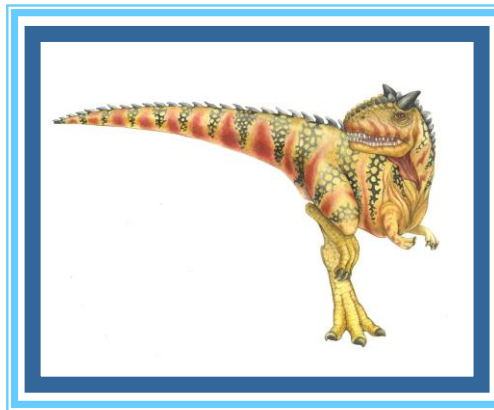
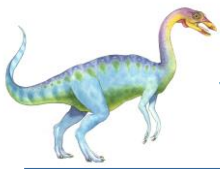


# Virtual Machines & Distributed Systems





# Virtual Machines & Distributed Systems

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- ❑ **Virtual Machines**
- ❑ Benefits
- ❑ Types of Virtual Machines
- ❑ **Distributed Systems**
- ❑ Reasons for Distributed Systems
- ❑ Types of Network-oriented Operating Systems

**Chapter 16 + Chapter 17 of the module textbook**





# Virtual Machines

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- ❑ **Virtualization** is technology that allows to create multiple simulated environments or dedicated resources from a single, physical hardware system.
- ❑ Software called a **hypervisor** connects directly to that hardware and allows to split a system into separate, distinct, and secure environments known as **virtual machines (VMs)**.
- ❑ **Virtual machine manager** (VMM) or **hypervisor** – creates and runs virtual machines by providing interface that is *identical* to the host (except in the case of paravirtualization)

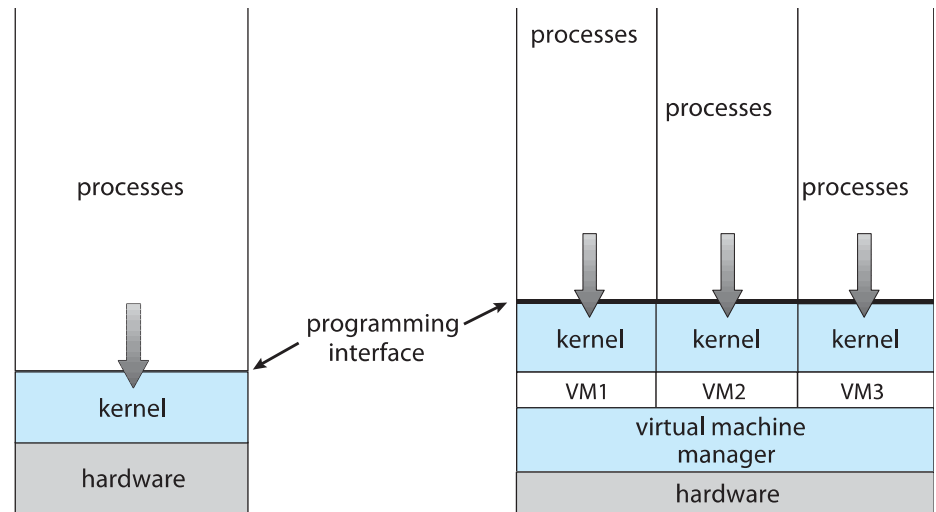




# Virtual Machine

Virtual machine implementations involve several components

- **Host** – the physical hardware equipped with a hypervisor.
  - **Guest** – an operating system
  - Single physical machine can run multiple operating systems concurrently, each in its own virtual machine
- the hypervisor provides a *layer between the hardware (the physical host machine) and the Virtual Machines (guest machines).*



