

Network Operating systems

Lecturer:

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Headlines

- ▶ Introduction to Networking
- ▶ TCP/IP Networking
- ▶ Configuring Hardware
- ▶ Name Service And Configurations
- ▶ Point to Point protocol
- ▶ Firewall
- ▶ Important network features
- ▶ E-Mail Administration
- ▶ IP v6 config
- ▶ Apache Web Server Config
- ▶ Active Directory
- ▶ Bash scripting
- ▶ Linux Security

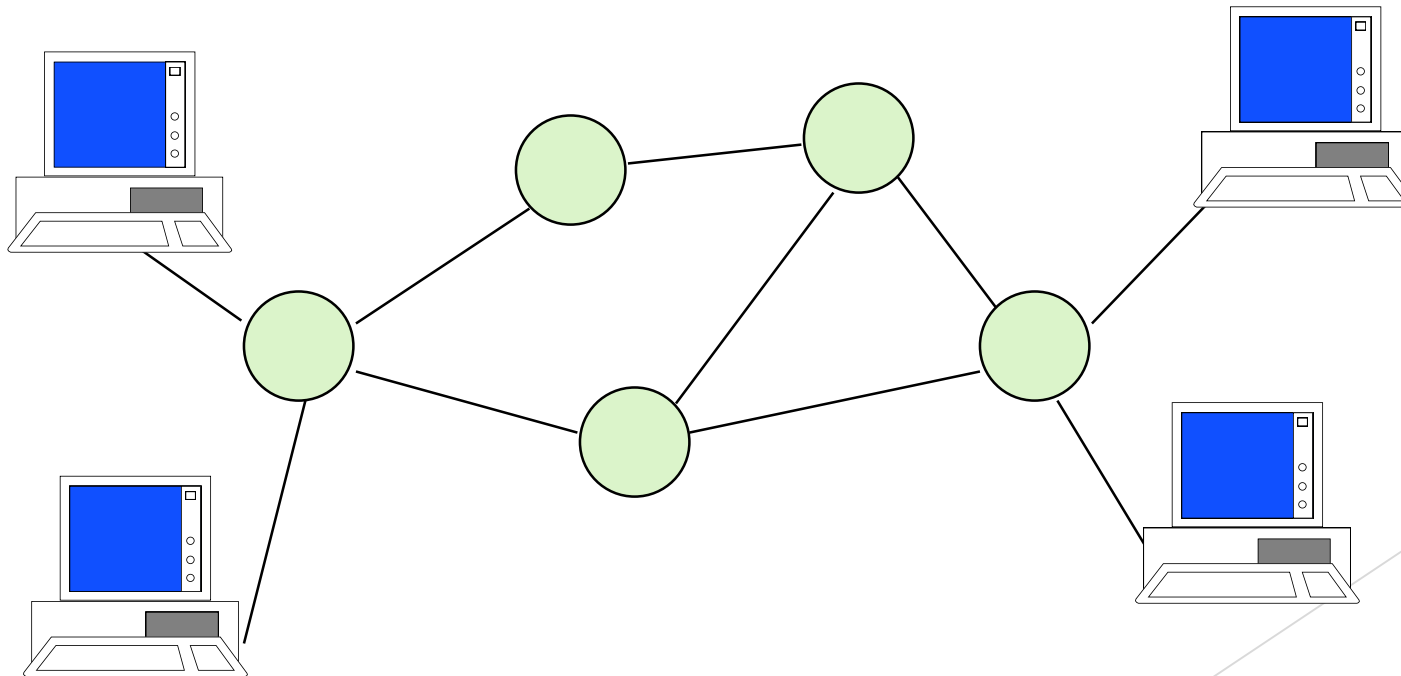
