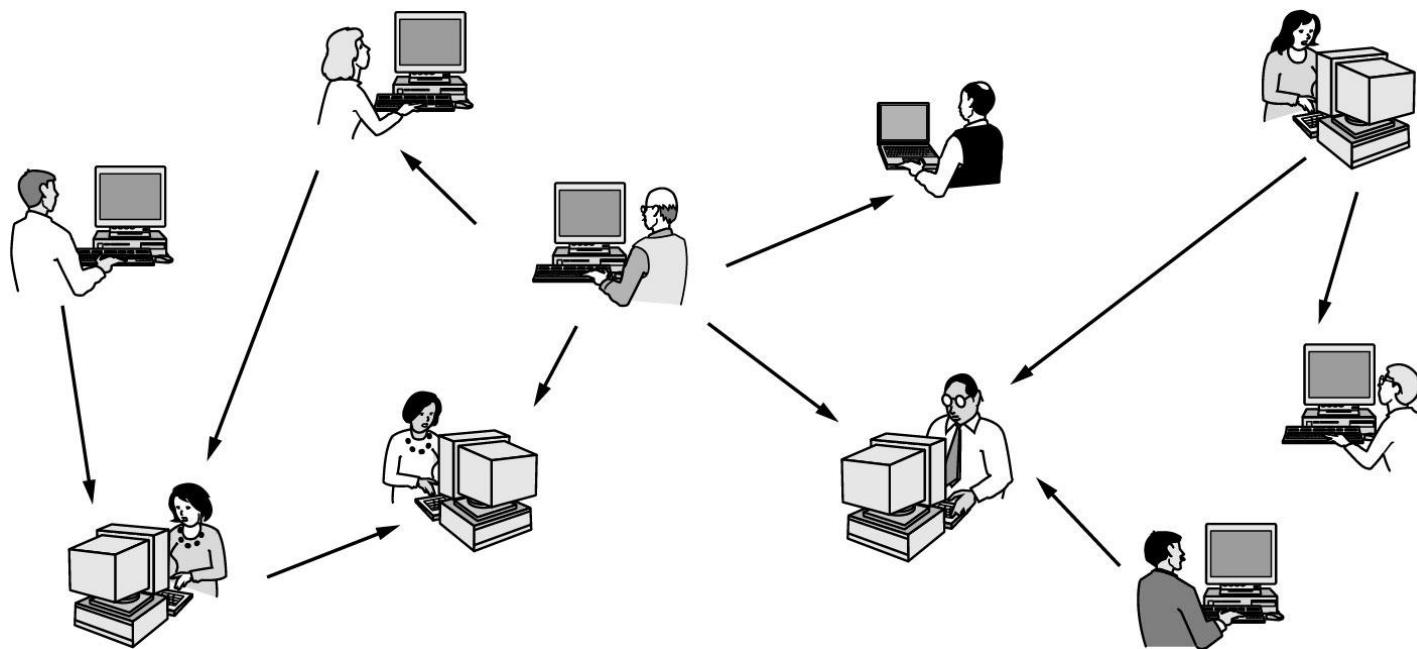


# Computer Networks

# Why Computer Networks?



Application Type	Example
Business-to-consumer	Ordering books on-line
Business-to-business	Car manufacturer ordering tires from supplier
Government-to-consumer	Government distributing tax forms electronically
Consumer-to-consumer	Auctioning second-hand products on-line
Peer-to-peer	File sharing

# Communications Tasks

<b>Transmission system utilization</b>	<b>Addressing</b>
<b>Interfacing</b>	<b>Routing</b>
<b>Signal generation</b>	<b>Recovery</b>
<b>Synchronization</b>	<b>Message formatting</b>
<b>Exchange management</b>	<b>Security</b>
<b>Error detection and correction</b>	<b>Network management</b>
<b>Flow control</b>	

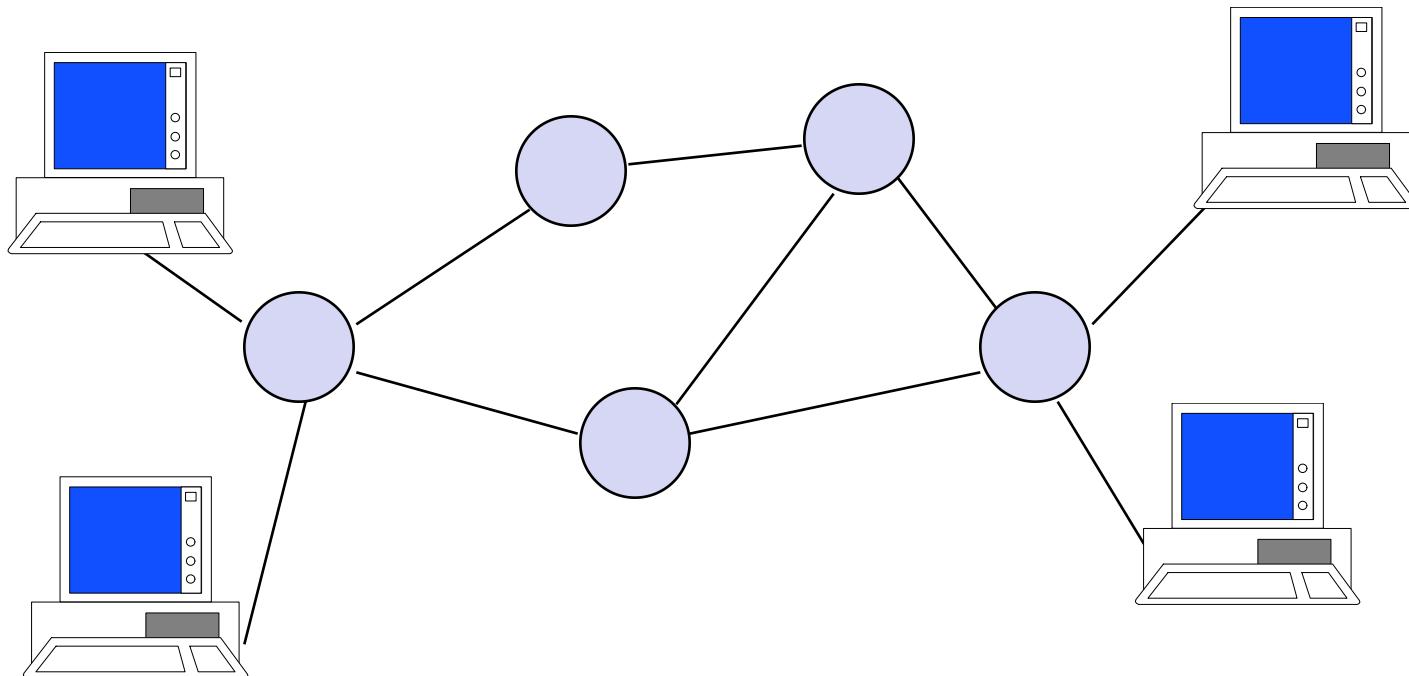
# Types of Communication Networks

Classification according to the way the  
“information flows” are transported to the  
users

- Switching Networks
- Broadcast Networks

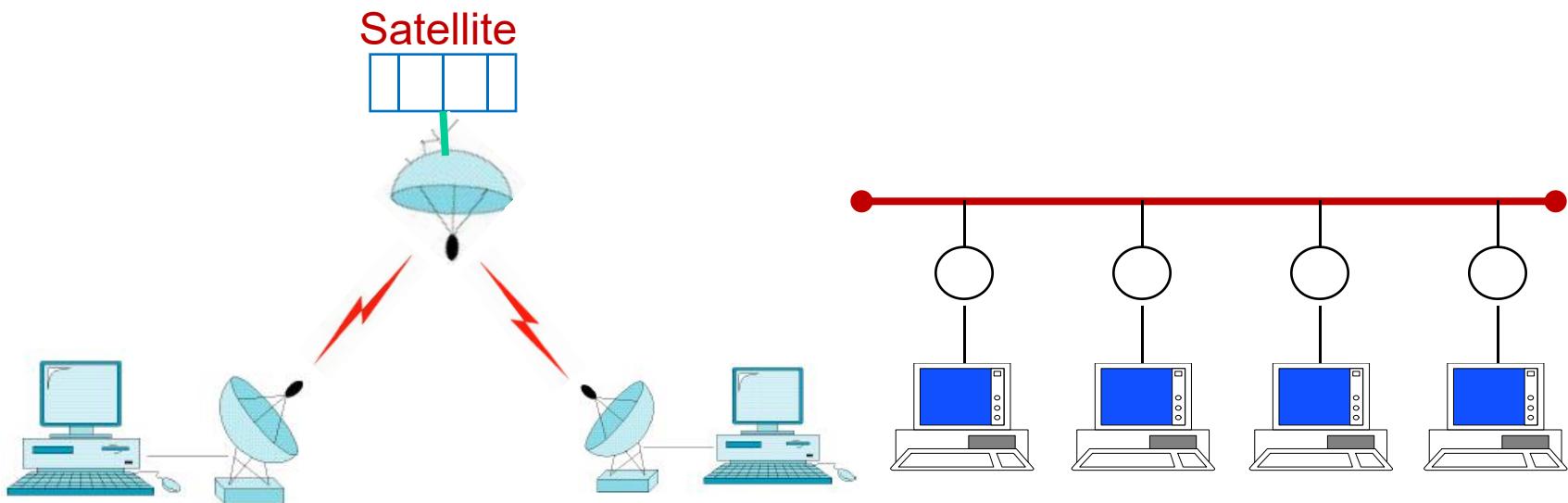
# Switching Networks

Data are transferred from source to destination through a series of intermediate nodes



# Broadcast Networks

- There are no intermediate switching nodes
- All users are connected on the same medium



