Introduction to Networks

Samadhi Edirisinghe
MSC In CS(Reading), PGD IN CS,
PGD PPIE(Reading), BSc in SE

NETWORKING TODAY

- Is an integral part of life and business
- Network has no boundary and supports the way we:
  - ✓ Communicate
  - ✓ Share
  - ✓ Work
  - ✓ Learn
  - ✓ Play

NETWORKS AND STANDALONE COMPUTERS

- Network
  - Group of computers and other devices connected by some type of transmission media
  - Networks enable users to share devices and data, collectively called a network's **resources**
- Standalone computer
  - Uses programs and data only from its local disks and is not connected to a network

COMMUNICATION BEFORE NETWORK

- Method of sharing data by copying it to a disk and carrying the disk from computer to computer

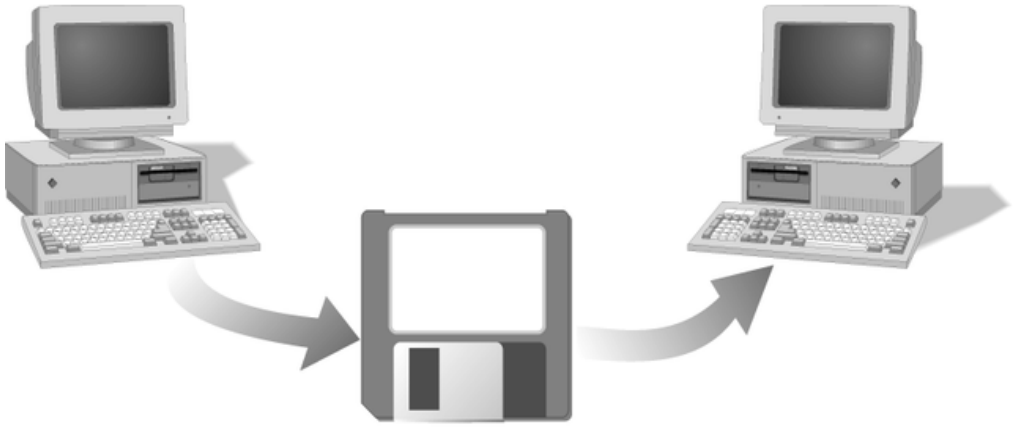
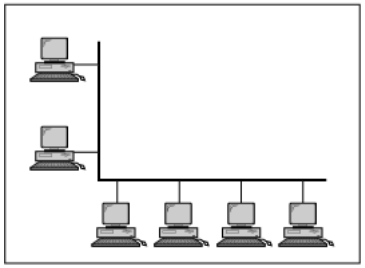


Figure 1-1: Data sharing before the advent of networks

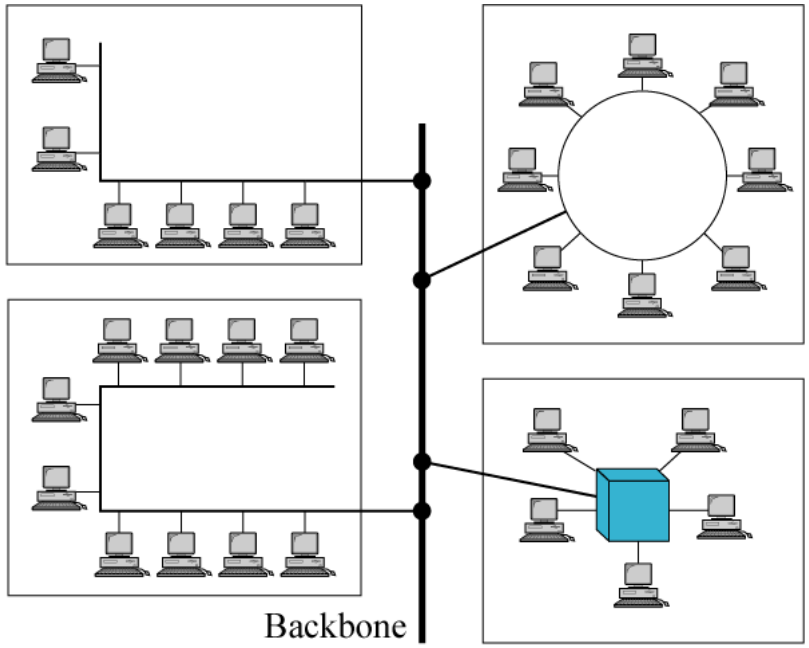
LOCAL AND REMOTE COMPUTERS

- Local computer
  - Computer on which user is working
- Remote computer
  - Computer that user controls or works on via network connection

LAN



a. Single-building LAN

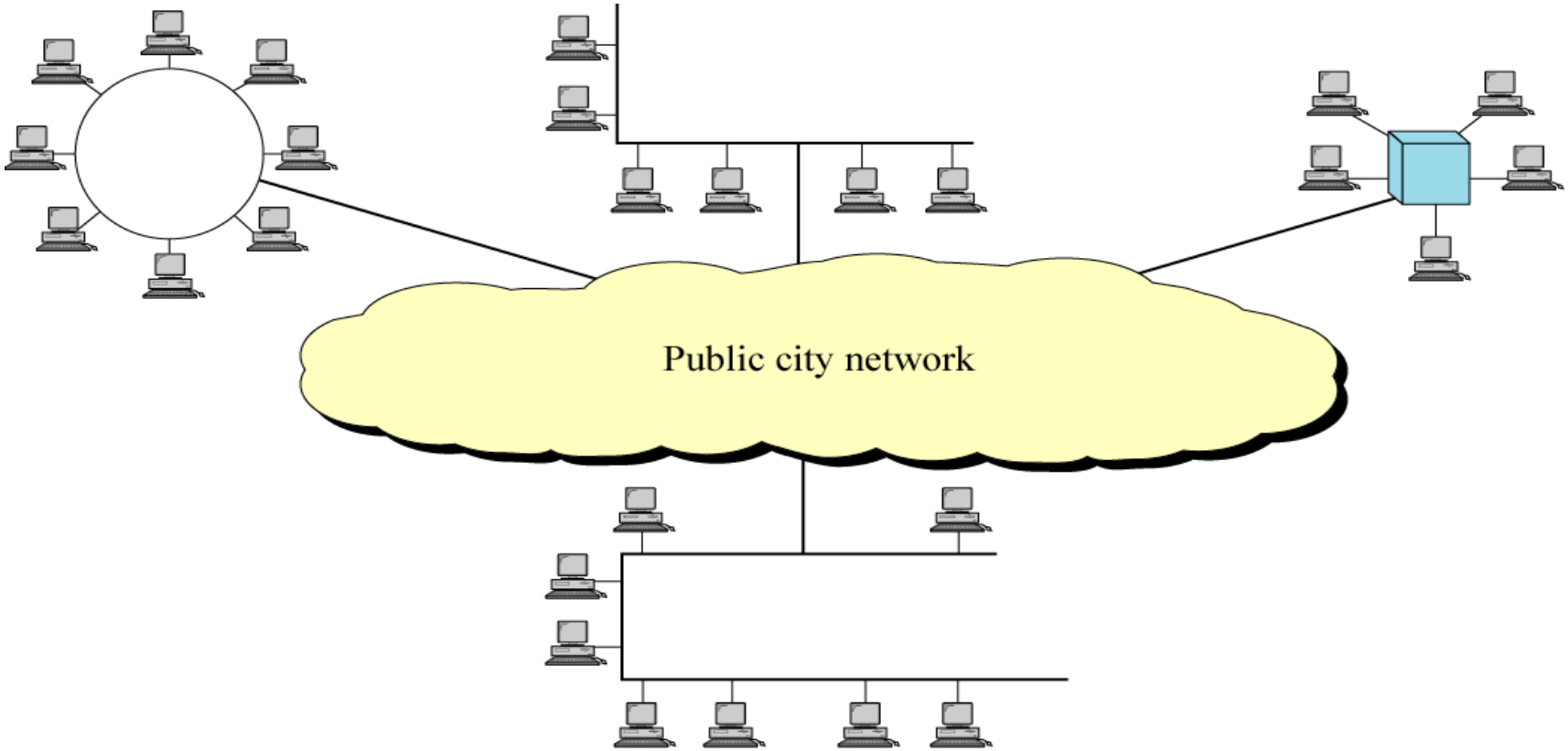


b. Multiple-building LAN

MANS AND WANS

- Metropolitan area network (MAN)
  - Network connecting clients and servers in multiple buildings within limited geographic area
- Wide area network (WAN)
  - Network that spans large distance and connects two or more LANs
  - The **Internet** is an example of a very intricate and extensive WAN that spans the globe

MAN



WAN

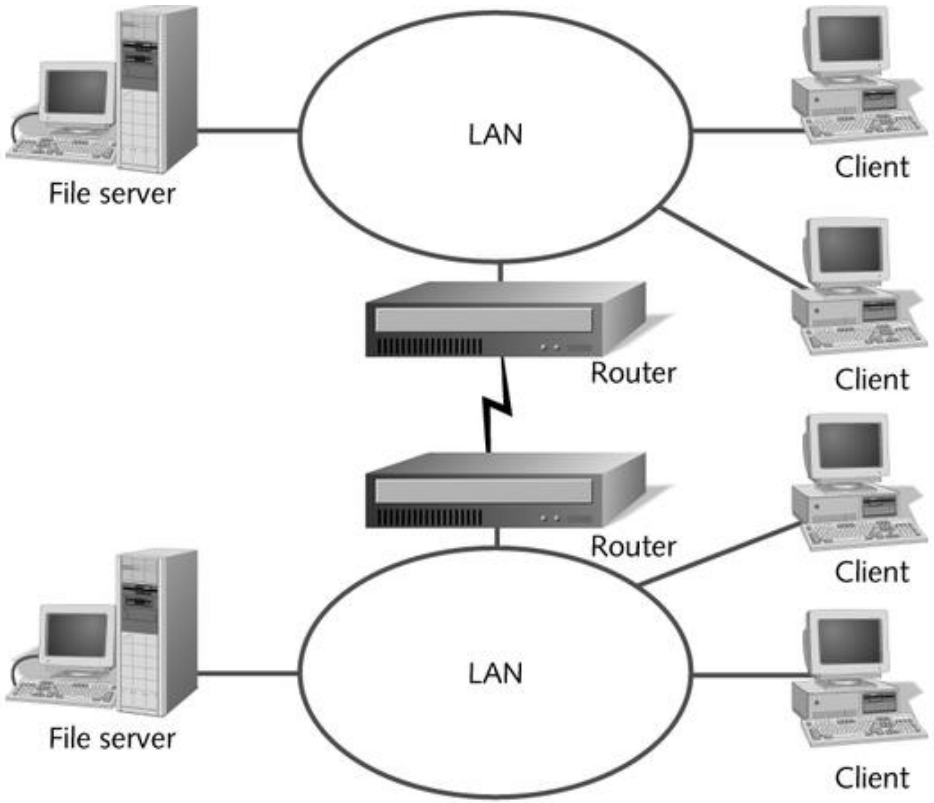


Figure 1-5:
A simple
WAN

TYPES OF NETWORK MODEL

- Peer-to-Peer Network
- Client/Server Network

PEER-TO-PEER NETWORK

- Computers communicate on single segment of cable and share each other's data and devices
- Simple example of a local area network (LAN)
- Also know as Workgroup Model

