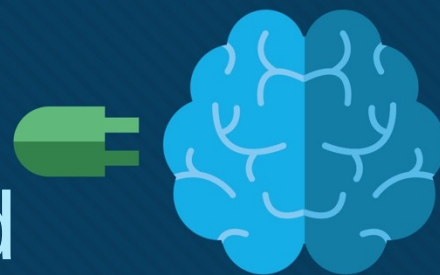




# Chapter 9: Virtualization and Cloud Computing

IT Essentials 8.0



# Chapter 9 - Sections & Objectives

## ▪ 9.1 Virtualization

- Install a virtual machine on a computer.
- Explain server virtualization.
- Install virtualization software on a computer.

## ▪ 9.2 Cloud Computing

- Compare cloud computing concepts.
- Describe the uses of the cloud.
- Explain characteristics of public, private, hybrid and community cloud computing.

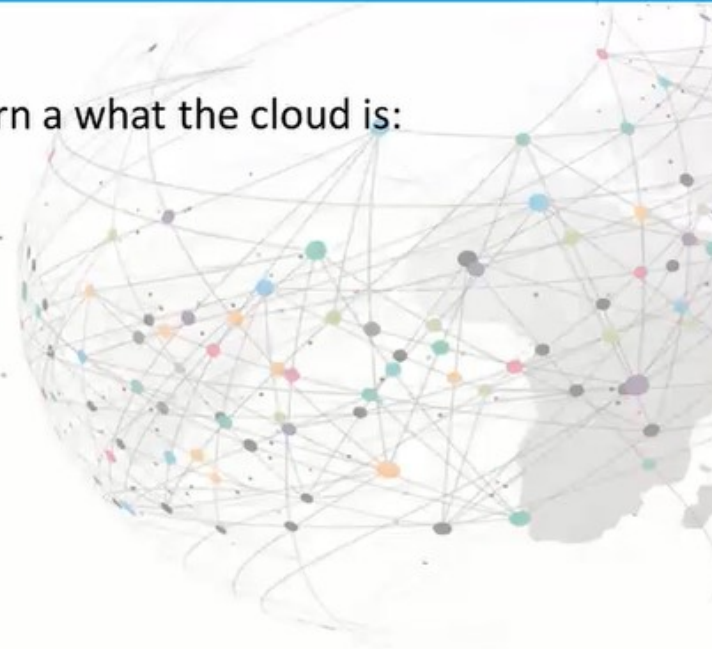
# 9.1 Virtualization

# Video Explanation – What is the cloud?

## Video Explanation: What is the Cloud?

In this video explanation, you will learn a what the cloud is:

- Why do we need the cloud?
- What is the cloud used for?
- Data storage and sharing
- Cloud services
- Advantages of the cloud



