

# Chapter 16 Basic Networking Concepts

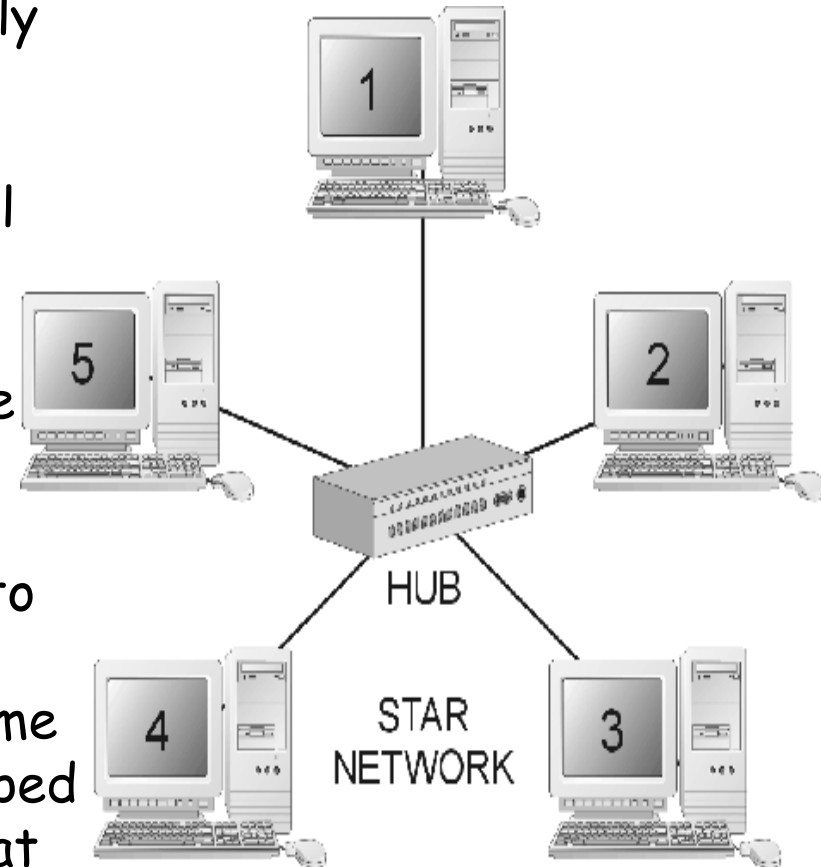
- ◆ This chapter deals with local area networking from the local desktop computer level
- ◆ The chapter presents a short course on basic networking terminology and concepts
- ◆ the two contemporary network access protocols in use—Ethernet and Token Ring.
- ◆ Installing LAN adapter (NIC) cards.

# LAN TOPOLOGIES

- ◆ Network topologies are physical connection/configuration strategies.
- ◆ LAN topologies fall into four types of configurations:
  - Bus
  - Ring
  - Star
  - Mesh

