

NETWORKING TECHNOLOGIES

(October 17, 2016)

BUS3500 - Abdou Illia, Fall 2016 1

LEARNING GOALS

- ❑ Identify the major hardware components in networks.
- ❑ Identify and explain the various types of computer networks.
- ❑ Identify the various types of transmission media
- ❑ Describe the role of software used in networks.

2

Why Networking ?

- ❑ **Resource sharing**
 - Sharing hardware (printers, processors, etc.)
 - Sharing software (programs, data files)
- ❑ **High reliability**
 - Could set automatic backup of programs and data at different locations
 - Fault tolerance (if one server is down, another provides service. If a disk fails, a mirror disk may be available)
- ❑ **Cost saving**
- ❑ **Communication tool**
 - Internal email service
 - Remote Access service

3

Computer Network

Once connected to the network, the computer (or another device) becomes a network **node**

- Two or more computers that are interconnected using network interface cards (NICs) and transmission media like coaxial cables, Ethernet cords, radio signals. (Textbook, p. 222).
- Its scope determines how big is a network



Network scope

- Local area network (LAN): computer network where the nodes are all in close proximity spanning a room, building
- Campus Area Network (CAN): a larger LAN that spans a college campus or corporate facility.
- Metropolitan area network (MAN): network that serves an area of 3 to 30 miles - approximately the area of a typical city.
- Wide area network (WAN): a large network that encompasses parts of states, multiple states, countries, and the world

5

Transmission Media

Physical
Wireless

- Physical media
 - Transmission media used to physically connect nodes to the network
 - Transmits electrical or optical signals
 - Could be copper wire or fiber optic cable

Type	Picture	Description
Twisted pair		Copper wire twisted into pairs
Coaxial cable		Single copper wire surrounded by insulation and metallic mesh
Fiber optic cable		Glass fiber strands coated with metal send light signals

6

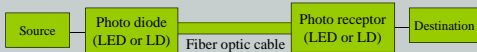
Transmission Media (Continued)

Twisted Pair

Category	Use	Signal	Data rate	Distance	Problem
Category 1	Telephone	Analog/Digital	<100Kbps	3-4 miles	Security, noise
Category 2	T1, ISDN	Digital	<2 Mbps	3-4 miles	Security, noise
Category 3	LANs	Digital	10 Mbps	100 m	Security, noise
Category 4	LANs	Digital	20 Mbps	100 m	Security, noise
Category 5	LANs	Digital	100 Mhz	100 m	Security, noise
Category 6	LANs	Digital	250 Mhz	100 m	Security, noise
Category 7	LANs	Digital	600 Mhz	100 m	Security, noise

Fiber optic

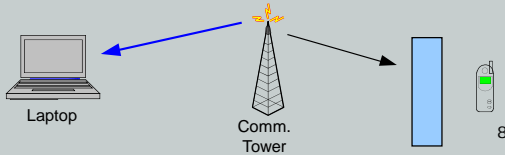
- Thin glass fibers surrounded by coating
- Uses laser or light for data transmission
- Very fast (10+ Gbps, 100 miles without any repeater)
- Very secure



7

Wireless Media

- Uses electromagnetic waves or electromagnetic radiation for data transmission
- Propagation through space, and indirectly, through solid objects
- Two kinds of wireless media used
 - Radio waves (radio Frequency)
 - Affected by Multipath interference
 - Highly vulnerable to snooping
 - Limited distance
 - Blocked by thick objects
 - Infrared light
 - Close proximity and "line of sight" location required

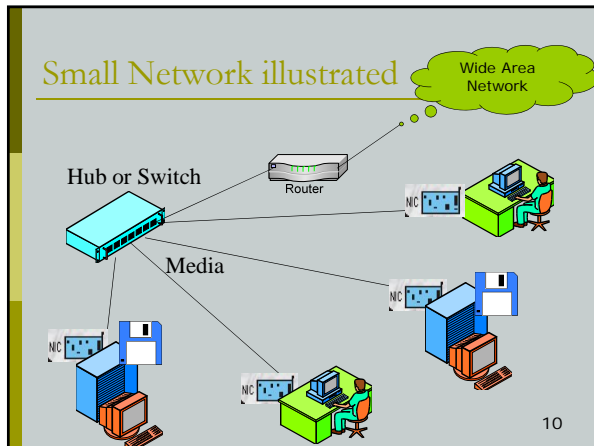


8

Computing Equipment

- Network interface card (NIC): Device that
 - provides a computer with unique address
 - Converts data into signal for transmission
- Hub / Switch: Central collection point for transmission media that interconnect computers
- Modem
 - Converts digital data into analog signal and back again
- Router
 - special hardware that determines optimal routing path for data packets
 - Usually used to connect a LAN to a WAN
- Bridge
 - Forwards messages between LANs