**Non-virtual machine**

**Virtual machine**



# Implementation of VMMs

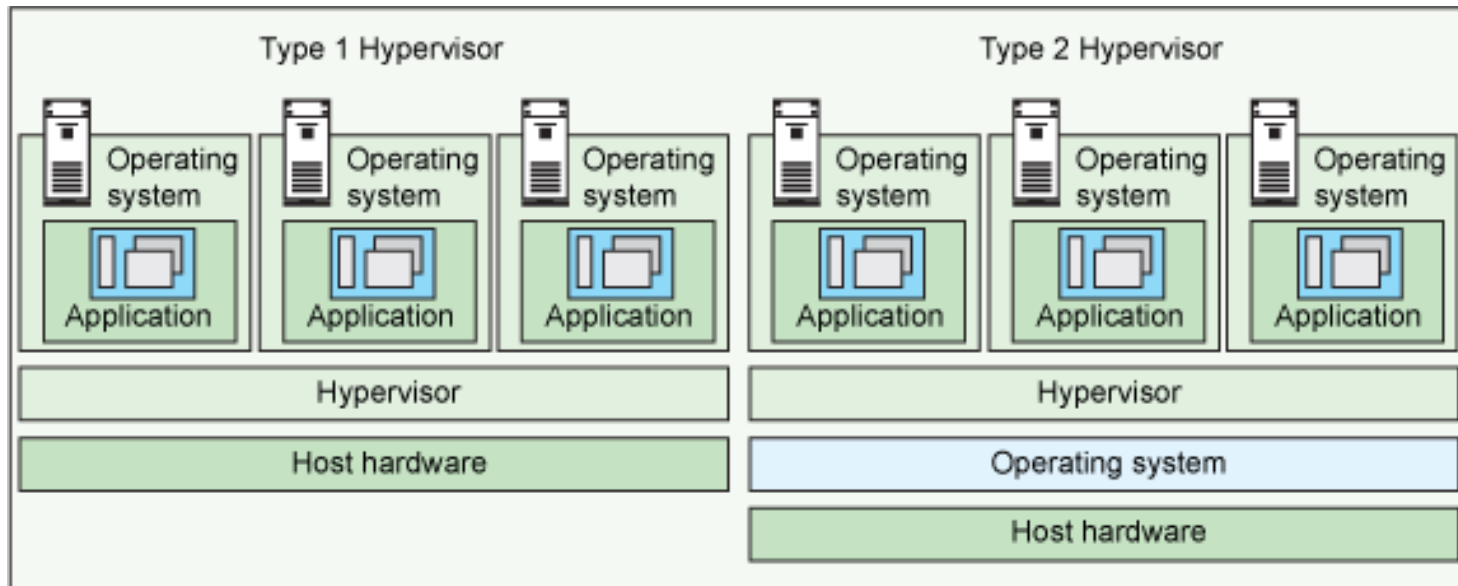
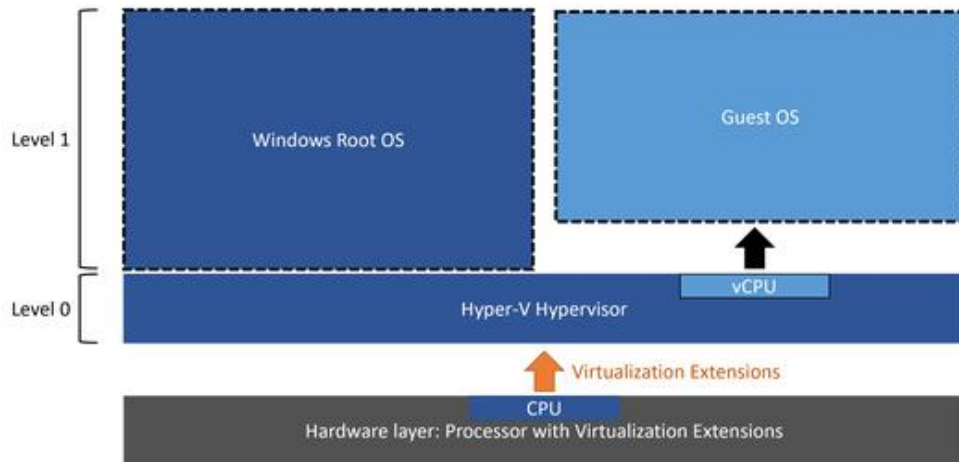
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Types of virtual machine manager VMMs:

- **Type 0 hypervisors** - *Hardware-based solutions* that provide support for virtual machine creation and management via firmware.
  - **No need an embedded host OS** to support virtualization, runs in an “**Un-Hosted**” environment.
    - » IBM LPARs and Oracle LDOMs are examples
- **Type 1 hypervisors** - *Operating-system-like software* built, **is a layer of software run directly on the system hardware.**
  - » Including VMware ESX, Joyent SmartOS, and Citrix XenServer
  - » Including Microsoft Windows Server with HyperV and RedHat Linux with KVM
- **Type 2 hypervisors** - **allows users to run multiple operating systems simultaneously on a single platform**
  - » Including VMware Workstation and Fusion, Parallels Desktop, and Oracle VirtualBox



