



Introduction to Networking & Telecommunications

(August 24, 2016)

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Meaning of star symbols

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- Something to which you should pay special attention. 
- Multiple stars are for especially important or difficult material 

Learning Objectives 3

You should be able to describe basic Networking Concepts in wide use today:

- *Basic terminology* of computer networks
- *Voice and Video Communications Versus Data Communication*
- *Circuit Switching Versus Packet Switching*
- Components of a computer network

Computer Network 4

- An interconnection of computers and computing equipment using either wires or radio waves over small or large geographic distances ★

The diagram illustrates a network with five nodes: ABC, DEF, GHI, MNO, and JKL. Nodes ABC, MNO, and JKL are represented by desktop computers, while DEF and GHI are server racks. A red arrow originates from node ABC and points towards node GHI, with the text "Connect to GHI" written below it. All nodes are enclosed within a light blue oval boundary.

Computer Network 5

- Local area network - networks that are small in geographic size spanning a room, building, or campus ★
- Metropolitan area network - networks that serve an area of up to 40 miles - approximately the area of a typical city
- Wide area network - a large network that encompasses parts of states, multiple states, countries, and the world ★

Why Networking ? 6

- **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

The Language of Computer Networks ⁷

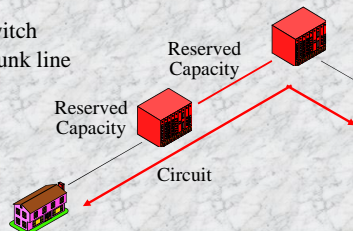
- Voice network - a network that transmits telephone signals
- Voice communication - Transmission of **analog data** (specifically spoken words) usually between people
- Telecommunication - the study of telephones and the systems that transmit telephone signals
- Data network - a network that transmits **computer data**
- Data communication - the transfer of **digital or analog data** using **digital or analog signals** ★ ★

Voice & Data Communication ⁸

- Originally, There was a Sharp Distinction:
 - *Voice Communication*
 - *Data Communication*, in which one or both parties is a computer ★
 - Database
 - Electronic mail
 - World Wide Web
- Distinction is fading because voice communication is increasingly computer-based

Circuit Switching and Reserved Capacity ⁹

- Circuit capacity is reserved during duration of each call
- At each switch
- On each trunk line



Pros and cons of Reserved Capacity

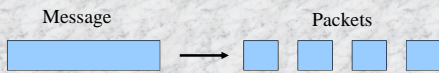
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- Nothing like the congestion on the Internet
- Reserved Circuit Capacity is Expensive
 - ★ - Have to pay for it whether you use it or not
 - Good for voice, because conversations are fairly constant ★
 - ★ ★ - Bad for data, because most data transmission is *bursty*; e.g., in World Wide Web, download, then stare at screen for a long time until next download

Packet-Switching Data Networks

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- Packet Switching
 - ★ - Large messages are broken into small pieces called *packets* (or *frames*)
 - Packets are short (averaging a few hundred bytes) because networking devices handle short messages more efficiently



Packet-Switching Data Networks

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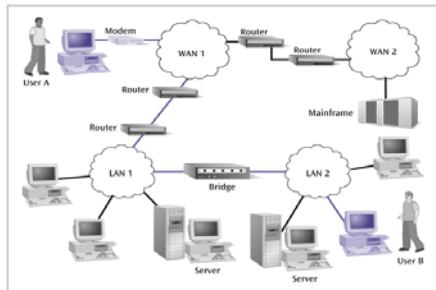
- Multiplexing
 - Packets from many conversations are mixed (*multiplexed*) over each trunk line



The Big Picture of Networks

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Figure 1-1
An overall view of the interconnection between local area networks and wide area networks



The Big Picture of Networks

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Workstations

PCs or terminals used to receive services from the Network



Servers

Computers that store the Network software and shared or private user files



Bridges

Connecting devices between separate LANs

Routers

Connecting devices between LANs and WANs



Nodes

Any computer (or computing device) connected to a network.

hubs (or switches)

Collection points for wires that interconnect Workstations

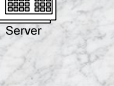
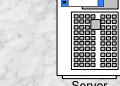
Elements of a Simple LAN