Types of Communication Networks

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

- ▶ Switching Networks
- ▶ Broadcast Networks

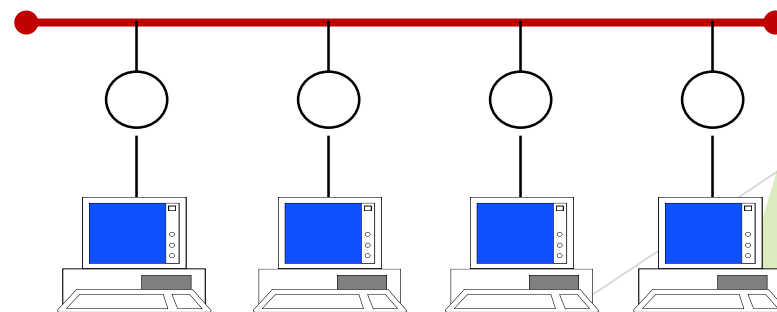
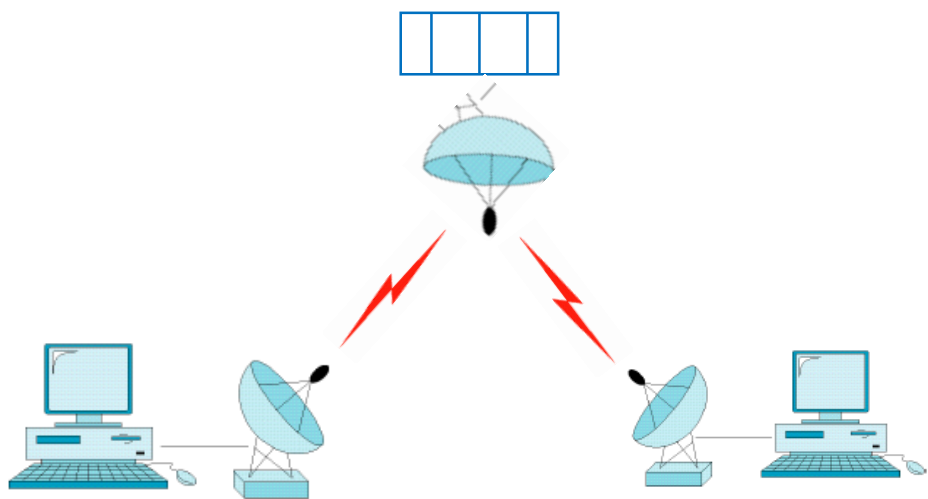
Switching Networks

- ▶ 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)

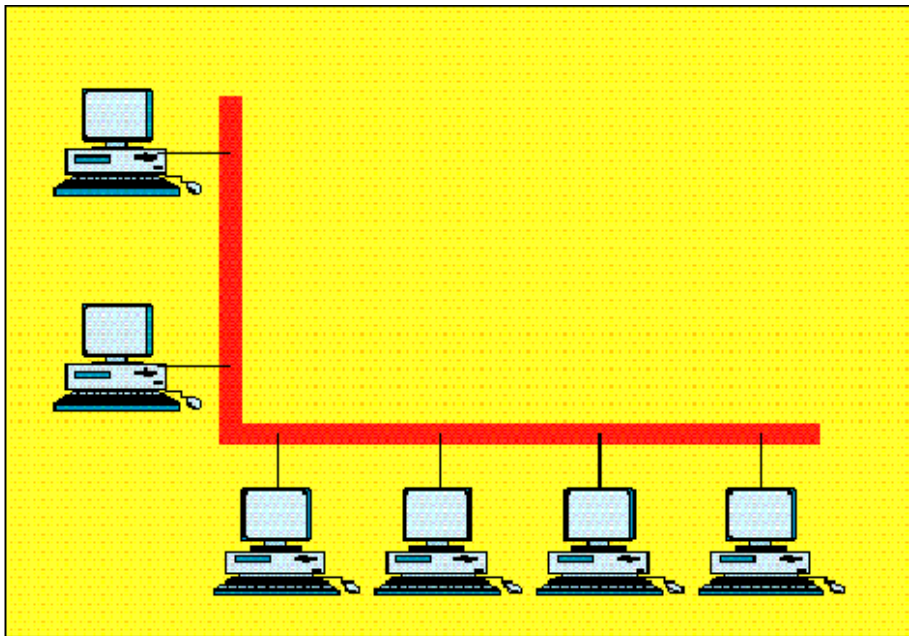
- ◆ Wide Area Networks (country, continent)
 - ▶ transmission lines, switching elements