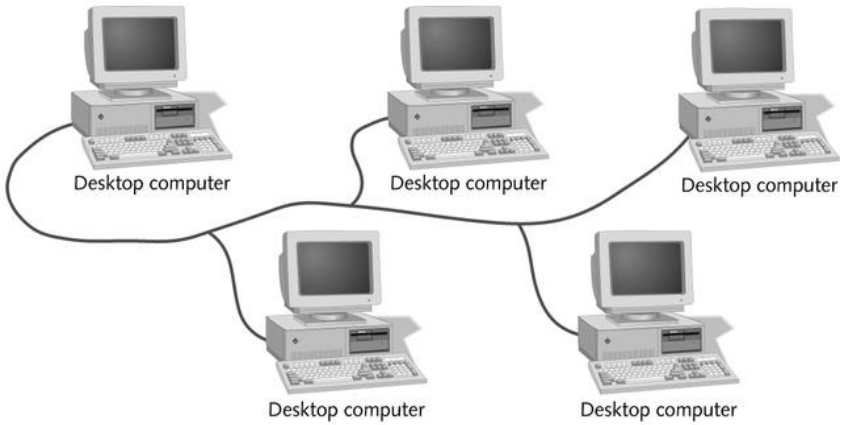
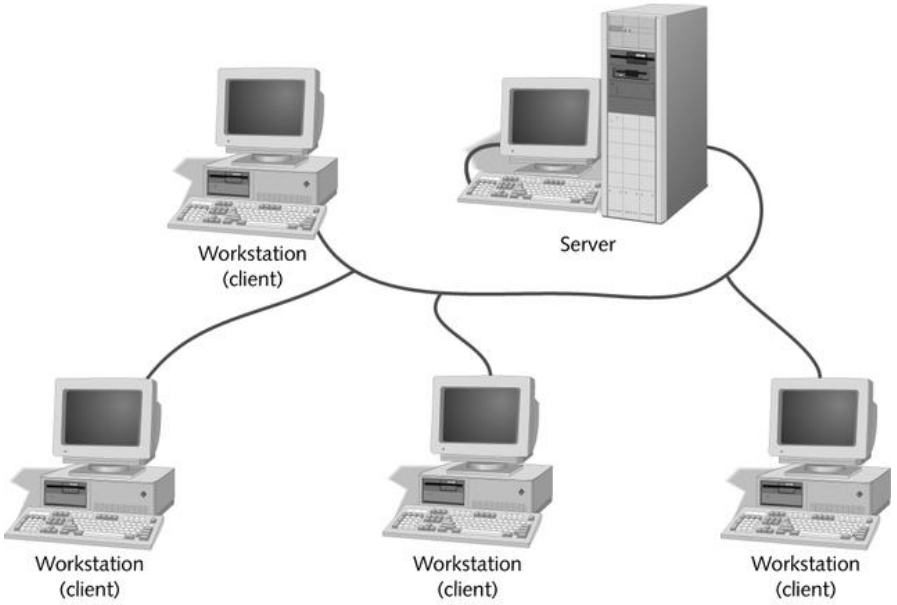


Figure 1-2: Simple peer-to-peer network

CLIENT/SERVER NETWORK

Figure 1-3: LAN with a file server



INTRANET

- It is a worldwide system which has the following characteristics:
- Internet is a world-wide / global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP)
- Every computer in internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer's location.
- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name.
- Internet is accessible to every user all over the world.


internet

INTRANET

- Intranet is system in which multiple PCs are connected to each other.
- PCs in intranet are not available to the world outside the intranet.
- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.
- Each computer in Intranet is also identified by an IP Address which is unique among the computers in that Intranet.

INTRANET FIG.

SIMILARITIES IN INTERNET AND INTRANET

- Intranet uses the internet protocols such as TCP/IP and FTP.
- Intranet sites are accessible via web browser in similar way as websites in internet. But only members of Intranet network can access intranet hosted sites.
- In Intranet, own instant messengers can be used as similar to yahoo messenger/ gtalk over the internet.

DIFFERENCES IN INTERNET AND INTRANET

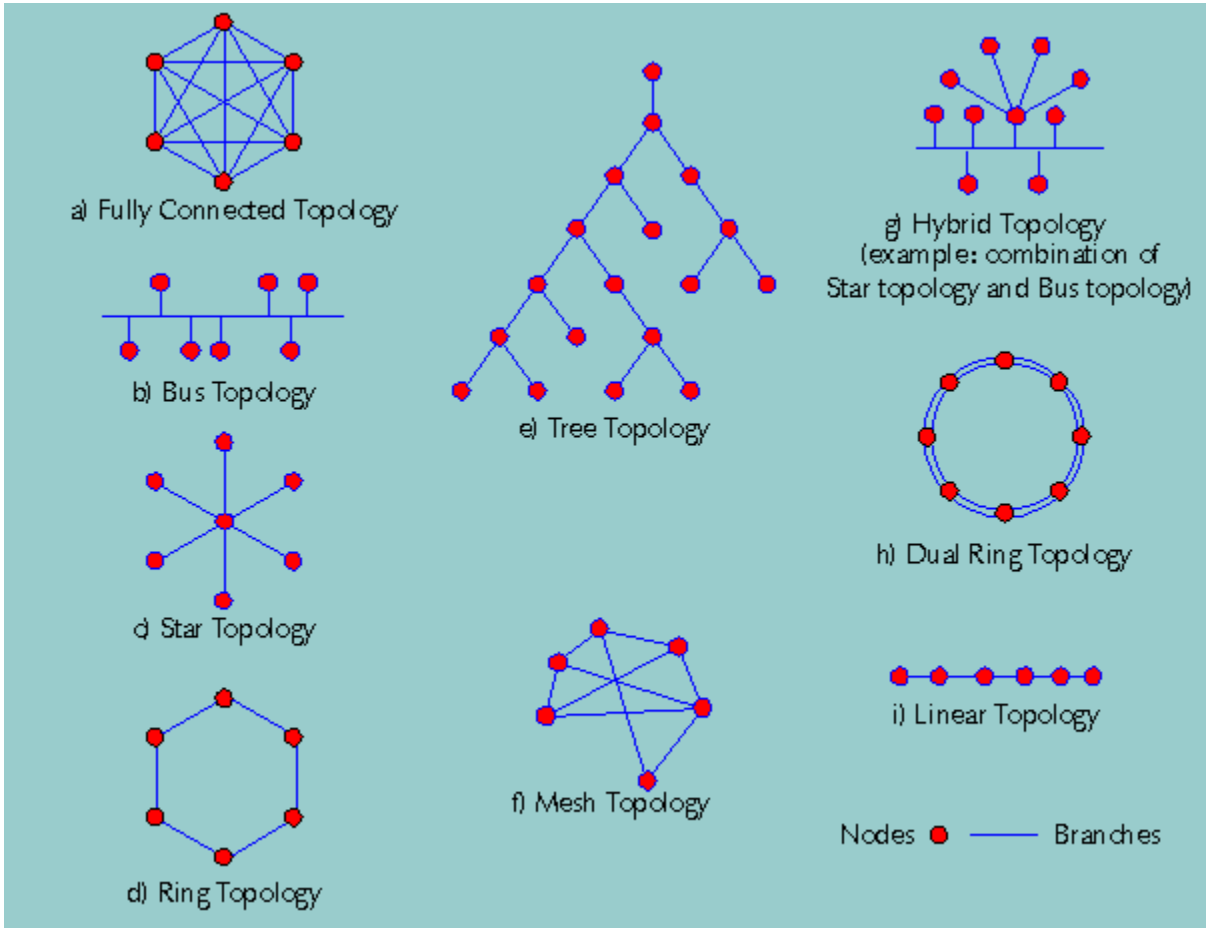
- Internet is general to PCs all over the world whereas Intranet is specific to few PCs.
- Internet has wider access and provides a better access to websites to large population whereas Intranet is restricted.
- Internet is not as safe as Intranet as Intranet can be safely privatized as per the need.