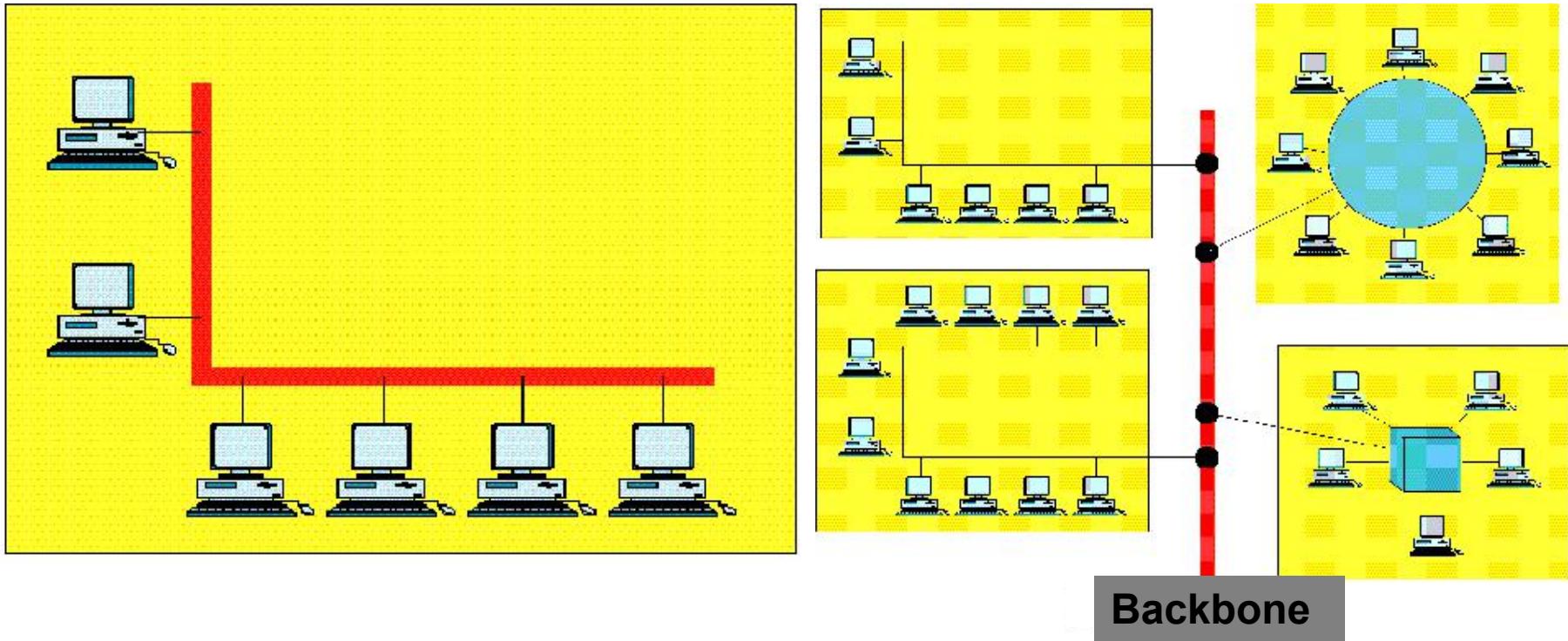
# Classification According to Coverage Area

- ◆ Local Area Networks (0-2 Km; campus)
  - Ethernet (10/100/1000 Mbps), Token ring (4, 16 Mbps), IEEE 802.11(b, g, a, n)
- ◆ Metropolitan Area Networks (2-50 km; corporate offices, city)
  - DQDB (Distributed Queue Dual Bus), WiMAX (IEEE 802.16.a/b/e)
- ◆ Wide Area Networks (country, continent)
  - transmission lines, switching elements
- ◆ Personal Access Networks (PANs)
  - Bluetooth, IEEE 802.15.3

# Local Area Networks (LANs)

- It expands over small geographic areas (within a building or close-by buildings)
- It is usually owned by the same organization
- The internal data rates are typically much greater than those of WANs
- Typically, they make use of broadcast rather than switching

# Local Area Networks (LANs)

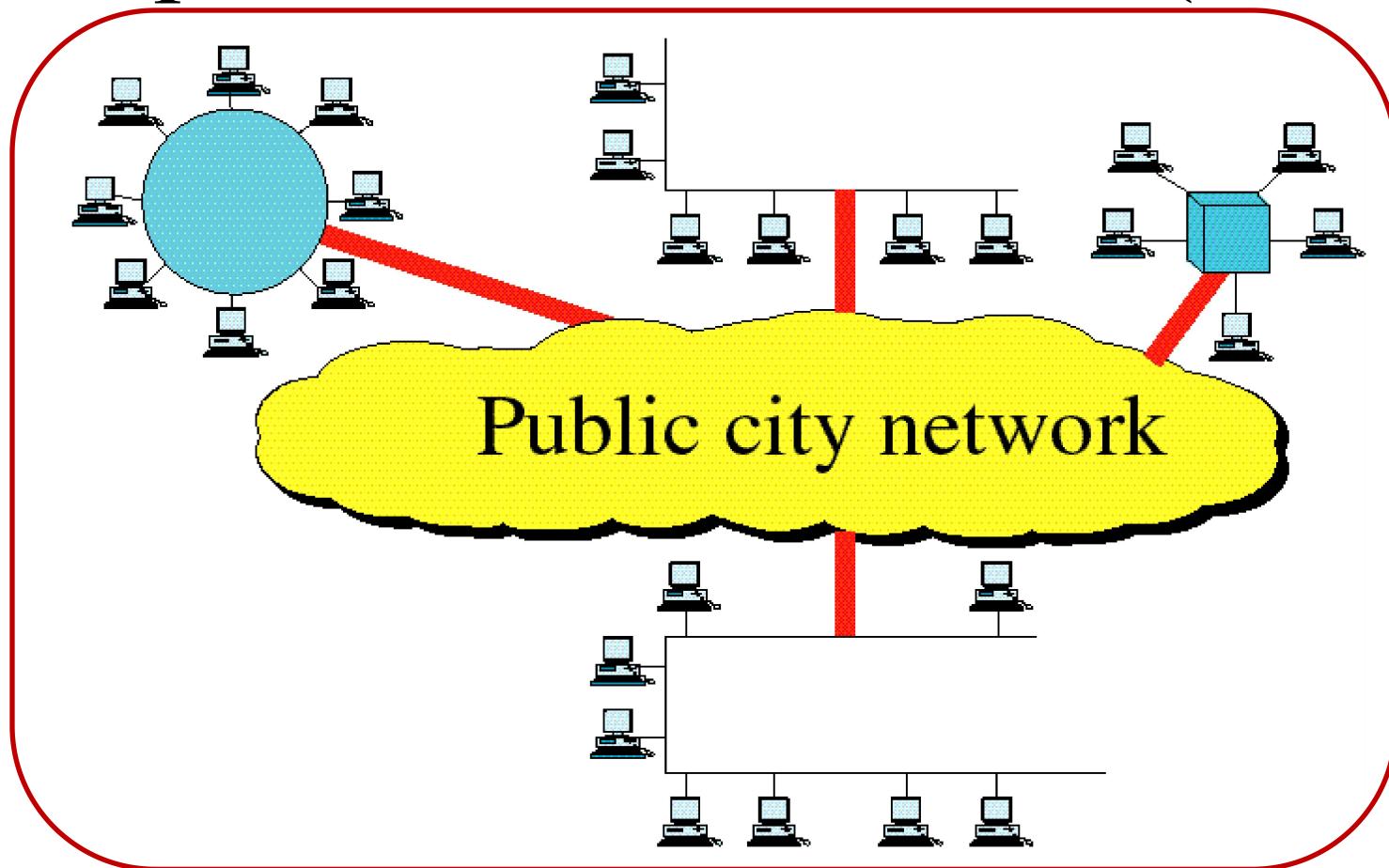


**Single-building LAN**

**Multi-building LAN**

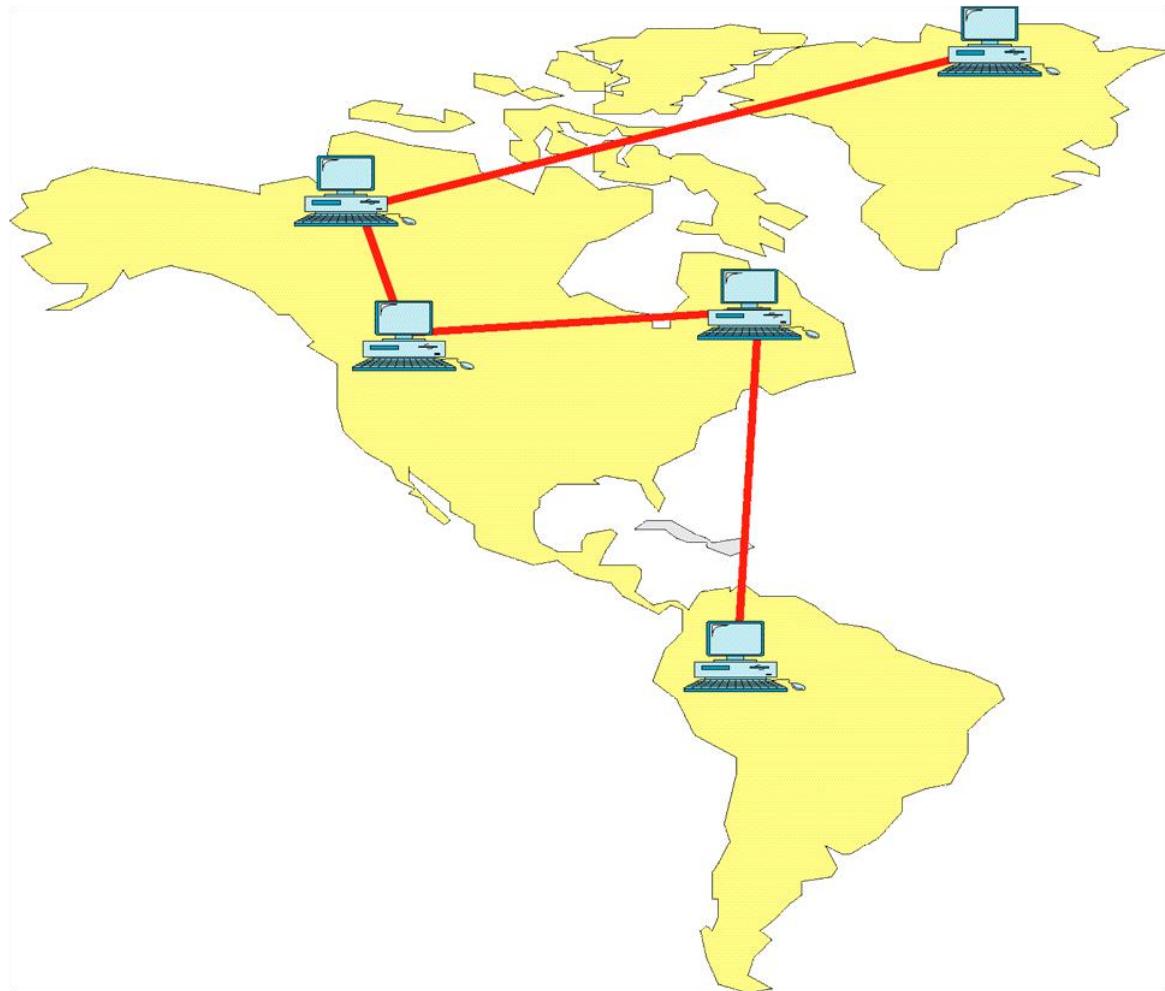
Examples: home network, wireless-wired campus network