- ◆ Personal Access Networks (PANs)
 - ▶ Bluetooth, IEEE 802.15.3

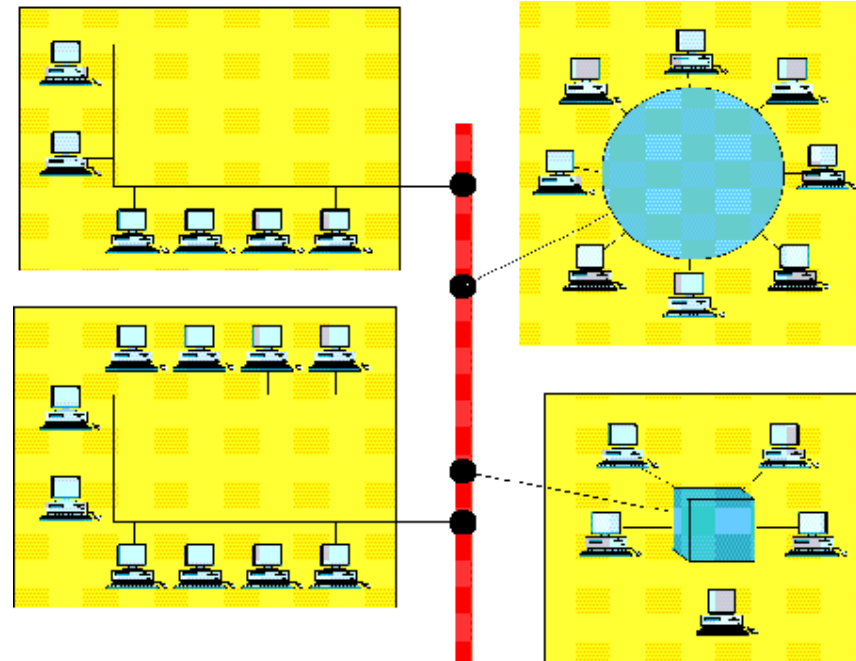
Local Area Networks (LANs)

- ▶ 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)



