

System Administration 1

Prepared by Dr. Ahmed Omar

IT391

System Administration 1

Lecture 2



Network Foundations

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Agenda

- **Introduction to Networks**
- **Network Components Overview**
- **Types of Networks**
- **Network Topologies**
- **Network Protocols**
- **Client and Server**
- **Network Operating System (NOS)**
- **Virtual Machine (VM)**

Introduction to Networks

- **Definition of a Network**

A network is a group of computers connected to each other to provide services to users.

- **Purpose**

Enables communication, resource sharing, and access to modern technologies.



Types of Network Services

- **Data Sharing**

- ☐ Example: File server allows multiple users to access and share files.

- **Resource Sharing**

- ☐ Example: Shared devices like printers and scanners.

- **Modern Technologies**

- ☐ Examples: VOIP (Voice Over IP), Video Conferencing, Internet of Things (IoT), Cloud Computing.

Types of Network Services

•Data Sharing

- ☐ Example: **File server** allows multiple users to access and share files.
- ☐ Centralized storage for documents and media.
- ☐ Facilitates collaboration and backup.

Types of Network Services

•Resource Sharing

- ☐ Shared access reduces cost and increases efficiency.
- ☐ Users can send print or scan jobs from any connected device.
- ☐ Example: Shared devices like printers and scanners.

Types of Network Services

- **Modern Technologies**

- ☐ **VOIP**

- ✓ Internet-based voice communication.

- ☐ **Video Conferencing**

- ✓ Real-time video meetings over the network.

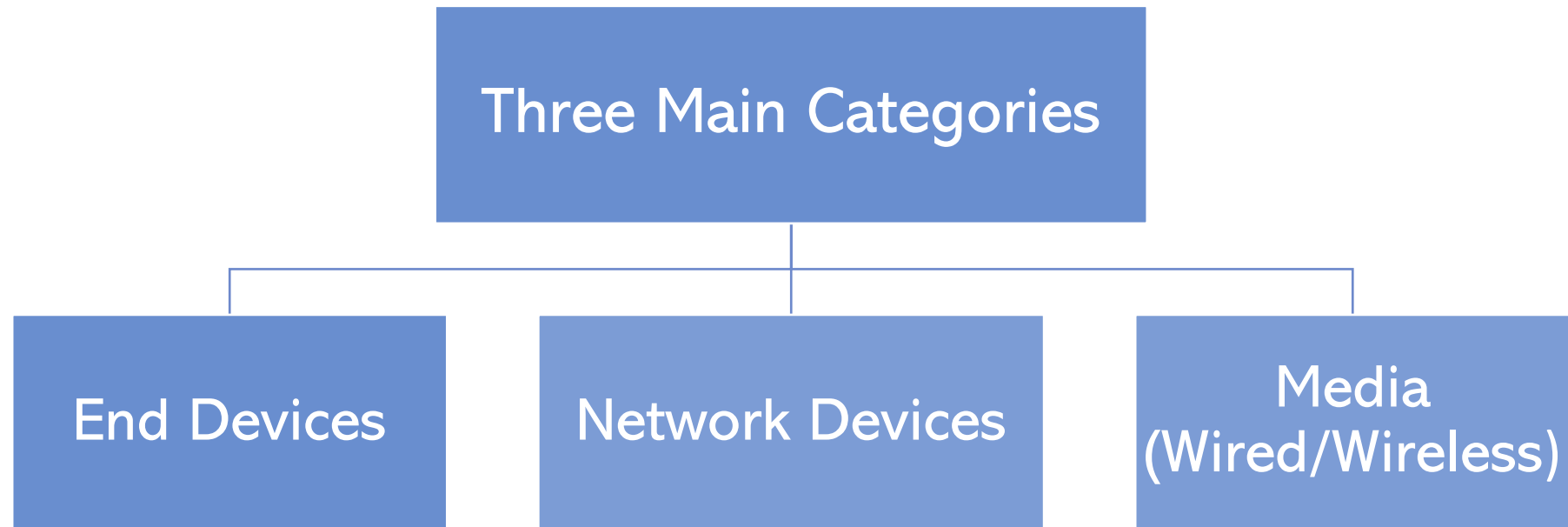
- ☐ **IoT (Internet of Things)**

- ☐ Connecting smart devices for automation and monitoring.

- ☐ **Cloud Computing**

- ☐ Access to computing resources and storage over the internet.

Network Components Overview



Network Components Overview

❑ End Devices

Devices that users interact with directly.

