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Networks and Telecommunications

Chapter 10

Applying Telecommunications in Business

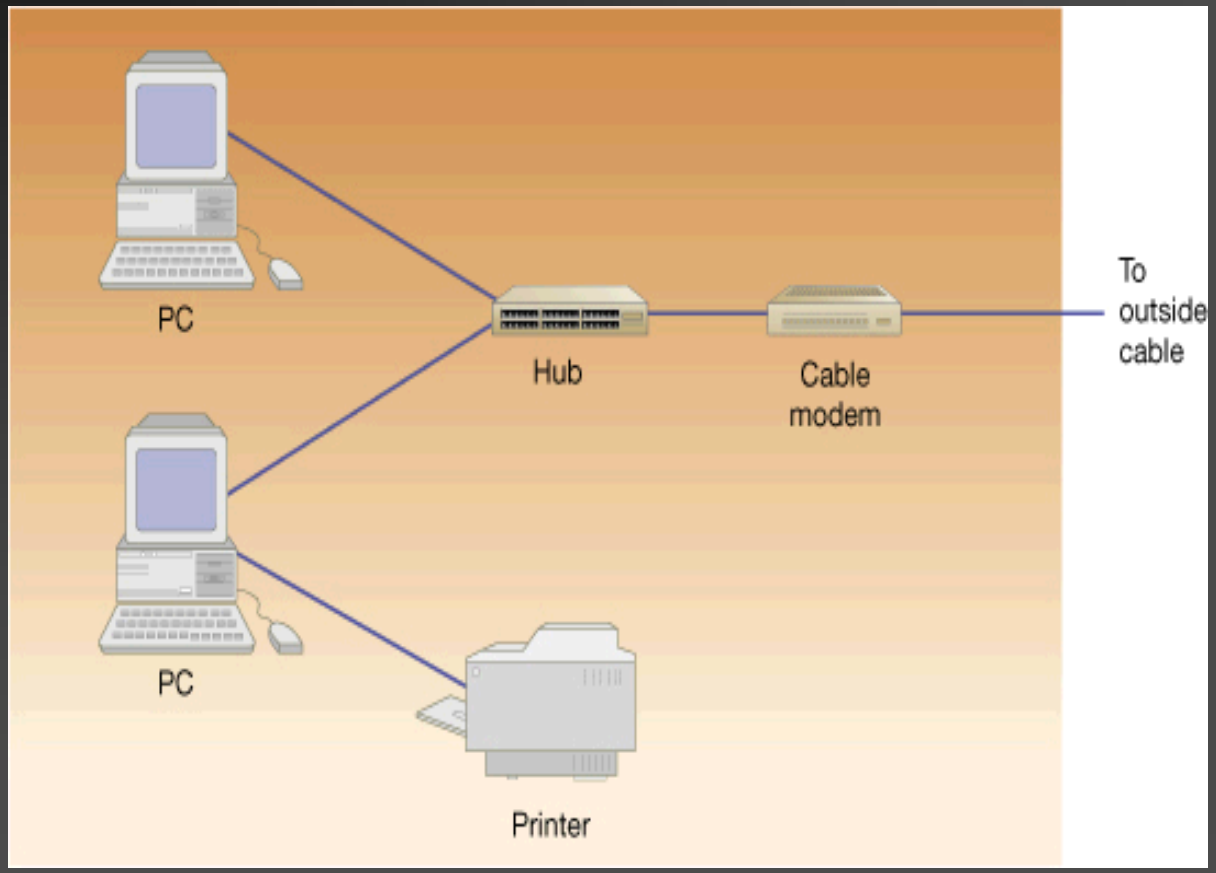
TELECOMMUNICATIONS – the transmission of data between devices in different locations

Vital Role of Telecommunications in E-Business

- Telecommunications essential to:
  - E-retailers
  - E-marketplaces
  - Internet content providers
  - Internet service providers (ISPs)
  - Application service providers (ASPs)
  - Telephone and cable companies
  - Telecommunication equipment manufacturers
  - Internet and telecommunications software firms