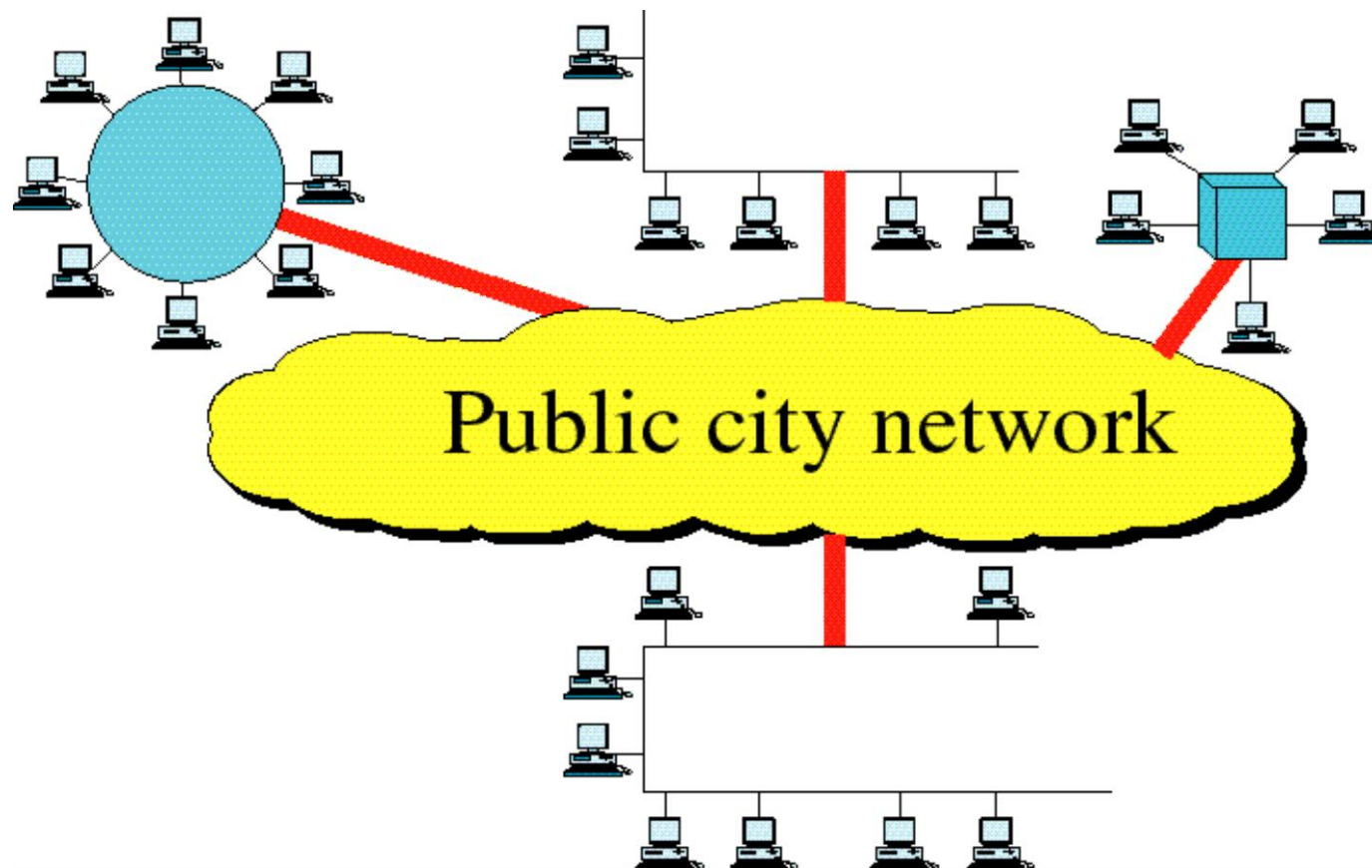
Single-building LAN



Multi-building LAN

Examples: home