NETWORKS

- Networks of many sizes
  - Small Home / Office Networks
  - Medium to Large Networks
  - World Wide Network
- Two main type
  - Clients and Servers
  - Peer-to-Peer

NETWORK TOPOLOGY

- Refers to the physical layout of the network



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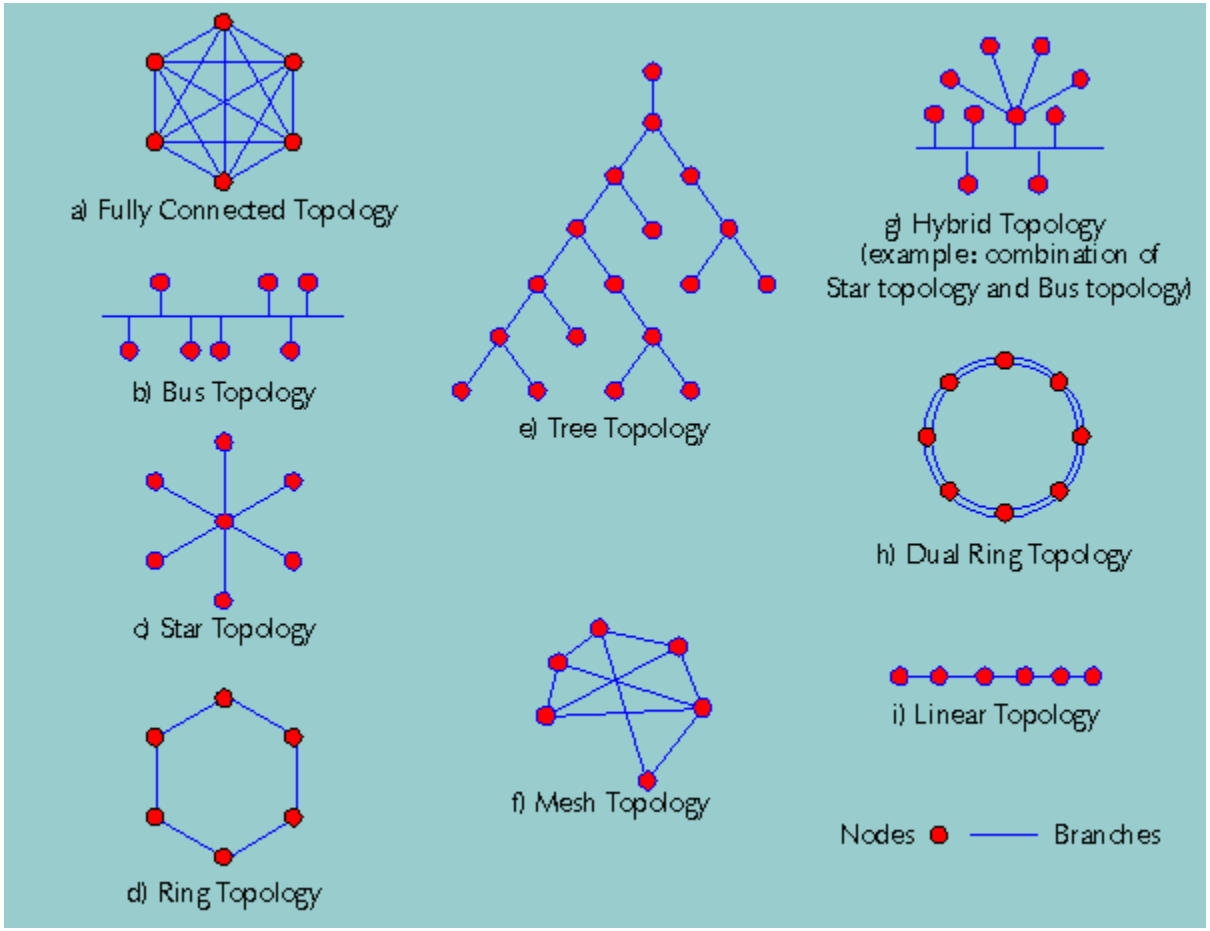
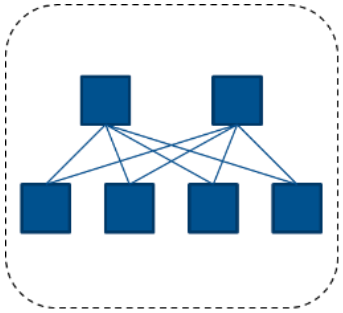
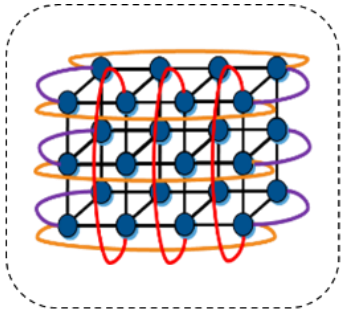


NETWORK TOPOLOGY

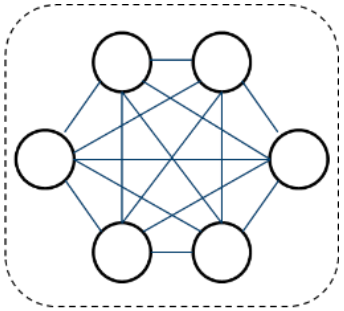
- Exercise – read about some specialist network topologies and identify their strengths and weaknesses and complete the provided table



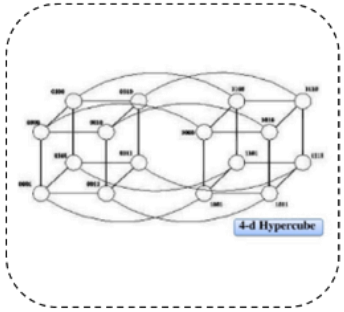
Fat Tree



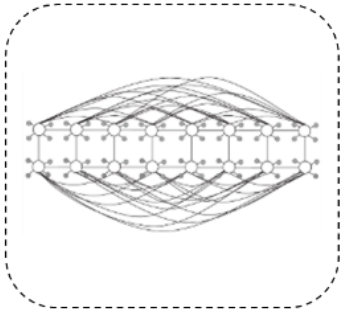
Torus



Dragonfly



Hypercube

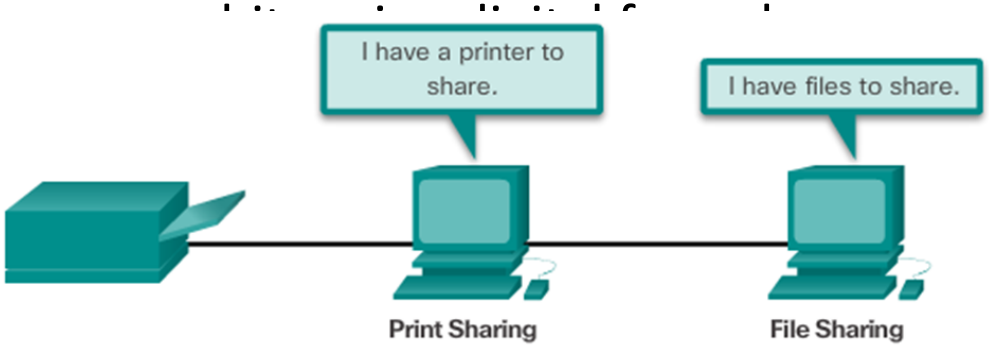


HyperX

NETWORKS COMMUNICATION

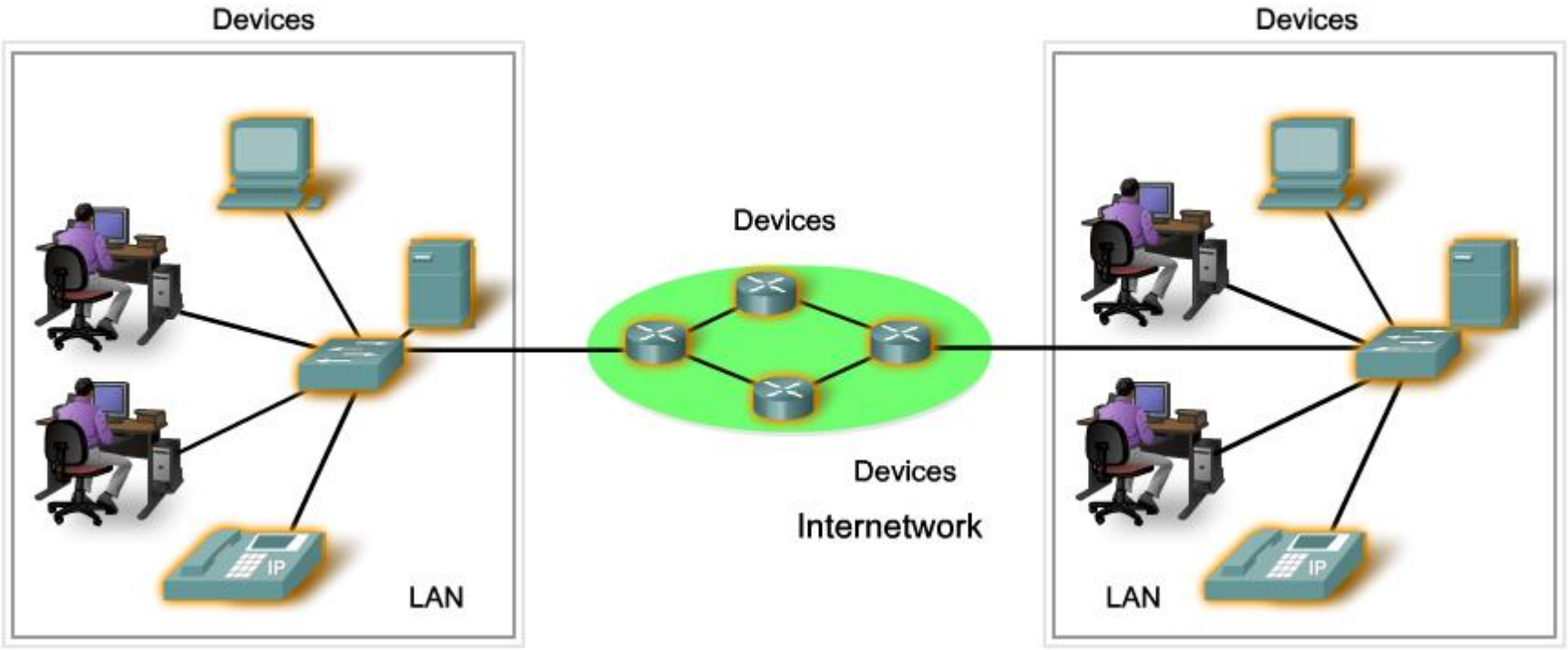
- Consists of 4 main elements
  - Message
  - Message source
  - Message destination
  - Medium/Channel

