Chapter Four

Telecommunications: Networks and the New IT Infrastructure

Outline

- Introduction
- Trends in Telecommunications
- Network
  - What is Computer Network?
  - Use of Computer Networks
  - Components of communication
  - Types of Networks
  - Network Topologies
- Telecommunications control software

Introduction

- IT infrastructure consists of a set of physical devices and software applications that are required to operate the entire enterprise.
  - But IT infrastructure is also a set of firm wide services(telecommunications, data management, IT standards, IT education, IT research and development, etc.)
- Businesses have become networked enterprises.
  - The Internet, the Web, and intranets and extranets are networking business processes and employees together and connecting them to their customers, suppliers, and other business stakeholders.
- Telecommunications is the exchange of information in any form (voice, data, text, images, audio, video) over networks.
  - *tele-* means operating at a distance

Trends in Telecommunications

- Rapid change from analog to digital network technologies. This conversion provides:
  - Significantly higher transmission speeds
  - The movement of larger amounts of information
  - Greater economy
  - Much lower error rates than with analog systems
  - Allow telecommunications networks to carry multiple types of communications (data, voice, video) on the same circuits
- Change from reliance on copper wire–based media and land-based microwave to fiber-optic and wireless technologies
- These changes are causing a significant change in the business use of telecommunications.

The Business Value of Telecommunications Networks

Strategic Capabilities	e-Business Examples	Business Value
Overcome geographic barriers: Capture information about business transactions from remote locations.	Use the Internet and extranets to transmit customer orders from traveling salespeople to a corporate data center for order processing and inventory control.	Provide better customer service by reducing delay in filling orders and improves cash flow by speeding up the billing of customers.
Overcome time barriers: Provide information to remote locations immediately after it is requested.	Credit authorization at the point of sale using online POS networks.	Credit inquiries can be made and answered in seconds.
Overcome cost barriers: Reduce the cost of more traditional means of communication.	Desktop videoconferencing between a company and its business partners using the Internet, intranets, and extranets.	Reduce expensive business trips; allow customers, suppliers, and employees to collaborate, thus improving the quality of decisions reached.
Overcome structural barriers: Support linkages for competitive advantage.	Business-to-business electronic commerce Web sites for transactions with suppliers and customers using the Internet and extranets.	Fast, convenient services lock in customers and suppliers.

What is Computer Network?

- A ***computer network*** – a group of computers and associated devices that are connected by communications facilities.
- A network provides two principle benefits: the ability to communicate and the ability to share.
  - A network supports ***communication*** among users in ways that other media cannot.
    - ✔ Eg. e-mail, chat rooms, Usenet newsgroups, VoIP/ Internet telephony, video conferencing.
  - **Sharing** involves not only information (database records, e-mail, graphics, etc.), but also resources (applications, printers, disk space, scanners, etc.) Through its ability to share, a network promotes ***collaboration***(supporting mutual efforts of teams.
    - ✔ E.g. designing products in collaboration with customers, suppliers, etc.)

Uses of Computer Networks

a. Business applications

- for **resource sharing** including programs, equipment, data (mostly databases on central servers), …
- a **communication medium** – e-mail, writing a report together by making changes on an online document
- **videoconferencing** – to hold meetings by hearing and seeing each other
- **electronic business**
  - business to business - placing orders, …
  - business with consumers, usually called e-commerce – home shopping

Cont.

b. Home applications

- Access to remote information – newspapers, radio, on-line digital libraries (ACM, IEEE, …), …
- Person-to-person communication
  - e-mail (audio, video, pictures, …)
  - instant messaging (between two people in real time, e.g., Yahoo Messenger, Skype),
  - chat room (for a group of people in real time)
  - using Internet to carry telephone calls, video phone, and Internet radio
- Electronic commerce – with online manuals