network, wireless-wired campus network

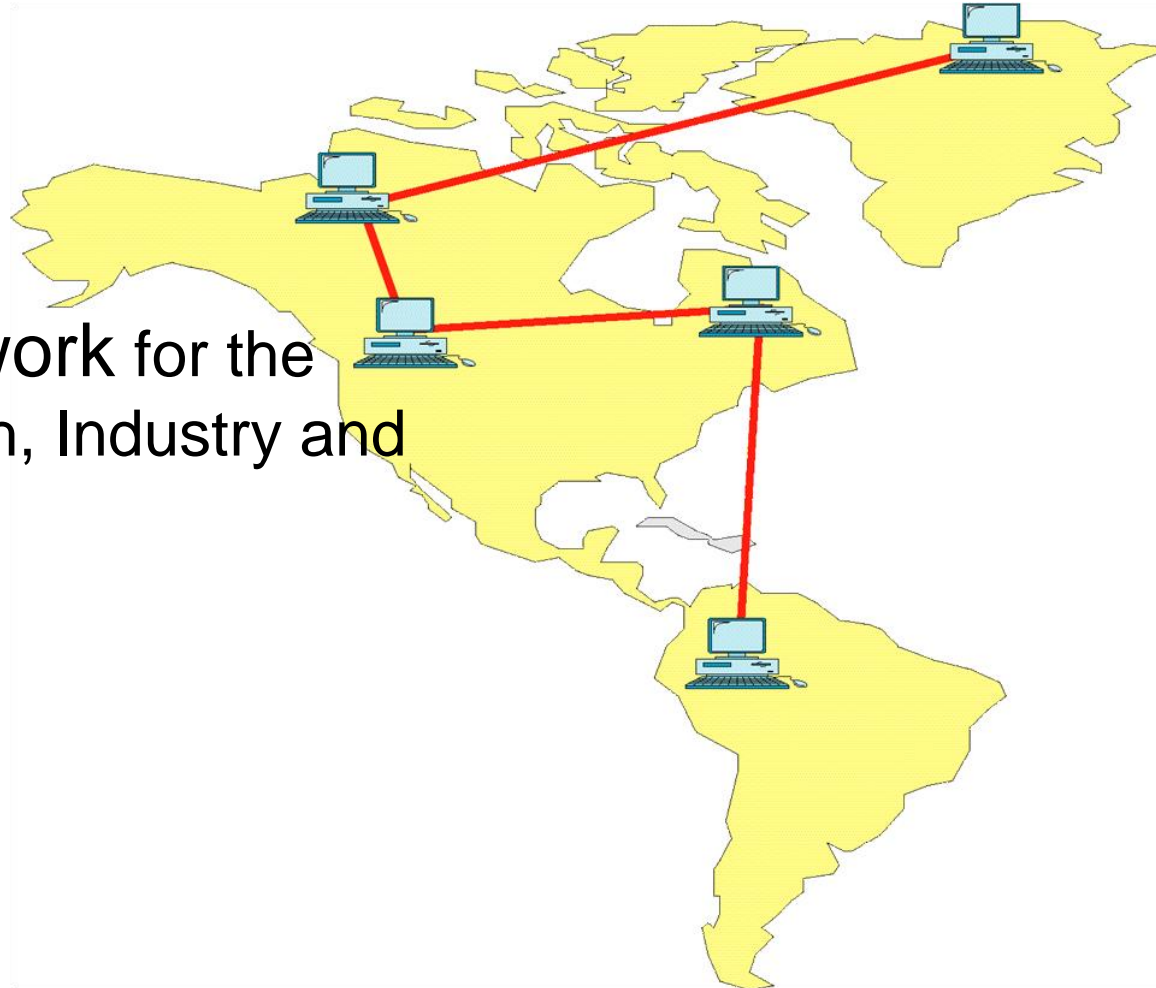
Metropolitan Area Networks (MAN)