Types of Networks

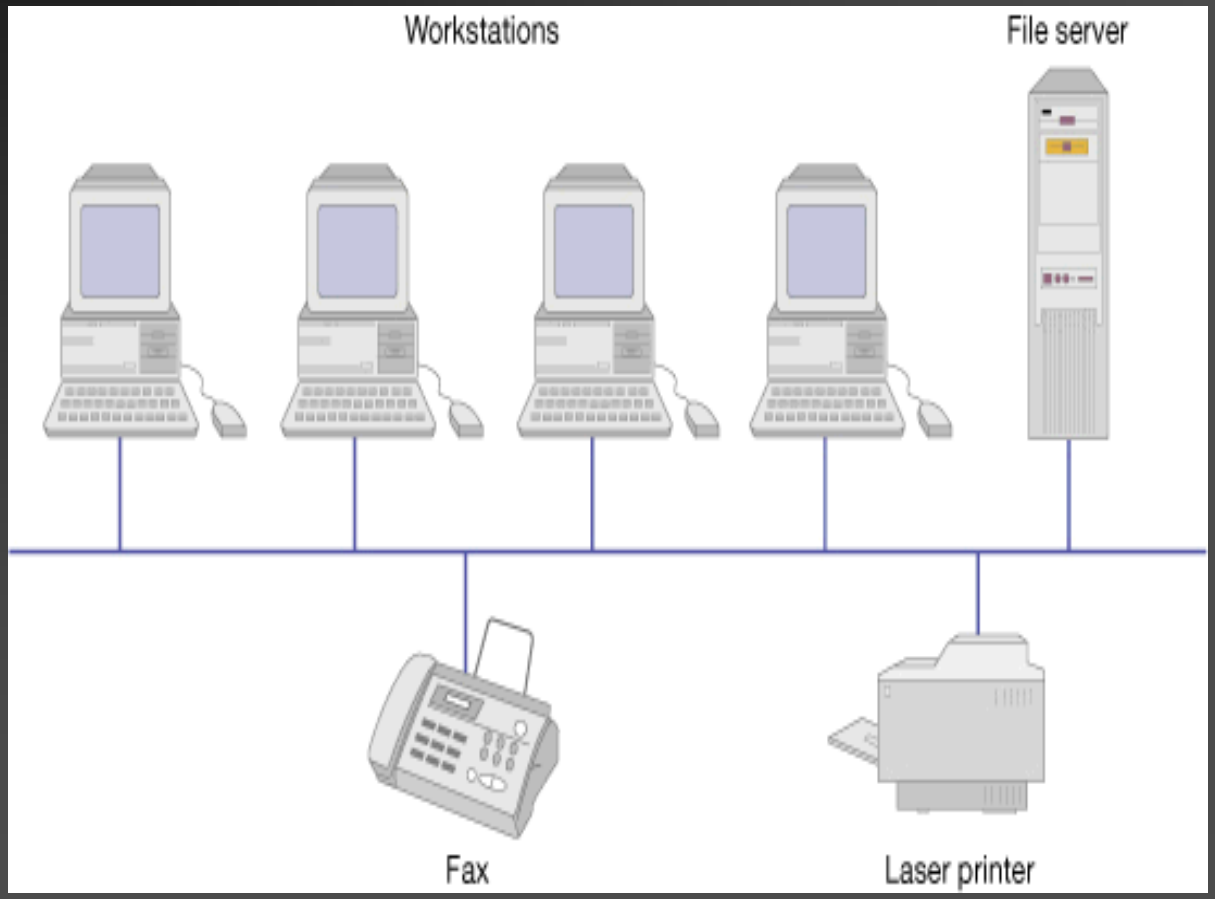
A Typical Home Network Figure 10.3



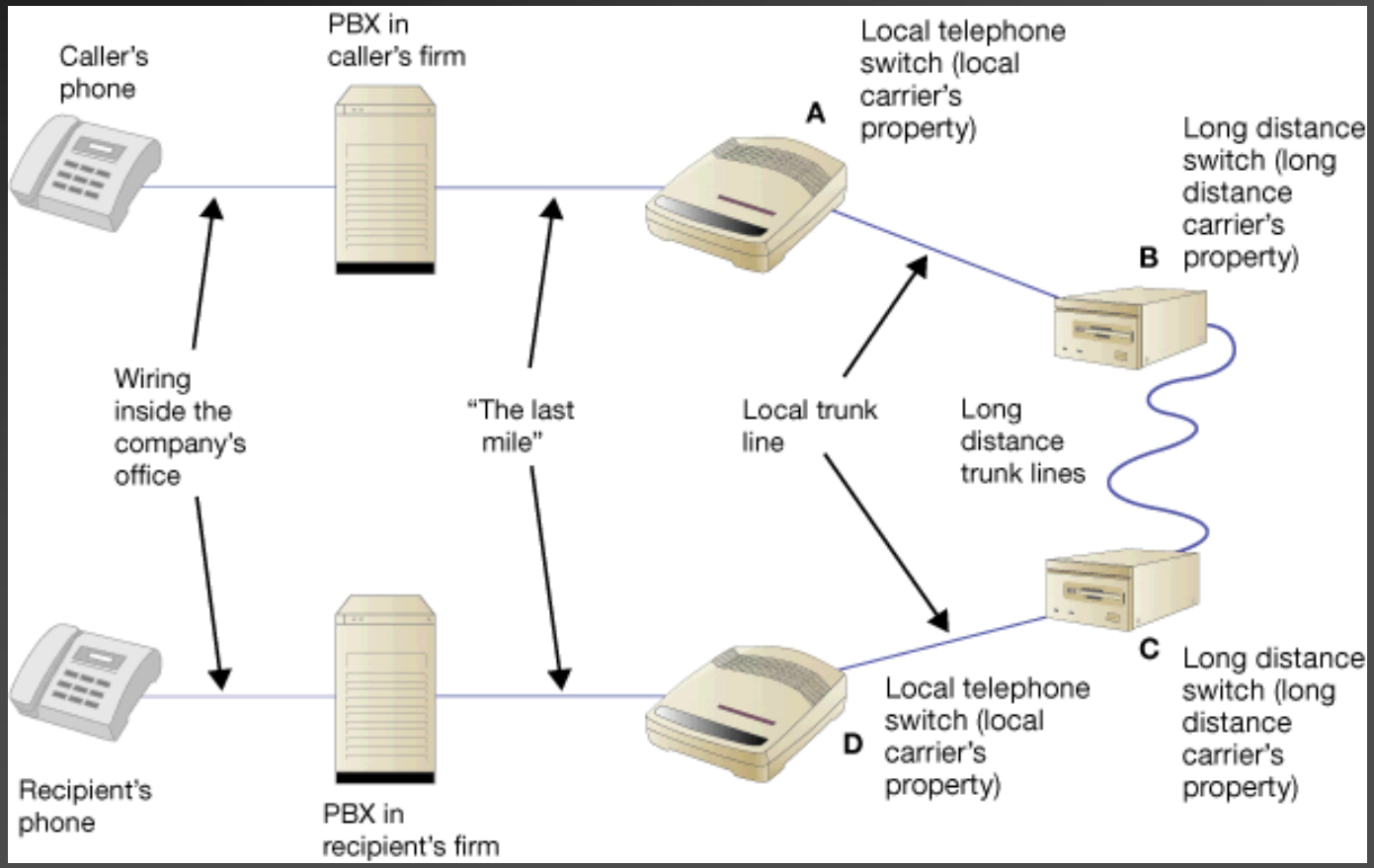
A Local Area Network (LAN) in a Business