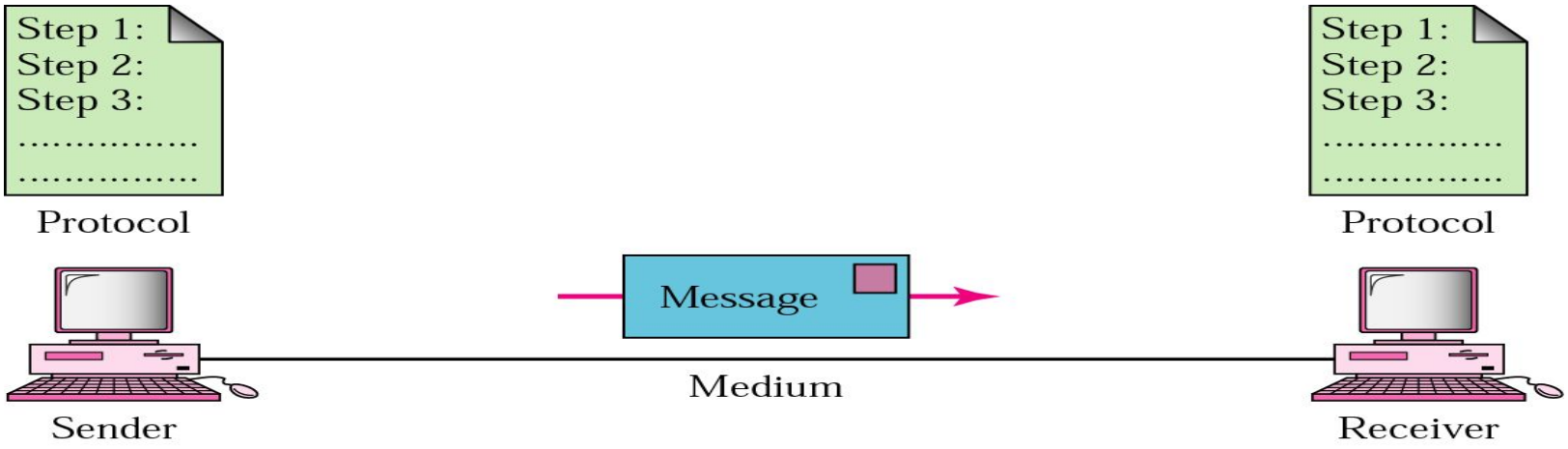
c. Mobile Users: using mobile computers(Laptop and handheld computers) and wireless networks in cars and airplanes?

Business Networks

- Business networks support four basic functions or needs: mobility, collaboration, relationships, and search.
  - **Mobility:** Secure, reliable access from anywhere at acceptable speeds.
  - **Collaboration:** Working as a team or with others, with members having access to and sharing documents or other types of files.
  - **Relationships:** Maintaining contact or interaction with customers, supply chain partners, shareholders, employees, regulators, and so on.
  - **Search:** Looking for and finding data, documents, spreadsheets, e-mail messages, and so on easily and efficiently.

Components of Network

i A data communication system has 5 components

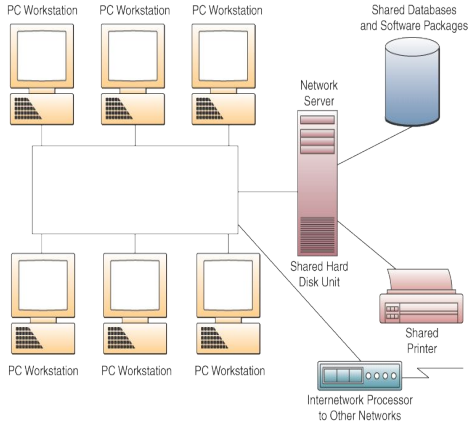


1. **Message:** the information to be communicated (text, numbers, pictures, sound, video - or combinations)
2. **Sender:** the device - computer, video camera, …
3. **Receiver:** still the device
4. **Medium:** the physical path by which a message travels from sender to receiver
5. **Protocol:** the set of rules that govern data communications; an agreement between the communicating devices

Types of Computer Network

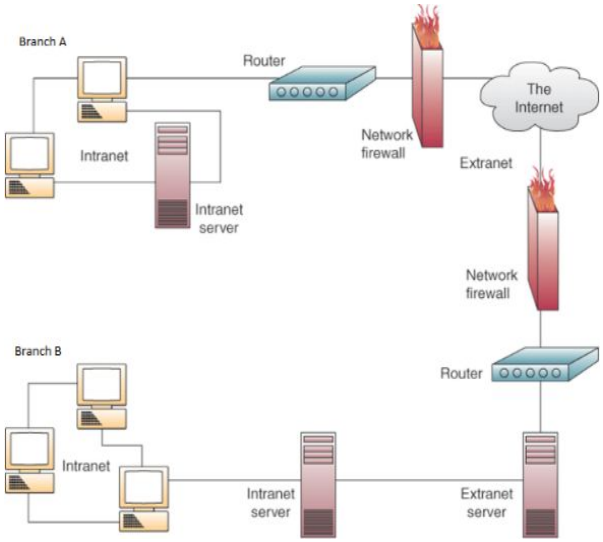
- **Classification by network geography**
  - Networks are frequently classified according to the geographical boundaries spanned by the network itself.
  - LAN, WAN, and MAN are the basic types of classification, of which LAN and WAN are frequently used.
- **Classification by component roles**
  - Networks can also be classified according to the roles that the networked computers play in the network's operation.
  - Peer-to-peer, and server-based are the types of roles into which networks are classified.