# Implementation of VMMs





# Benefits

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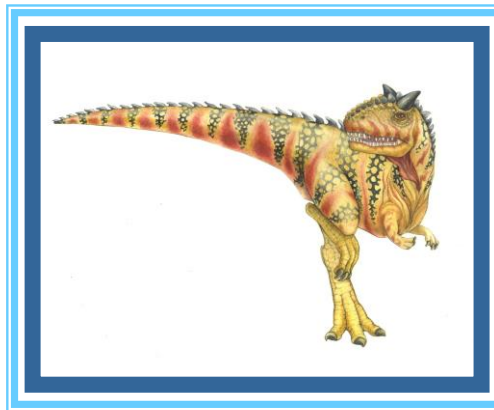
- the ability to share the same hardware yet run several different execution different operating systems concurrently.
- Host system protected from VMs, VMs protected from each other
  - ▶ against virus - less likely to spread
  - ▶ each virtual machine is almost completely isolated from all other virtual machines

**Disadvantage** of isolation is that it can prevent sharing of resources.

- a perfect for operating-system research and development.
- virtualized workstation allows for rapid porting and testing of programs in varying environments.
- Consolidation involves taking two or more separate systems and running them in virtual machines on one system.
- can improve resource utilization and resource management.
- Live migration – move a running VM from one host to another.

# Distributed Systems

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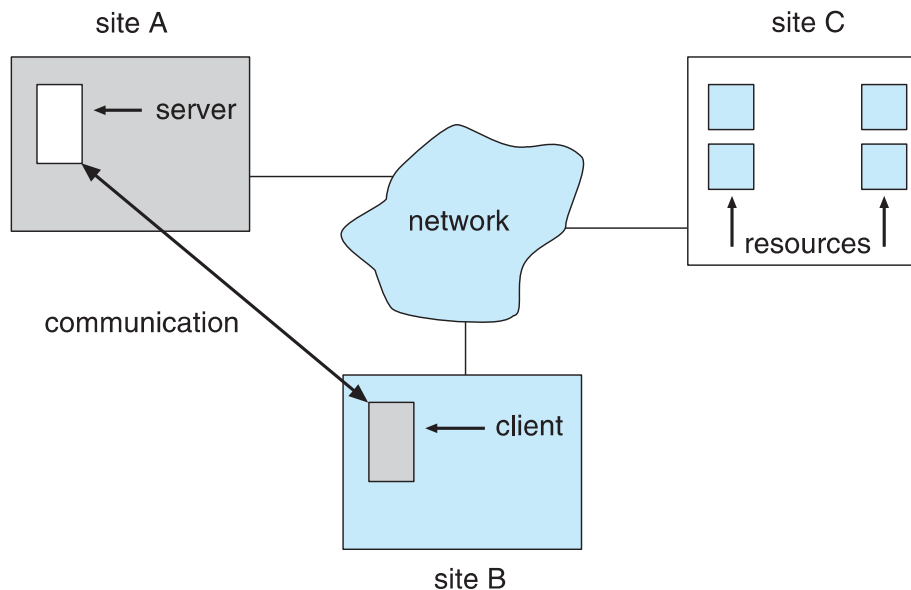






# Overview

- **Distributed system** is a loosely-coupled architecture, wherein processors are inter-connected by a communication network.
- Processors variously called ***nodes, computers, machines, hosts***
- The processors and their respective resources for a specific processor in a distributed system are *remote*, while its own resources are considered as *local*.





# Reasons for Distributed Systems

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## □ Resource sharing

- » Sharing and printing files at remote sites
- » Processing information in a distributed database
- » Using remote specialized hardware devices

## □ Computation speedup – *load sharing* or *job migration* (are distributed and run concurrently on various nodes on the system)

## □ Reliability – detect and recover from site failure, function transfer, reintegrate failed site; may utilize an alternative path in the network, in case of any failure.

## □ Communication – exchange information at geographically-distant nodes

## □ Economy and Incremental growth - a number of cheap processors together provide a highly cost-effective solution for a computation-intensive application. The DS may be increased with the introduction of any new hardware or software resources.



# Types of Network-oriented OS

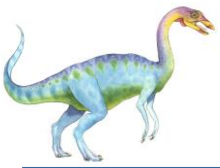
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## ❑ Network Operating Systems

- **Remote logging** into the appropriate remote machine (telnet, ssh)
- **Remote File Transfer** - transferring data from remote machines to local machines, via the File Transfer Protocol (FTP) mechanism
- Users must establish a *session*

## ❑ Distributed Operating Systems

- **Data Migration** – transfer data by transferring entire file, or transferring only those portions of the file necessary for the immediate task
- **Computation Migration** – transfer the computation, rather than the data, across the system
- **Process Migration** – execute an entire process, or parts of it, at different sites



# THE END

## CPT104