- LANs connect PCs and other equipment within a local area
- Benefits:
  - Sharing equipment
  - Sharing personal files
  - Sending messages
  - Sharing databases
  - Administering software
- Usually wired, but may also be wireless

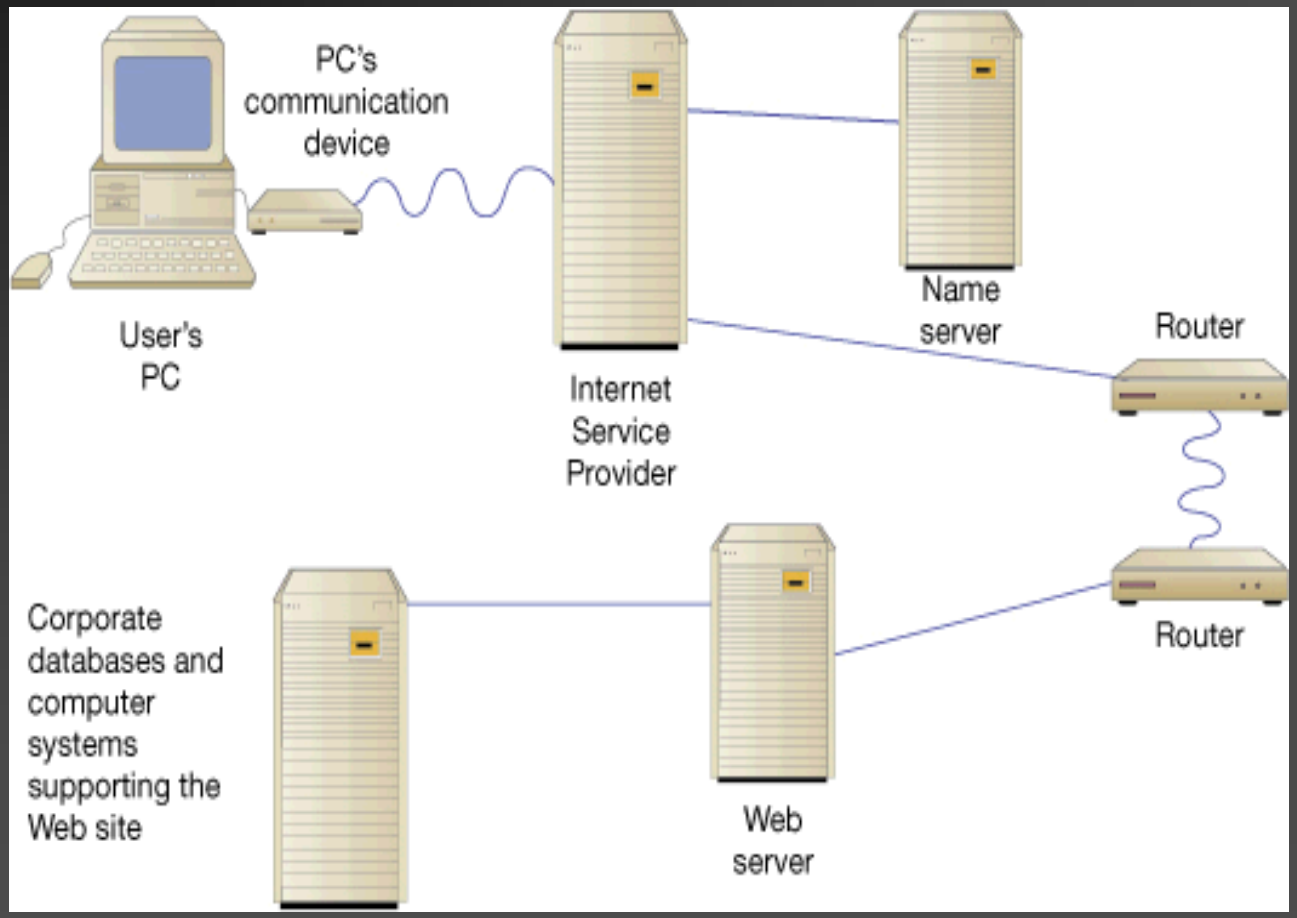
Figure 10.4



A Telephone Network: Figure 10.6



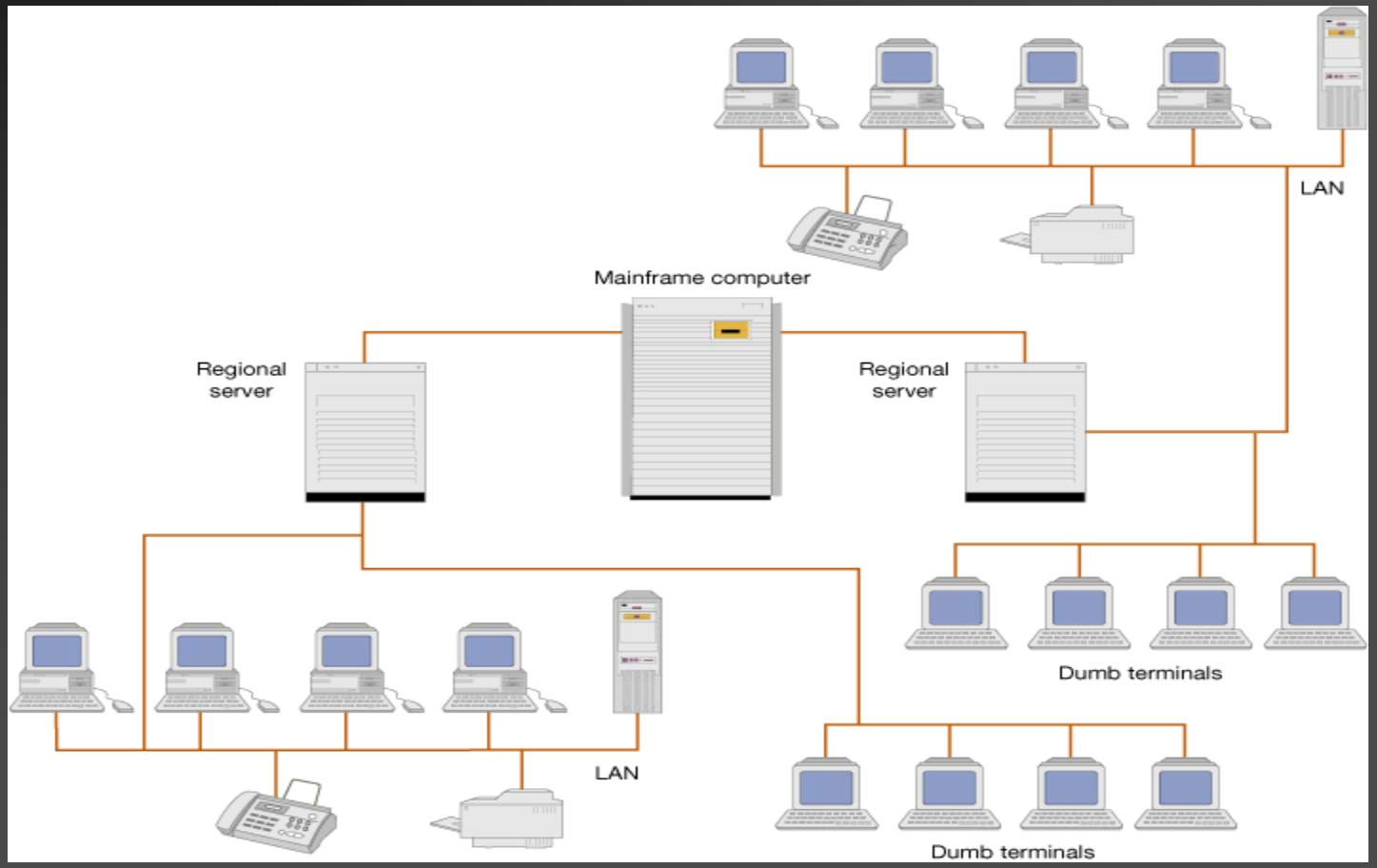
The Internet (From a User's Viewpoint): Figure 10.7



A Wide Area Network (WAN)

- WANs are networks that span a wide geographical area
- Many uses, e.g.,
  - Form the communication backbone for large distributed organizations
  - Focus on particular transaction processing application(s)
  - Transfer and consolidate corporate data, etc.

