Experiment 1

Aim: Study of network components, network representations and topologies, types of networks, and network IP address.

Objectives: To learn basics of:

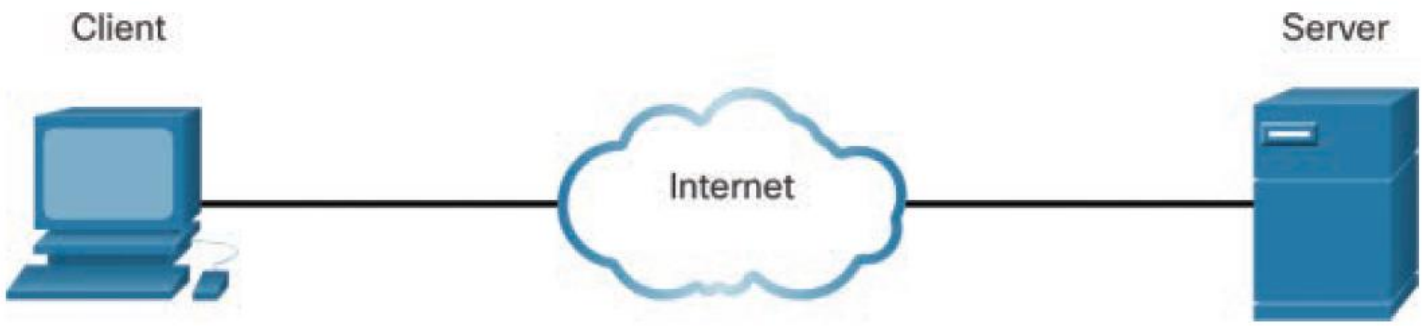
1. Network Components
    - Host Roles
    - Peer-to-Peer
    - End Devices
    - Intermediary Devices
    - Network Media
2. Network Representations and Topologies
    - Network Representations
    - Topology Diagrams
3. Common Types of Networks
    - LANs and WANs
    - The Internet
    - Intranets and Extranets
4. Network IP Address
    - IPv4 and IPv6 addressing

1. Network Components:

i) Host Roles:

Servers are computers with software that allows them to provide information, such as email or web pages, to other end devices on the network. Each service requires separate server software. For example, a server requires web server software in order to provide web services to the network. A computer with server software can simultaneously provide services to many different clients.

Clients have software for requesting and displaying the information obtained from the server.



- There are three common types of server software.

Table 1-1 Common Server Software

Software Type	Description
Email	An email server runs email server software. Clients use mail client software, such as Microsoft Outlook, to access email on the server.
Web	A web server runs web server software. Clients use browser software, such as Windows Internet Explorer, to access web pages on the server.
File	A file server stores corporate and user files in a central location. The client devices access these files with client software such as Windows File Explorer.

Network Components: (contd.)

ii) Peer to Peer:

Client and server software usually run-on separate computers, but it is also possible for one computer to be used for both roles at the same time. In small businesses and homes, many computers function as both servers and clients on the network.