# Metropolitan Area Networks (MAN)



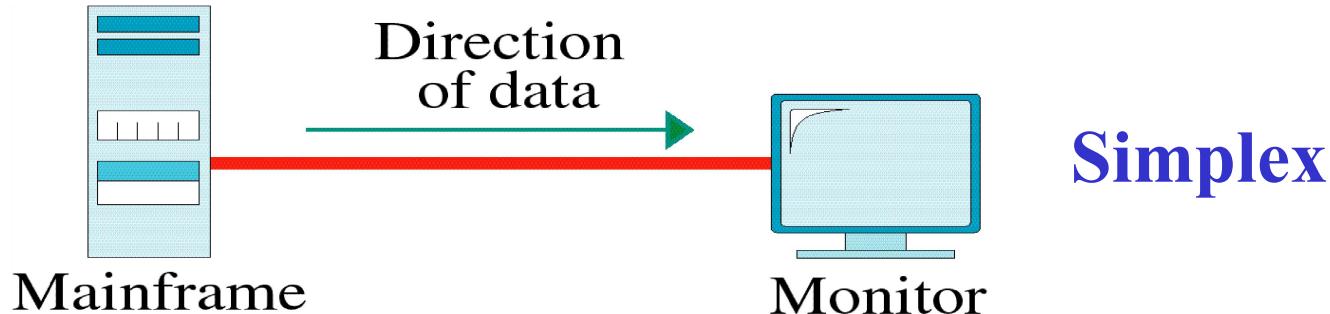
Examples: Ottawa-Carleton Research Institute (**OCRI**) MAN,  
National Capital Institute on Telecommunications (**NCIT**) MAN

# Wide Area Networks (WAN)

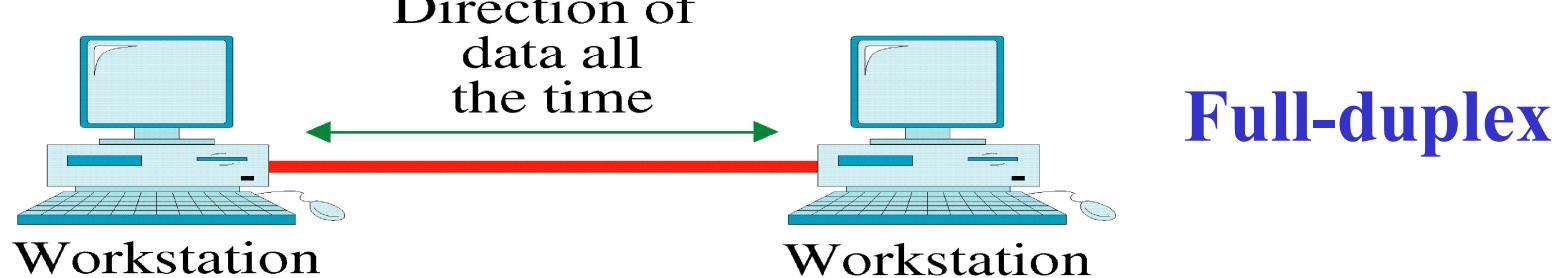
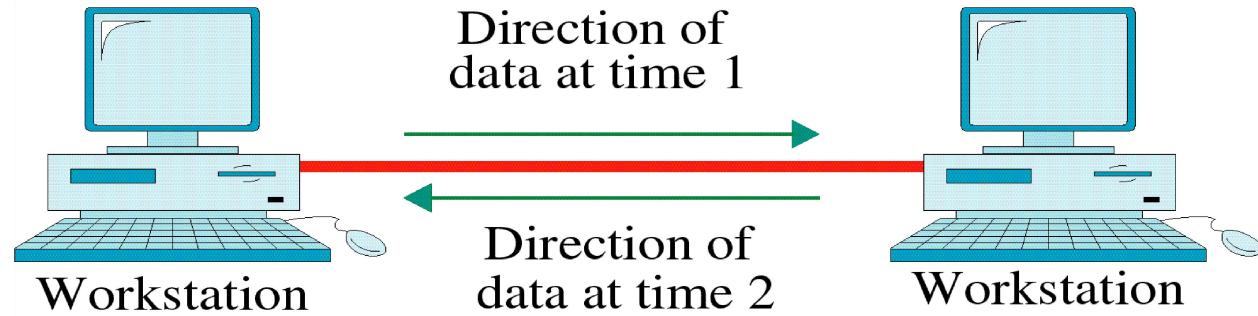


Example: Canadian Network for the Advancement of Research, Industry and Education (**CANARIE**).