- Modern networks send me



COMPONENTS OF THE NETWORK - DEVICES

- ✓ End devices
- ✓ Intermediate devices



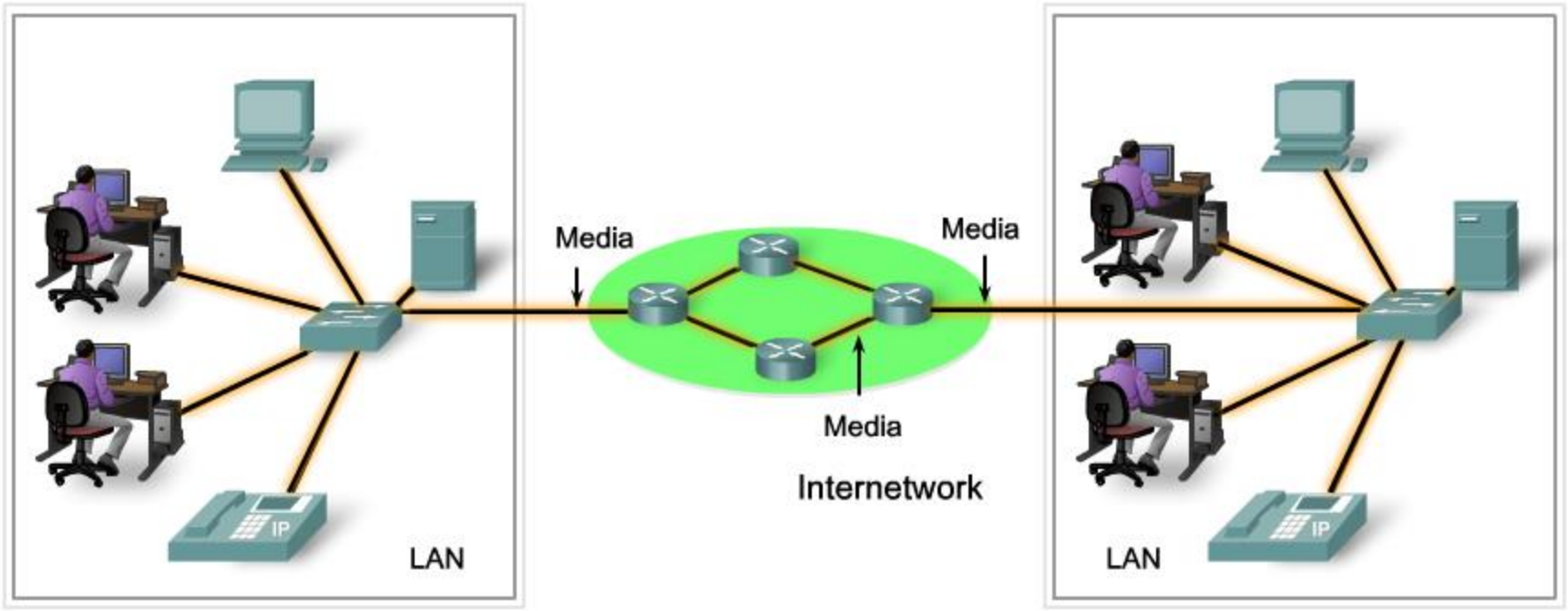
INTERMEDIATE DEVICES

- Switches – used to filter and forward traffic in a LAN
  - Hardware based - Fast
  - Uses MAC address of devices to remember their location
  - Keeps dynamic MAC address table

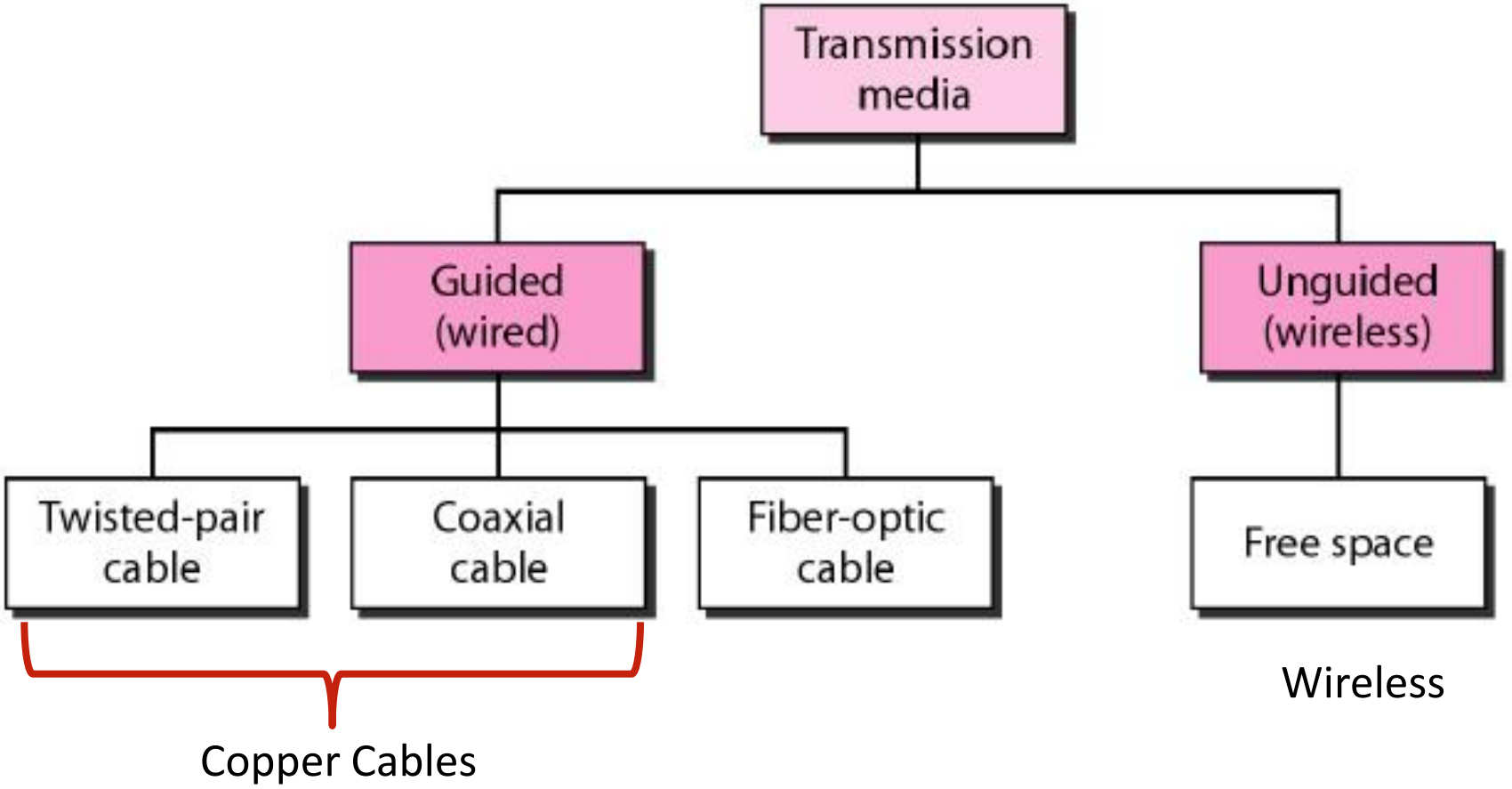
- Routers – used to filter and forward traffic in a WAN
  - Software + hardware based – More expensive
  - Uses Routing protocols to locate subnetworks
  - Keeps a dynamic routing table

COMPONENTS OF THE NETWORK - MEDIA

- Provide the pathway for data transmission
- Interconnect devices



NETWORK MEDIA



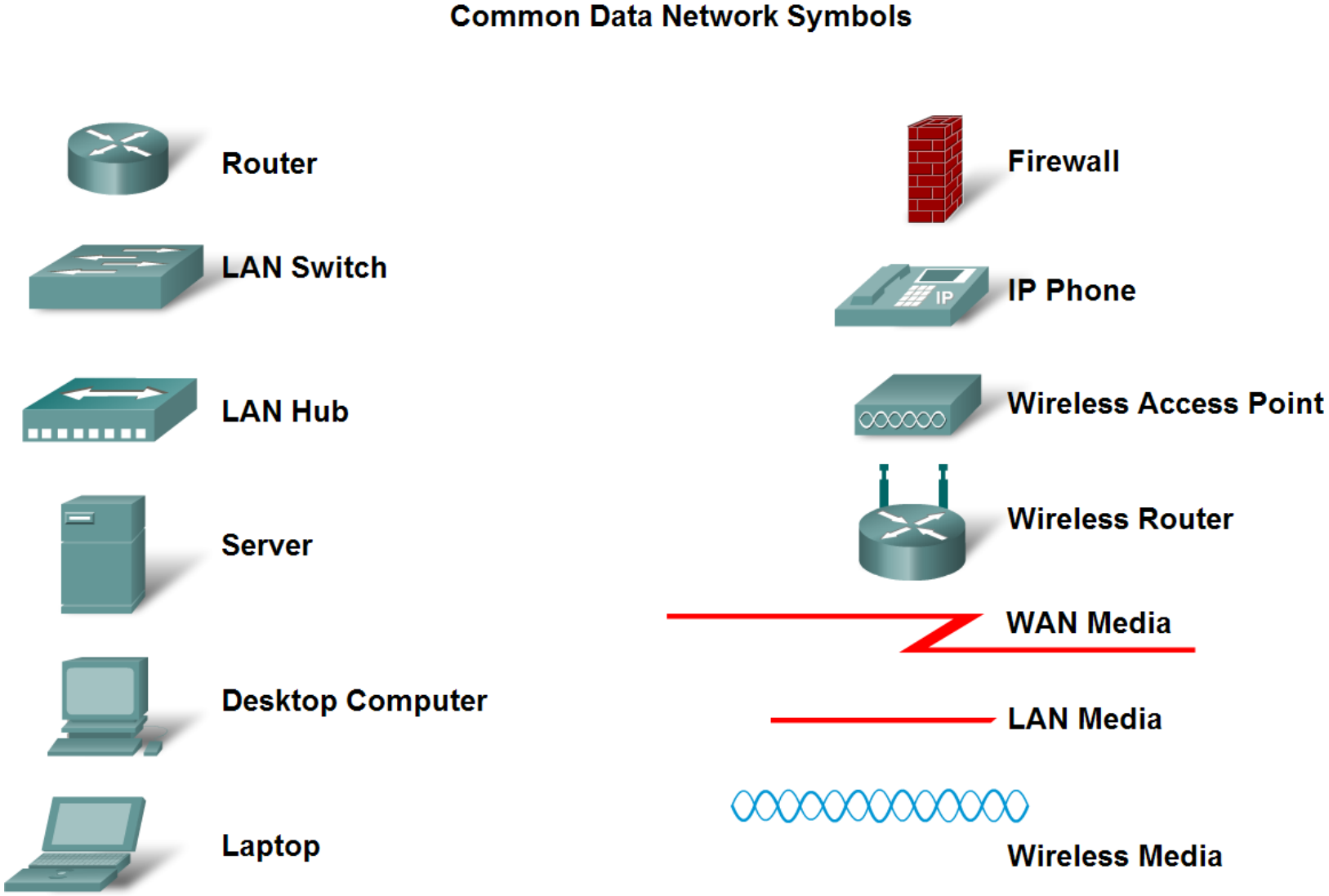
NETWORK MEDIA CONT.