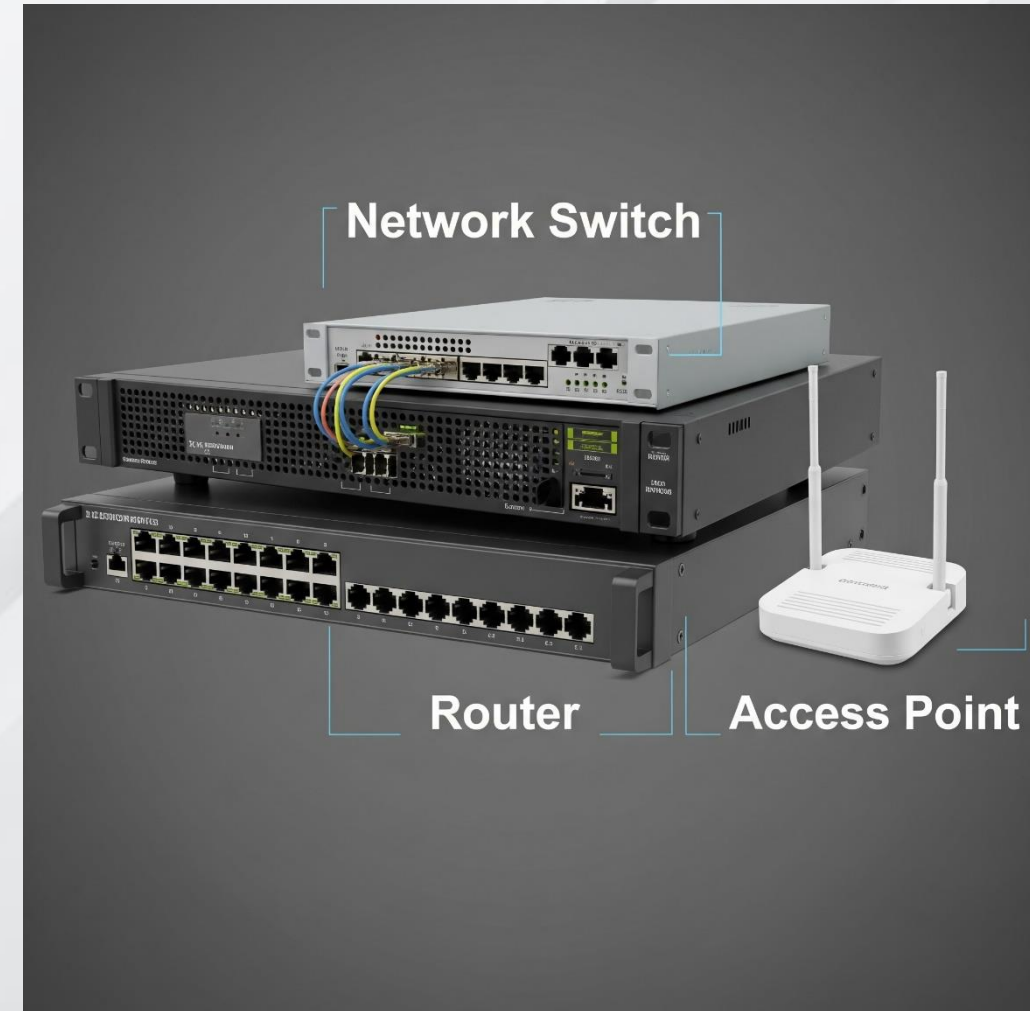
❖ Examples

- ✓ PCs (Personal Computers)
- ✓ Laptops
- ✓ CAM (likely refers to Cameras)
- ✓ IP Phones
- ✓ Printers

Network Components Overview

❑ Network Devices

Their primary roles : Establishing and Managing Connections



Network Components Overview

☐ Network Media

- ✓ the physical **pathways** or channels that carry data signals between devices in a network.
- ✓ serve as the channel over which data travels from the source to the destination, enabling communication between computers, servers, and other devices



Network Components Overview

❑ Network Media

❖ Wired Media

- Examples: Ethernet cables, fiber optics.
- Advantages: High speed, reliability.

❖ Wireless Media

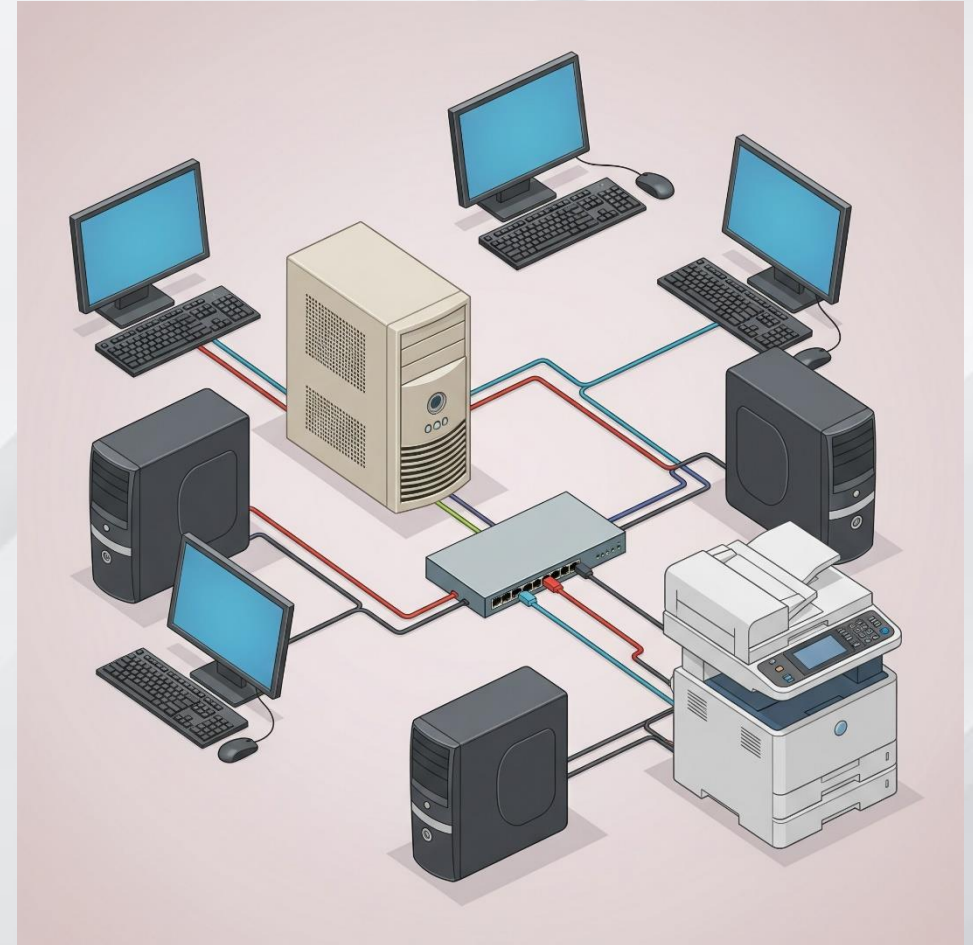
- Examples: Wi-Fi, Bluetooth.
- Advantages: Mobility, ease of installation.



Types of Networks

•LAN (Local Area Network):

- Covers a small geographic area (e.g., home, school, office).
- Owned and maintained by a single organization.
- Used for sharing resources like files and printers within a building.



