



Introduction to LAN Topologies Cabling



Objectives

Upon completion of this chapter, you will be able to perform the following tasks:

- **Media / Cabling**
- **Local Area Network Cabling**
- **Types of cables**

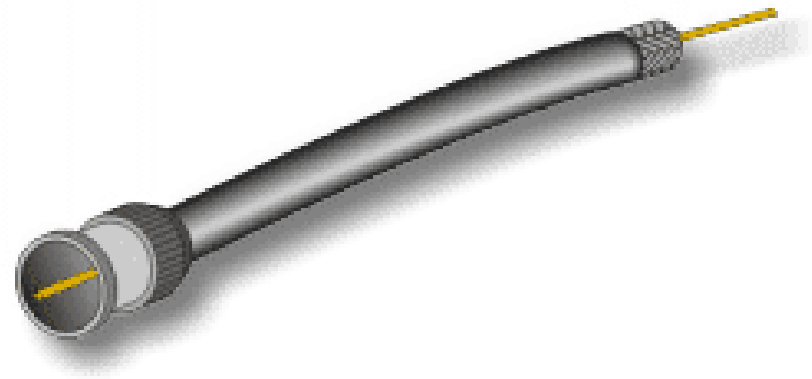
Cabling

The earliest LANs used coaxial cables. Over time, the twisted pair cables used in telephone systems were improved to carry higher frequencies and support LAN traffic. More recently, fiber optic cables have emerged as a high-speed cabling option. Local Area Networks use four types of cables:

- **Coaxial**
- **Unshielded Twisted Pair (UTP)**
- **Shielded Twisted Pair (STP)**
- **Fiber Optic**

Coaxial Cables

- **A coaxial cable consists of:**
- **a single copper conductor**
- **a layer of shielding with a ground wire**
- **an outer jacket**



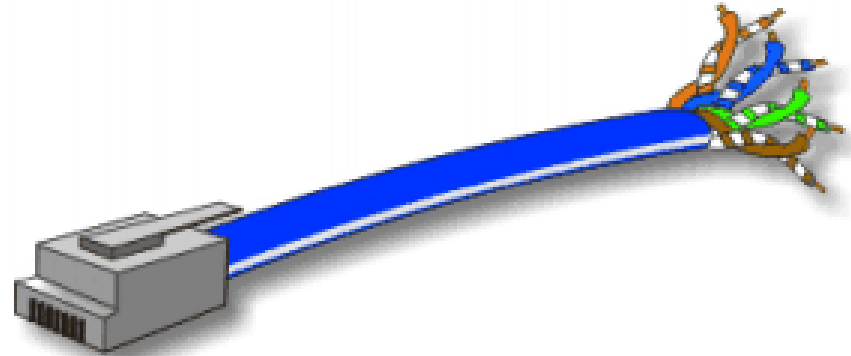
Coaxial Cable

- **Coaxial cables are sometimes used for bus topologies, but many LAN products are dropping support of coaxial cable connectivity.**
- **Types of coaxial cable**
- **Thick net(10base5)**
- **Thin net(10base2)**

Twisted pair cable

Two types of twisted pair cable

1. Unshielded Twisted Pair
2. Shielded Twisted Pair



Unshielded Twisted Pair

- Used for both LANs and telephone systems. Color-coded pairs of copper , twisted around each other. Outer jacket provides protection 8 pin modular connectors RJ-45 plugs.

Twisted pair cable

UTP Categorized

There are 5 categories (levels) for UTP cable. These support low-speed voice signals and high-speed LAN signals.

Category	Usage	Performance (MHz)
CAT 1	Voice, Mainframe, Dumb Terminal	1
CAT 2	4 MB Token Ring	4
CAT 3	10MB Ethernet	10
CAT 4	16 MB Token Ring	20
CAT 5	100 MB Ethernet	100

Category 5 UTP is the recommended minimum category for LAN installations.