# Transmission Mode

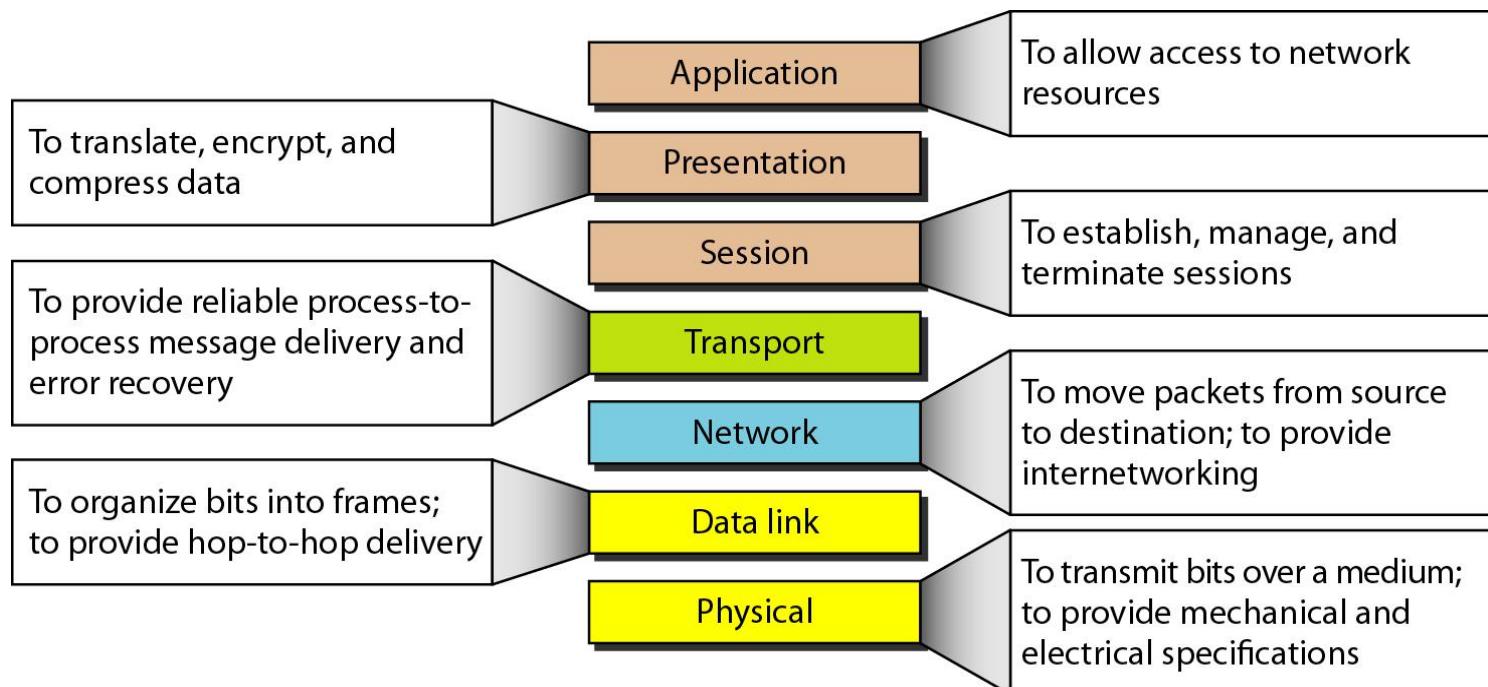


Half-duplex

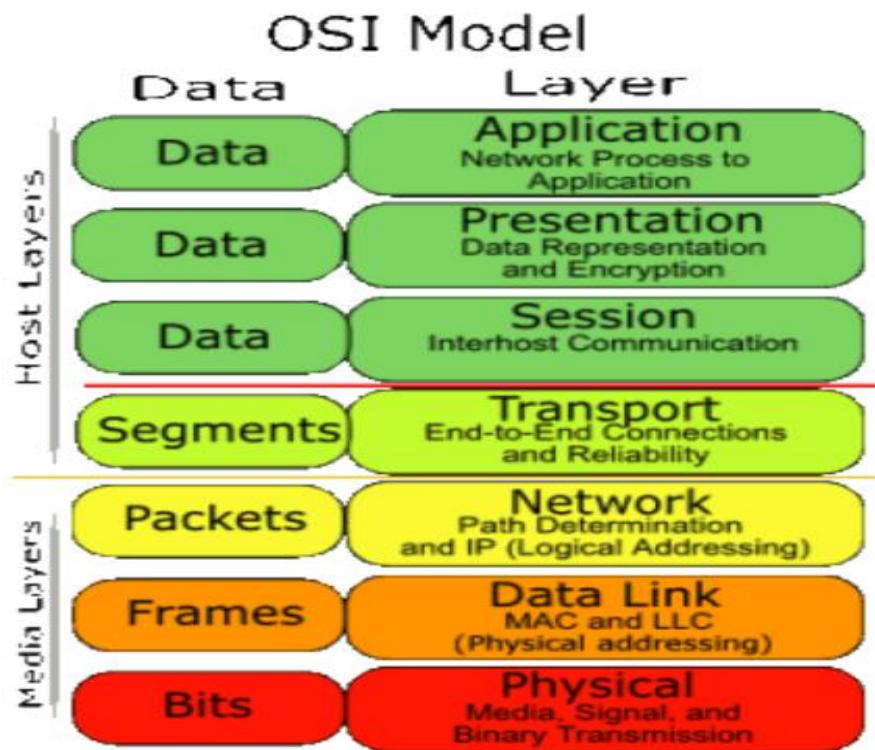


# (Open Systems Interconnection)

## OSI Model:



# PDUs in Different Layers:



# Protocol Data Unit (PDU)

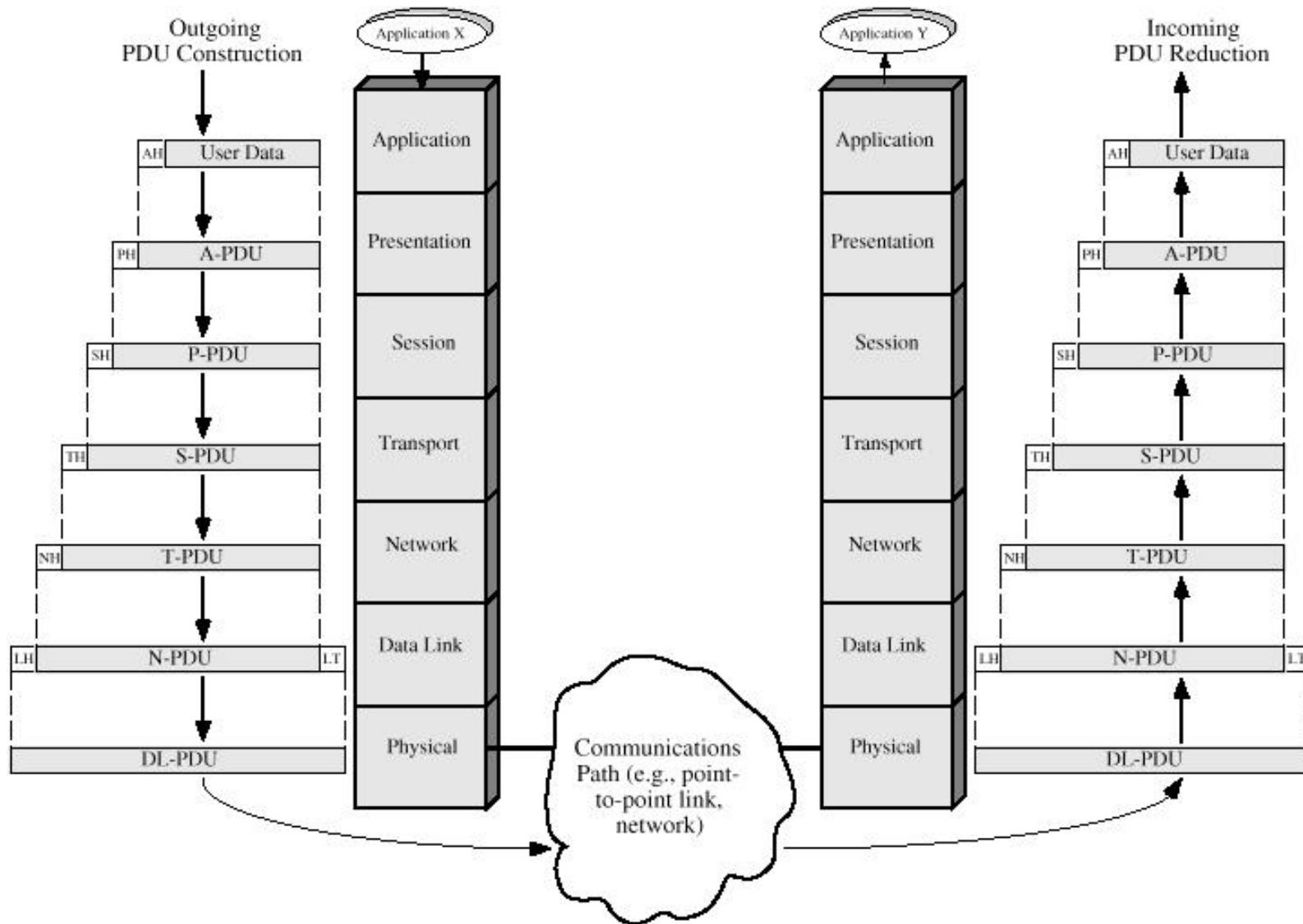
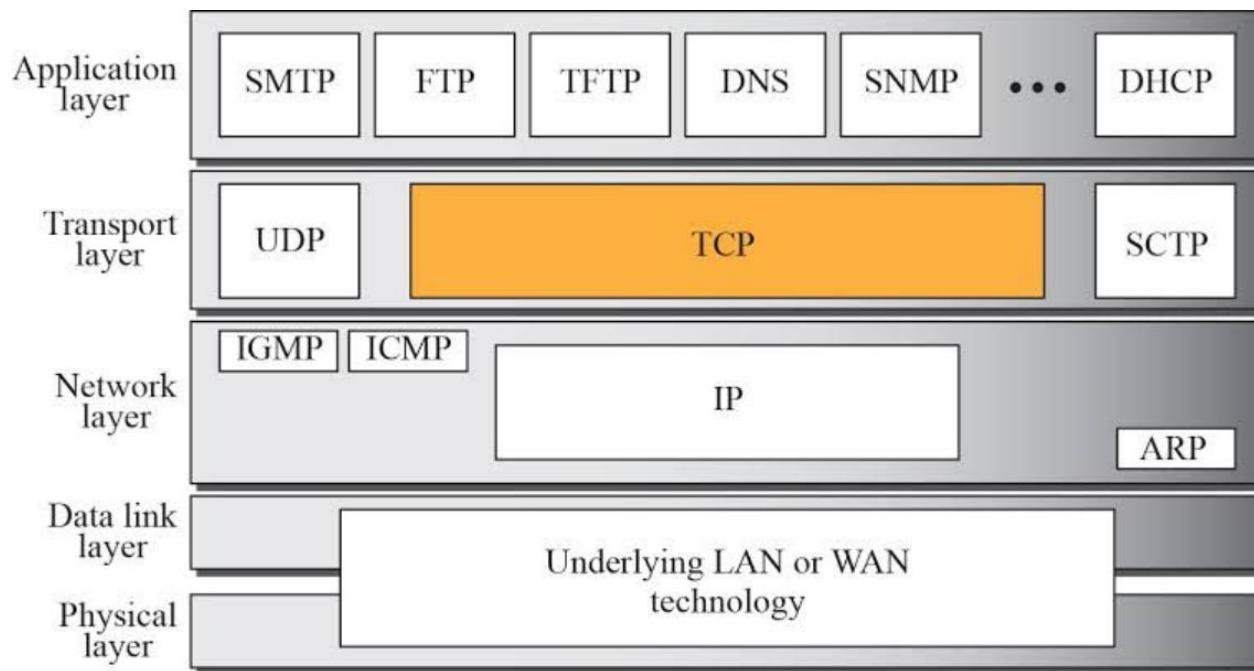