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).



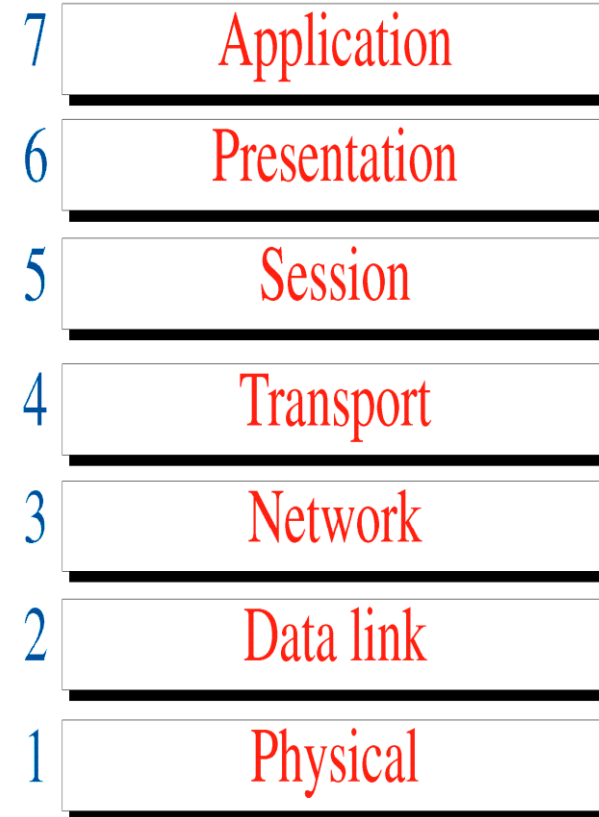
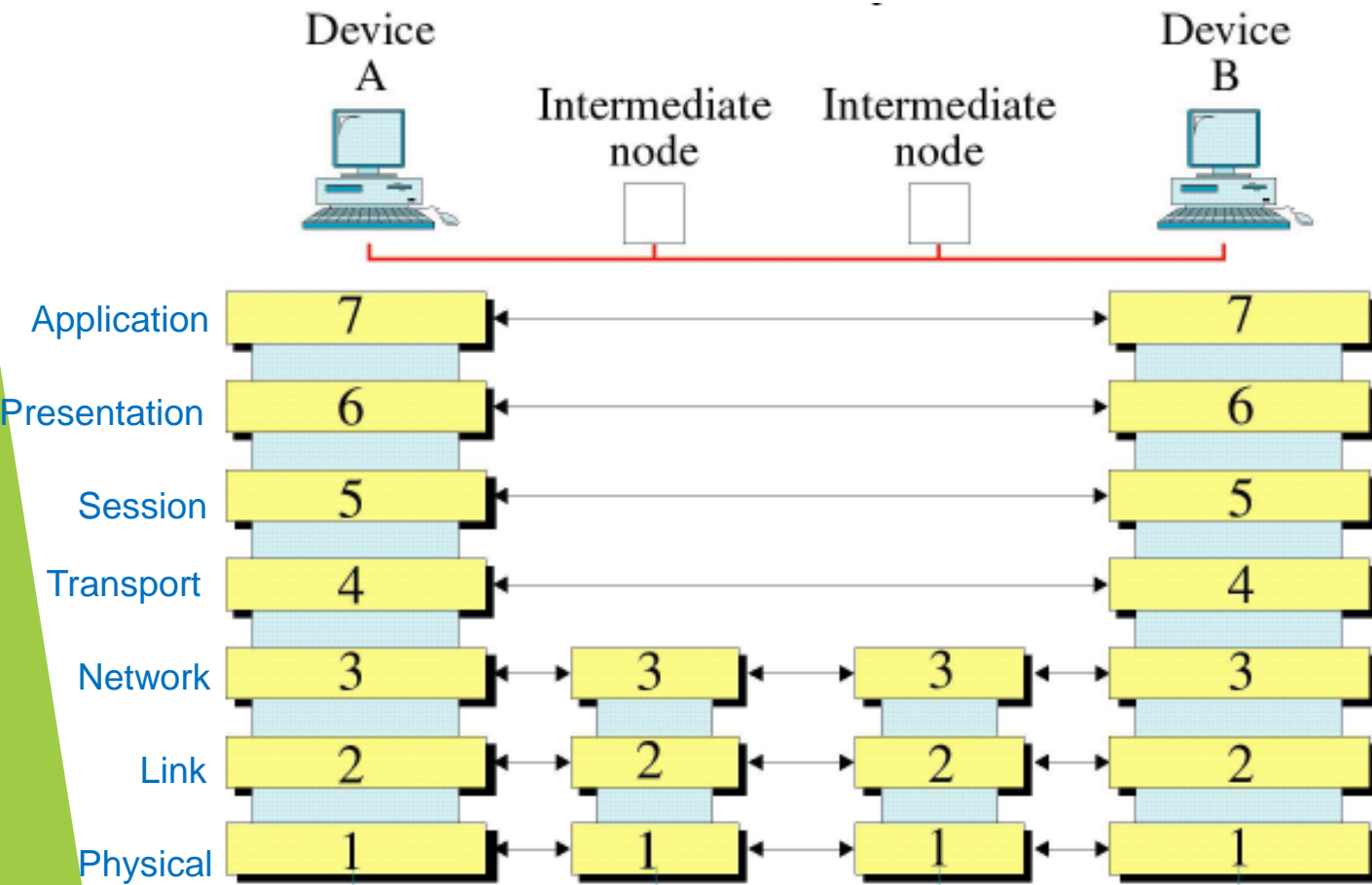
Wide Area Networks (WAN)