Types of Networks

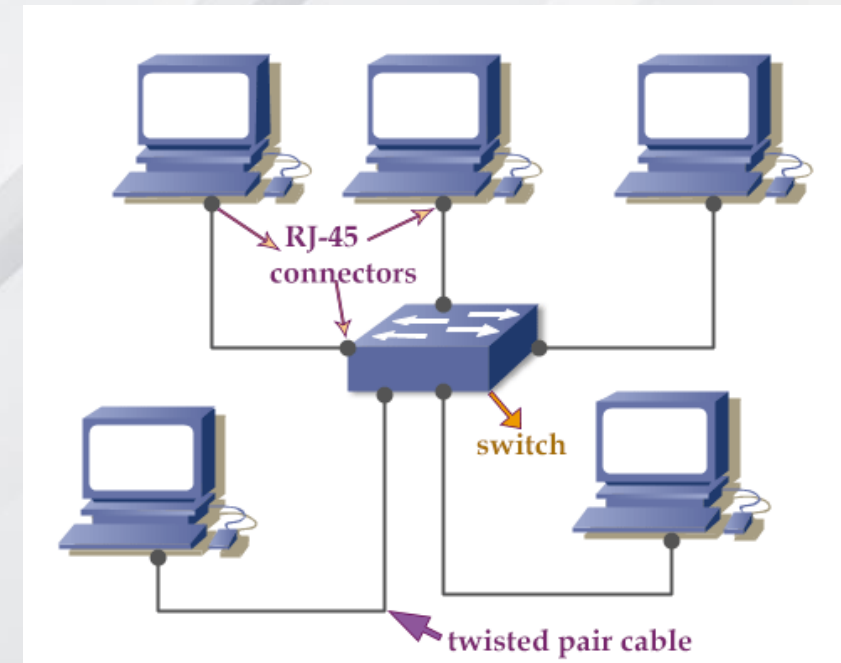
•WAN (Wide Area Network):

- Spans a large area, connecting LANs across cities, countries, or globally.
- Used by organizations with multiple locations (e.g., banks, multinational companies)



Network Topologies

- ❑ Network topology refers to the **arrangement** of various elements (links, nodes, devices) in a computer network. It describes how different computers, devices, and network resources are physically or logically connected and how data flows between them



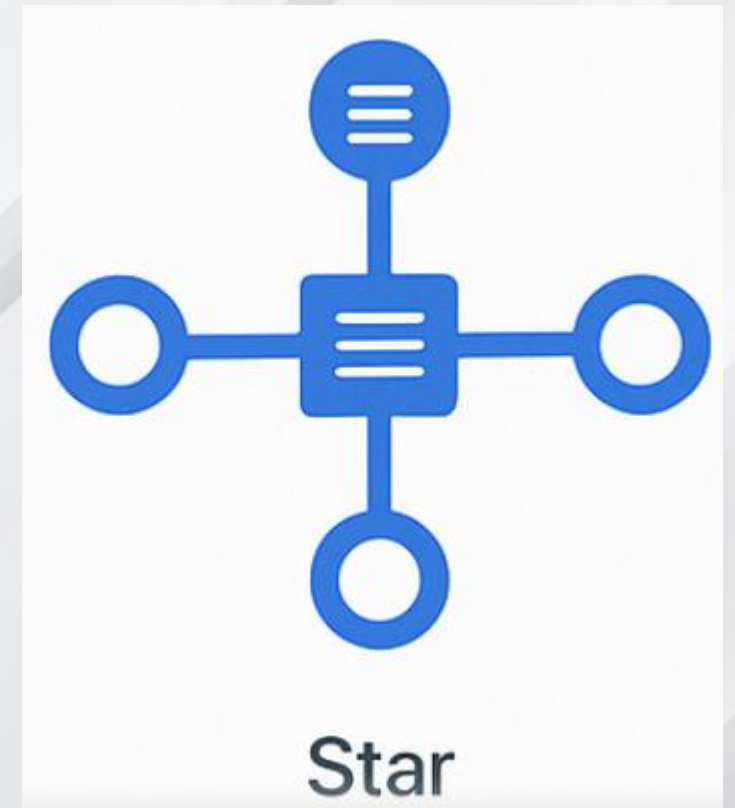
Network Topologies

- ❑ **Ring Topology**
- ❑ In ring topology, devices are connected in a circular pattern, with each device connected to exactly two neighbors. Data travels unidirectionally around the ring until it reaches its destination



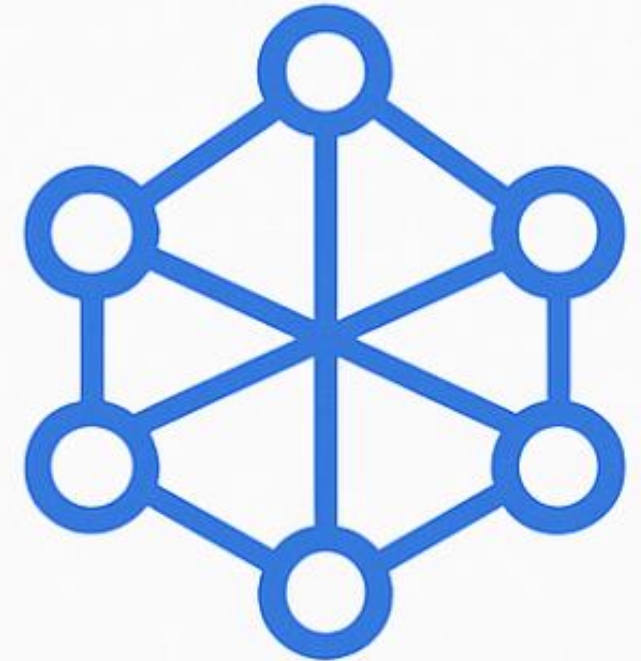
Network Topologies

- ❑ **Star Topology**
- ❑ Star topology connects all devices to a central hub, switch, or concentrator, with each device having a dedicated connection to the central point. All communication between devices must pass through this central hub



Network Topologies

- ❑ **Mesh Topology**
- ❑ Mesh topology connects every device to every other device in the network, creating multiple paths for data transmission. This configuration can be full mesh (every device connected to all others) or partial mesh (devices connected only to frequently communicating partners)