Figure 10.8


LAN
Mainframe computer
Regional server
Regional server
Dumb terminals
LAN
Dumb terminals

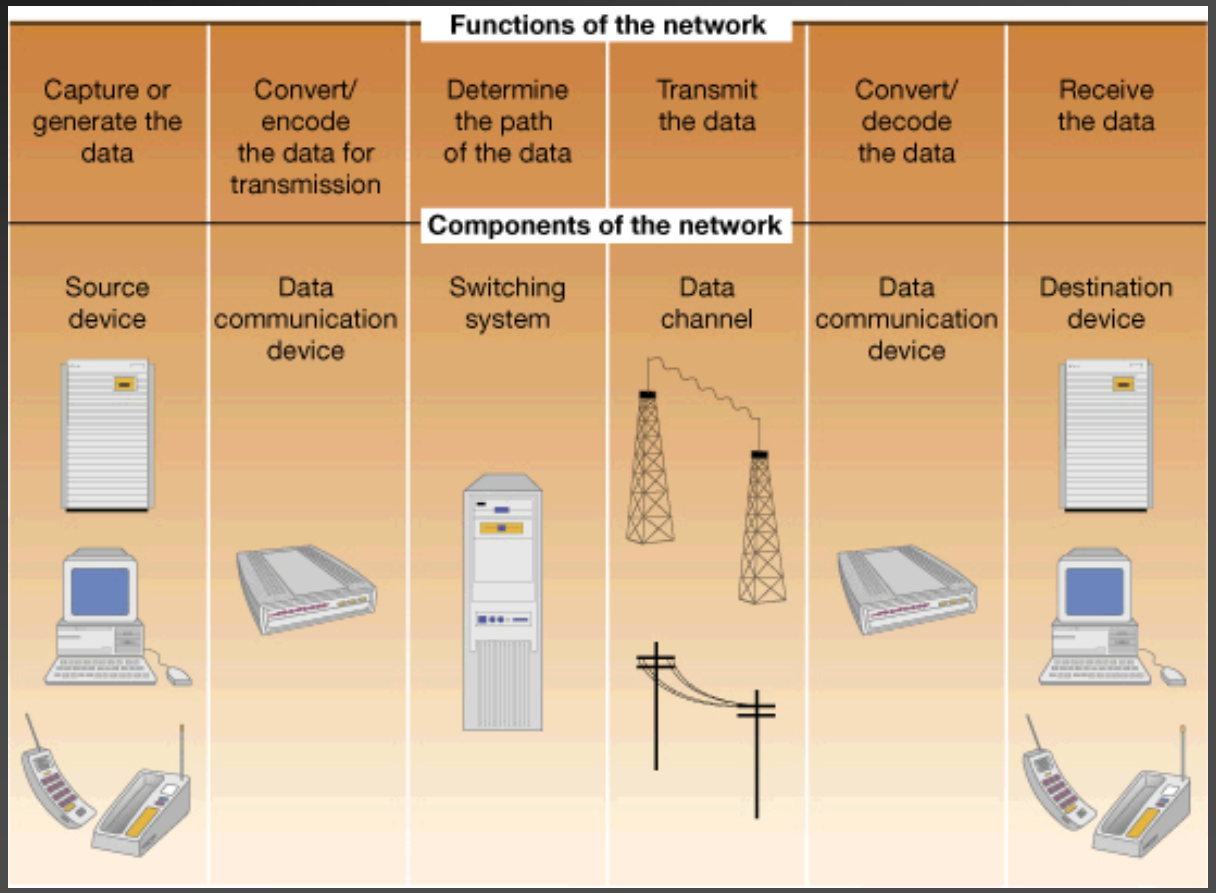
Functions and Components of Telecommunication Networks

Basic Terminology

- ***Network*** = a set of devices and communications channels
  - Devices are called **nodes**
- ***Connectivity*** = the ability to transmit data between devices at different locations
- ***Switching*** = the process of directing a signal from its source to its destination

- ***Channel*** = a path along which data are transmitted
  - Wired or wireless
- ***Decoding*** = converting the data back into their original form upon arrival at its destination
- ***Network management*** = the process of monitoring the network's operations, detecting and repairing faults, and balancing traffic

Figure 10.9


Functions of the network
Capture or generate the data
Convert/ encode the data for transmission
Determine the path of the data
Transmit the data
Convert/ decode the data
Receive the data
Components of the network
Source device
Data communication device
Switching system
Data channel
Data communication device
Destination device

Generating and Receiving Data

- An ever increasing number of different types of devices can be connected to a network
  - General purpose
  - Special purpose
- ***Front-end processor*** – a specialized computer that handles network traffic for another computer
  - Improves the efficiency of the overall system

Transmitting Analog versus Digital Data

- Data transmission requires that ***data*** be encoded as electrical or optical ***signals***, and then decoded at destination
- Two important factors:
  - Are the original data analog or digital?
  - Are the data transmitted in analog or digital form?