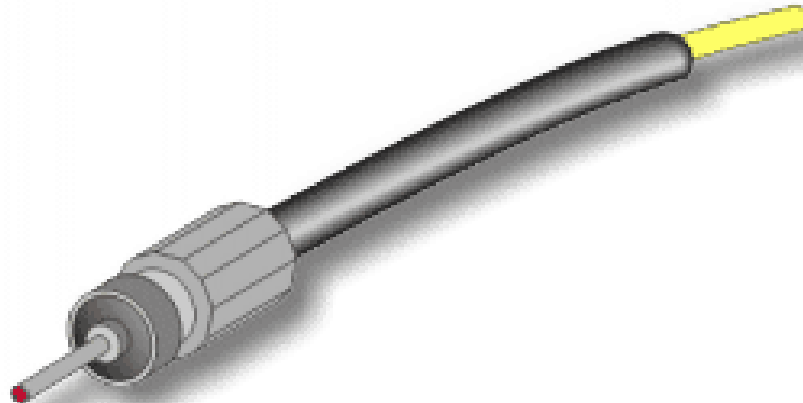
Twisted pair cable

- **Shielded Twisted Pair**
- Special kind of copper telephone wiring . Outer covering or shield is added to the ordinary twisted pair.
- **Usage of STP cable**
Shielding allows greater tolerances for protection from EMI
- **STP cable has several drawbacks:**
- Biggest drawback is the cost and physical size of the cabling.



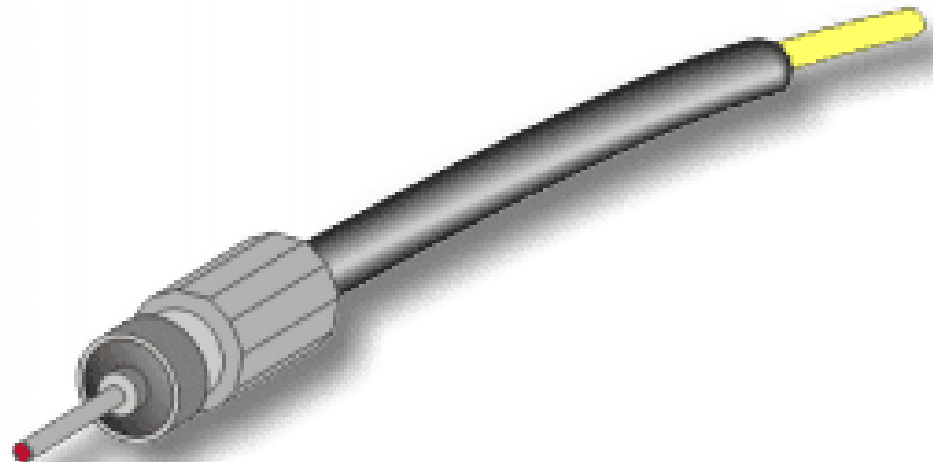
Fiber Optic Cable

Constructed from optical glass. There is a central glass filament, called the core, and surrounding layers of cladding, buffer coatings, strengthening materials, and an outer jacket. Information is transmitted by wavelengths of light. This is accomplished through devices that convert electrical signals into rapid pulses of either LED or Laser light.



Advantages of Fiber Optics

- Fiber optic cables offer several advantages:
- high bandwidth capacity (many gigabits per second).
- longer distances between devices (from 2 to over 60 KM).
- immunity to electromagnetic interferences