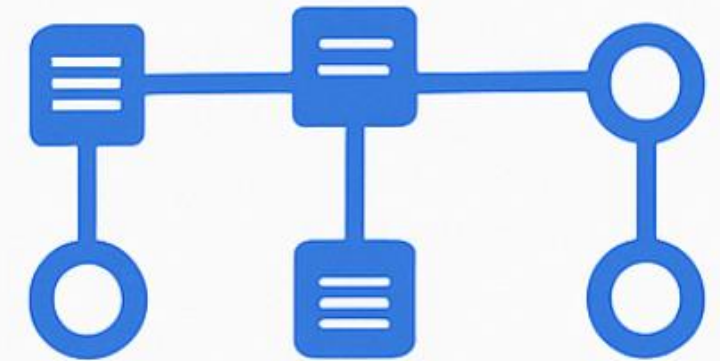


Mesh

Network Topologies

❑ Bus Topology

- ❑ Bus topology features all devices connected to a single main cable called the backbone, with terminators at both ends. In this configuration, data travels in one direction along the cable, and all connected devices receive the information, but only the intended recipient processes it

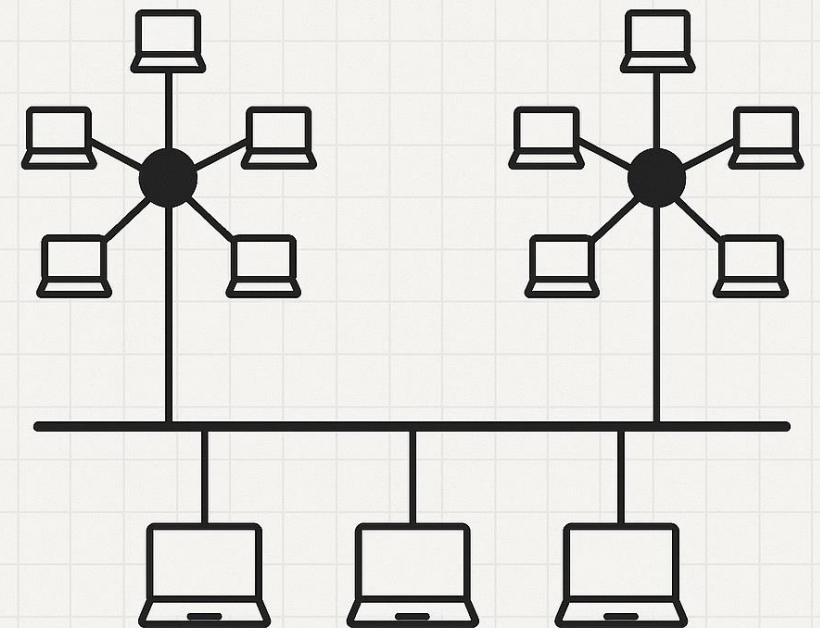


Bus

Network Topologies

- ❑ Hybrid network topology diagram illustrating combination of multiple topology types in a single network

HYBRID NETWORK TOPOLOGY



Network Topologies

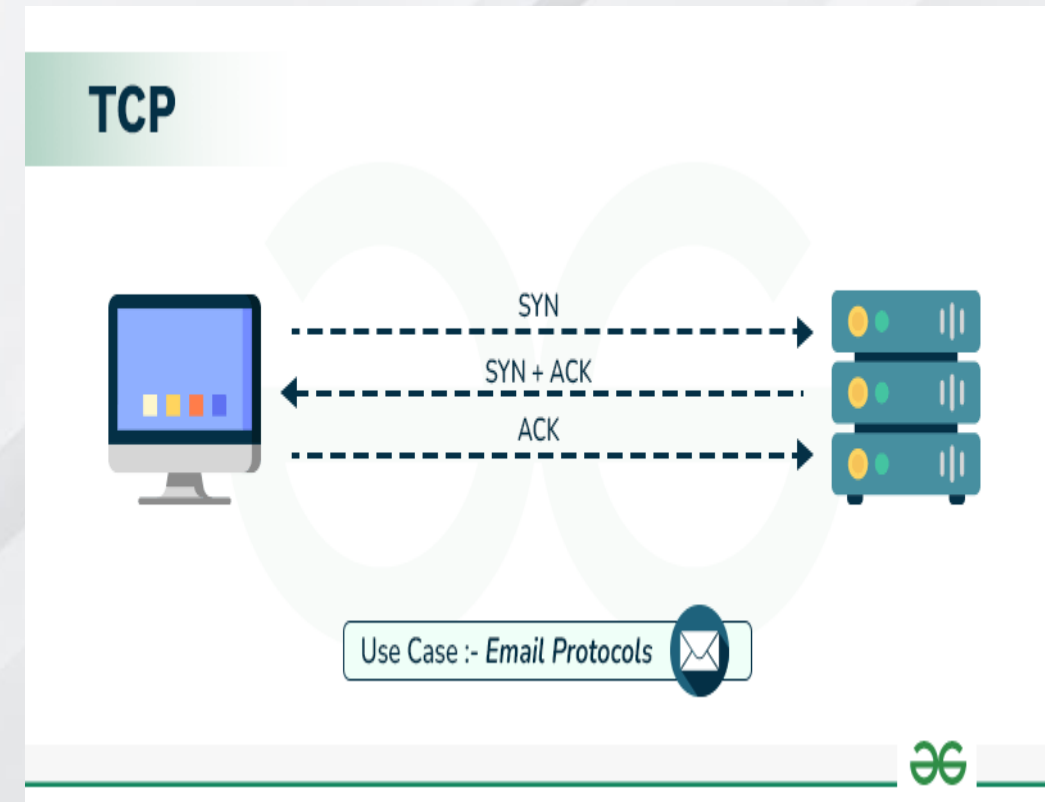
Topology	Cost	Installation	Scalability	Reliability	Performance
Bus	Low	Easy	Limited	Low	Decreases with more devices
Star	Medium	Easy	Good	Good	Consistent
Ring	Medium	Moderate	Limited	Low	Predictable
Mesh	High	Complex	Excellent	Excellent	High
Hybrid	High	Complex	Excellent	Good	Variable

Network Protocols

- ❑ Network protocols are sets of rules that determine how devices communicate and exchange information across a network.
- ❑ **Key Protocols:**
 - TCP
 - IP
 - HTTP
 - FTP

Network Protocols

- ❑ **TCP (Transmission Control Protocol)**
 - TCP is a connection-oriented protocol that ensures reliable, ordered, and error-checked delivery of data between applications over a network.