- Analog data, analog signal
  - Original signal added to a *carrier signal*
  - Used for voice communication
- Analog data, digital signal
  - Data must be digitized
  - The digitized data are only an approximation of the original
    - The quality depends on the precision of the digitizing process

- Digital data, analog signal
  - Must use a modem at each end
    - Superimposes a pattern of 0s and 1s on the carrier signal
- Digital data, digital signal
  - Modems are no longer needed
  - *Digital subscriber line (DSL)*

- Significance of analog vs. digital transmission
  - Digital technology improves the quality of the transmission
  - Digital coding allows for error detection and correction
  - Digital data can be readily manipulated
    - High definition television (HDTV)

Circuit Switching vs. Packet Switching

- **CIRCUIT SWITCHING**:
  - The method used in telephone networks
  - Sets up a temporary circuit between the source and the destination
  - Resources are reserved for the duration of the session (call)

- **PACKET SWITCHING:**
  - Appropriate when data are transmitted infrequently from a large number of nodes
    - Used on the Internet
  - The message is divided into packets containing control information
    - No circuit is established
  - Provides better sharing of resources
    - Multiple users share the same resources

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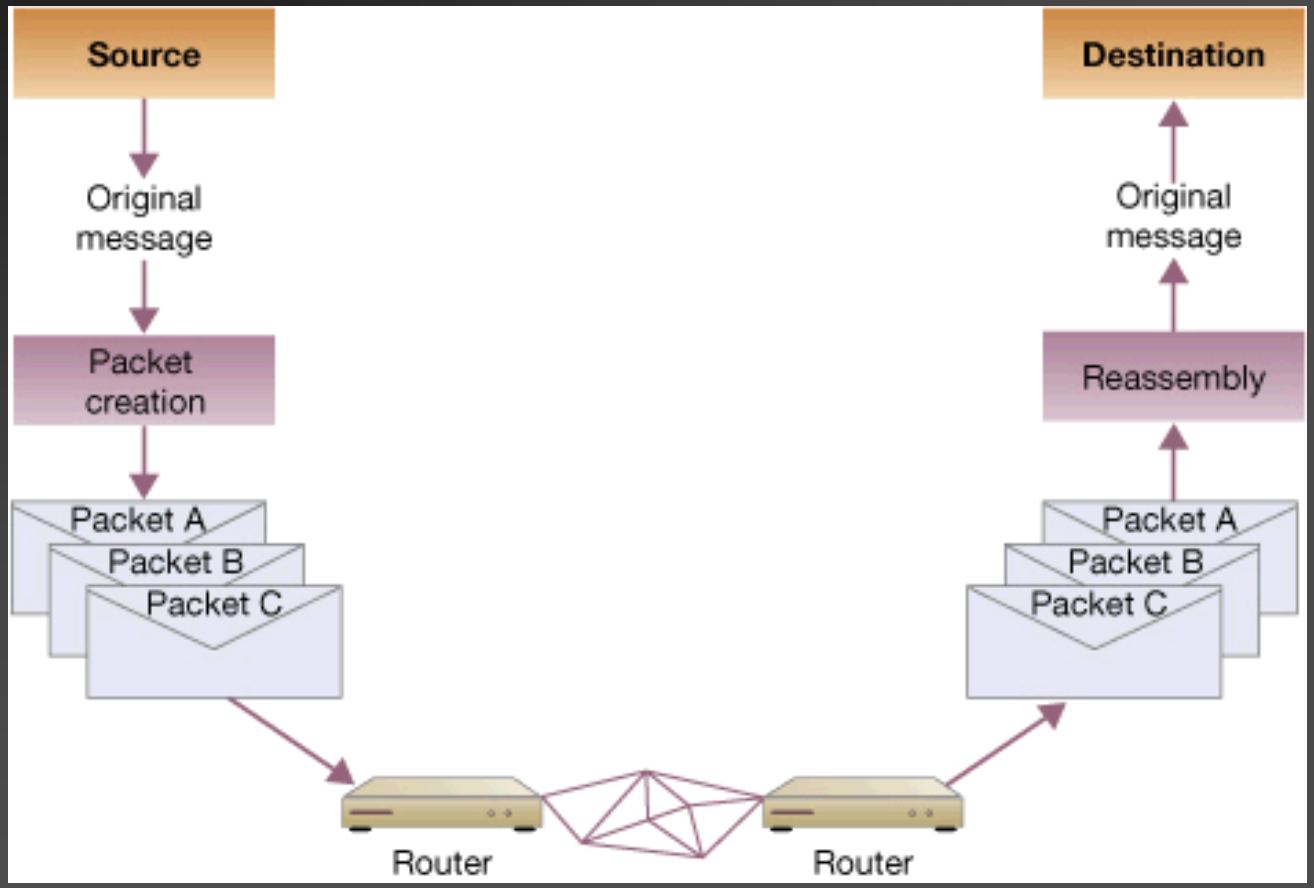
Figure 10.13