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Hub or Switch

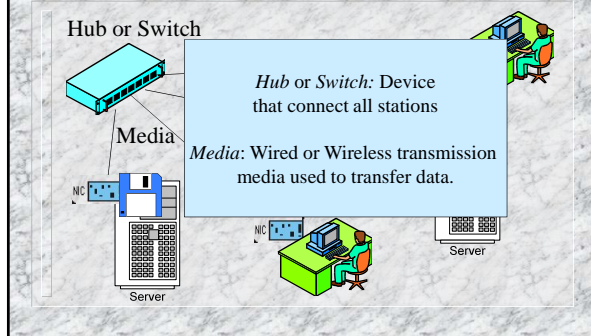
Media

Server



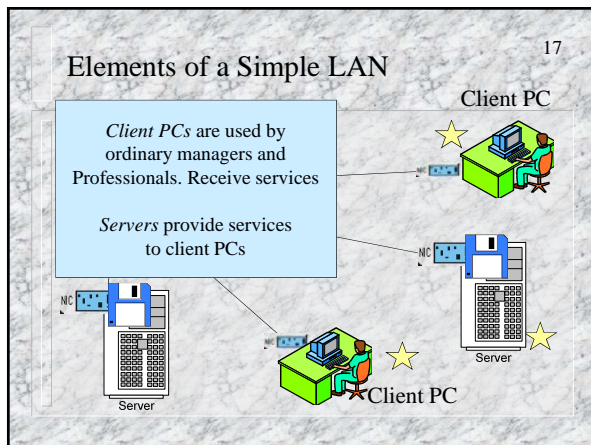
Elements of a Simple LAN

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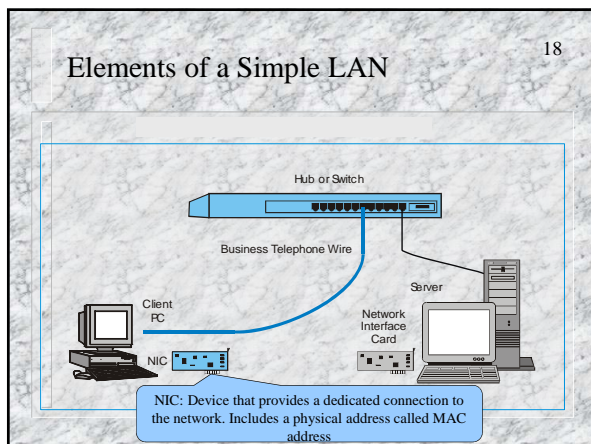
Elements of a Simple LAN

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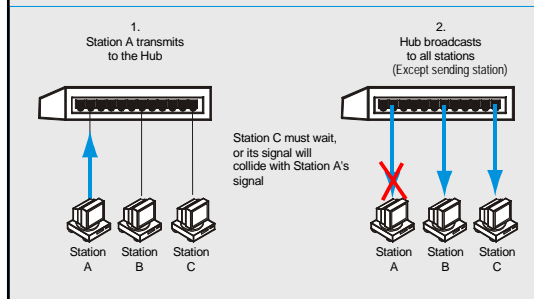
Elements of a Simple LAN

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Hub operation

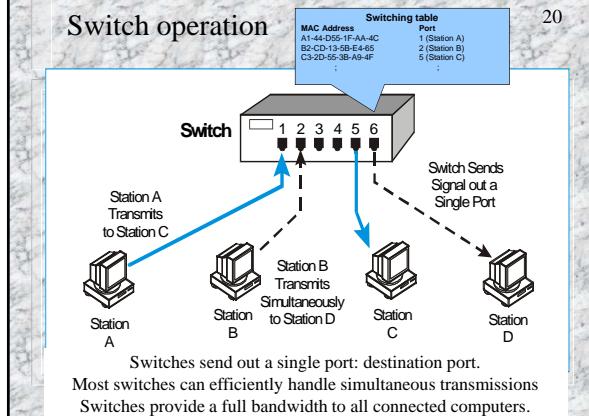
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Hubs split available bandwidth among computers, i.e. with a 100 Mbps hub, the network speed will be $100 \text{ Mbps} / n$ (where n is the number of computers)
Active hubs include repeater capabilities for regenerating signals.
Passive hubs don't regenerate signals. Limited to a 30meter distance apart from computers.

Switch operation

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Switches send out a single port: destination port.
 Most switches can efficiently handle simultaneous transmissions
 Switches provide a full bandwidth to all connected computers.

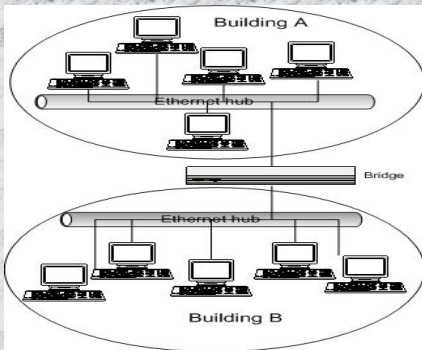
Summary Questions

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- | | |
|----------------------------------------------------------------|-----------------------|
| a) Define the following: | |
| - Computer Network | - Data communications |
| - Voice Network | |
| | 4,7 |
| b) Distinguish between voice and data communications. | 8 |
| c) Distinguish between circuit switching and packet switching. | 9-12 |
| d) List and explain the elements of a Simple Network | 15- |

Summary Questions (cont.)

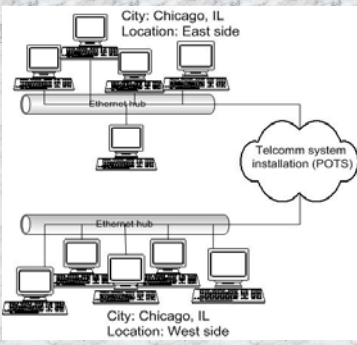
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What category of network is illustrated here?

Summary Questions (cont.)

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What category of network is illustrated here?