What is Internet Protocol (IP)?

- ❑ IP is a set of rules for addressing and routing data packets so they can travel across networks.
- IP addresses are the backbone of device **identification** on the network.
- ❑ **Function:**
 - Assigns unique addresses to devices.
 - Ensures data reaches the correct destination.

Example:

- **IPv4:** 192.168.1.1;
- IPv6:** 2001:db8:85a3::8a2e:370:7334

HTTP (Hypertext Transfer Protocol)

- ❑ HTTP is an application-layer protocol used for communication between web browsers (clients) and web servers, forming the foundation of data exchange on the World Wide Web.
- ❑ Follows a client-server model: clients send requests, servers send responses.
- ❑ Stateless protocol: each request is independent, with no memory of previous interactions.
- ❑ Supports various data formats (HTML, images, video, etc.).

FTP (File Transfer Protocol)

- ❑ FTP is a standard protocol for transferring files between a client and a server over a TCP/IP network.
- ❑ Uses a client-server model for uploading, downloading, and managing files.

The Internet

- ❑ The internet is a global network of interconnected computers, servers, phones, and smart devices communicating via protocols like TCP/IP
- ❑ **Infrastructure:**
 - Built on LANs, WANs, fiber optics, copper wires, and wireless



Intranet

- ❑ An intranet is a private network used within an organization for sharing information, communication, and collaboration.
- ❑ **Features:**
 - Accessible only to authorized users (usually employees).
 - Uses the same technologies as the internet (TCP/IP).
 - Includes tools like internal websites, search engines, and communication apps.

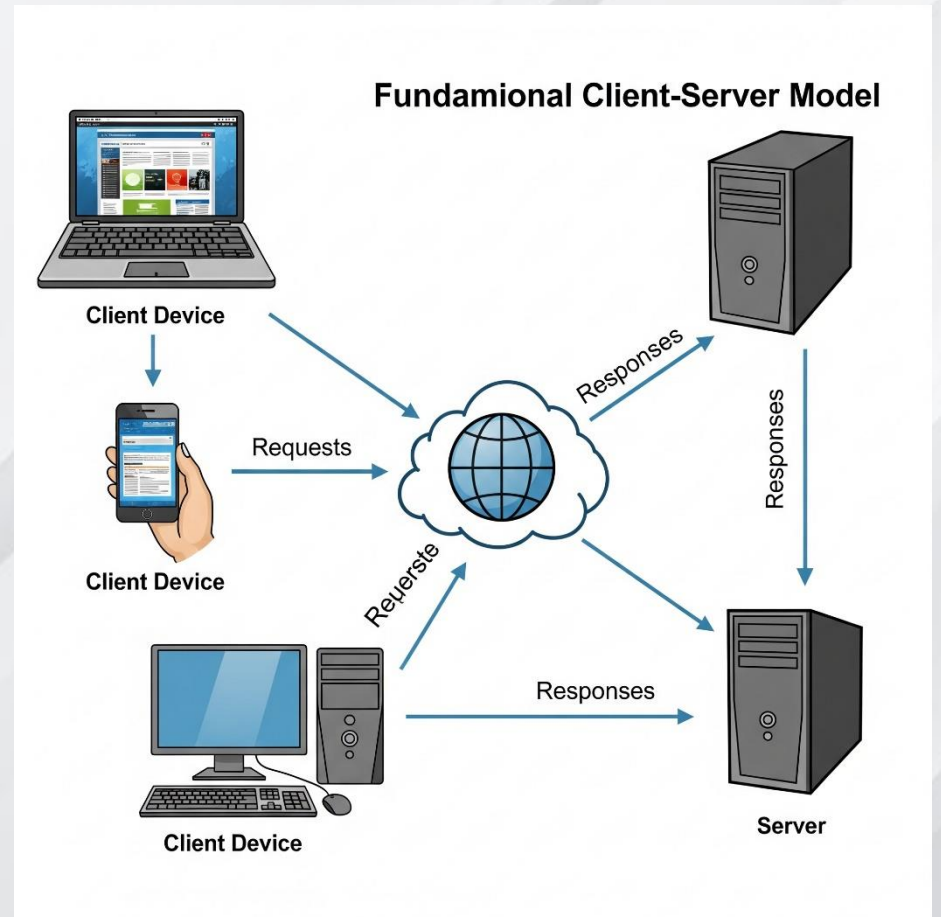


Extranet

- ❑ An extranet is a private network that allows controlled access to outsiders (e.g., partners, suppliers, customers) for collaboration and information sharing.
 - Requires strong authentication and monitoring due to external access
- ❑ **Use Cases:**
 - ✓ Project collaboration
 - ✓ Supply chain management
 - ✓ Customer self-service platforms

Client and Server

- ❑ In networking, the client and server are two distinct roles that interact to provide and consume services or resources.
- ✓ This model distributes tasks between ***clients*** (requesters) and ***servers*** (providers), forming the backbone of most modern network applications



What is a Client?

- ❑ **A client** is a hardware device or software application that initiates requests for services or resources from a server

- ❑ **Function:**
 - ✓ Acts as the front end, interacting directly with the user.
 - ✓ Sends requests and processes responses from the server.

- ❑ **Characteristics:**
 - ✓ Handles user interface and displays information.
 - ✓ Typically supports a single user login.
 - ✓ Simpler hardware and software configuration compared to servers

What is a Server?