Source
Original message
Packet creation
Packet A
Packet B
Packet C
Destination
Original message
Reassembly
Packet A
Packet B
Packet C
Router
Router

Transmitting Data Through Wire and Wireless Media

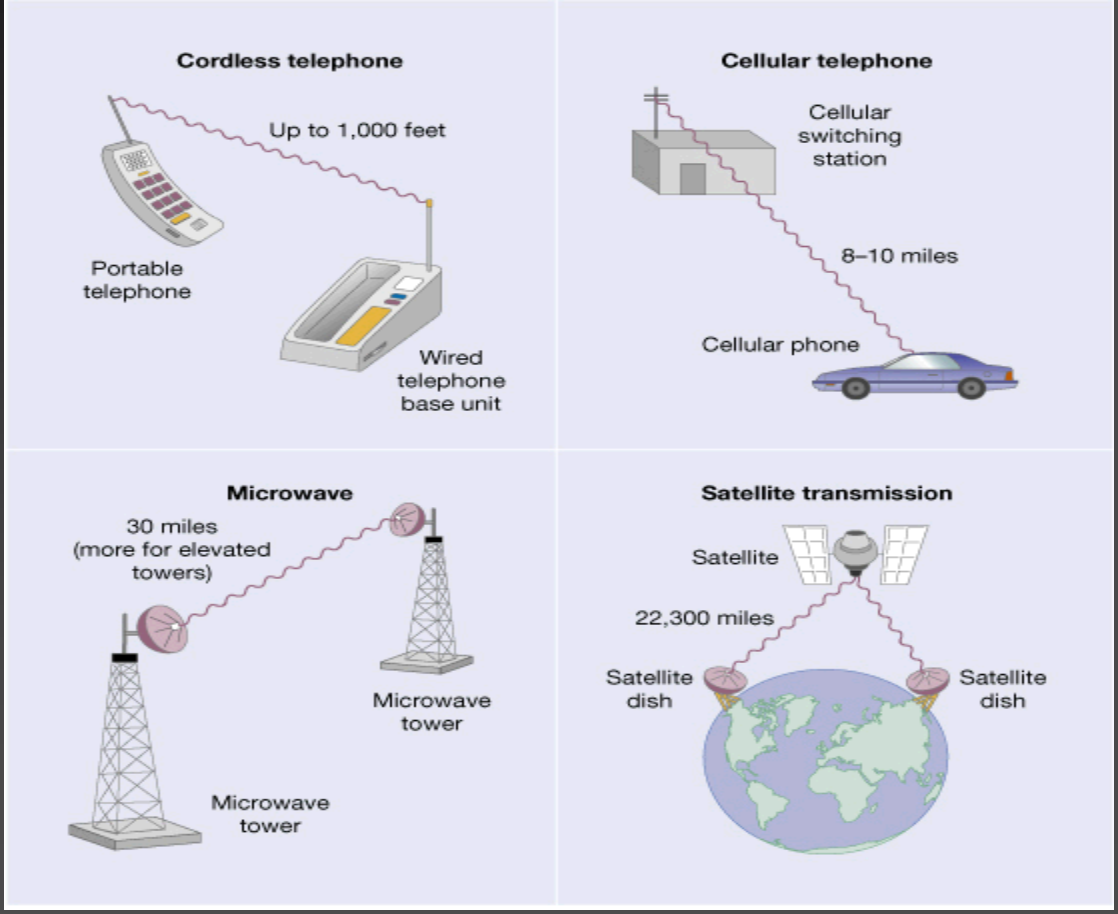
- Bandwidth – corresponds to the capacity of the transmission channel
  - Mbps or Gbps

Wired Transmission

- **TWISTED PAIR**
  - Used for voice transmission and for low volume data transmission
  - Slow
- **COAXIAL CABLE**
  - Used in LANs and for data transmissions of less than 10 miles
  - Faster and more versatile than twisted pair

- FIBER OPTIC
  - Carries data in the form of light
  - Extremely fast
  - Very light
  - Very difficult to tap into
  - Very little data loss
  - Costly

