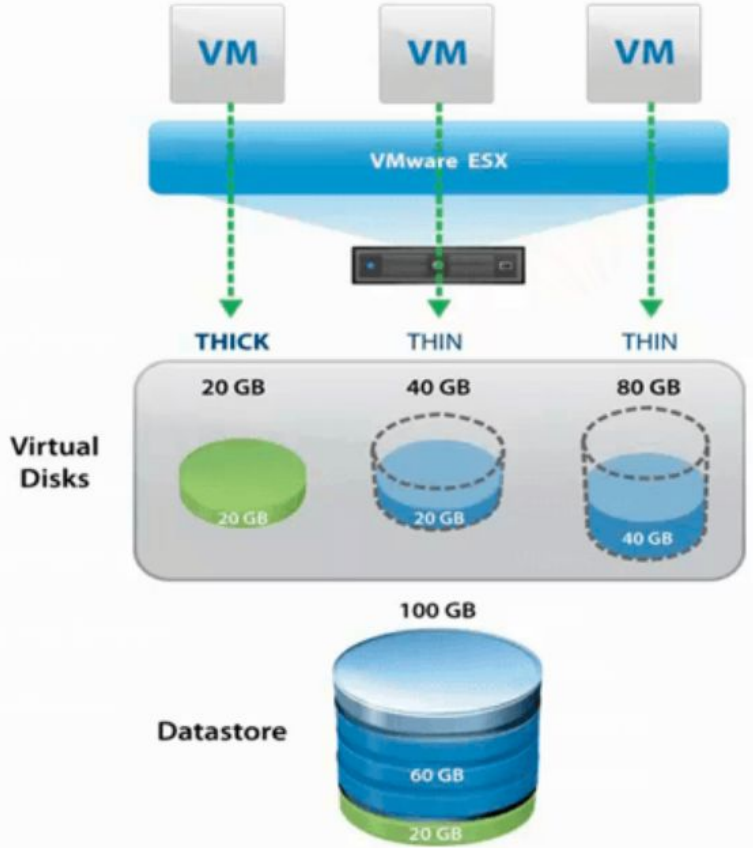
Availability - Introducing virtualization to increase application availability and data recoverability

Simple Recovery



- Eliminate recovery steps
- Standardize recovery process

Better Storage Utilization



- Provisioning storage only based on what is needed now and can grow over time
- Drastically save on storage costs

Cost Avoidance

Before VMware

More applications per machine = less machines

After VMware

Servers	10
Utilization	8%
Annual cost per server	$4,000
Total Cost	**$40,000**

Servers	3
Utilization	80%
Annual cost per server	$4,000
Total Cost	**$12,000**

$28,000 in cost avoidance