Classification by Network Geography



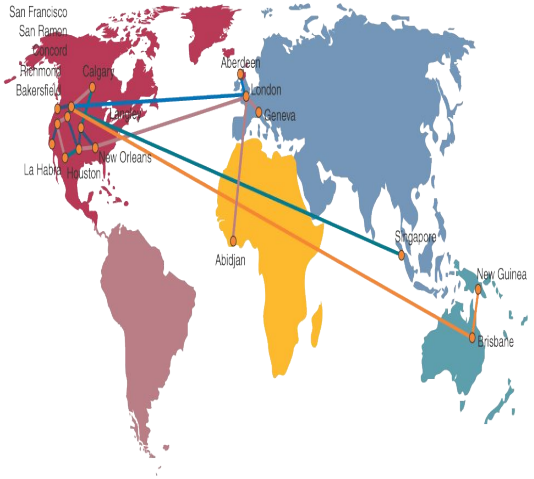
LAN

- limited physical area ▫ office, classroom, or building



MAN

- large cities



WAN

- large geographic area
- cities, regions, countries or the world

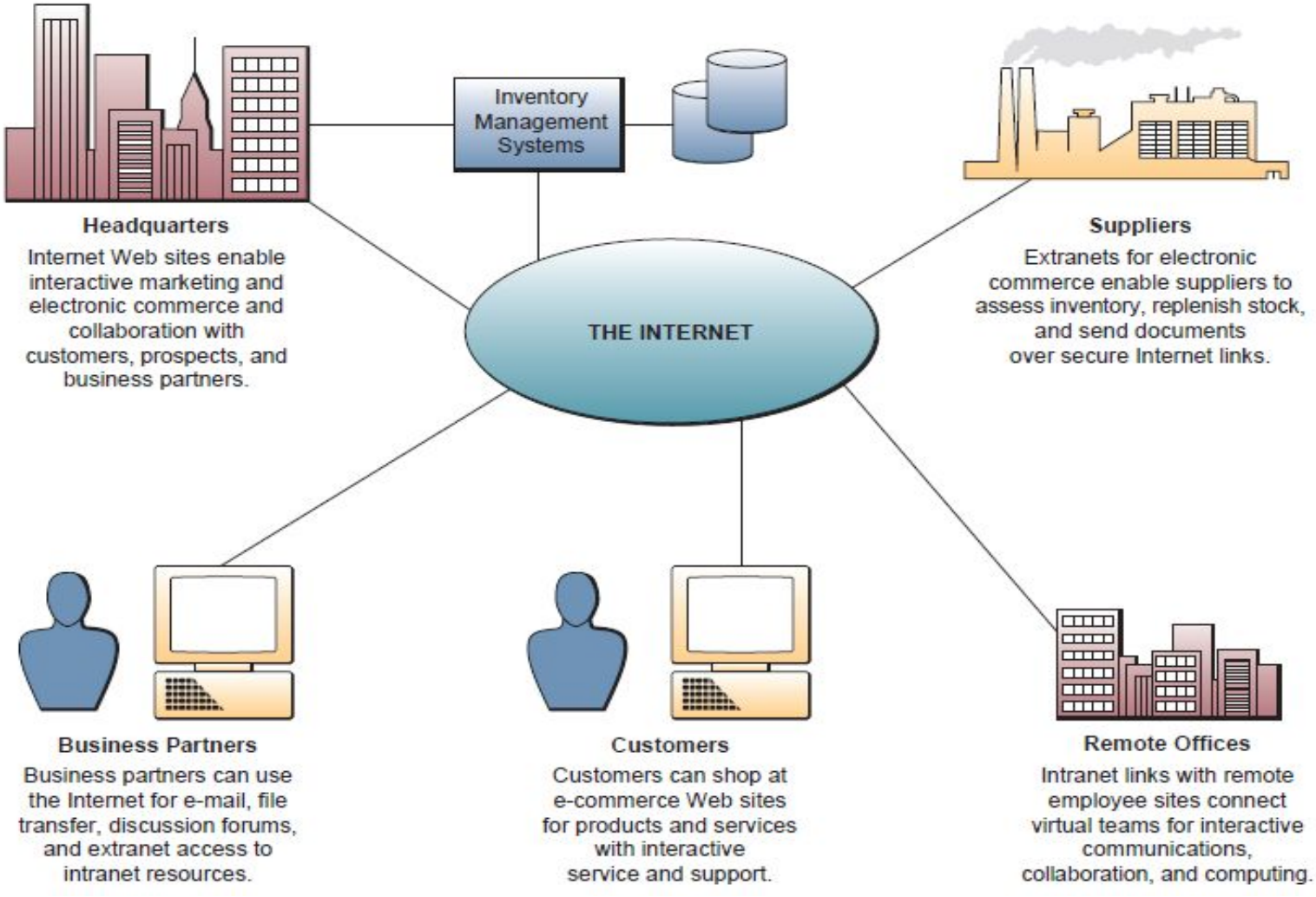
Cont.