Copper

Fiber Optic

Wireless

NETWORK SYMBOLS

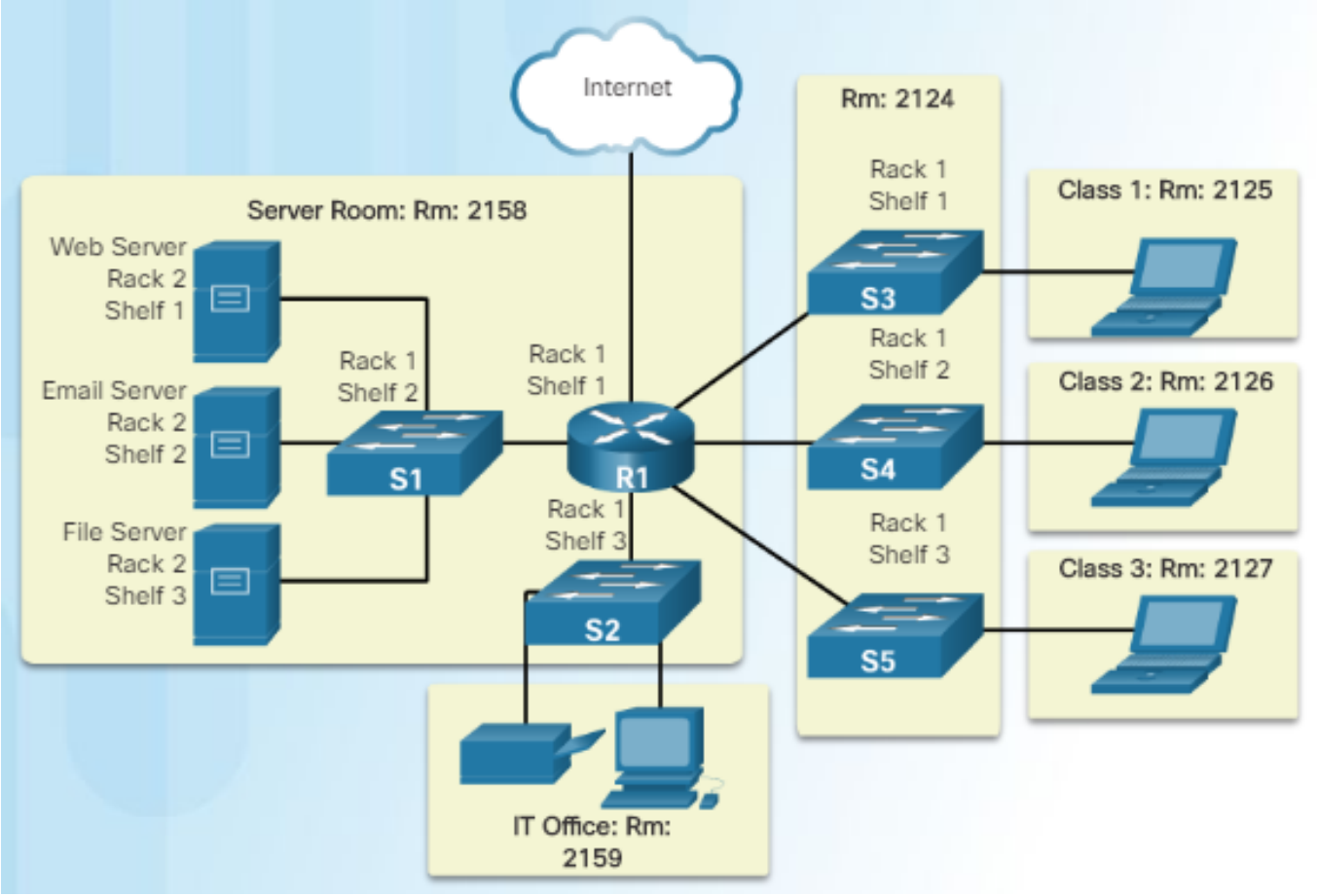


EXERCISE

- Compare the commonly used network media based on these features
  - The distance the media can successfully carry a signal.
  - The environment in which the media is to be installed.
  - The amount of data and the speed at which it must be transmitted.
  - The cost of the media and installation

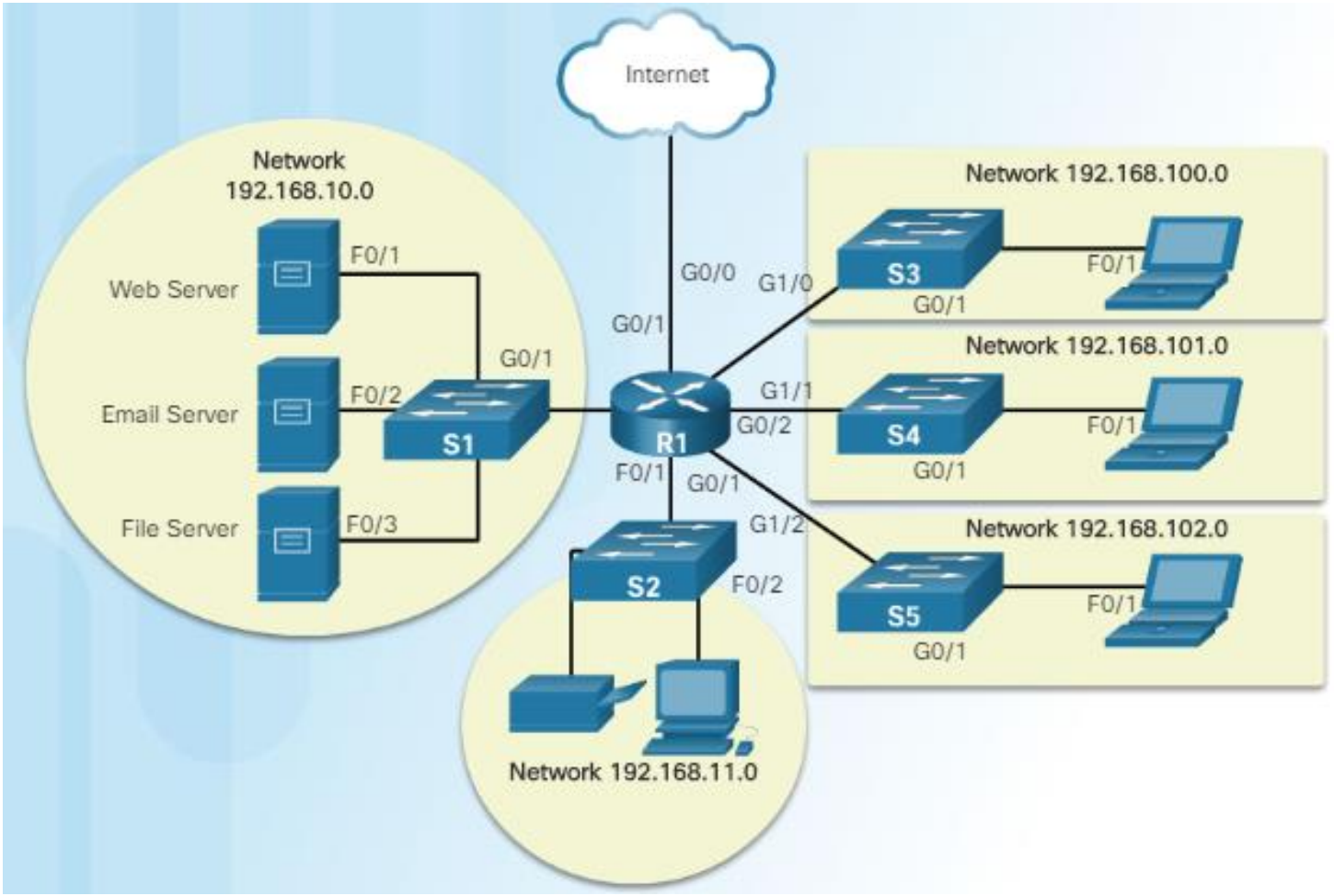
TOPOLOGY DIAGRAMS

- Physical topology diagrams - Identify the physical location of intermediary devices and cable installation.



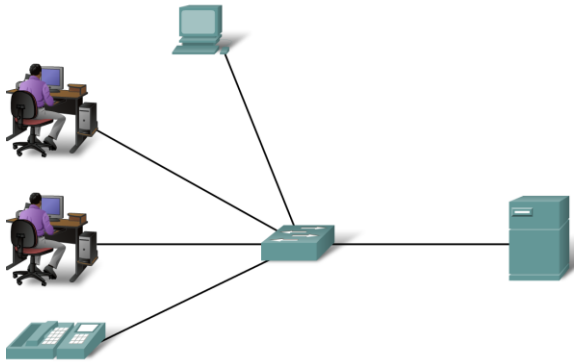
TOPOLOGY DIAGRAMS CONT.

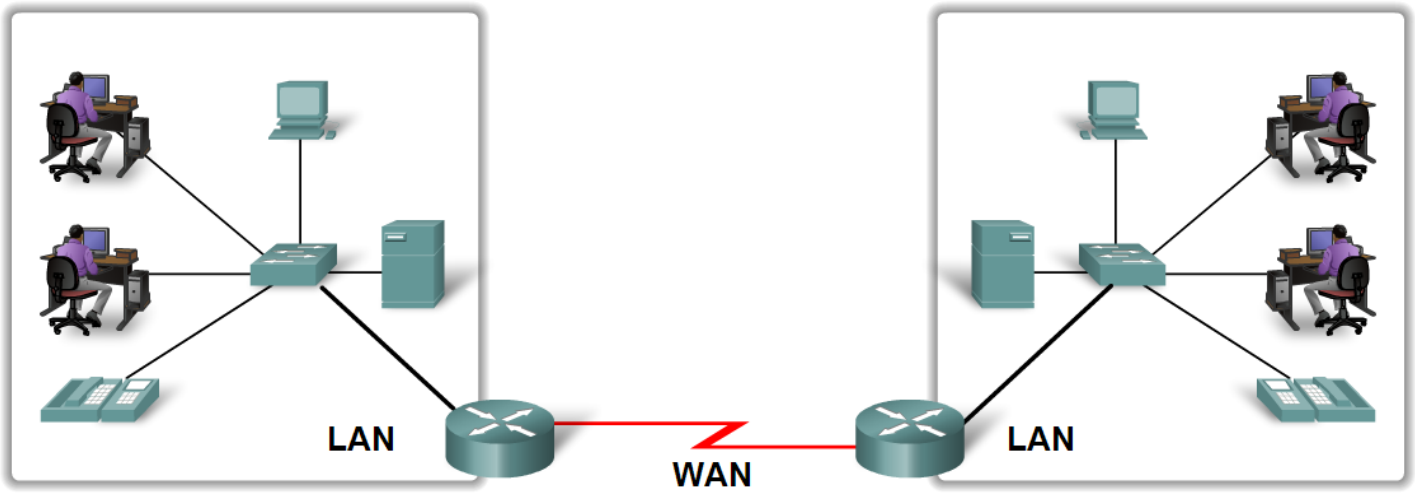
- Logical topology diagrams - Identify devices, ports, and addressing scheme.