- ❑ **A server** is hardware or software that provides resources, data, or services to clients over a network.

- ❑ **Function:**
 - ✓ Acts as the back end, managing and storing data.
 - ✓ Waits for and processes client requests, then sends responses

- ❑ **Characteristics:**
 - ✓ Can handle multiple client requests simultaneously.
 - ✓ More complex hardware and software setup, designed for reliability and scalability.
 - ✓ Supports multiple user logins

Client and Server

Feature	Client	Server
Role	Requests services/resources	Provides services/resources
User Interaction	Direct (front end)	Indirect (back end)
Example Devices	Laptops, desktops, smartphones	Web server, database server, file server
Hardware/Software	Simple configuration	Advanced configuration
Number of Users	Typically single-user	Supports multiple users
Tasks	Initiates requests, processes responses	Handles requests, manages and stores data
Performance	Lower performance needs	High performance, reliability, and scalability
Dependency	Depends on server for services	Operates independently, serves many clients

What is a Network Operating System (NOS)

- ❑ **A Network Operating System (NOS)** is specialized software designed to *manage, coordinate*, and **secure** network resources, enabling multiple computers and devices to **communicate, share files**, and **access shared resources** like printers and applications within a network.
- ❑ **Purpose**
 - Unlike a traditional OS (which manages a single device), a NOS manages the entire network, ensuring efficient, secure, and reliable operations across all connected devices.

Main Functions of a Network Operating System

- ☐ Resource Sharing
- ☐ User and Group Management
- ☐ Network Security
- ☐ Remote Access
- ☐ Monitoring and Troubleshooting
- ☐ Data Backup and Recovery

Types of Network Operating Systems

❑ Peer-to-Peer (P2P) NOS

- All devices are equal; users share resources directly.
- Best for small networks; less expensive and easier to set up.
- Example: Windows for Workgroups

❑ Client-Server NOS

- Central server provides resources and services to client devices.
- Centralized management, better security, and scalability.
- Example: **Windows Server, Linux Server, UNIX**

Key Features of Modern NOS

- ☐ **Centralized Resource Management.**
- ☐ **Multiuser and Multitasking Support**
- ☐ **Scalability**
- ☐ **Stability and Reliability**
- ☐ **Hardware Compatibility**

NOS in Practice – Use Cases

☐ **Corporate Networks:**

- Centralized management of departments, offices, and resources

☐ **Educational Institutions:**

- Manage computer labs, student accounts, and shared learning resources.

☐ **Healthcare:**

- Secure management of patient data and interdepartmental communication.

☐ **Government and SMEs:**

- Efficient, secure, and scalable networking for public sector and small businesses

What is a Virtual Machine (VM)

- A virtual machine (VM) is a software-based emulation of a physical computer. It runs programs and operating systems in an isolated environment, using virtualized hardware resources such as CPU, memory, storage, and network interfaces.

❑ Key Concept:

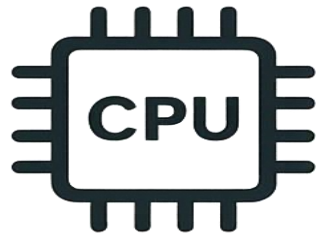
- Multiple VMs can run on a single physical "host" machine, each VM acting as a separate "guest" computer with its own OS and applications

Introduction to VMware Workstation

- VMware Workstation is a leading desktop virtualization software that allows users to create, configure, and manage multiple virtual machines on a single Windows or Linux computer