Types of fiber optic cable

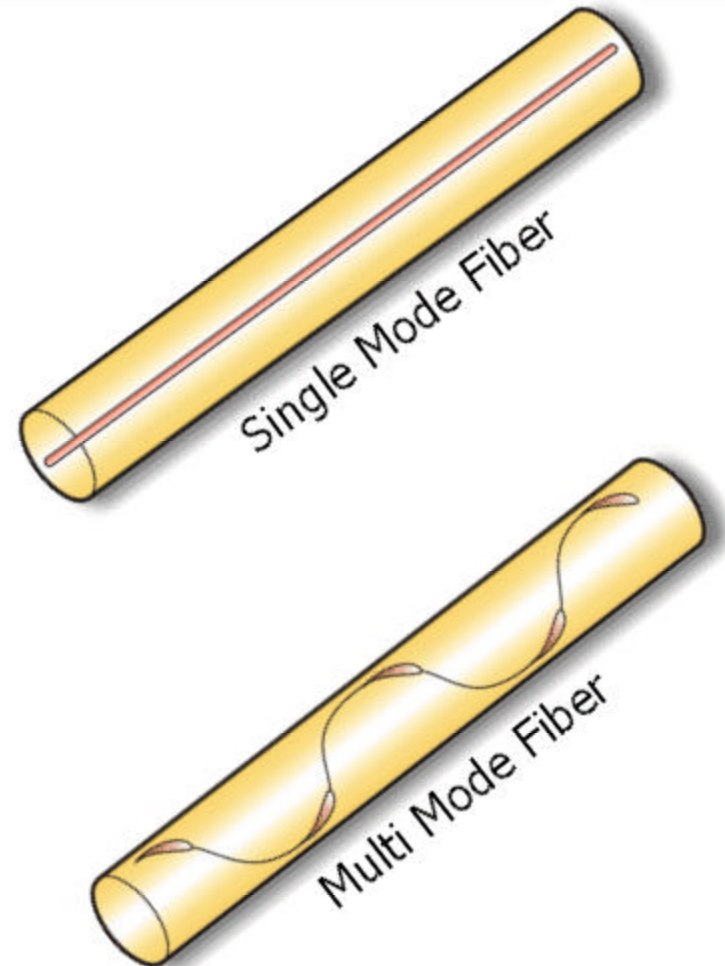
- **Two types of fiber optic**
- Single mode fiber (SMF)
- Multi mode fiber (MMF)

Single Mode Fiber (SMF)

Single Mode Fiber transmits data by means of a laser through the optical fiber medium.

• **Multi Mode Fiber (MMF)**

MMF uses LED to transmit light by bouncing it off reflective surfaces within the cable walls.



Cabling Characteristics

EEE 802.3 Values	Data Rate Mbps	Signaling Method	Physical Media	Maximum Segment Length	Topology
10Base2	10	Baseband	50-ohm coax (thin)	185	Bus
10Base5	10	Baseband	50-ohm coax (thick)	500	Bus
10BaseT	10	Baseband	Unshielded twisted-pair cable	100	star
100BaseT	100	Baseband	Unshielded twisted-pair cable	100	Bus

Designing LAN

Two major issues when designing and implementing a LAN include:

1. Distance

Local Area Networks are limited by distance.

Transmission cable & repeaters

Devices should be in response in respective time

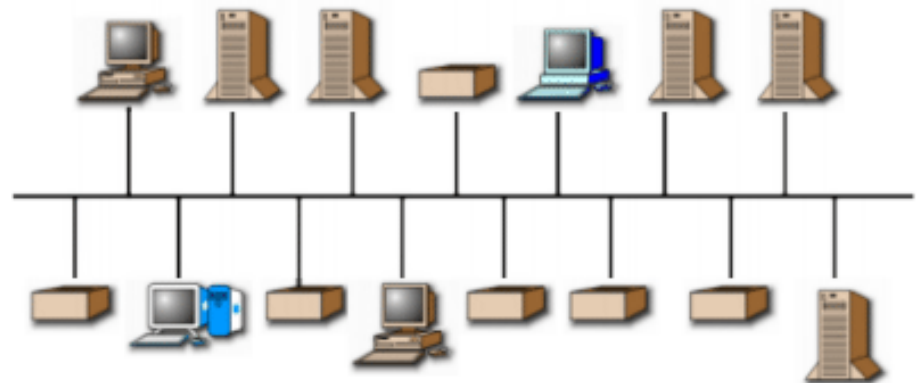
Ethernet technology LAN can be extended up-to approx 2500 meter less than 3000 meters
connected devices should response in 50 micro seconds