- **Personal Area Network (PAN):** meant for one person;
  - e.g. a wireless network connecting a computer with its mouse, keyboard and printer
- **Local Area Network (LAN):** usually privately owned and links devices in a single office, building or campus
  - LANs are inexpensive to install and also provide higher speeds.
- **Metropolitan Area Network (MAN):** designed to extend over an entire city; it may be a single network or interconnected LANs
  - The cost of installation and operation is higher.

Cont.

- Wide Area Network (WAN)
  - WANs span a larger area than a single city.
  - These use long distance telecommunication networks for connection, thereby increasing the cost.
  - The Internet is a good example of a WAN.
- The Internet
  - When two or more networks are connected, they become an internetwork, or internet
  - the most notable internet is called the Internet, a collaboration of more than hundreds of thousands of interconnected networks
  - it came into being in 1969 - by ARPA (Advanced Research Project Agency) of DoD for researchers they funded to share findings

The business value of the Internet



Network Topologies

- A ***topology*** refers to the way in which a network is laid out physically
- Four basic topologies are possible:
  - Mesh
  - Star
  - Bus
  - Ring

Mesh

- Every device has a dedicated point-to-point link to every other device
- Every device must have n-1 I/O ports, where n is the number of devices connected
- Advantages
  - no traffic problem (no congestion)
  - robust; a failure of a link has no effect on others
  - fault identification and isolation are easy
  - privacy or security (provided there is no wire tapping)
- Disadvantages
  - Amount of cabling and I/O ports needed(expensive)