- ▶ Traditionally, WANs have been implemented using one of two technologies
 - ▶ Circuit Switching
 - ▶ Packet Switching
 - ▶ Datagram
 - ▶ Virtual Circuit

OSI Reference Model

- ▶ Open System Interconnection (OSI) Reference Model
 - Developed by the International Organization for Standardization (ISO).
 - Has become the standard model for classifying communication functions.
 - Has seven layers.
 - It is a “theoretical” system delivered too late!
 - It has NOT dominated. TCP/IP is the de facto standard.
 - Several reasons:
 - TCP/IP appeared earlier
 - Internet “won” the game
 - OSI has a “complex” structure that could result in “heavy processing”

OSI Model



Functions of the OSI Layers

▶ Physical

- ▶ The bits that are transmitted over the communication media.
- ▶ Deals with network hardware, bit encoding.
- ▶ Examples: copper, fiber, radio, satellite.

▶ Data Link

- ▶ Activates, maintains, and deactivates the physical link between two adjacent nodes (node-to-node delivery).
- ▶ Deals with framing, windowing, flow control, error detection and recovery.

▶ Network

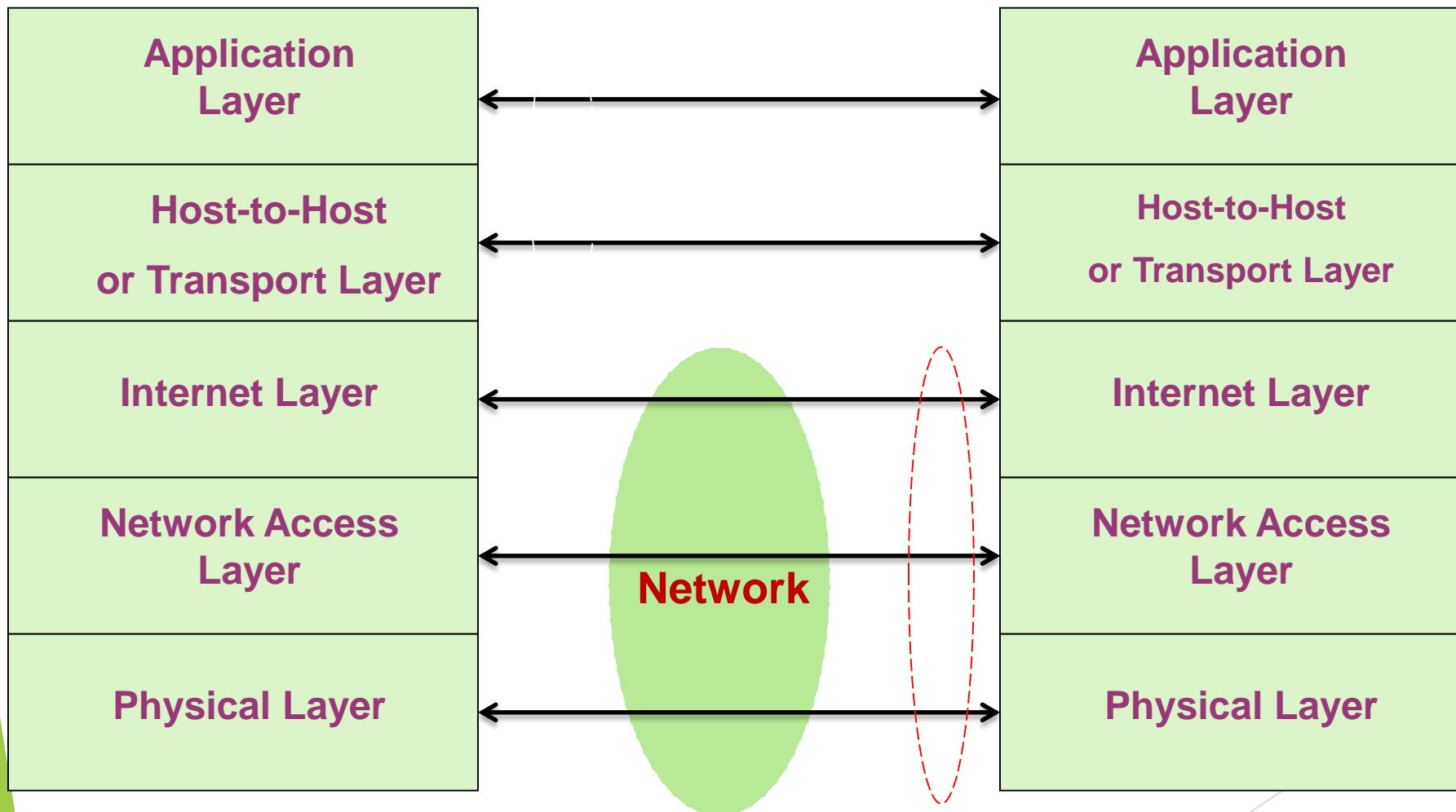
- ▶ Determines how best to route packets of data from source to destination via intermediate network nodes.
- ▶ Deals with addressing, routing, fragmentation, and congestion.