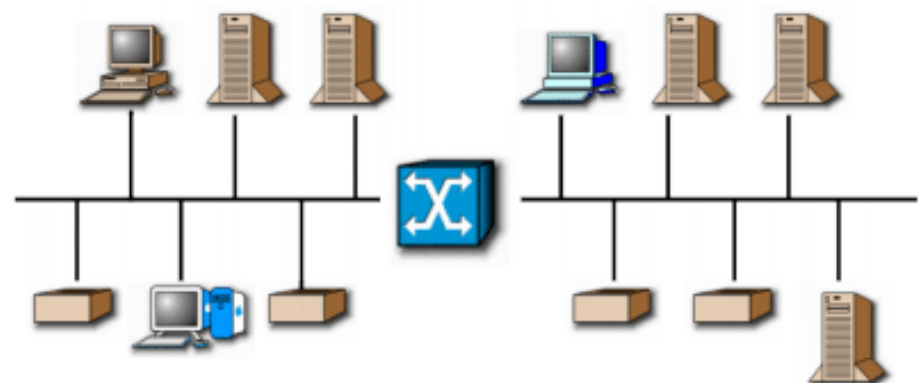
• Designing LAN

2. Cost

At some point, cost is a major consideration in the design of a LAN and how large it can grow.



- The larger a LAN becomes, the more equipment it needs to function properly.

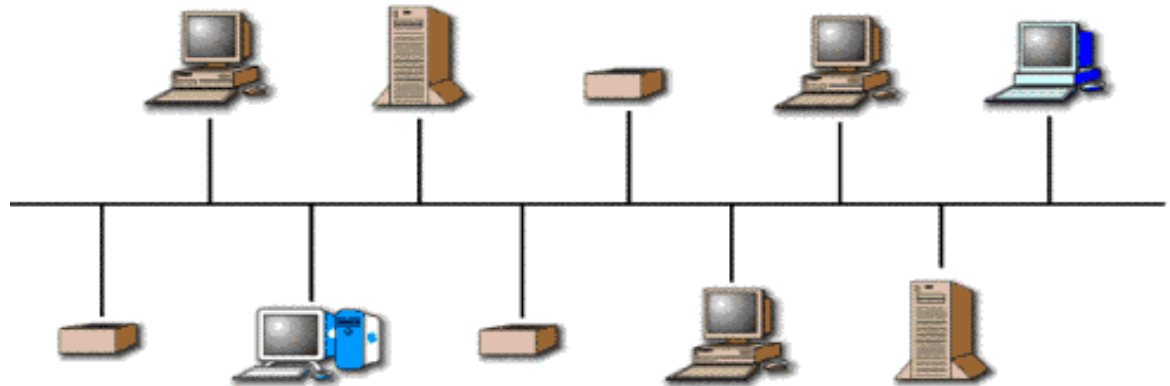


- Eventually, a LAN must segment due to bandwidth overloading and other issues.