NETWORK TYPES

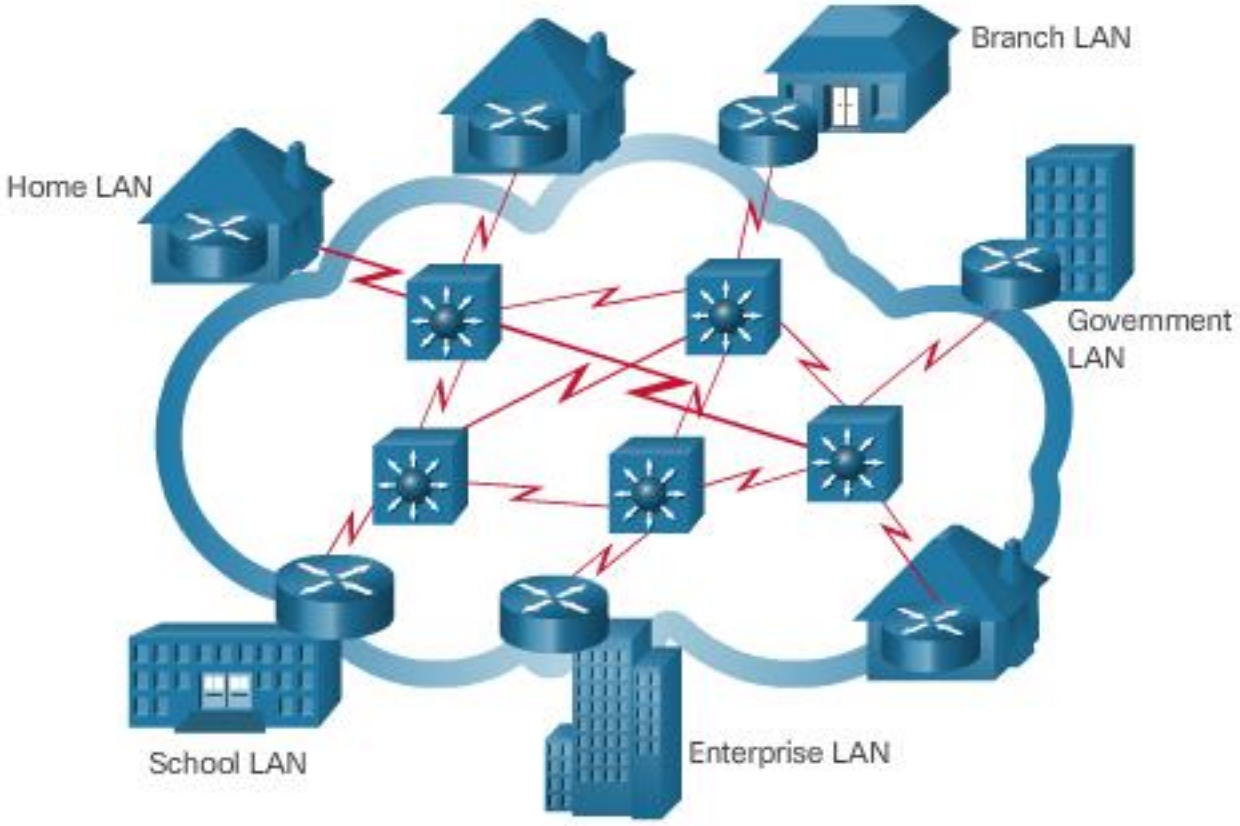
- Local Area Network (LAN)
- Wide Area Network (WAN)





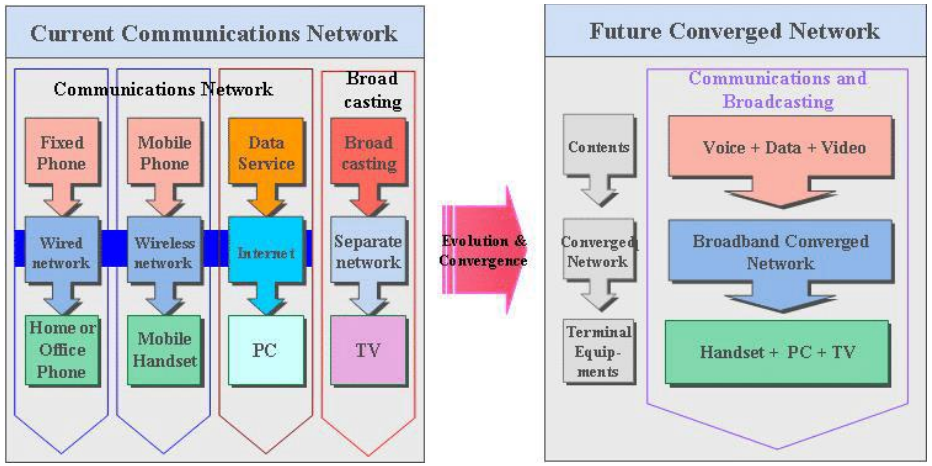
NETWORK TYPES CONT.

- Intranets
- Extranets



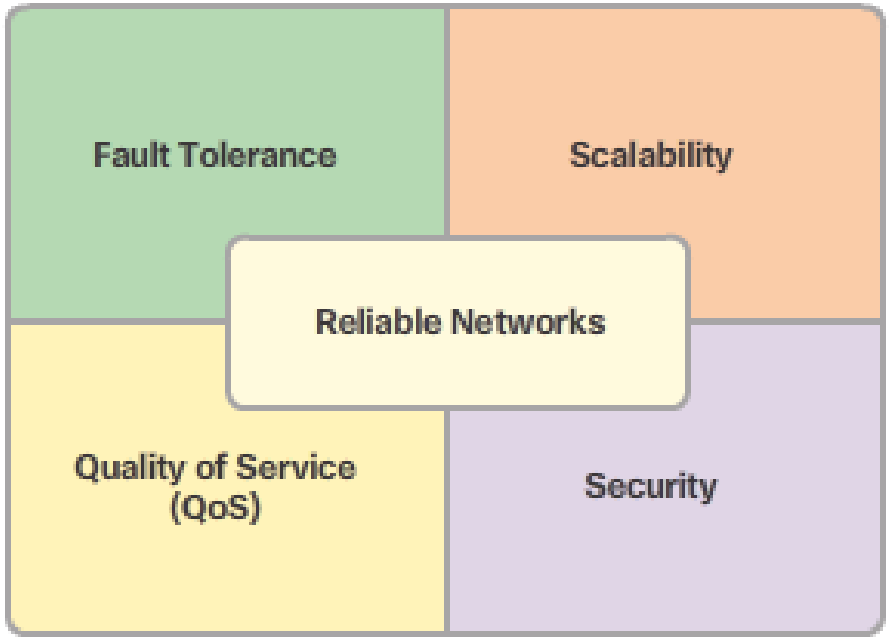
CONVERGED NETWORKS

- **Traditional Networks**
  - Different network infrastructure and technology for various data types
    - Data – Internet
    - Voice – PSTN
    - Video – TV Broadcast
- **The Converging Networks –**
  - Capable of delivering data, voice, and video over the same network infrastructure



RELIABLE NETWORKS

- Four Basic Characteristics of Network Architecture
  - ✓ Fault Tolerance
  - ✓ Scalability
  - ✓ Quality of Service (QoS)
  - ✓ Security



DISCUSSION

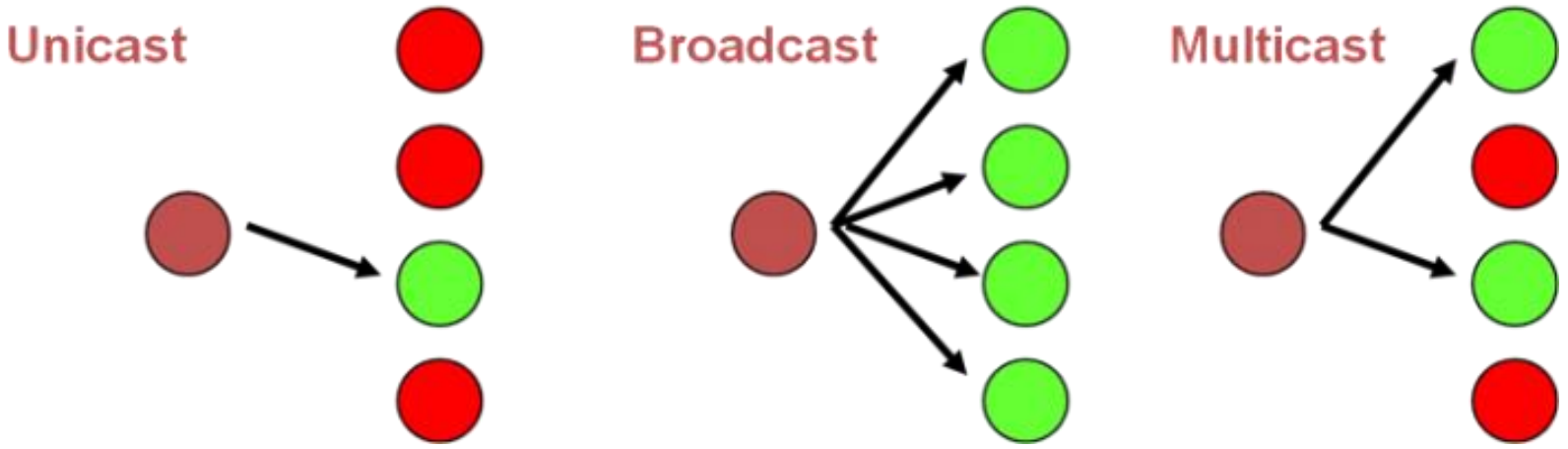
- Read regarding the 4 main characteristics of modern networks and participate in the class discussion

ELEMENTS OF COMMUNICATION

- ✓ Message source
- ✓ The channel
- ✓ Message destination

- ✓ Rules
  - Common language and grammar
  - Speed and timing of delivery
  - Confirmation or acknowledgment requirements