Figure 2.6 The OSI Environment

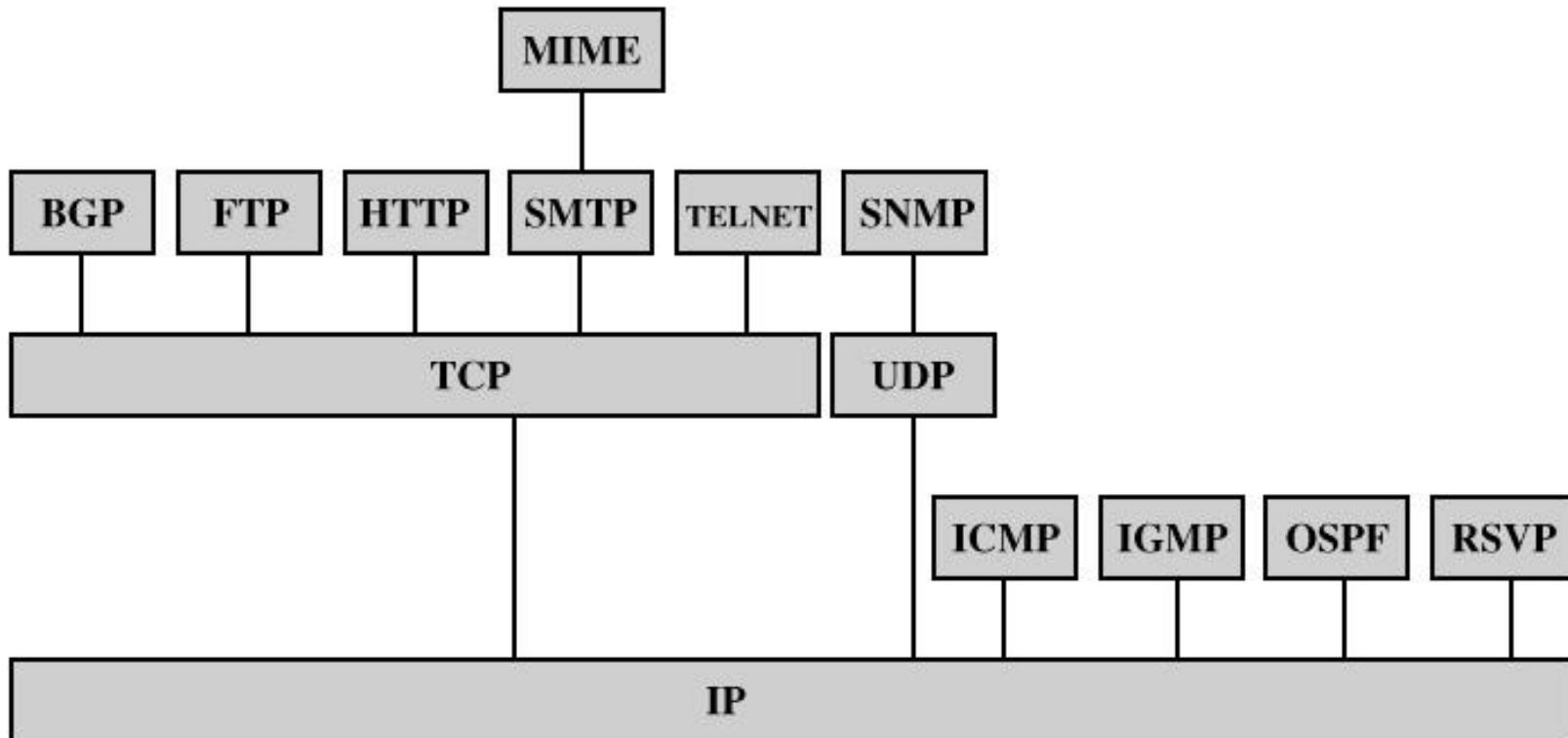
# TCP/IP Protocol Architecture

- No official model but a working one.
- Has **5** layers (OSI has **7** layers)
- Was the result of research conducted on ARPANET, funded by DARPA (USA).
- Initially developed as a US military research effort funded by the Department of Defense
- It has dominated.
- It is the “heart” of Internet.