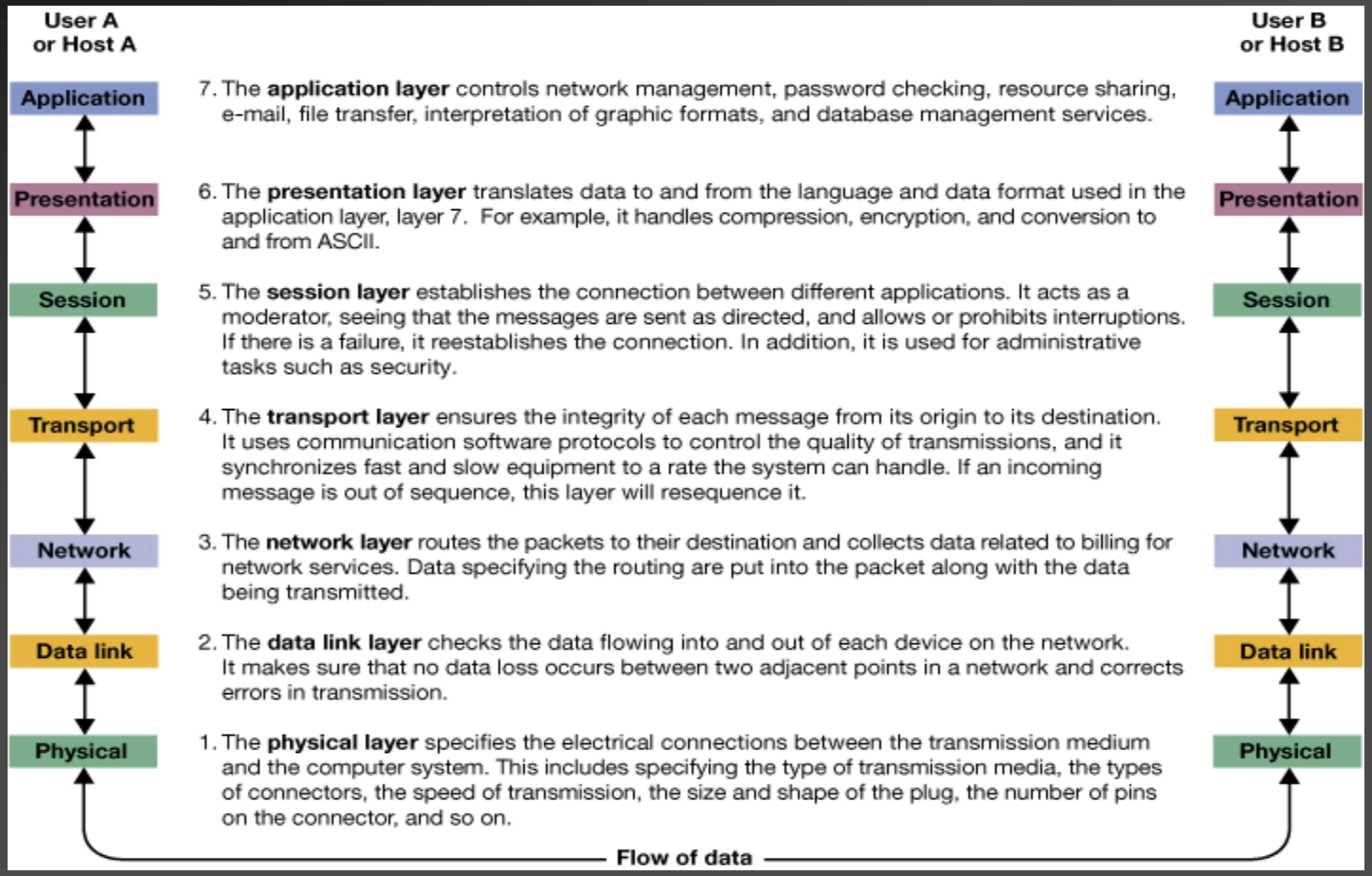
Wireless Transmission Figure 10.16



OSI

- The **OSI (open systems interface) model** is a framework for defining telecommunications standards
  - Covers all aspects of network operations and management
  - Developed by the International Standards Organization (ISO)
  - Each level in the model is implemented through *protocols*

Figure 10.18



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- **TCP/IP (Transmission Control Protocol/ Internet Protocol)**
  - Used on the Internet
  - Five layer model
  - HTML and HTTP are examples of application layer standards

More About Network Technology

More About LANs

- Main *topologies*:
  - Star – all messages go through a central node that serves as a switch
  - Ring – the nodes are linked directly in a closed loop
  - Bus – each node is attached to a central channel called a bus

- **Token passing**:
  - One of the most common methods for internal communication
  - Used in ring topologies
  - Token – a bit pattern that circulates between the nodes
  - To transmit data, a node appends it to the token

- LANs use two types of transmission:
  - **Baseband** – the entire capacity of the cable is used to transmit a single digitally encoded signal
    - Ex.: Ethernet
  - **Broadband** – the capacity of the cable is divided into separate frequencies to permit it to carry several signals at the same time

- Interconnection devices – a combination of hardware and software:
  - Routers
  - Bridges
  - Gateways

More About WANs

- Virtual private networks (VPNs):
  - A private network configured within a public network
  - Can be built on top of the Internet
  - Service offered by the telephone companies and ISPs

- Value added networks (VANs):
  - Public data networks that “add value” by transmitting data and by providing access to commercial databases and software
  - Use packet switching
  - Subscription based
  - Often used in **electronic data interchange (EDI)** systems

- Public switched data network technologies (PSDN)
  - Data flows through a public network managed by a telecommunications carrier
  - Most common technologies:
    - ISDN (integrated service digital network)
    - X.25
    - Frame relay
    - Asynchronous transfer mode (ATM)

Wireless Networking

- *Wireless application protocol (WAP)* - a standard technology framework for wireless Internet
  - Allows for some of the Internet content to be accessed by mobile devices
- *Bluetooth* – a fast short-range wireless technology
  - Wireless office