Functions of OSI Layers

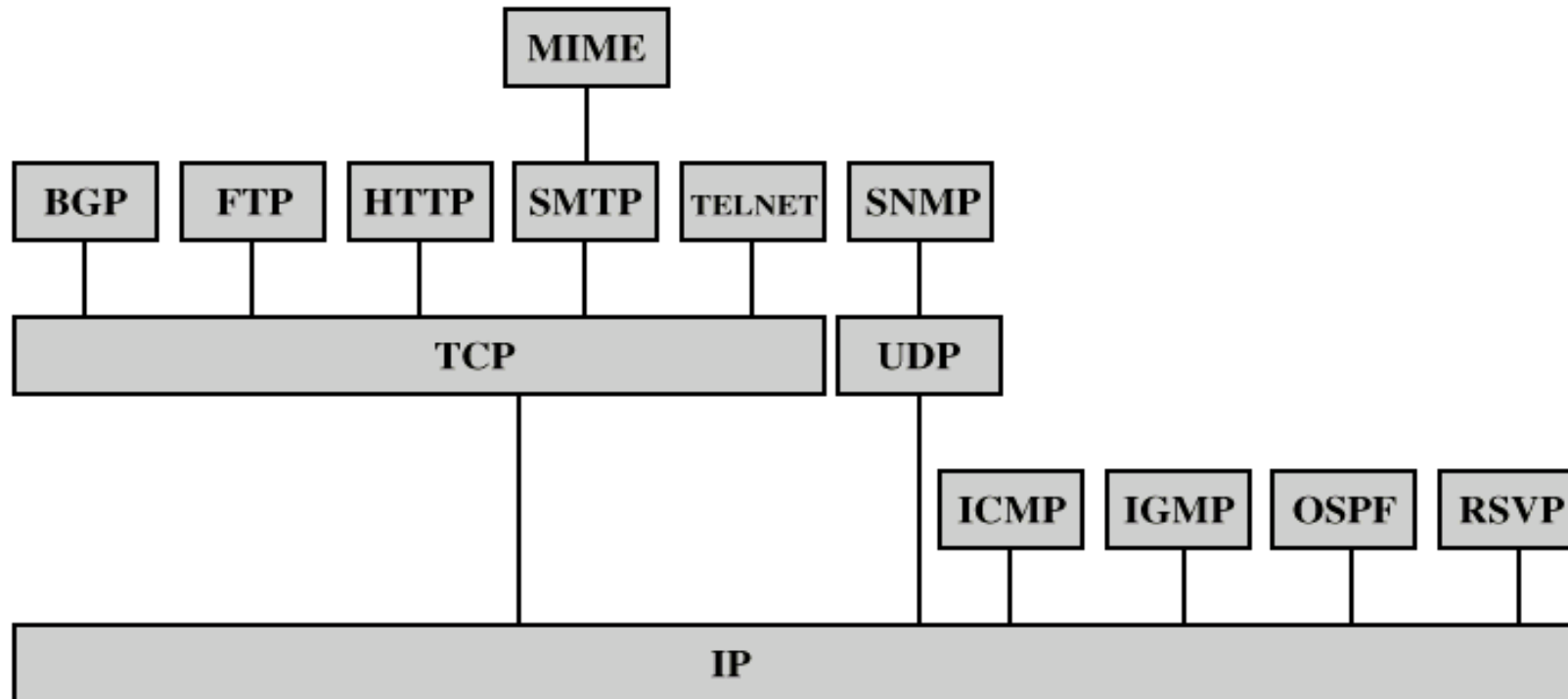
- ▶ **Transport**
 - ▶ Provides end-to-end message delivery and error recovery.
 - ▶ Deals with end to end integrity and quality of service.
- ▶ **Session**
 - ▶ To establish, manage, and terminate **sessions**.
 - ▶ Controls the dialogue between two host applications.
 - ▶ Reports exceptions to upper layers.
- ▶ **Presentation**
 - ▶ Resolves data representation differences.
 - ▶ To translate, encrypt, and compress data.
- ▶ **Application**
 - ▶ Perform functions to implement network applications.
 - ▶ E.g.; e-mail, teleconferencing.

TCP/IP Protocol Architecture

Application Layer	Contains the logic needed to support user applications (ftp, telnet, http etc.) Each application requires different module.
Host-to-Host or Transport	Concerned with the reliability of transmission/reception (error control, sequencing, flow control)
Internet Layer	Provides routing functions across multiple networks. It is implemented in <u>end-systems</u> and <u>routers</u>
Network Access Layer	Concerned with the exchange of data between end system and network (destination address, priority etc.) Depends on net. type
Physical Layer	Covers the physical interface between device (computer and transmission medium or network - medium, signals, data rates..)



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

Connecting Devices and the OSI Model