LAN Transmission Methods

- **LAN transmission methods fall into 3 main categories:**

1. Unicast transmission
2. Multicast transmission
3. Broadcast transmission



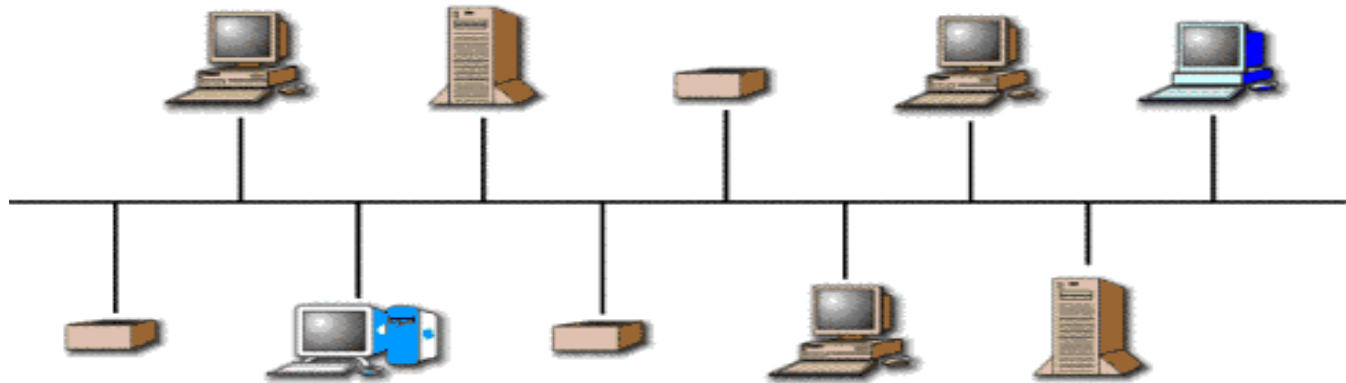
Unicast Transmission

A single data packet sent from a source to a single destination on the network

LAN Transmission Methods

Multicast Transmission

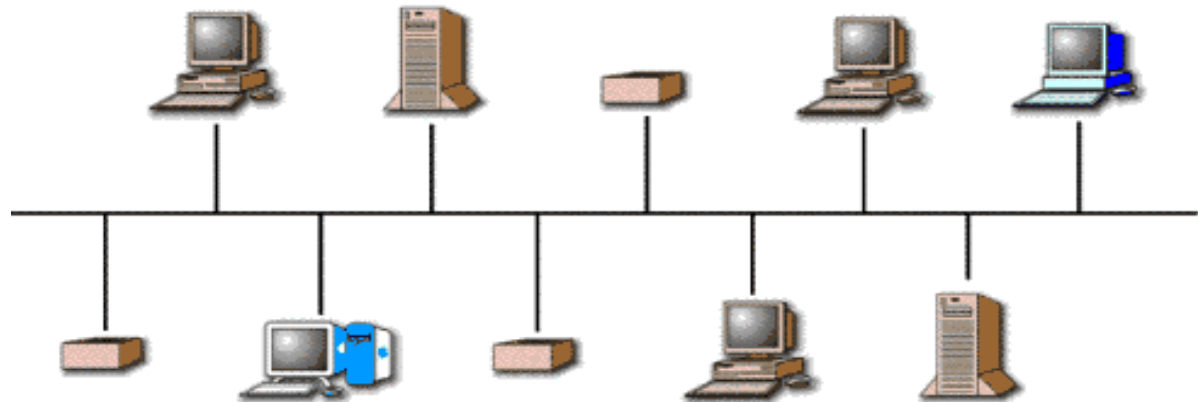
Single data packet is copied and sent to specific destinations on the network.



LAN Transmission Methods

Broadcast Transmission

Single data packet is copied and sent from a source to all destinations on the network.



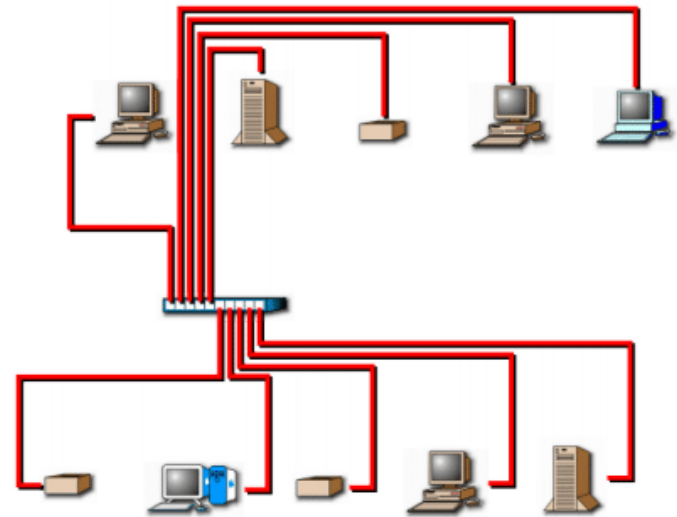
Physical and Logical Topology

LAN Topologies

Before defining LAN topologies, the distinction needs to be made between Physical Topology and Logical Topology.

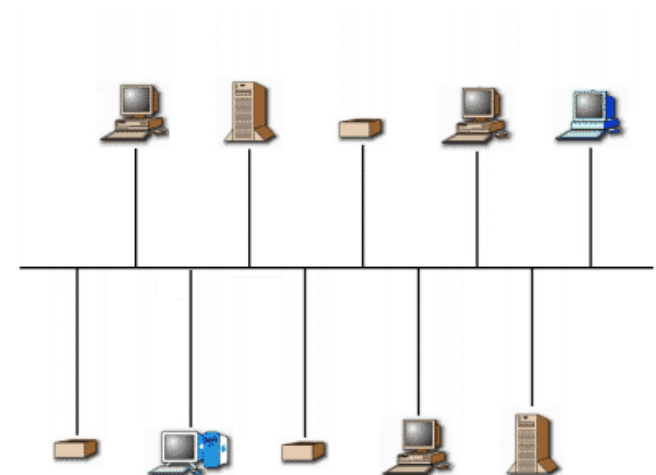
Physical Topology

It describes how network devices are physically connected by the media.