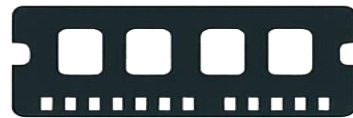
Download and install VMware Workstation

SYSTEM REQUIREMENTS for VMware Workstation



CPU

64-bit
processor



RAM

2 GB
or more



DISK SPACE

3 GB
or more

Download and install VMware Workstation

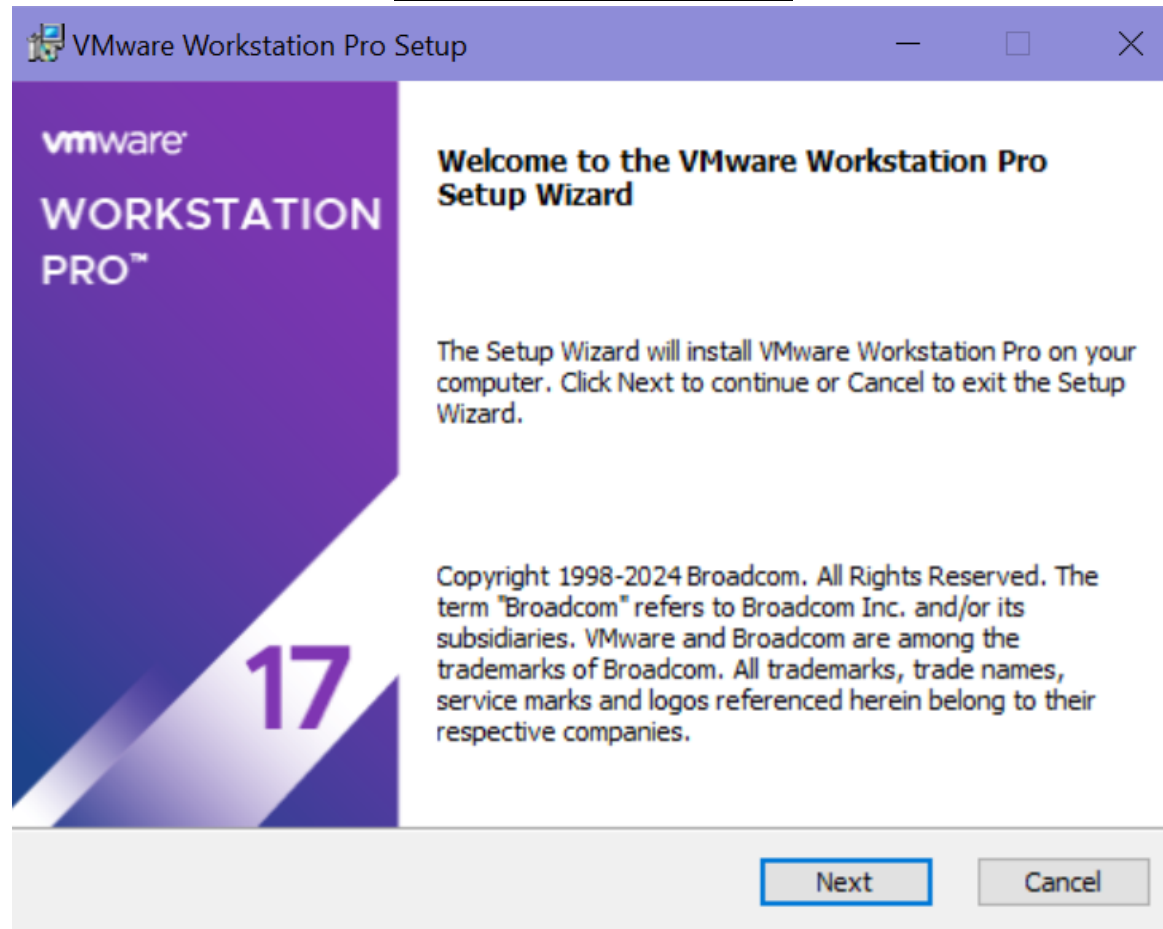
VMware Fusion Pro

Download link

<https://www.vmware.com/products/desktop-hypervisor/workstation-and-fusion>