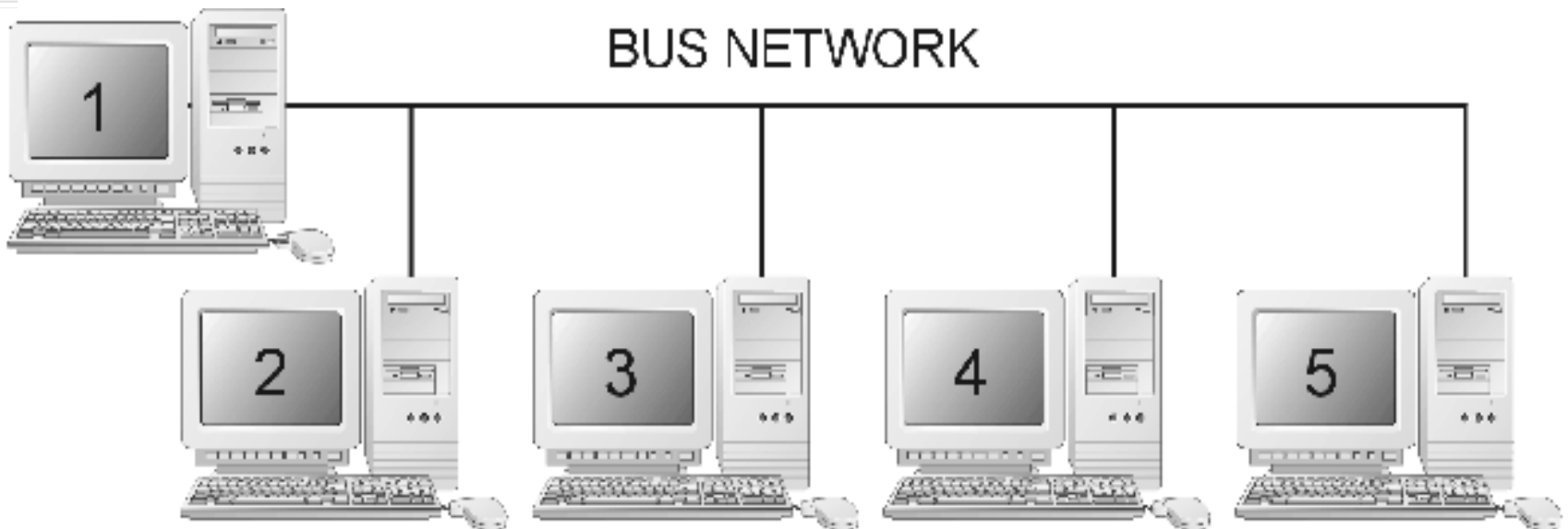
# Star Network

- 1) In a *star topology*, All the nodes are connected in branches that eventually lead back to a central unit.
- 2) Nodes communicate with each other through the central unit. The central station coordinates the network's activity by polling the nodes, one by one, to determine whether they have any information to transfer.
- 3) If so, the central station gives that node a predetermined slice of time to transmit.
- 4) If the message is longer than the time allotted, the transmissions are chopped into small packets of information that are transmitted over several polling cycles.



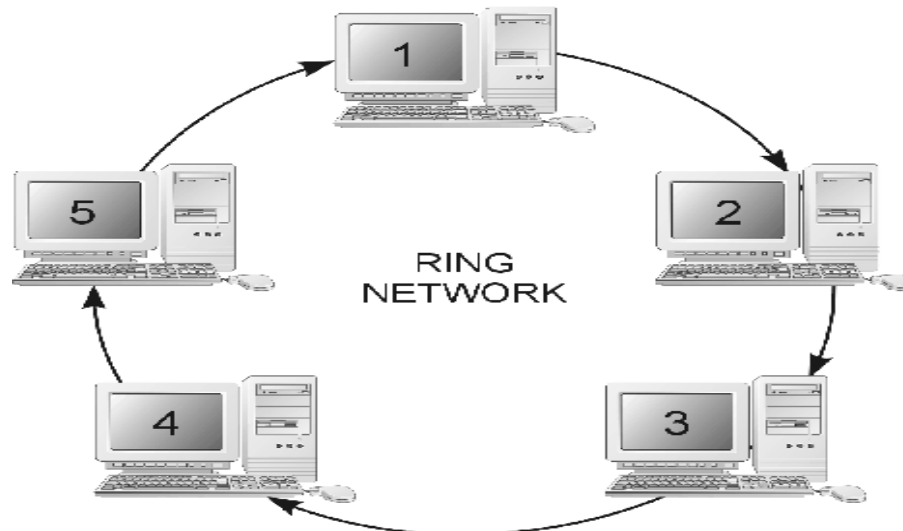
# Bus Network

- In the *bus topology*, the stations, or nodes, of the network connect to a central communication link.
- Each node has a unique address along the bus that differentiates it from the other users on the network.
- Information can be placed on the bus by any node. The information must contain network address information about the node, or nodes that the information is intended for.
- Other nodes along the bus will ignore the information.