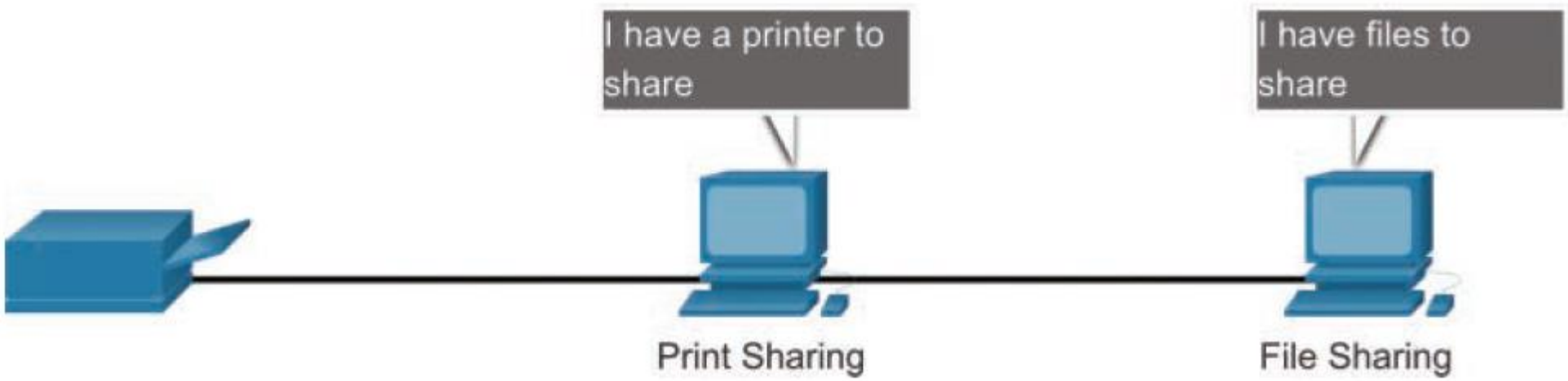


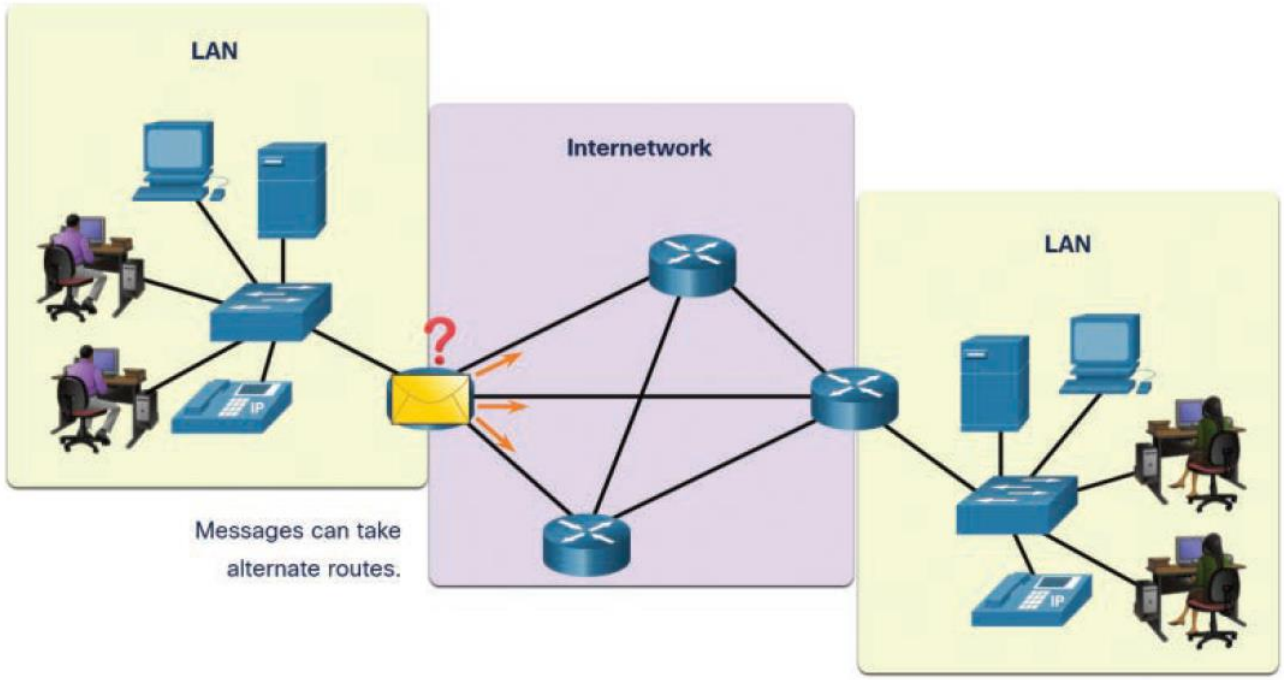
Table 1-2 Peer-to-Peer Networking Advantages and Disadvantages

Advantages	Disadvantages
Easy to set up	No centralized administration
Less complex	Not as secure
Lower cost because network devices and dedicated servers may not be required	Not scalable
Can be used for simple tasks such as transferring files and sharing printers	All devices may act as both clients and servers, which can slow their performance

Network Components: (contd.)

iii) End devices:

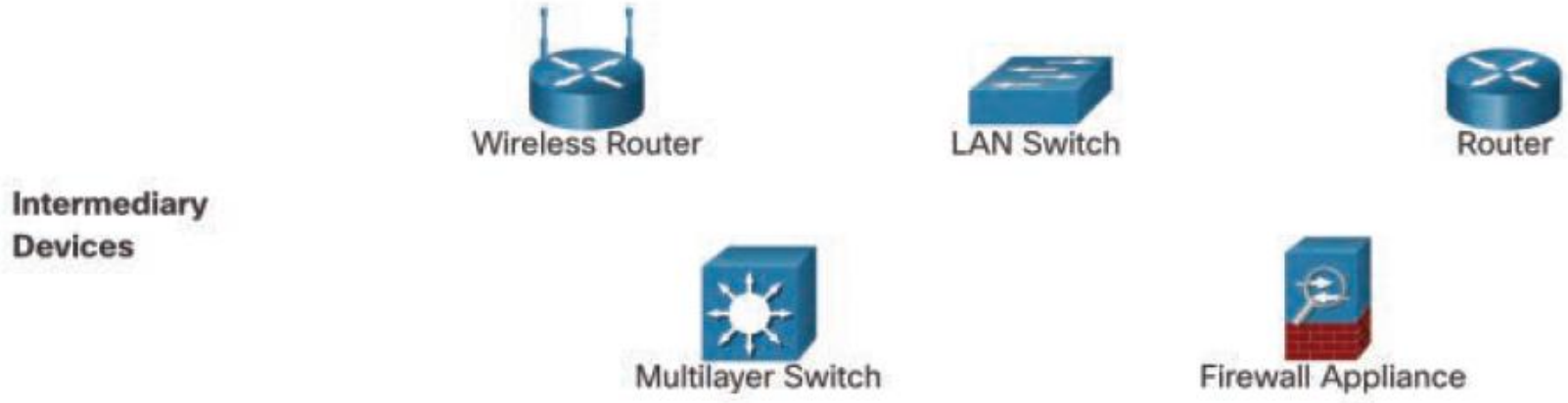
- The network devices that people are most familiar with are end devices. To distinguish one end device from another, each end device on a network has an address. When an end device initiates communication, it uses the address of the destination end device to specify where to deliver the message.



Network Components: (contd.)

iv) Intermediary devices:

- Intermediary devices connect individual end devices to a network. They can connect multiple individual networks to form an internetwork. These intermediary devices provide connectivity and ensure that data flows across the network. Intermediary devices use the destination end device address, in conjunction with information about the network interconnections, to determine the path that messages should take through the network.



- Intermediary network devices perform some or all these functions:

- Regenerate and retransmit communication signals.
- Maintain information about what pathways exist through the network and internetwork.
- Notify other devices about errors and communication failures.
- Direct data along alternate pathways when there is a link failure.
- Classify and direct messages according to priorities.
- Permit or deny the flow of data, based on security settings.

Network Components: (contd.)

v) Network media:

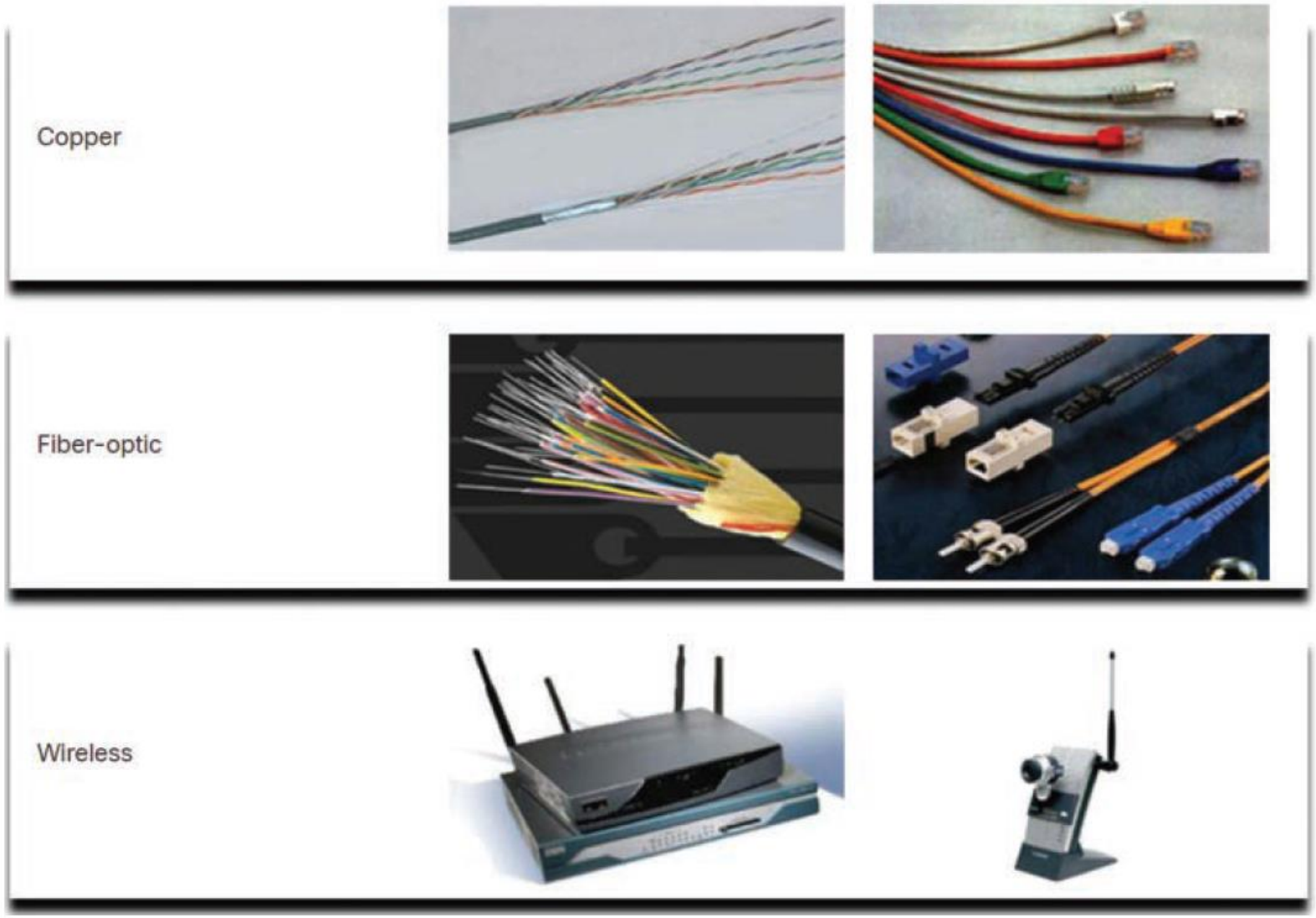
- Communication transmits across a network on media. The media provide the channel over which a message travels from source to destination.

- Modern networks primarily use three types of media to interconnect devices. They are:

- Metal wires within cables: Data is encoded into electrical impulses.

- Glass or plastic fibers within cables (fiber-optic cable): Data is encoded into pulses of light.

- Wireless transmission: Data is encoded via modulation of specific frequencies of electromagnetic waves. Different types of network media have different features and benefits. Not all network media have the same characteristics, and they are not all appropriate for the same purpose.