# Cloud Computing and Virtualization

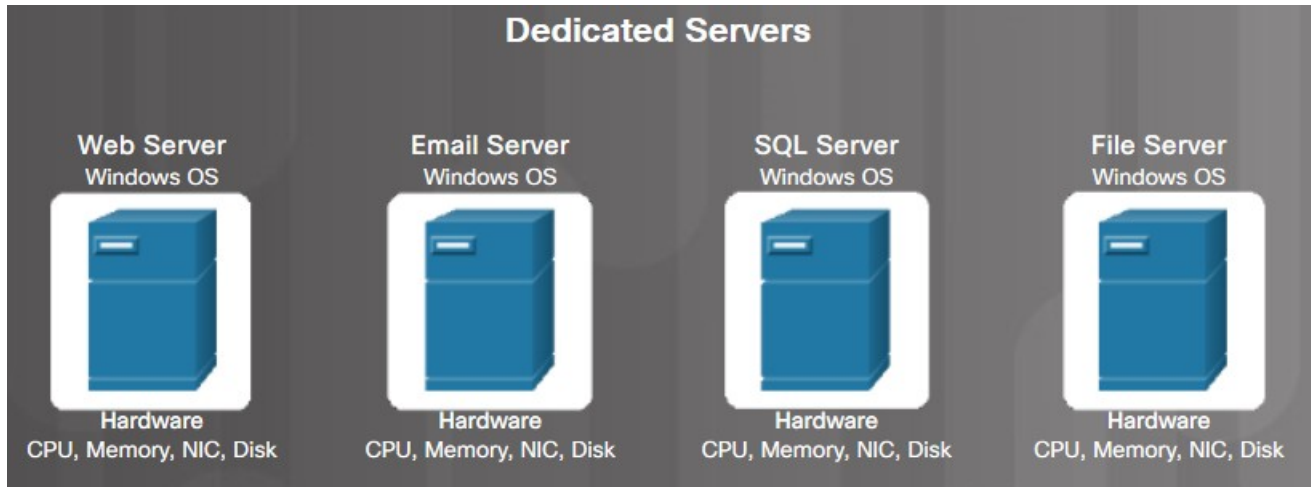
- Virtualization enables a single computer to host multiple independent virtual computers called virtual machines (VM) that share the host computer hardware.
- Virtualization software separates the actual physical hardware from the VM instances.
- An image of a VM can be saved as a file and then be re-started when required.
- Cloud computing separates the applications from the hardware.
- Service providers such as Amazon Web Services (AWS) own and manage the cloud infrastructure.

**Virtualization is the foundation which supports cloud computing.**



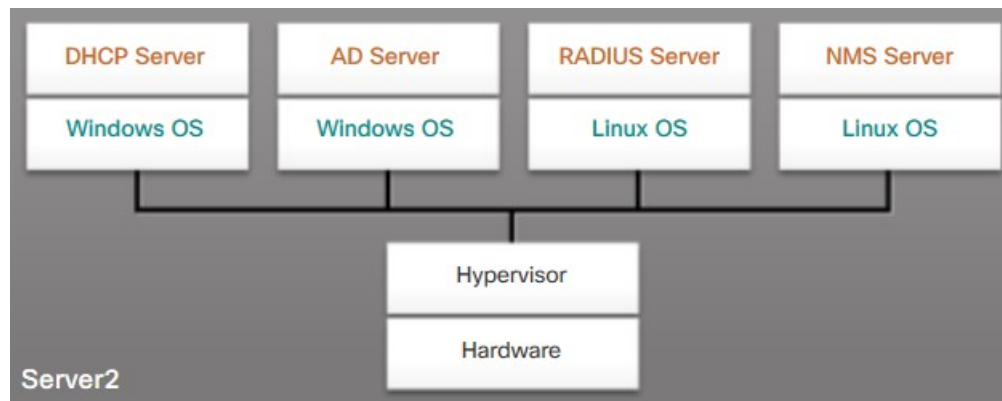
# Traditional Server Deployment

- Traditionally, organizations delivered applications and services using powerful dedicated servers.
- These dedicated servers are equipped with large amounts of RAM, powerful CPUs, and multiple large storage devices.
- Disadvantages include wasted resources, single-point of failure, and server sprawl.



# Server Virtualization

- Server virtualization takes advantage of idle resources to reduce the number of servers required.
- A program called the **hypervisor** is used to manage the computer resources and various VMs.
- It provides VMs access to the hardware in the physical machine such as CPUs, memory, disk controllers, and NICs.
- Each VM runs a complete and separate operating system.