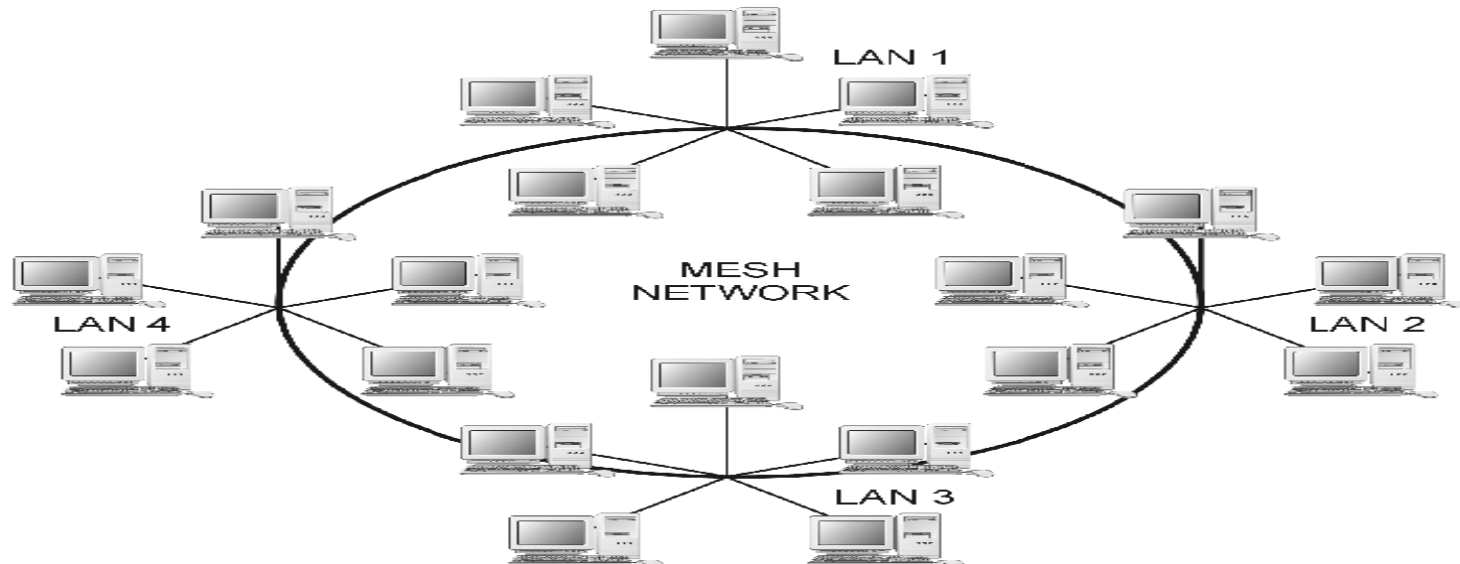
# Ring Network

- 1) In a *ring network configuration*, the communication bus is formed into a closed loop. Each node inspects the information on the LAN as it passes by.
- 2) A repeater, built in to each ring LAN card, regenerates every message not directed to it and sends the message to the next appointed node.
- 3) Ring topologies tend to offer very high data transfer rates but require additional management overhead.
- 4) If a node in a ring network fails, the entire network could fail. To overcome this, rings are developed with Primary and Secondary data paths.
- 5) If a break occurs in a primary link, the network controller can reroute the data onto the secondary link to avoid the break.



# Mesh Network

- 1) each node has a direct physical connection to all the other nodes in the network.
- 2) Although the overhead for connecting a mesh network topology together in a LAN environment is prohibitive,
- 3) this topology is employed in two very large network environments— the public telephone system and the Internet.