# TCP/IP Protocols:



# Some TCP/IP Protocols



BGP = Border Gateway Protocol

FTP = File Transfer Protocol

HTTP = Hypertext Transfer Protocol

ICMP = Internet Control Message Protocol

IGMP = Internet Group Management Protocol

IP = Internet Protocol

MIME = Multi-Purpose Internet Mail Extension

OSPF = Open Shortest Path First

RSVP = Resource ReSerVation Protocol

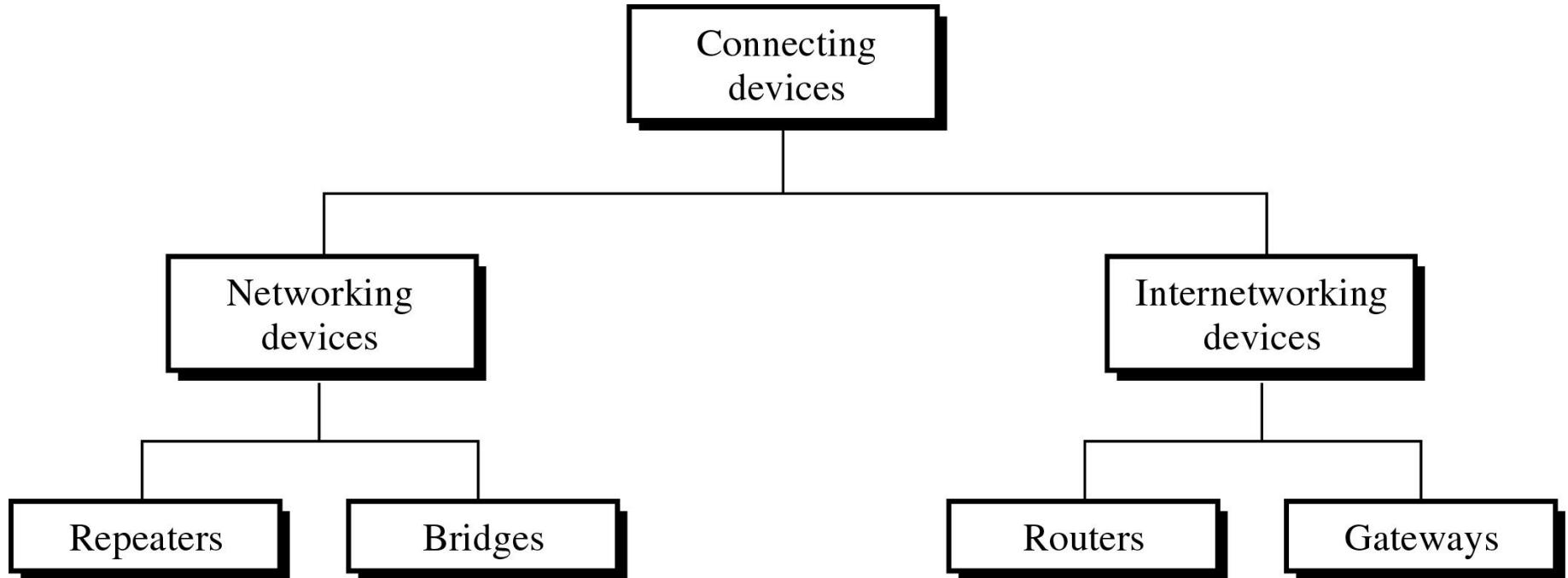
SMTP = Simple Mail Transfer Protocol

SNMP = Simple Network Management Protocol

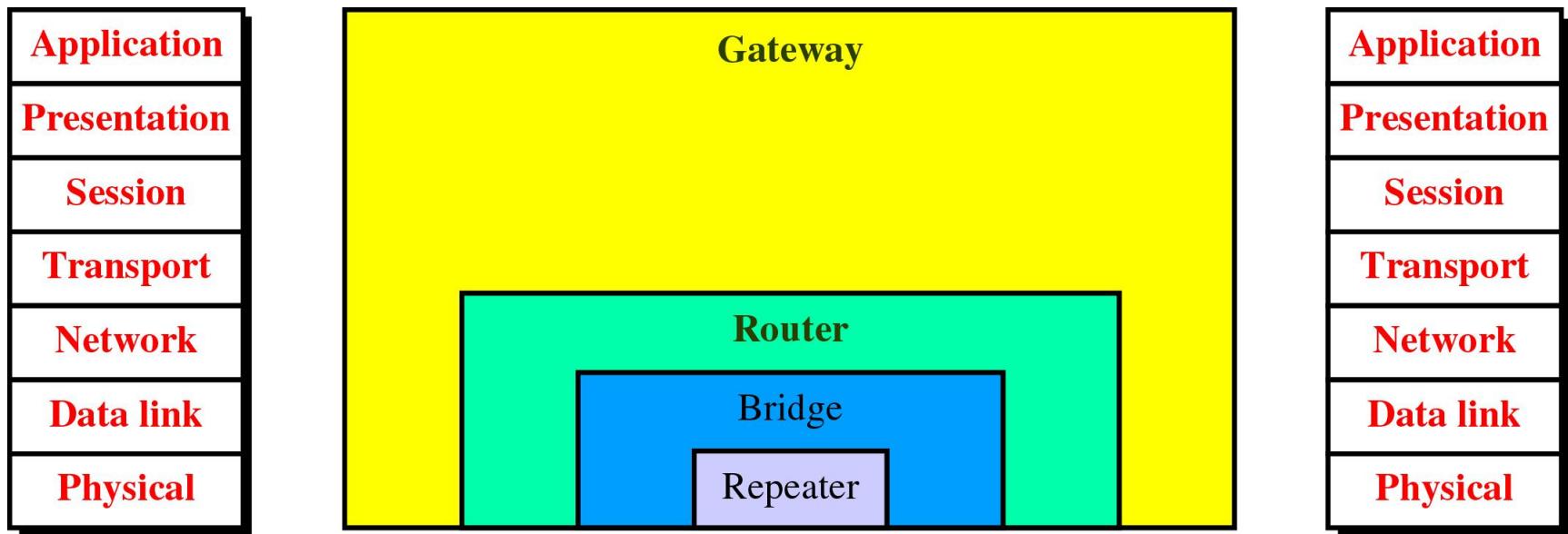
TCP = Transmission Control Protocol