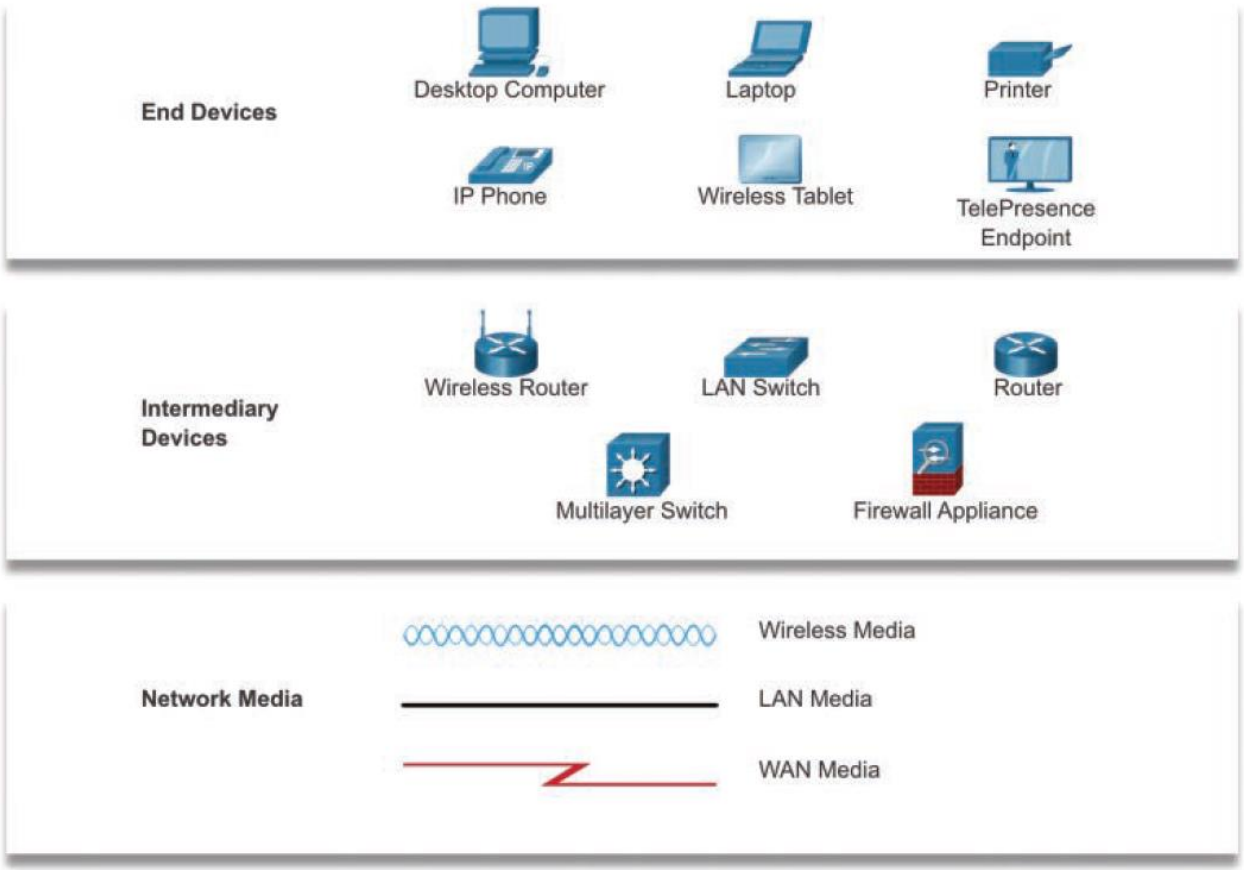


Different type of Network Media

2. Network Representations & Topologies:

i) Network representations:

- Network architects and administrators must be able to show what their networks look like. They need to be able to easily see which components connect to other components, where they are located, and how they are connected. Diagrams of networks often use symbols, like those shown in figure to represent the different devices and connections in a network.



Network Symbols for Topology Diagrams

A diagram provides an easy way to understand how devices connect in a network. This type of picture of a network is known as a **topology diagram**. The ability to recognize the logical representations of the physical networking components is critical to being able to visualize the organization and operation of a network.

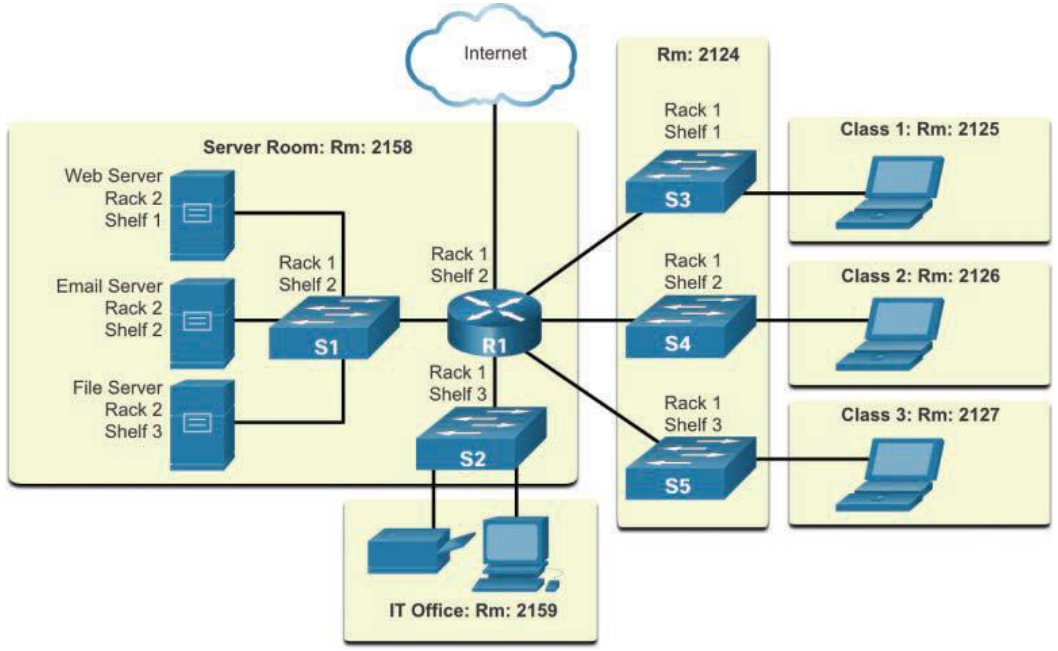
In addition to these representations, specialized terminology is used to describe how each of these devices and media connect to each other:

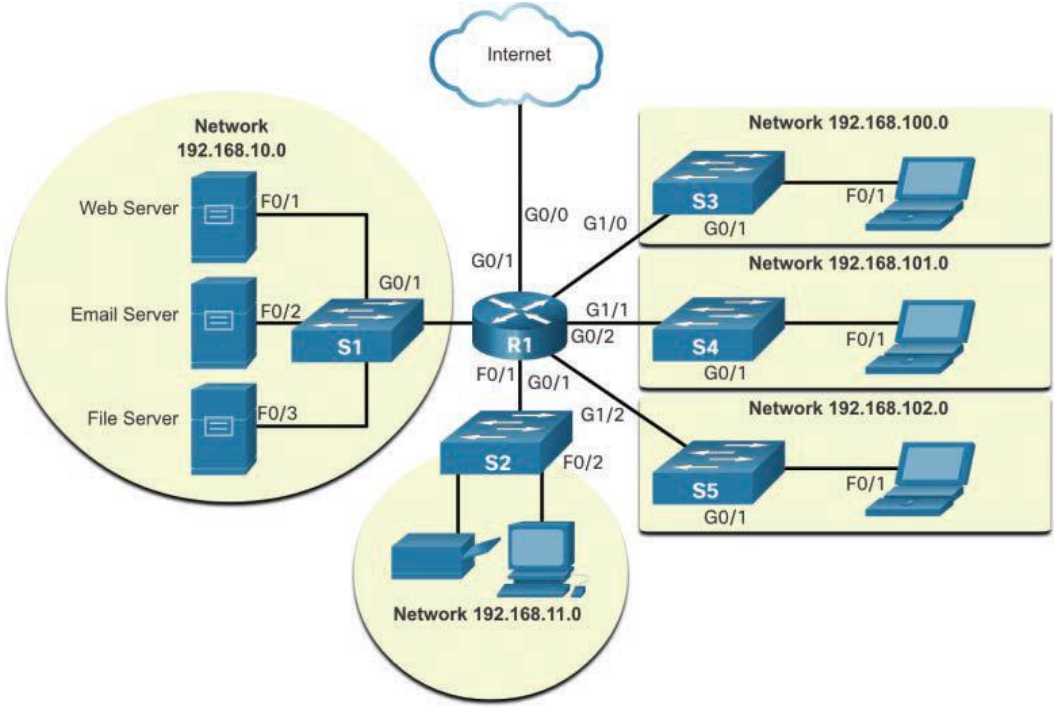
- **Network interface card (NIC):** A NIC physically connects an end device to a network.
- **Physical port:** A port is a connector or an outlet on a networking device where a medium connects to an end device or another networking device.
- **Interface:** An interface is a specialized port on a networking device that connects to a network. Because routers connect networks, the ports on a router are referred to as network interfaces.

2. Network Representations & Topologies: (Contd.)

ii) Topology diagrams:

Physical Topology	Logical Topology
A physical topology diagram illustrates the physical locations of intermediary devices and cable installation. One can see that the rooms in which these devices are located are labeled in physical topology.	A logical topology diagram illustrates devices, ports, and the addressing scheme of a network. One can see which end devices are connected to which intermediary devices and what media are being used.