9

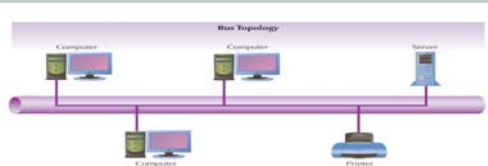


- ### Network Software
- Network operating system
 - Used on servers
 - Used for managing network resources
 - Examples: Novell NetWare, Windows Server 2003
 - Workstation operating system
 - Used on client PCs
 - Used to manage local resources & access network resources
- 11

- ### Network Topologies
- The configurations of network components
 - How physically the network looks like
 - How logically data is transferred on the network
 - Types of network topologies:
 - Bus
 - Star
 - Ring
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- The diagram shows three network topologies: Bus (a central line with nodes), Star (a central node with lines to other nodes), and Ring (nodes connected in a closed loop). The number 12 is in the bottom right corner.

Bus Network Topology

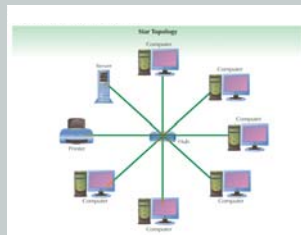
- ❑ Most simple network topology
- ❑ All devices connected to a common central cable called a "bus"
- ❑ Inexpensive
- ❑ If cable fails, the entire network will shut down



13

Star Network Topology

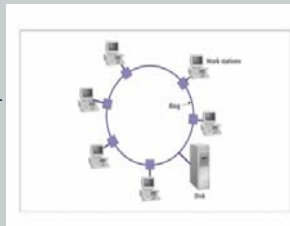
- ❑ Centered around central device called a **hub** or a **switch**
- ❑ All network nodes connect to the hub/switch
- ❑ Easy to install and update
- ❑ If hub fails, network fails



14

Ring Topology

- ❑ Node connected to a logical ring in a central device called MAU
- ❑ More reliable than bus or star
 - Only one node sends at a time (no collisions)
- ❑ Expensive and limited speed



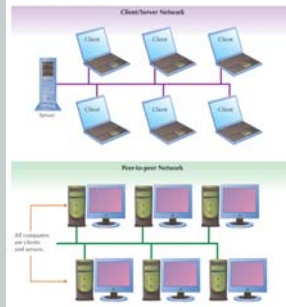
15

Network Architectures/Models

- Defines how the processing takes place on the network

- Two primary models

- Client-server
- Peer-to-peer (P2P)



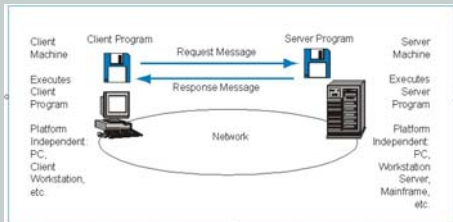
Client-server model

- Nodes are **either clients or servers**
- Clients use services
- Servers provide services
 - File service
 - E-mail service
 - Printing service
 - Database service
- Client software on client node cooperates with server software on server node
 - The WWW is the largest client server application

17

Client-server model

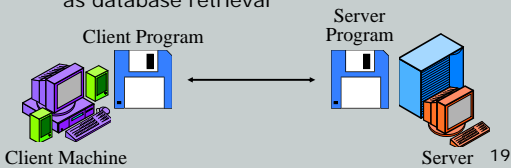
- Collaboration between Client and Server program



18

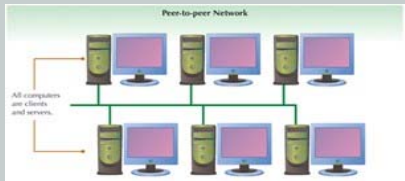
Client-server model

- Division of Labor
 - *Client program handles lighter work*, such as user interface chores and light processing chores
 - *Server program handles heavy work*, such as database retrieval



Peer-to-Peer model

- All nodes on the network are equal.
- Any node can be both a client and a server.



20

Summary Questions

	Book	Notes
1) Name categories of computer networks based on their scope; i.e. their range of operation		5
2) Name one example of: (a) WAN, (b) LAN		
3) Name physical and wireless media used in networking		6-8
4) What is the role of (a) a modem, (b) a router, (c) a bridge?		9
5) What is the difference between a Network operating system and a workstation operating system?		11
6) What is a network topology?		12
7) Distinguish between network topologies		13-16
8) Distinguish between Client-server and P2P networks		18-21

21