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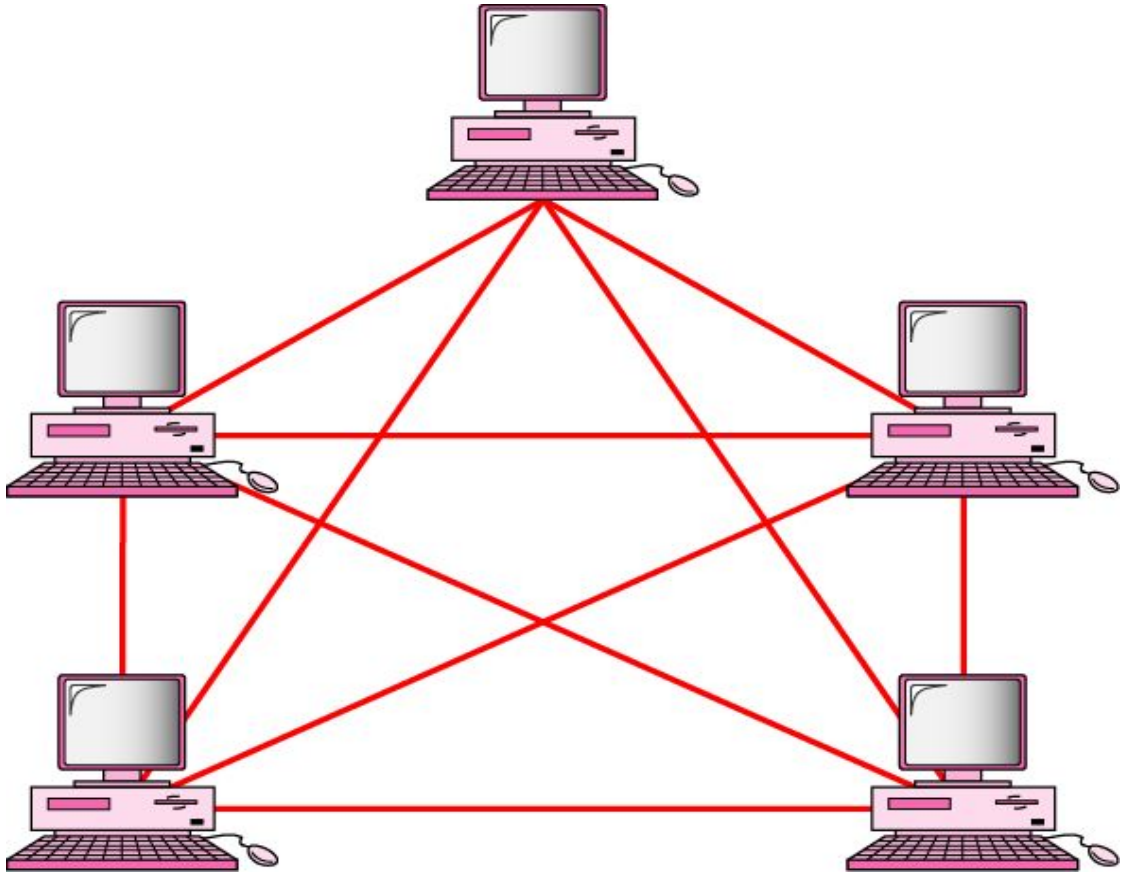
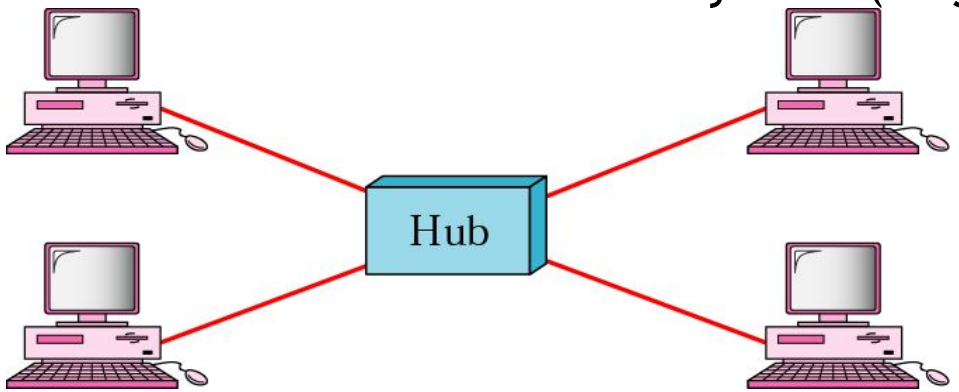


Mesh Topology

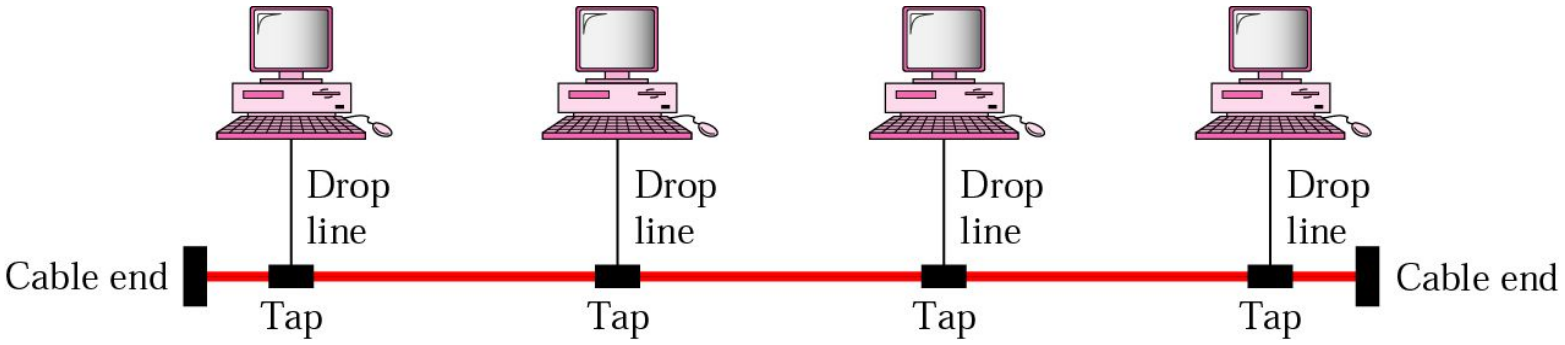
Star

- each device has a dedicated point-to-point link only to a central controller, usually called a hub
- advantages
  - robust; a failure of a link has no effect on others
  - fault identification and isolation are easy
  - less expensive than mesh (but more expensive than others)
- disadvantage
  - failure of the hub halts the system (single point of failure)