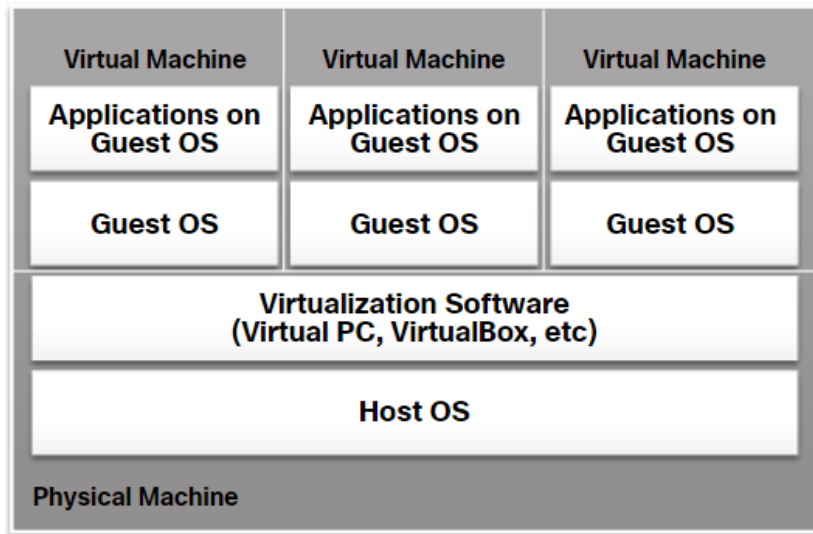


# Advantages of Server Virtualization

- Better use of resources
- Less space required
- Less energy consumed
- Reduced cost
- Faster server provisioning
- Maximize server uptime
- Improved disaster recovery
- Support for legacy systems



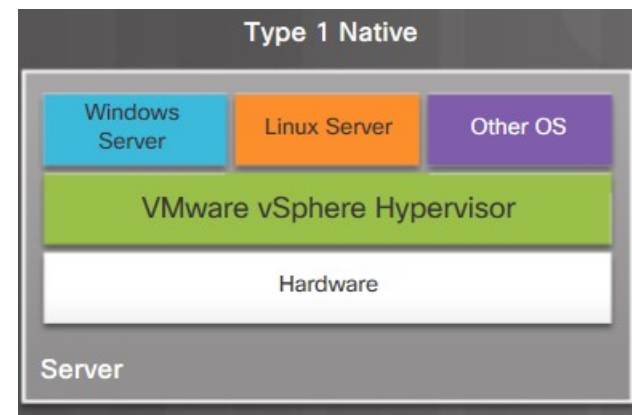
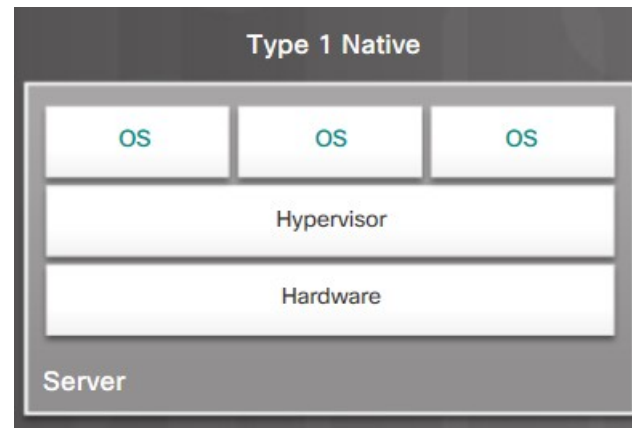
# Client-Side Virtualization



- Client-side virtualization enables users to run VMs on their local computer.
- It allows users to test new operating systems, software, or to run older software.
- **Host computer** – the physical computer controlled by a user.
- **Host OS** - the operating system of the host computer.
- **Guest OS** - the operating system that is running in the VM.