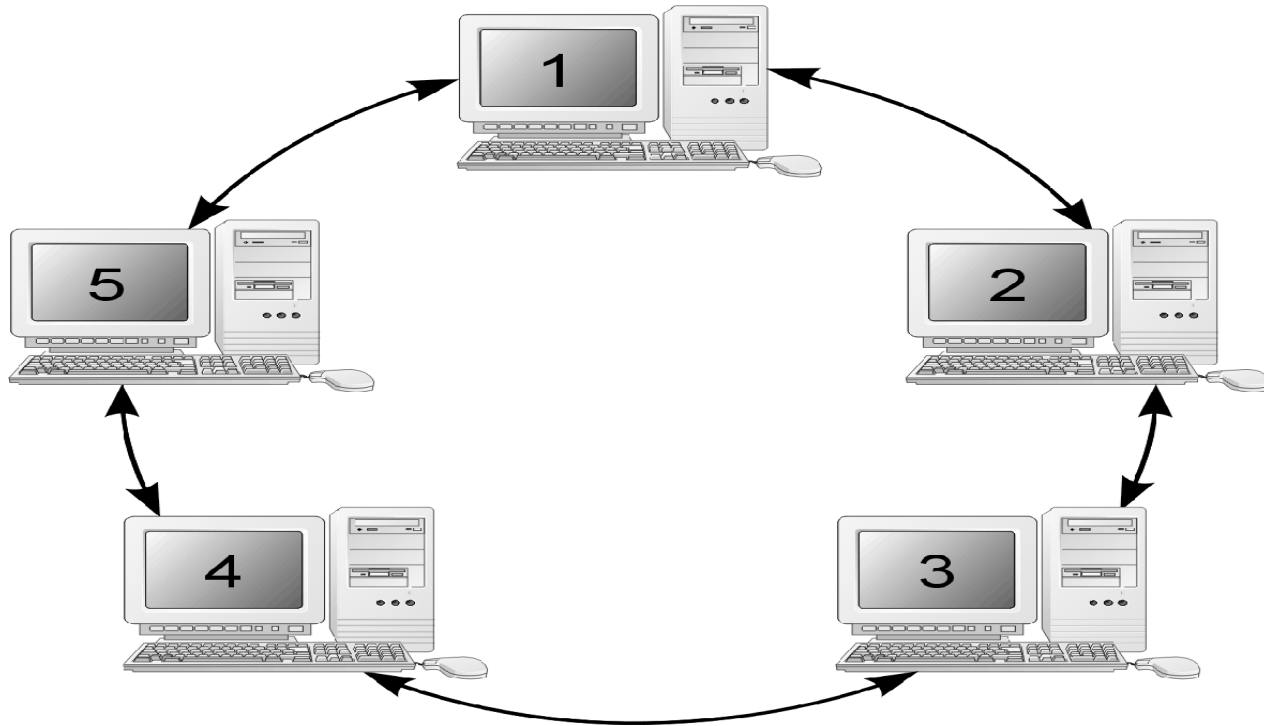
# NETWORK CONTROL STRATEGIES

Control of a network can be implemented in two ways:

- ◆ As a *peer-to-peer network* in which each computer is attached to the network in a ring or bus fashion and is equal to the other units on the network
- ◆ As a *client/server network* in which dependent workstations, referred to as clients, operate in conjunction with a dedicated master computer (server)

# Peer to peer network

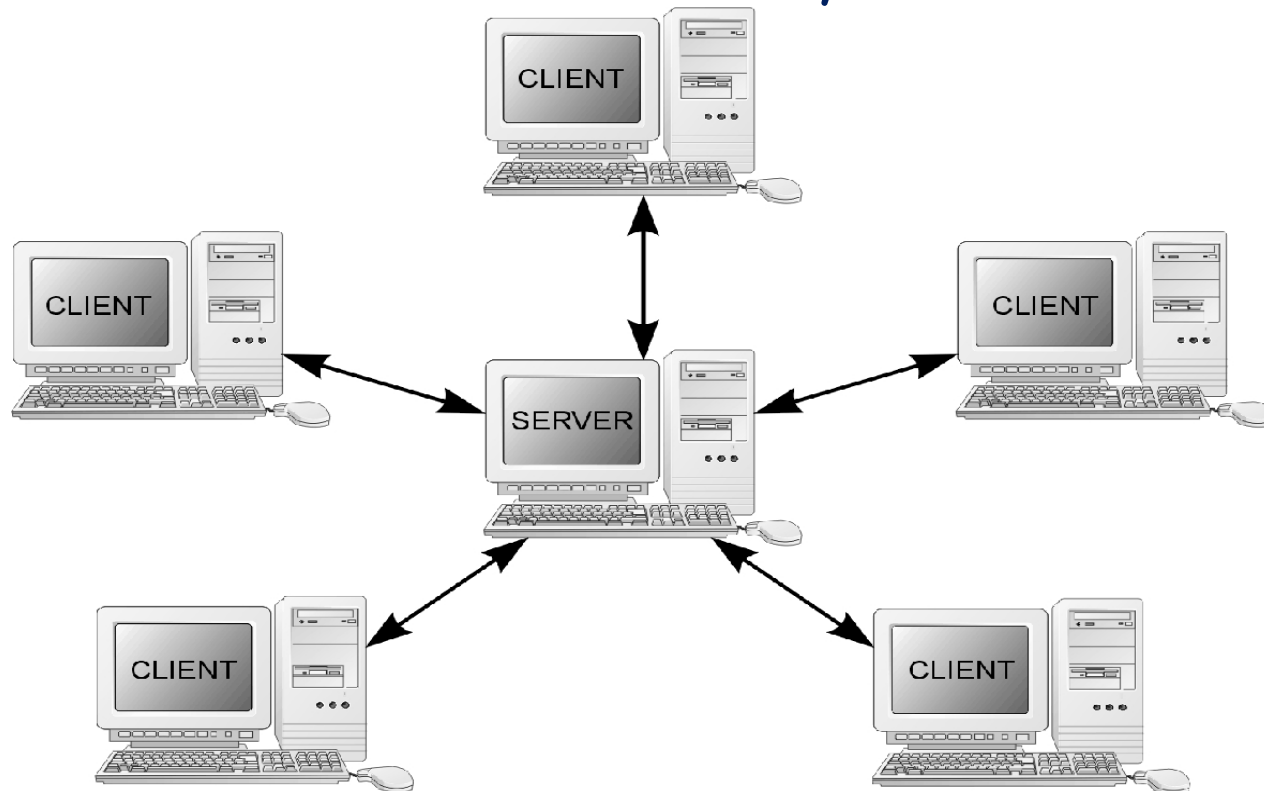
- 1) The nodes in this type of network configuration usually contain local hard drives and printers that the local computer has control of.
- 2) all the nodes can act as both clients and servers of the other nodes under different conditions