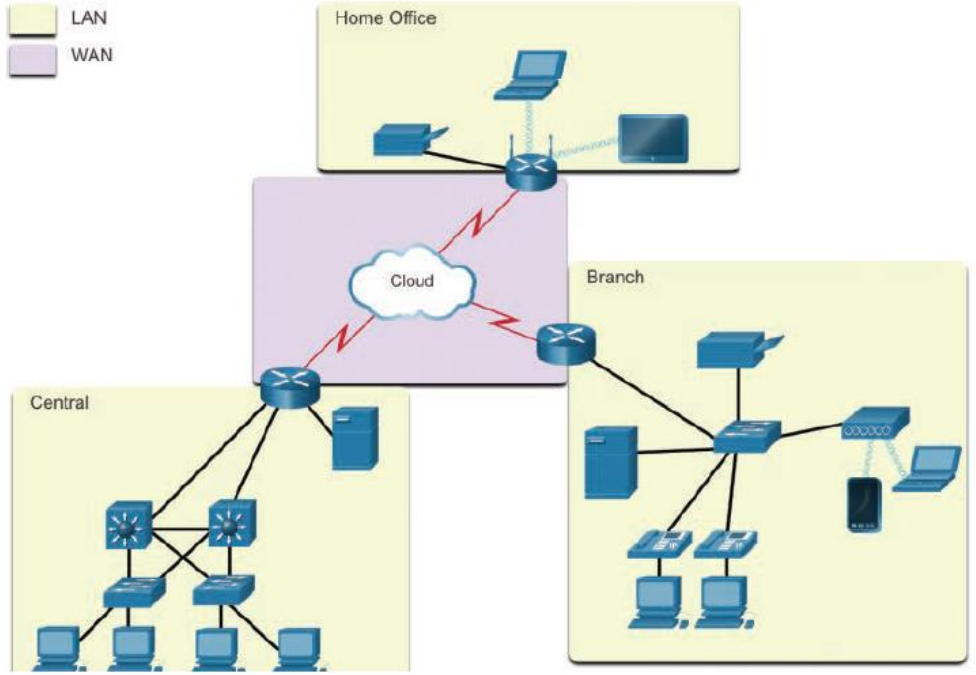
3. Common Types of Networks:

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Network infrastructures vary greatly in terms of:
- Size of the area covered
- Number of users connected
- Number and types of services available
- Area of responsibility

i) LAN and WAN:

- A LAN is a network infrastructure that provides access to users and end devices in a small geographic area.
- A WAN that interconnects multiple LANs. A WAN is a network infrastructure that spans a wide geographic area. WANs are typically managed by service providers (SPs) or internet service providers (ISPs).