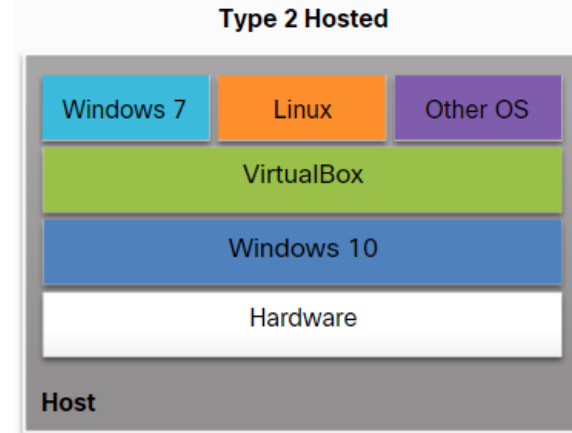
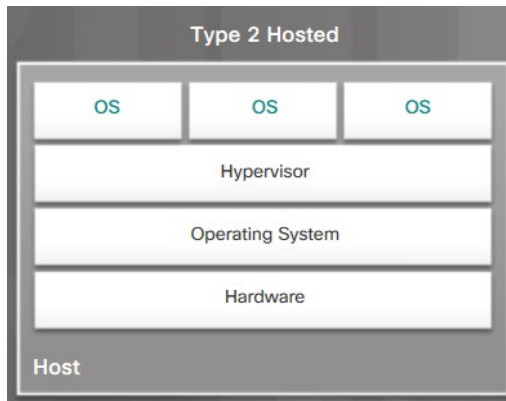
# Type 1 and Type 2 Hypervisors

- Type 1 (native) hypervisor is typically used with server virtualization. For example, they are used in data centers and cloud computing.
- Type 1 hypervisors run directly on the hardware of a host and manage the allocation of system resources to VMs.
- Type 1 hypervisors include VMware vSphere / ESXi, Xen, and Oracle VM Server.



# Type 1 and Type 2 Hypervisors (Cont.)

- Type 2 (hosted) hypervisors are commonly used with client-side virtualization.
- Type 2 hypervisors such as VMware Workstation work with the host computer to create and use multiple VMs.
- Type 2 hypervisors include VMware Workstation and Oracle VirtualBox.
- In the Type 2 implementation, the host OS on the computer is Windows 10.
- VirtualBox has been used to create and manage the Windows 7 VM and a Linux VM.



# Virtual Machine Requirements

Windows Hyper-V Requirements for Windows 10	
Host OS	Windows 10 Pro or Windows Server (2012 and 2016)
Processor	64-bit CPU with Second Level Address Translation (SLAT)
BIOS	CPU support for VM Monitor Mode Extension (VT-c on Intel CPUs)
Memory	Minimum 4GB system RAM
Hard Disk Space	At least 15GB per VM

**Hyper-V is included in Windows 10 Pro**

# Virtual Machine Requirements (Cont.)

## Windows Hyper-V Requirements for Windows 11

Host OS	Windows 11 Home or Pro
Processor	1 gigahertz (GHz) or faster with two or more cores on a compatible 64-bit processor or system on a chip (SoC)
BIOS	UEFI, Secure Boot capable, and support for Trusted Platform Module (TPM) 2.0
Memory	At least 4GB system RAM
Hard Disk Space	At least 10GB per Virtual OS
Graphics	DirectX 12 compatible or later with support for WDDM 2.0 driver and a display that supports 720p HQ

# Lab – Install Linux in a Virtual Machine and Explore the GUI

- In this lab, you will install a Linux OS in a virtual machine using a desktop virtualization application, such as VirtualBox.
- After completing the installation, you will explore the GUI interface.