The major advantages of the client/server networking arrangement Include

- ❑ Centralized administration
- ❑ Data and resource security



# NETWORK CABLING

four media are used to transmit data between computers.

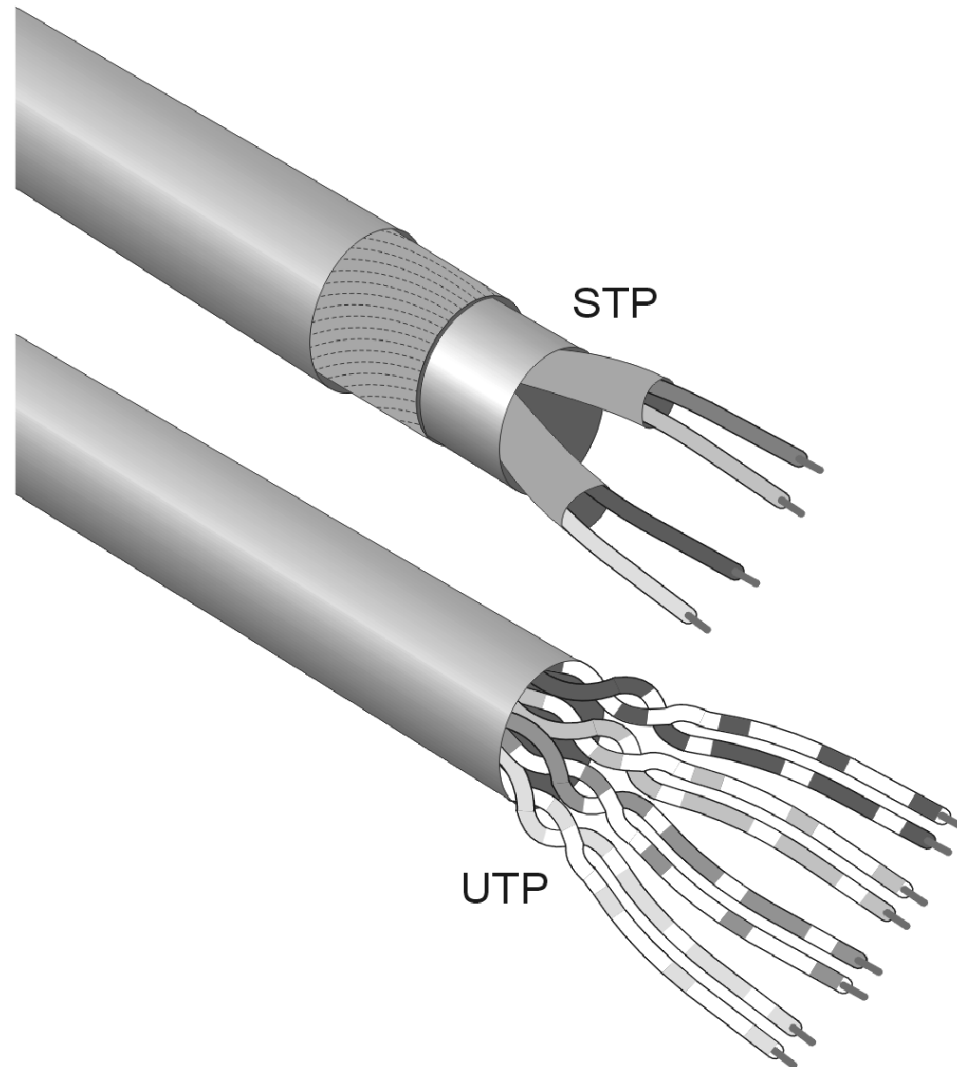
- Copper cabling
- Fiber optic cabling
- Infrared light
- Wireless radio frequency (RF) signals