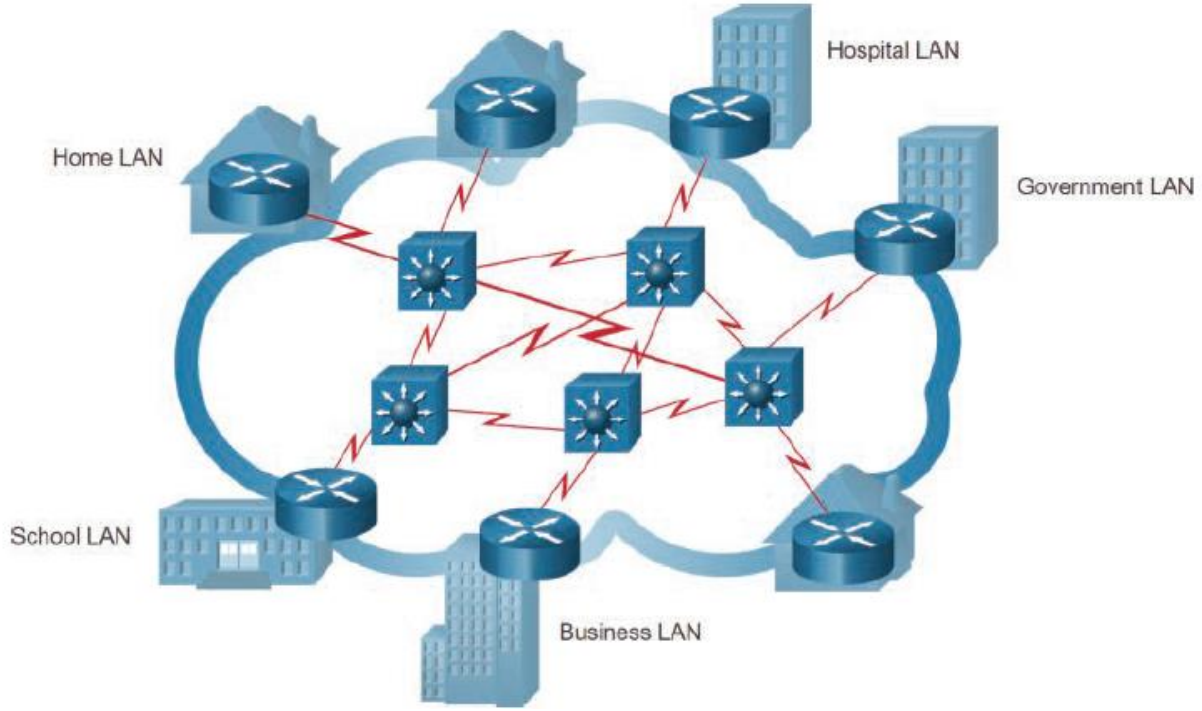


Example of Connected LANs and WANs

3. Common Types of Networks: (contd.)

ii) Internet:

- The internet is a worldwide collection of interconnected networks (internetworks, or internet for short). This figure shows one way to view the internet as a collection of interconnected LANs and WANs.

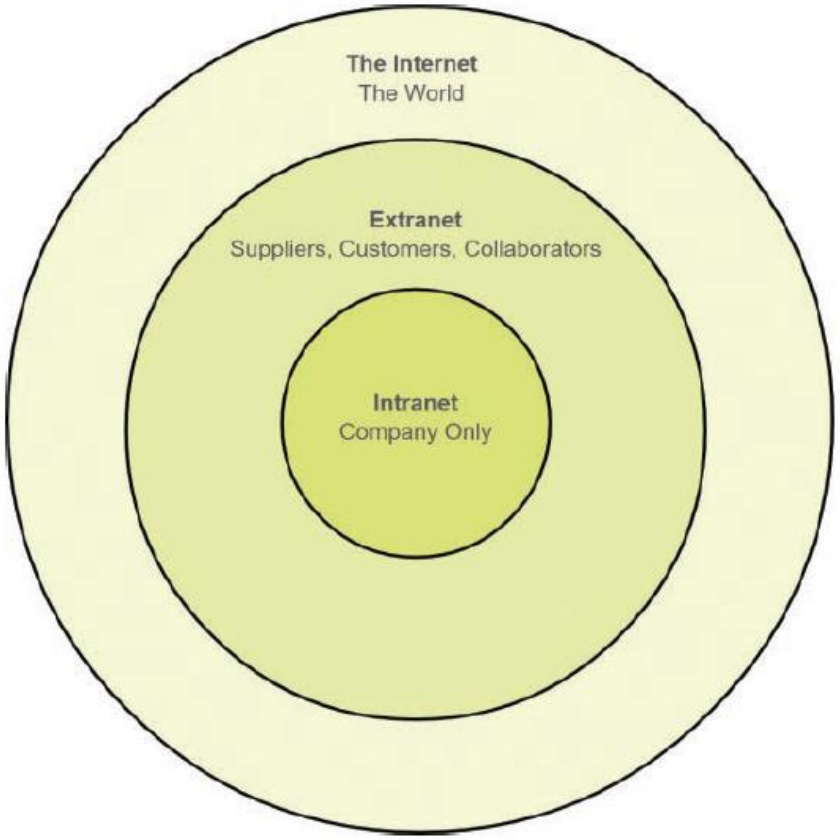


Example of a View of the Internet

3. Common Types of Networks: (contd.)

iii) Intranets and Extranets:

- The term intranet is often used to refer to a private connection of LANs and WANs, that belongs to an organization. An intranet is designed to be accessible only by the organization's members, employees, or others with authorization.
- An organization may use an extranet to provide secure and safe access to individuals who work for a different organization but require access to the organization's data.



Levels of Access from Intranet to Internet

4. Network IP address:

IPv4 and IPv4 Addressing:

IPv4 and IPv6 stands for Internet Protocol version 4 and 6 respectively. It is the underlying technology that makes it possible for us to connect our devices to the web.

- The IPv4 address is a **32-bit decimal number** that uniquely identifies a network interface on a machine. An IPv4 address is typically formatted as four 8-bit fields that are separated by periods. Each 8-bit field represents a byte of the IPv4 address. **The number that each field contains should be in the range of 0-255**.
- Whereas an IPv6 is a **128-bit hexadecimal** address. It also contains 8-bit fields separated by a colon, but each field is 16-bit in size.