### Objectives:

Part 1: Prepare a Computer for Virtualization

Part 2: Install a Linux OS on the Virtual Machine

Part 3: Explore the GUI

## 9.2 Cloud Computing

# How We Use the Cloud

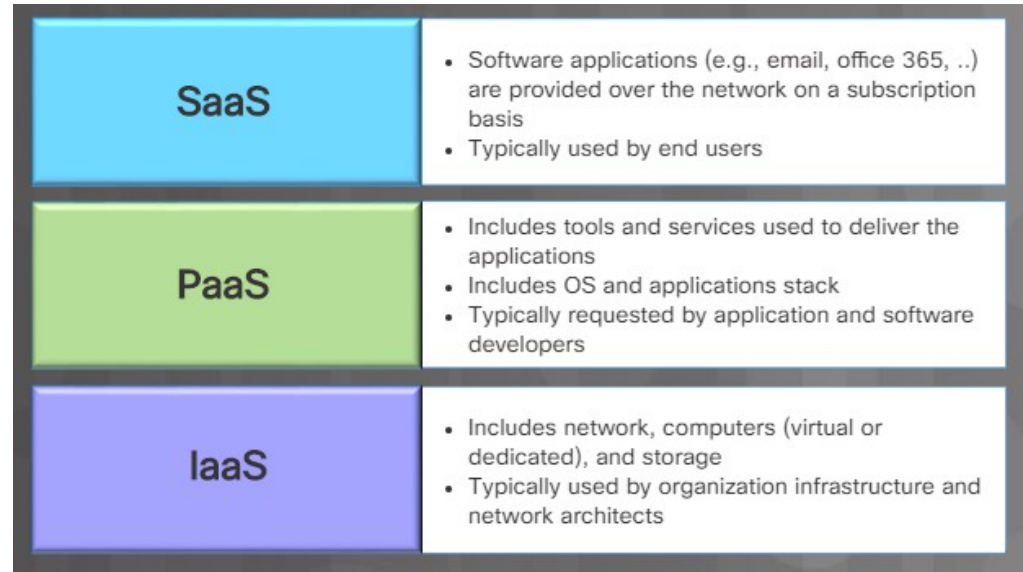
- Cloud computing provides users with on-demand delivery of computing services over the Internet.
- Cloud computing services are owned and hosted by service providers.
- Most of us already use cloud services when you use social media applications, access an online music library, or use online storage for save photos.
- Organizations typically pay cloud providers a usage fee based on user access and usage of services.



# Cloud Computing

## Cloud Services

- Cloud service providers can provide various services tailored to meet customer requirements.
  - Software as a Service (SaaS)
  - Platform as a Service (PaaS)
  - Infrastructure as a Service (IaaS)
- Cloud service providers have extended the IaaS model to also provide IT as a service (ITaaS).



# Cloud Computing Characteristics

- On-demand (self-service)
- Rapid elasticity
- Resource pooling
- Measured and metered service
- Broad network access

# Software Defined Networking

- To achieve efficient elasticity in the cloud, services must be provisioned and deprovisioned rapidly.
- This is done using scripting.
- Software-defined networking (SDN) is often used to perform these operations.
- In the SDN model, there are three layers, the application layer at the top, the control layer in the center, and the infrastructure layer at the bottom.
  - The application layer uses logic to decide how traffic is prioritized and where to switch it.
  - The infrastructure layer is the physical and virtual devices that perform the routing and switching of traffic.
  - The SDN controller in the center and controls the application and infrastructure layers.

## Software Defined Networking (Cont.)

- The control of the layers is performed by scripts through an application programming interface (API).
- The API between the SDN controller and the application layer is called the northbound API and the API between the SDN controller, and the infrastructure layer is called the southbound API.
- SD-WAN technologies make it possible to simplify an organization's network architecture, reducing it to a single orchestrated layer rather than a mixture of connected and integrated physical solutions.
- By virtualizing network architecture, organizations can better monitor and maintain their network organization, and can even offload a significant amount of work through automated processes.
- SD-WAN solutions include built-in firewalls, artificially intelligent security solutions, and integrated security features such as encryption, sandboxing, and IPS.
- Businesses are operating increasingly outside brick-and-mortar locations,
- SD-WAN technology can help reduce their costs.
- Through SD-WAN technology, companies can better improve their consistency and their reliability.

# 9.3 Chapter Summary

## Chapter 9: Virtualization and Cloud Computing

- Explain server virtualization.
- Install virtualization software on a computer.
- Describe uses of the cloud.
- Explain characteristics of public, private, hybrid and community cloud computing.