# Copper cables

Two types has to be considered : twisted-pair and coaxial cabling

- ◆ *Twisted-pair* cabling consists of two or more pairs of wires twisted together to provide noise reduction. The twist in the wires cause induced noise signals to tend to cancel each other out. In this type of cabling, the number of twists in each foot of wire indicates its relative noise immunity level. For transferring data in a networks, there are two types :
  - *unshielded twisted pair (UTP)*
  - *shielded twisted pair (STP)*.
- ◆ *UTP networking cable contains four* pairs of individually insulated wires
- ◆ STP cable is similar with the exception that it contains an additional foil shield that surrounds the four pair wire bundle. The shield provides extended protection from induced electrical noise and cross talk by supplying a grounded path to carry the induced electrical signals away from the conductors in the cable.

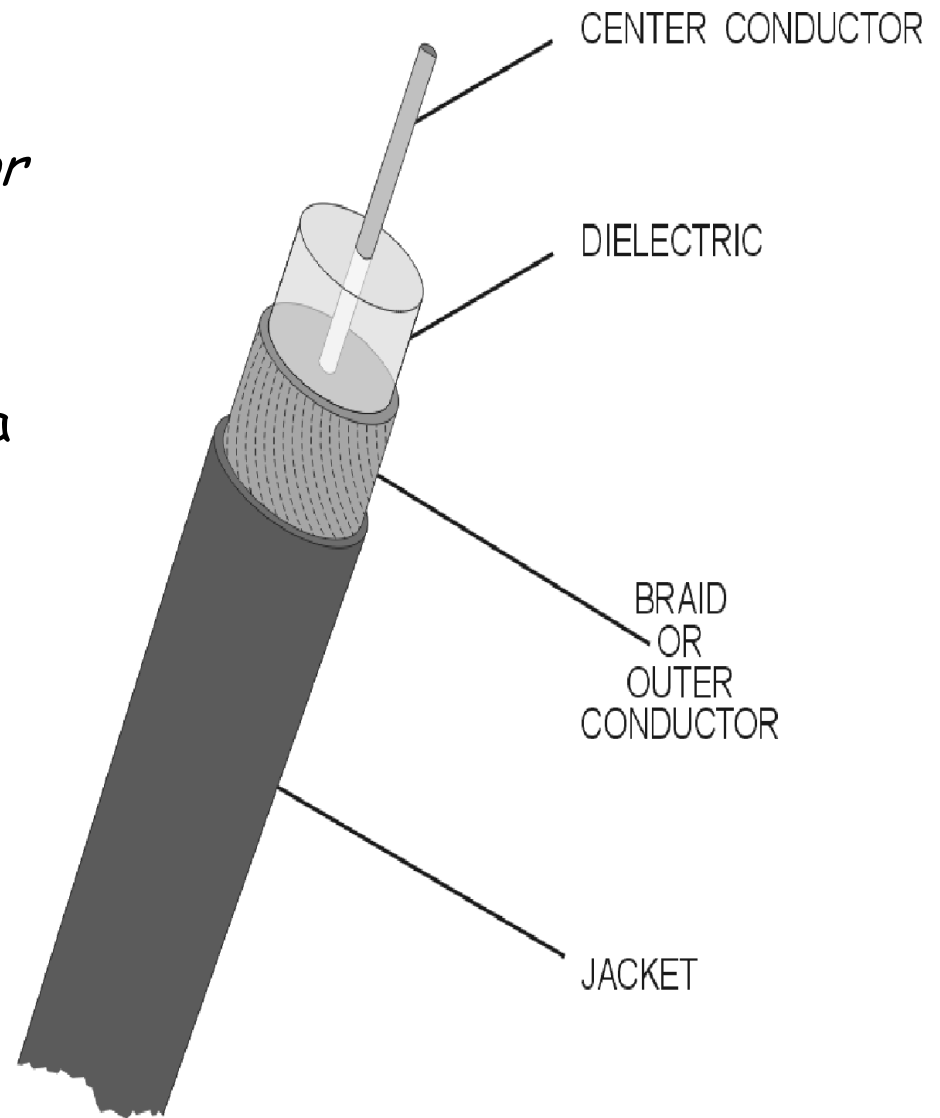
# STP & UTP



# Coaxial Cable

*Coaxial cable is familiar to most people as the conductor that carries cable TV into their homes.*

Coax has a single copper conductor in its center and a protective braided copper shield around it.