UDP = User Datagram Protocol

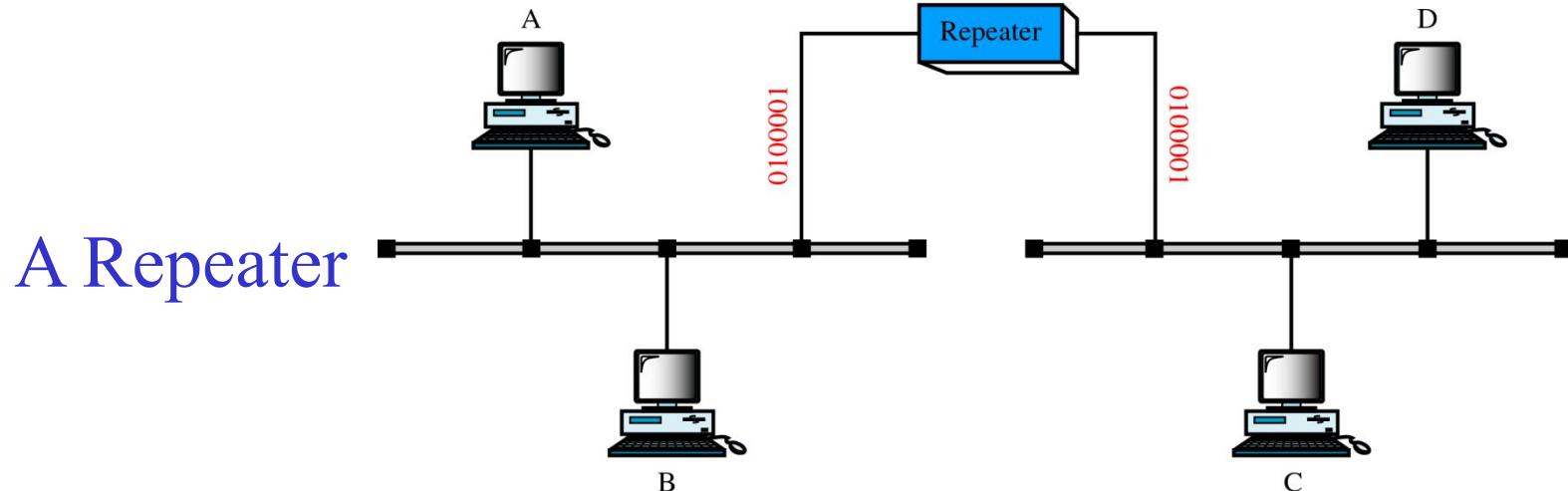
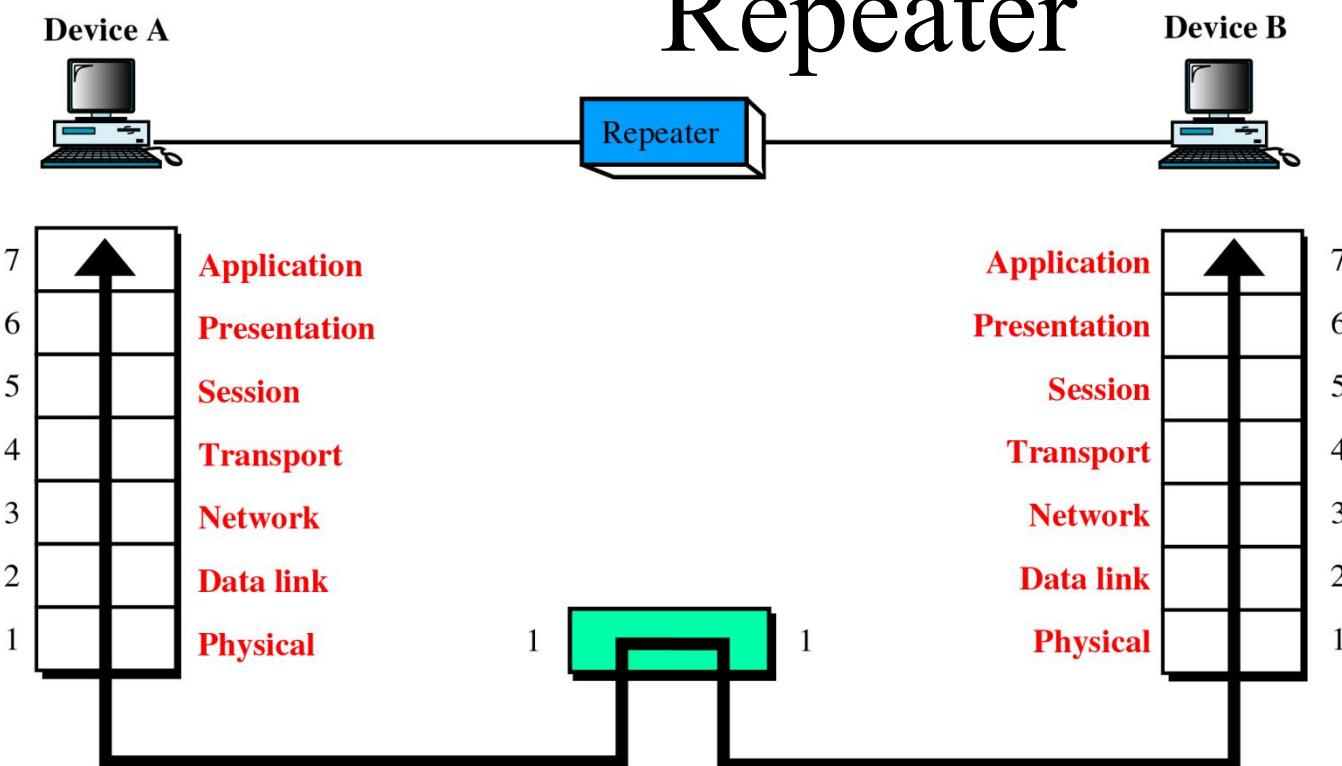
# Connection Devices



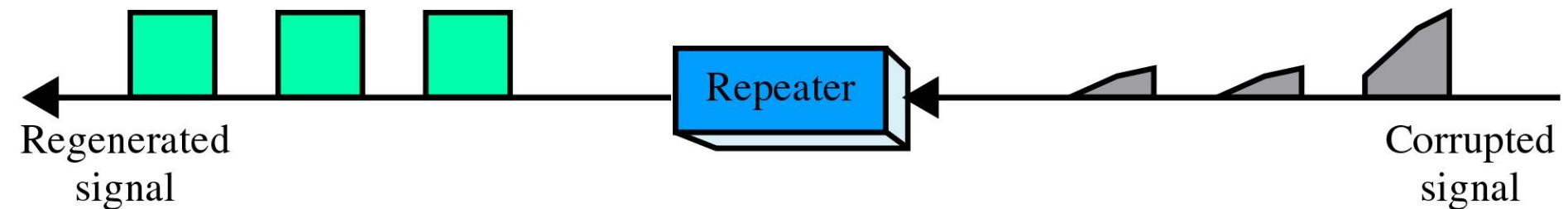
# Connecting Devices and the OSI Model



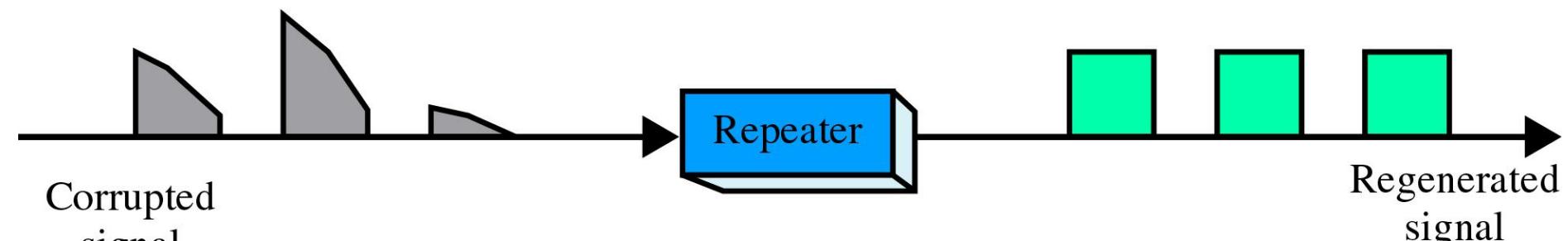
# Repeater



# Function of Repeater



(a) Right-to-left transmission.



(b) Left-to-right transmission.

# Bridge

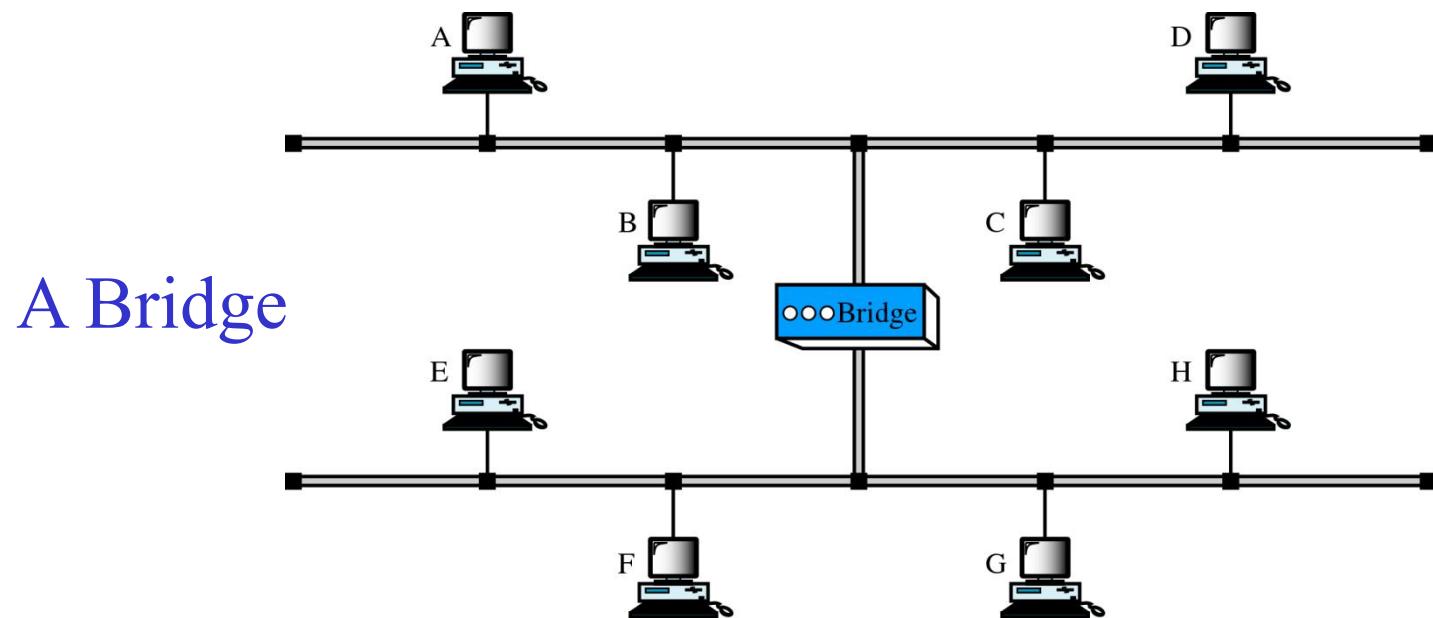
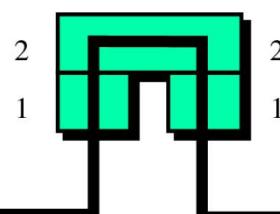
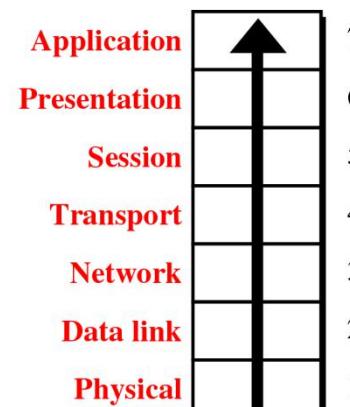
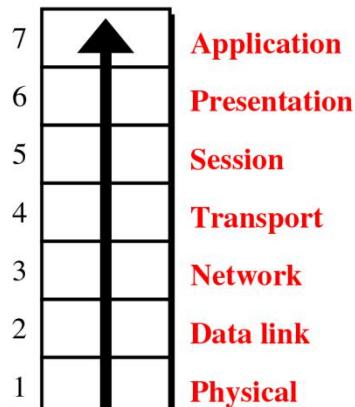
Device A