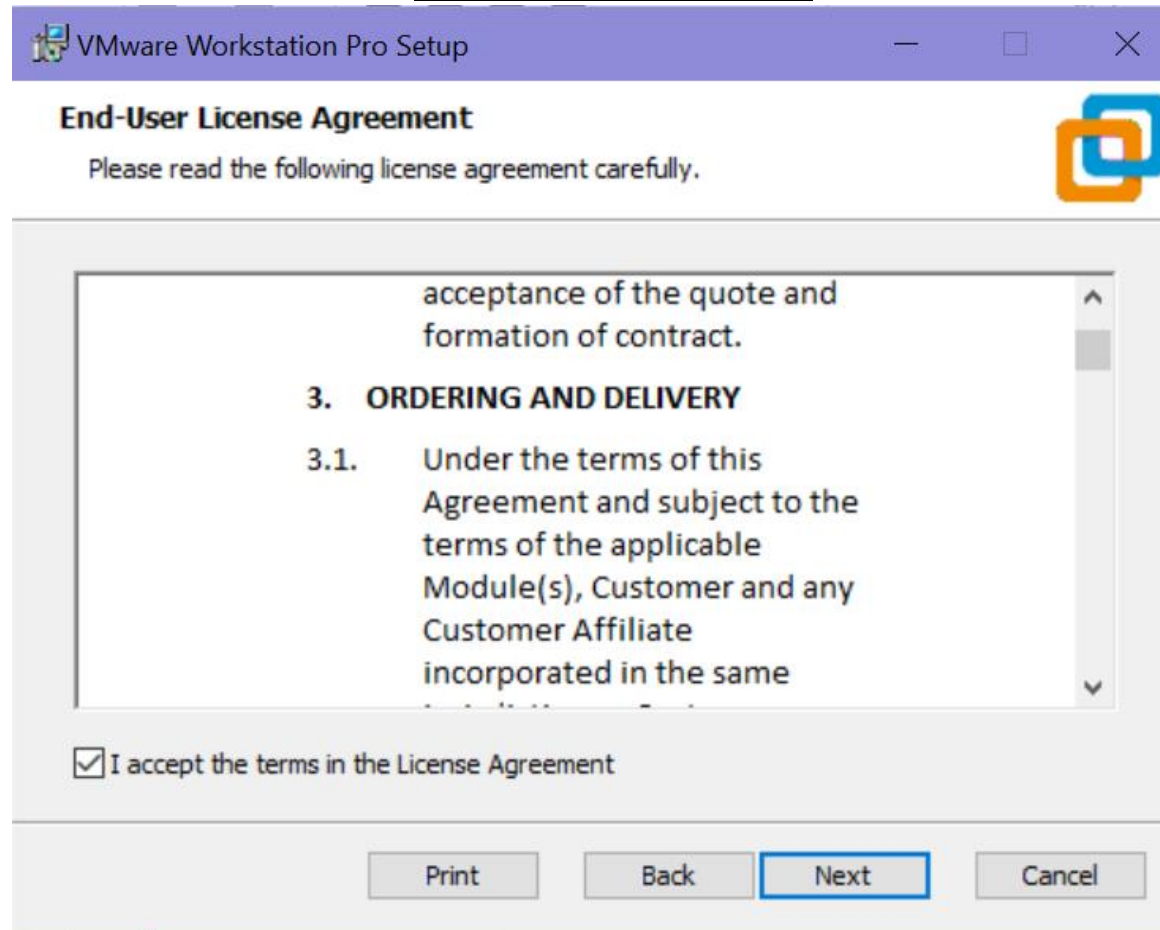
Download and install VMware Workstation

Installation



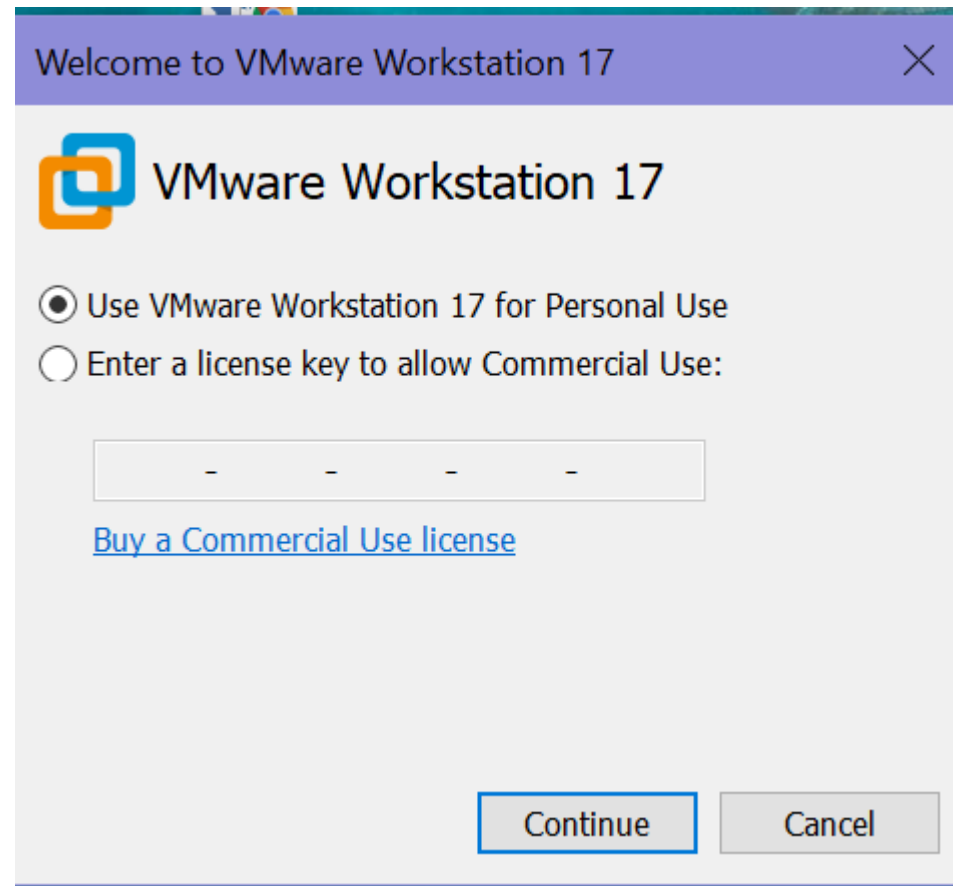
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Installation

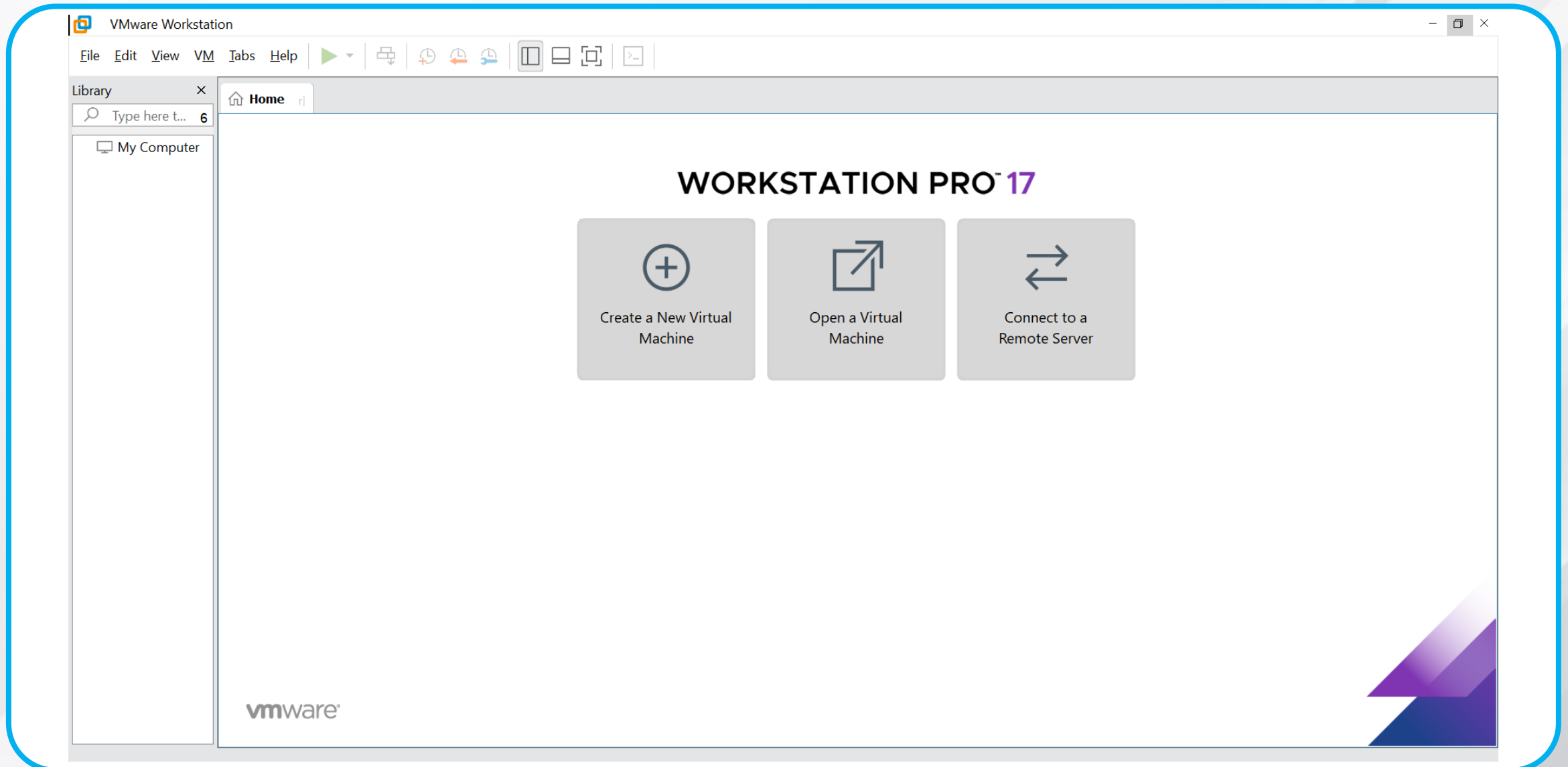


Download and install VMware Workstation

Installation



Open VMware Workstation



Open VMware Workstation





Thank You