# Fiber-Optic Cable

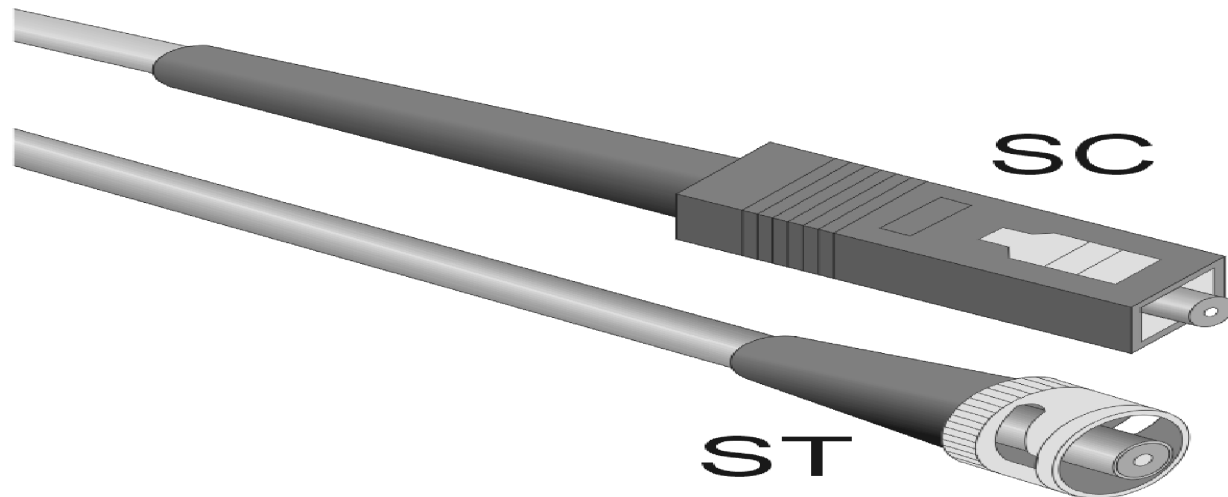
- ◆ *Fiber-optic cable is plastic or glass cable designed to carry voice or digital data in the form of light pulses. The signals are introduced into the cable by a laser diode and bounce along its interior until reaching the end of the cable. At the end, a light detecting circuit receives the light signals and converts them back into usable information. Band width rates in excess of 200,000Mbps*
- ◆ *Light does not attenuate (lose energy) as quickly as electrical signals moving along a copper conductor, the segment lengths between transmitters and receivers can be much longer with fiber-optic cabling, the maximum cable length can range up to 2 kilometers.*

# SC & ST

Getting the light out of the cable without significant attenuation is the key to making fiber-optic connections. The end of the cable must be perfectly aligned with the receiver and be free from scratches, film, or dust that would distort or filter the light.

Two types of connectors are used: a *Straight Tip (ST) connector*, And *SC connector*. The *SC connector* is the dominant connector for fiber-optic Ethernet networks.

In both cases, the connectors are designed so that they correctly align the end of the cable with the receiver.



# NETWORK ACCESS PROTOCOLS

- ◆ Some method must be used to determine which node has use of the network's communications paths, and for how long it can have it. The network's hardware protocol handles these functions, and is necessary to prevent more than one user from accessing the bus at any given time.
- ◆ If two sets of data are placed on the network at the same time, a data collision occurs and data is lost. Basically, there are two networking protocols in use: **Ethernet and Token Ring**.