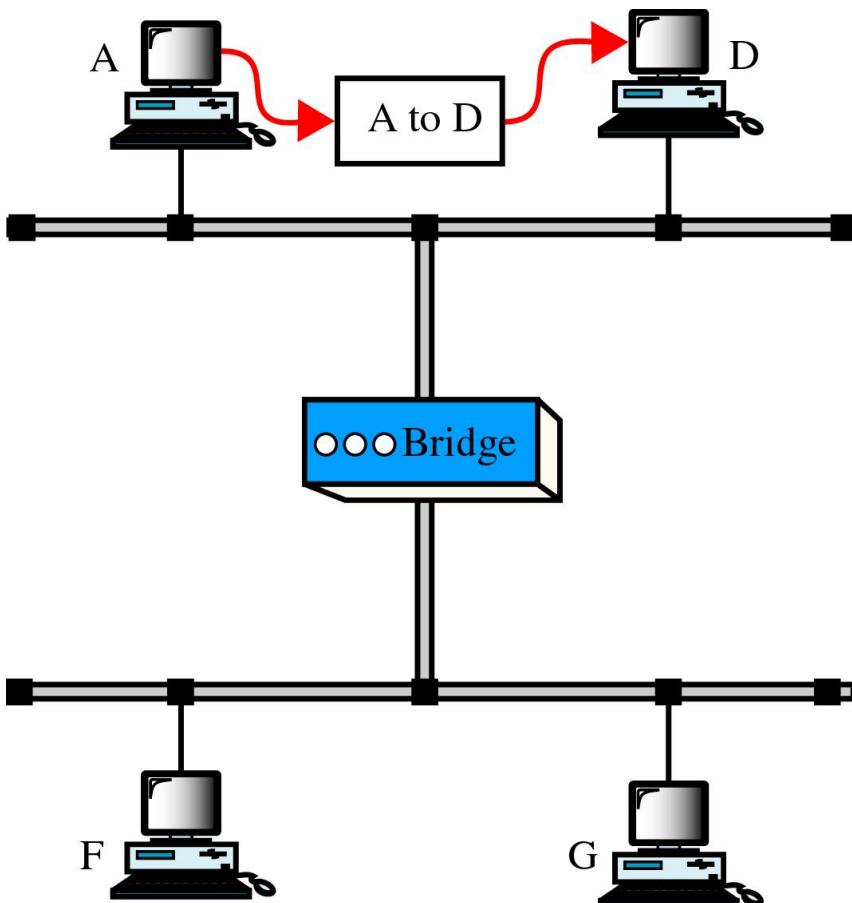
Device B



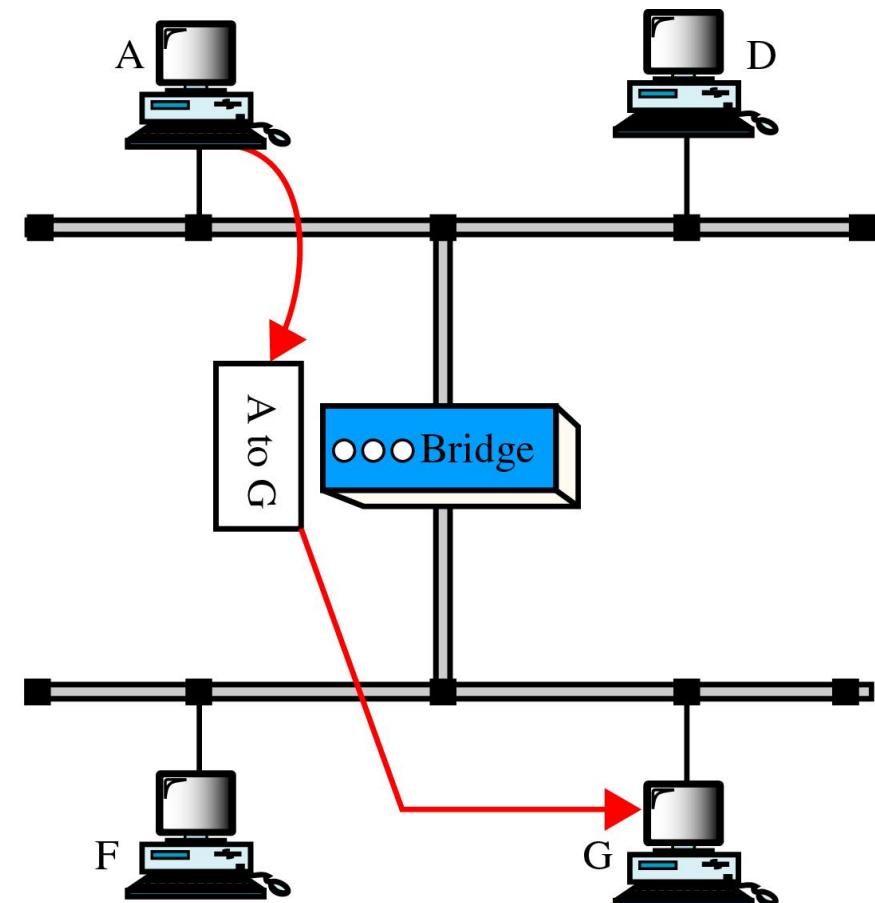
Bridge



# Function of Bridge

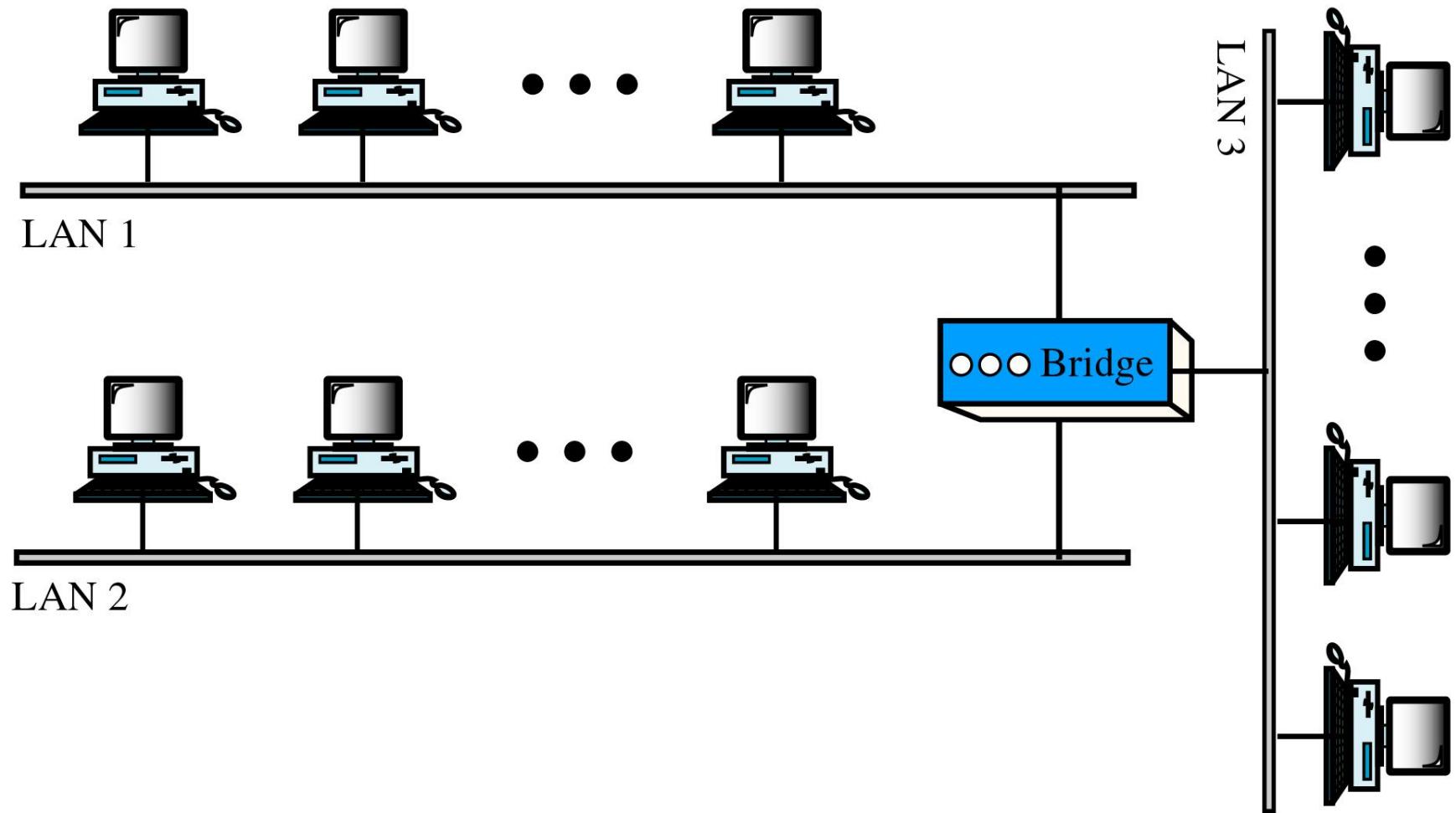


a. A packet from A to D

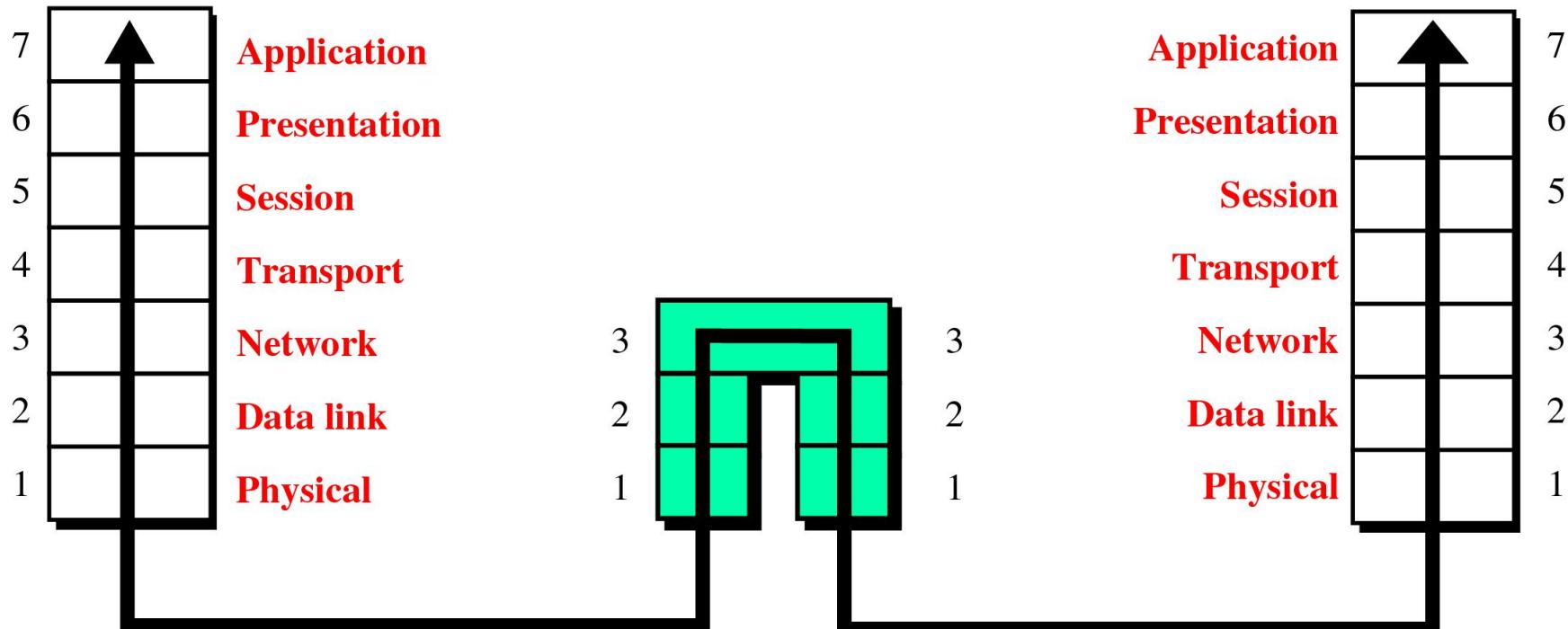
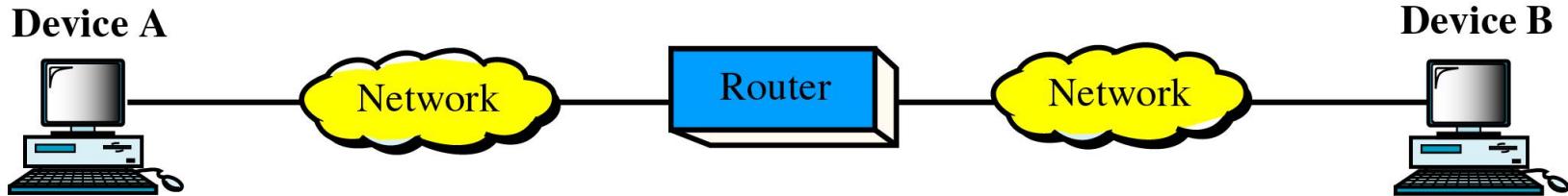


b. A packet from A to G

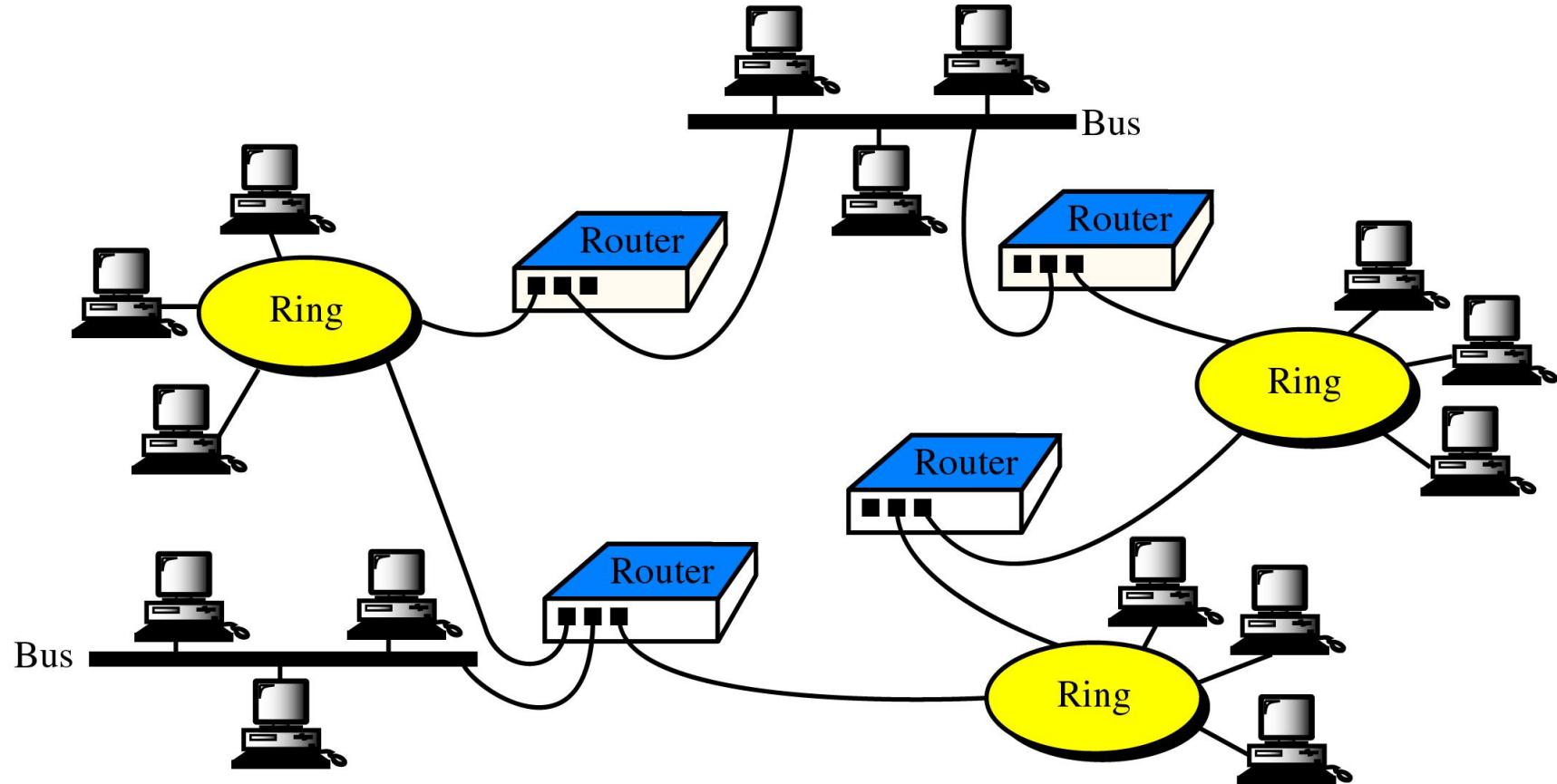
# Multiport Bridge



# Router

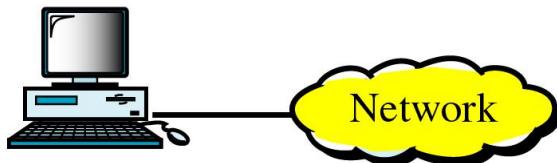


# Routers in an Internet



# Gateway

Device A



Device B