MESSAGE DELIVERY OPTIONS

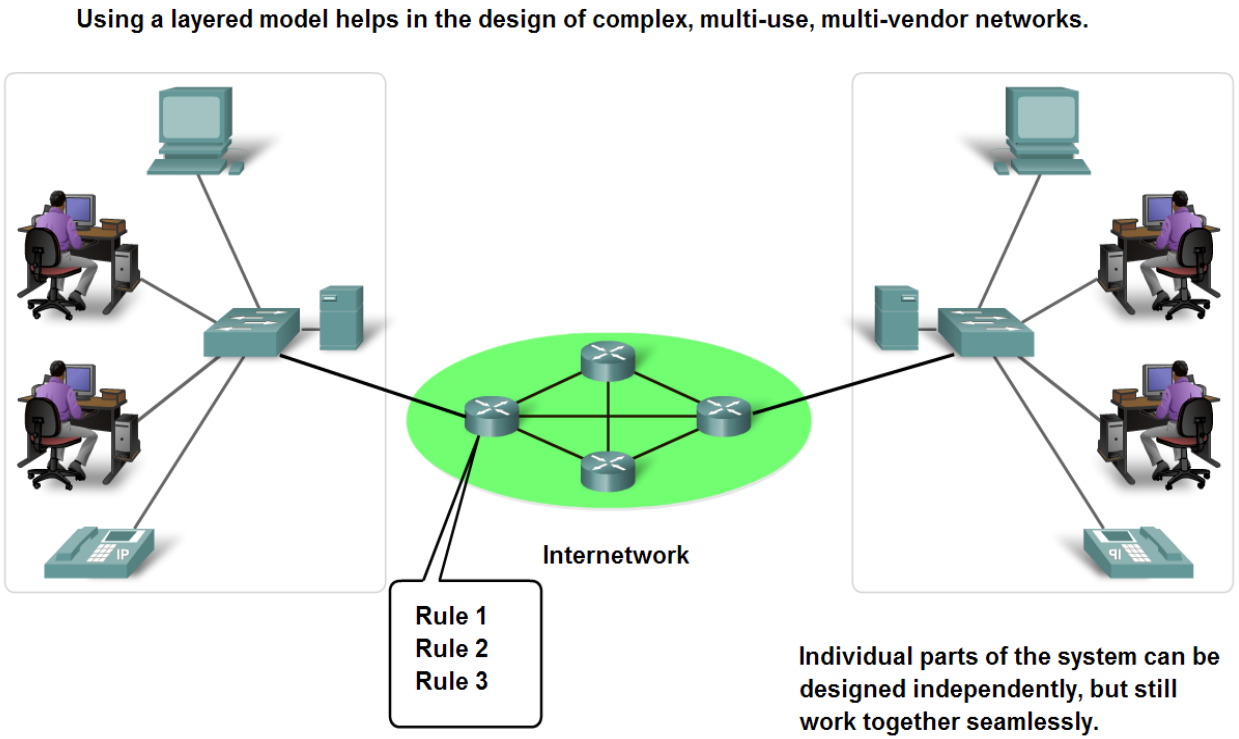


REFERENCE MODEL FOR NETWORK COMMUNICATION

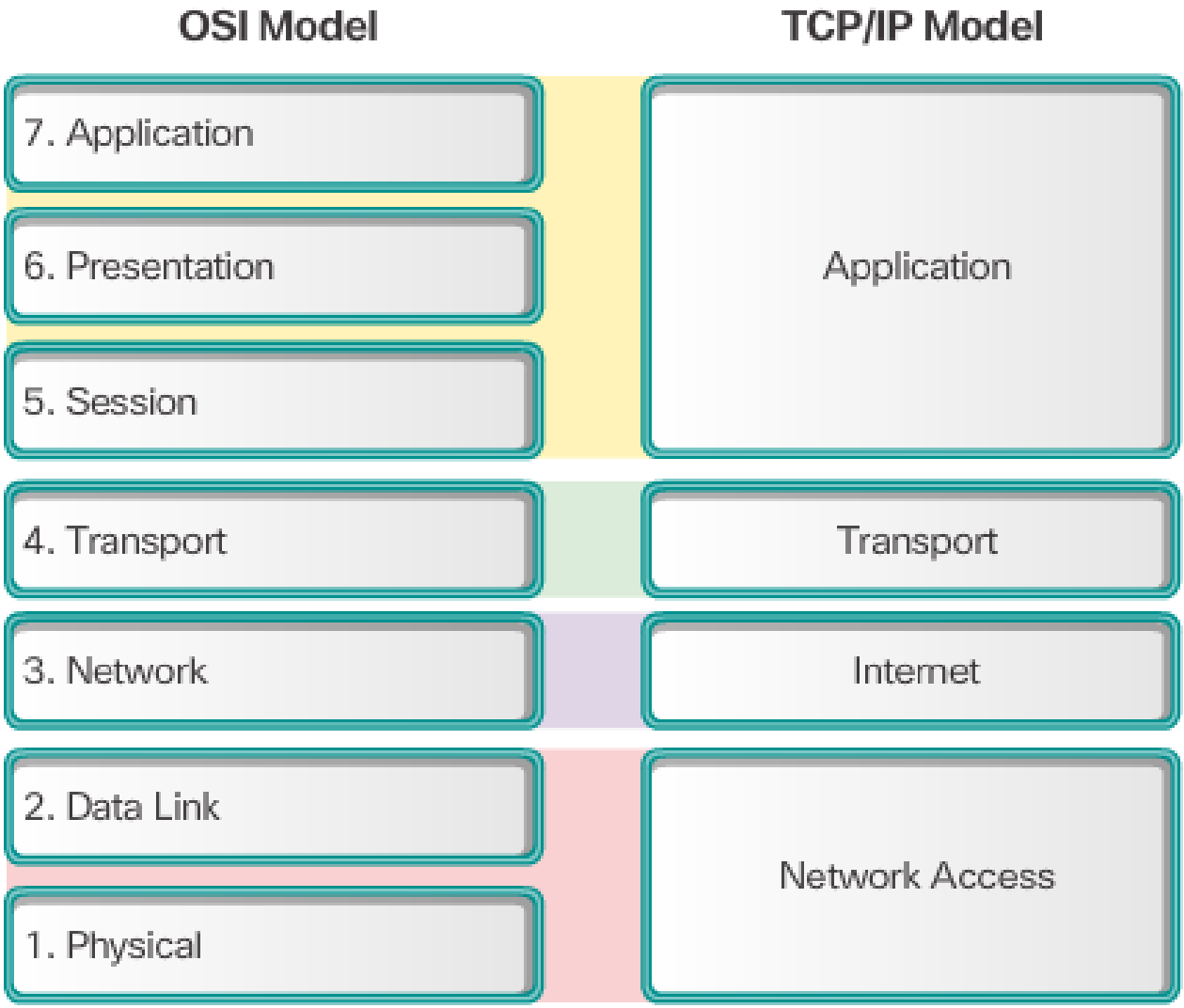
- A reference model defines how applications can communicate over a network (the full process)
- A layered reference model divides the full process into specific related groups of actions at each layer
- These actions are implemented via protocols or protocol suites
- Typically Defines :-
  - The format or structure of the message
  - The method by which networking devices share information about pathways with other networks
  - How and when error and system messages are passed between devices
  - The setup and termination of data transfer sessions

BENEFITS OF USING A LAYERED MODEL

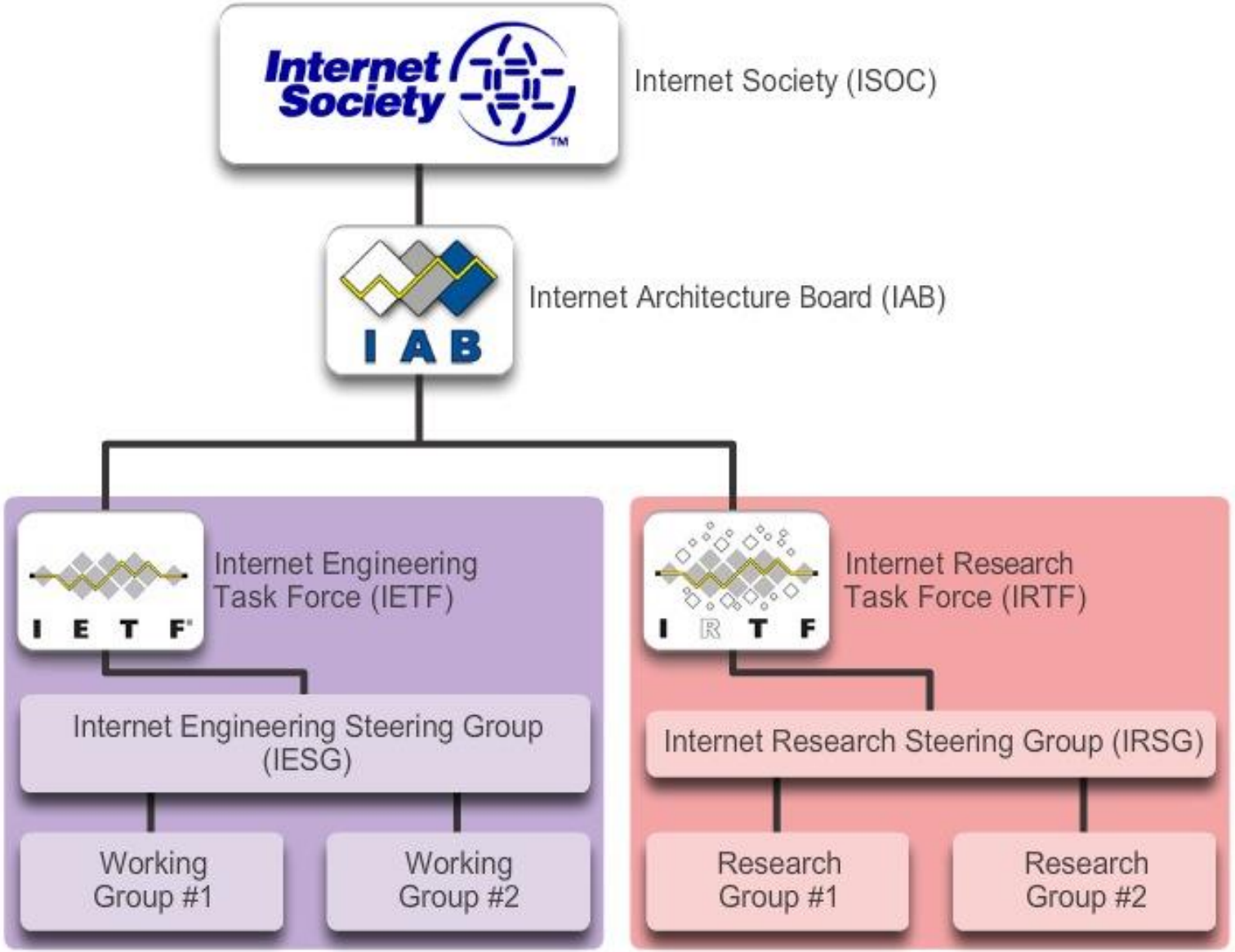
- Provides a common language for vendors
- Fosters competition between vendors
- Changes in one layer do not affect other layers