# Ethernet

- ◆ Ethernet has been published by the International Electrical and Electronic Association (IEEE) as the *IEEE-802.3 Ethernet protocol*.
- ◆ Its methodology for control is referred to as *carrier sense multiple access with collision detection (CSMA/CD)*.
- ◆ The Ethernet strategy provides for up to 1,024 users to share the LAN.
- ◆ The maximum length specified for Ethernet is 1.55 miles (2.5km), with a maximum segment length between nodes of 500 meters. This type of LAN is referred to as a **10BASE-5 LAN** by the IEEE organization

# Fast Ethernet

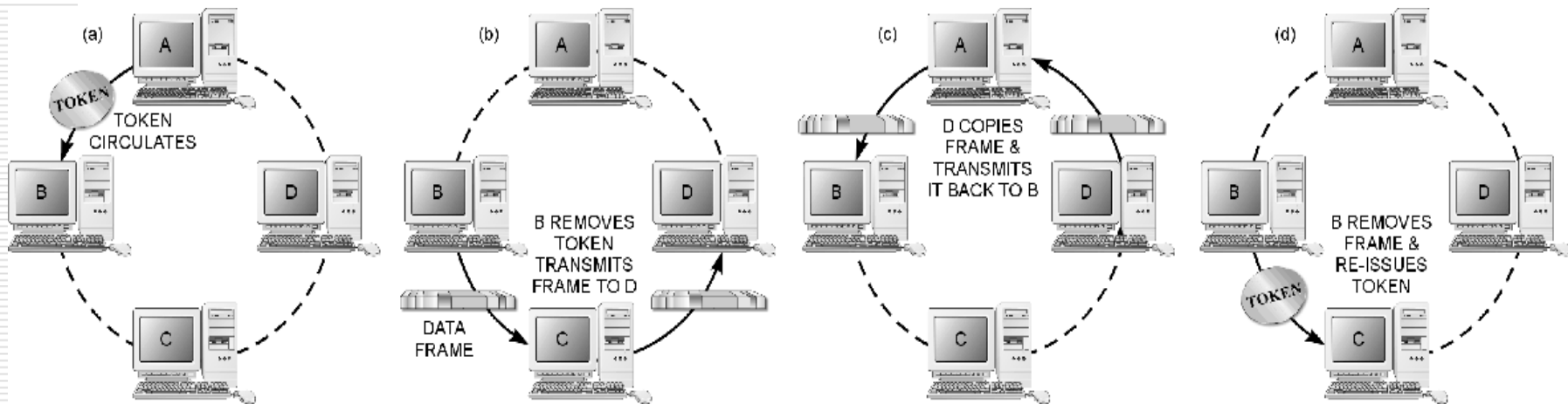
- ◆ Newer Ethernet implementations produce LAN speeds of up to 100Mbps using UTP copper cabling. For these networks, the IEEE adopted *10BASET*, *100BASET*, and *100BASETX* designations, indicating that they are operating on twisted-pair cabling and depend on its specifications for the maximum segment length.

## ETHERNET SPECIFICATIONS

<i>Classification</i>	<i>Conductor</i>	<i>Maximum Segment Length</i>	<i>Nodes</i>	<i>Maximum Length</i>	<i>Transfer Rate</i>
10BASE-2	RG-58	185m	30/1024	250m	10Mbps
10BASE-5	RG-8	500m	100/1024	2.5km	10Mbps
10BASE-T	UTP/STP	100m/200m	2/1024	2.5km	10Mbps
100BASE-T	UTP	100m	2/1024	2.5km	100Mbps
100BASE-FX	FO	412m	1024	5km	100Mbps

# Token Ring

- ◆ *Token Ring is a token-passing protocol operating on a ring topology. The token is a small frame that all nodes can recognize instantly. This access protocol standard specification is referred to as the IEEE-802.5 Token Ring Protocol.*



- ◆ The token is passed from node to node along the LAN. Each node is allowed to hold the token a prescribed amount of time. After sending its message, or after its time runs out, the node must transfer the token to the next node.
- ◆ If the next node has no message, it just passes the token along to the next designated node. Nodes do not have to be in numeric sequence; their sequences are programmed in the network management software. All nodes listen to the LAN during the token-passing time.

# Fiber Ethernet Standards

- ◆ These standards are referenced as the 10/100BASE-F specification. Variations of this standard include :
- ◆ **10 BASE-FP**—*This specification is used for passive star networks running at 10Mbps. It employs a special hub that uses mirrors to channel the light signals to the desired node.*
- ◆ **10BASE-FL**—*This specification is used between devices on the network. It operates in full-duplex mode and runs at 10Mbps. Cable lengths under this specification can range up to 2 kilometers.*
- ◆ **100BASE-FX**—*This protocol is identical to the 10BASE-FL specification with the exception that it runs at 100Mbps. This particular version of the specification is referred to as Fast Ethernet because it can easily run at the 100Mbps rate.*