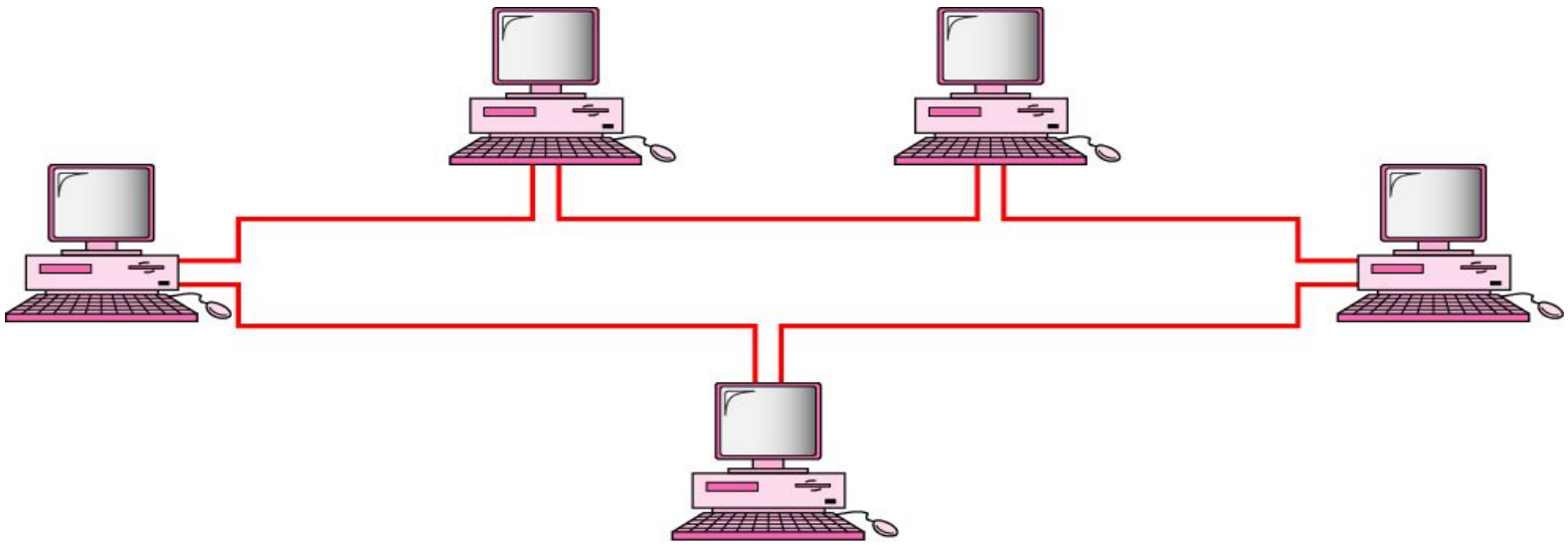
Bus

- multipoint (one long cable acts as a backbone to link all the devices in the network)
- advantages
  - ease of installation; less cabling than star or mesh
- disadvantages
  - difficult reconnection (adding new devices) and fault isolation
  - a fault in the bus cable stops all transmission



Ring

- each device has a dedicated point-to-point connection only with the two devices on either side of it
- a signal is passed along the ring in one direction, from device to device, until it reaches its destination
- each device incorporates a repeater (to regenerate bits received before passing it)



Cont.

- advantages
  - relatively easy to install and configure - adding or deleting a device requires changing only two connections
  - fault isolation is simplified (if one device does not receive a signal within a specified period, it can issue an alarm)
- disadvantages
  - a break in the ring (such as a disabled station) can disable the entire network

Choosing a Topology

- The following factors should be considered when choosing a topology:
  - Installation
  - Maintenance and troubleshooting
  - Expected growth
  - Distances
  - Infrastructure
  - Existing network
- Various topologies can be mixed on the same network.

Telecommunications control software

- Consists of programs that control telecommunications activities and manage the functions of telecommunications networks.
  - Examples: network management programs of all kinds, such as ***telecommunications*** *monitors* for mainframe host computers, ***network operating*** **systems** for network servers and ***Web browsers*** for microcomputers.

Reading Assignment

- Media
  - Twisted Pair
  - Coaxial Cable
  - Fiber-Optic Cable
  - Wireless – Bluetooth, Microwave, Satellites, etc.
- Network devices
  - Network Interface card
  - Modem
  - Repeater
  - Hub
  - Switch
  - Bridge
  - Router

Thank you !!!!