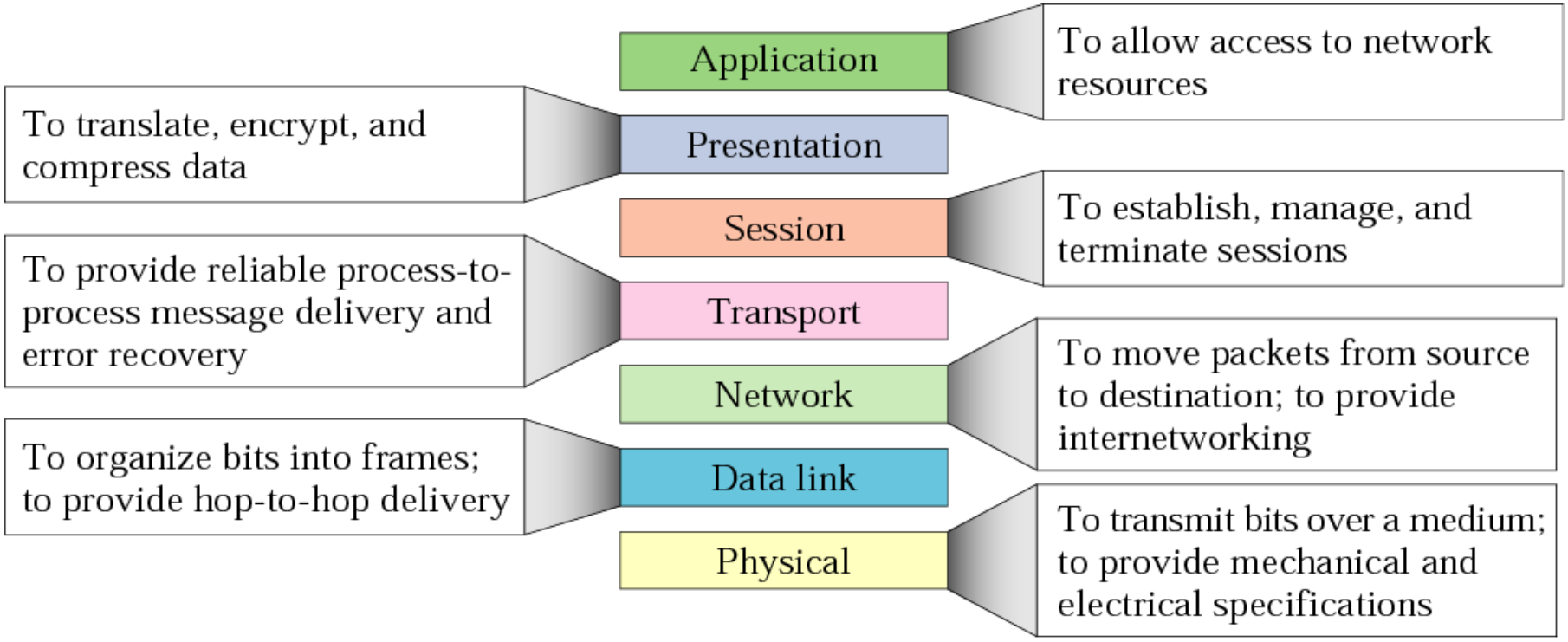
LAYERED REFERENCE MODELS



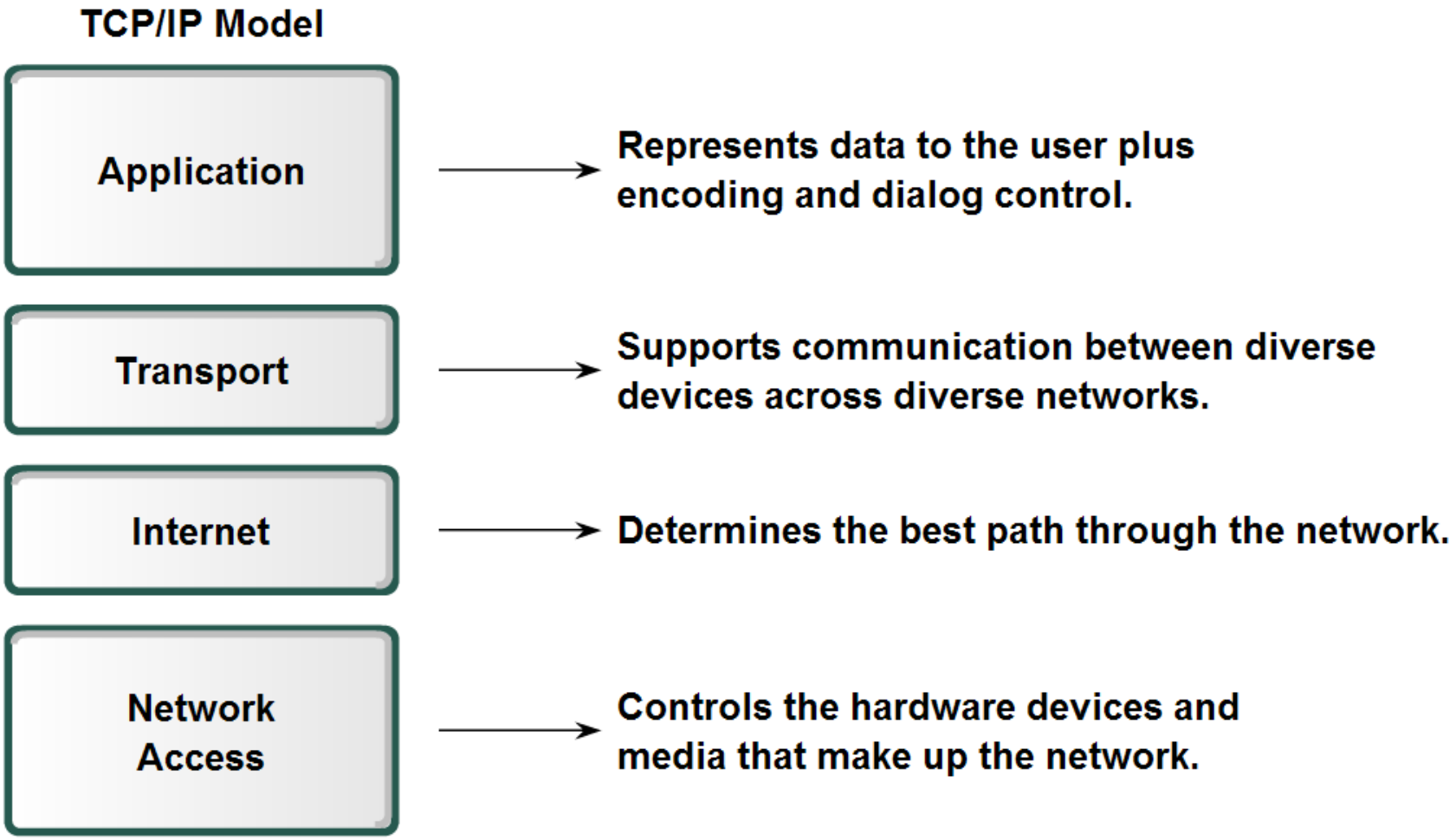
INDUSTRY STANDARDS CONT.



ISO/OSI MODEL

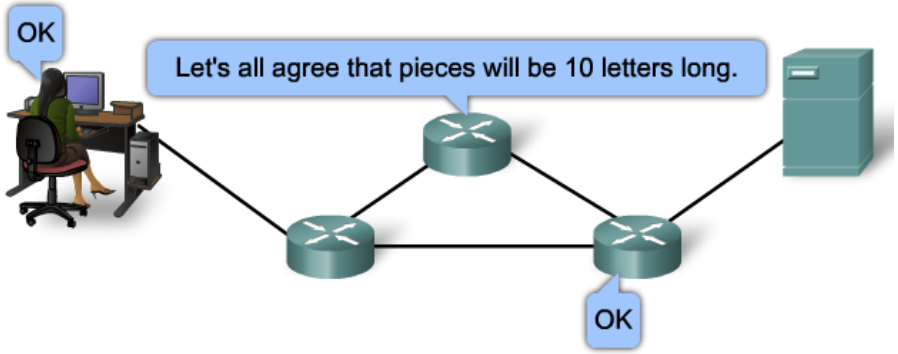


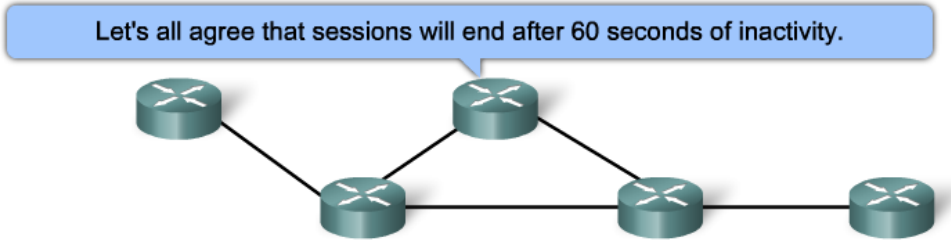
TCP/IP MODEL


TCP/IP Model
Application
Represents data to the user plus encoding and dialog control.
Transport
Supports communication between diverse devices across diverse networks.
Internet
Determines the best path through the network.
Network Access
Controls the hardware devices and media that make up the network.

NETWORK PROTOCOLS

- Define a common format and a set of rules for the data communication
  - Number and type of messages
  - The header fields in each message
  - Meaning and content of each header field






That's all Folks!


Questions