Logical Topology

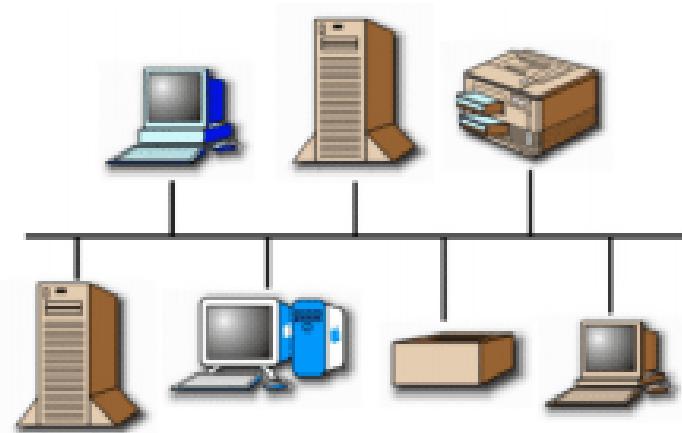
It creates a simple view of the basic network structure



Common LAN Topologies

Bus Architecture

- a single cable connects each workstation in a chained fashion.
- signals are broadcasted to all stations, but stations only act on the frames addressed to them



Bus Topology Pros/Cons

Common LAN Topologies

Ring Architecture

- Unidirectional links connect the transmit side of one device to the receive side of another device.
- Devices transmit frames to the next device (downstream member) in the ring.



Ring Topology Pros/Cons

Common LAN Topologies

- **STAR TOPOLOGY**
- Each station is connected to a central hub or concentrator that functions as a multi-port repeater.

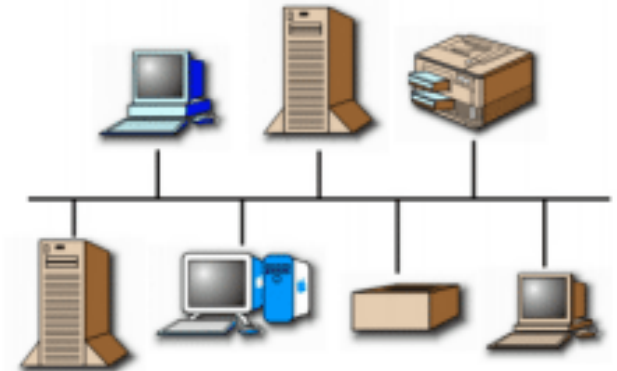


- **Star Topology Pros/Cons**

LAN Technologies

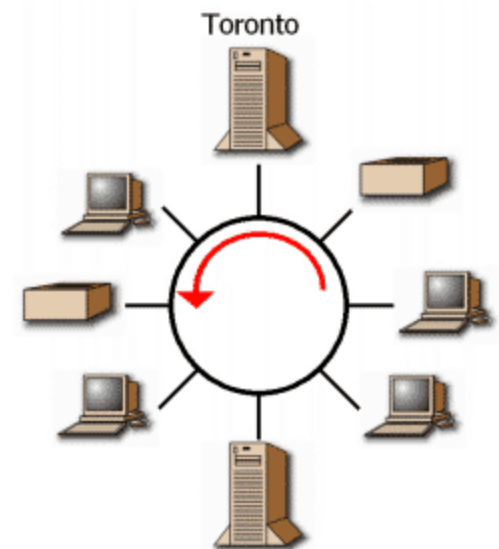
Ethernet

LAN specification developed by Xerox, Intel, and Digital
Based upon CSMA/CD and runs over various cable types.
Can run at 10, 100 and 1000 Mbps.



Token ring

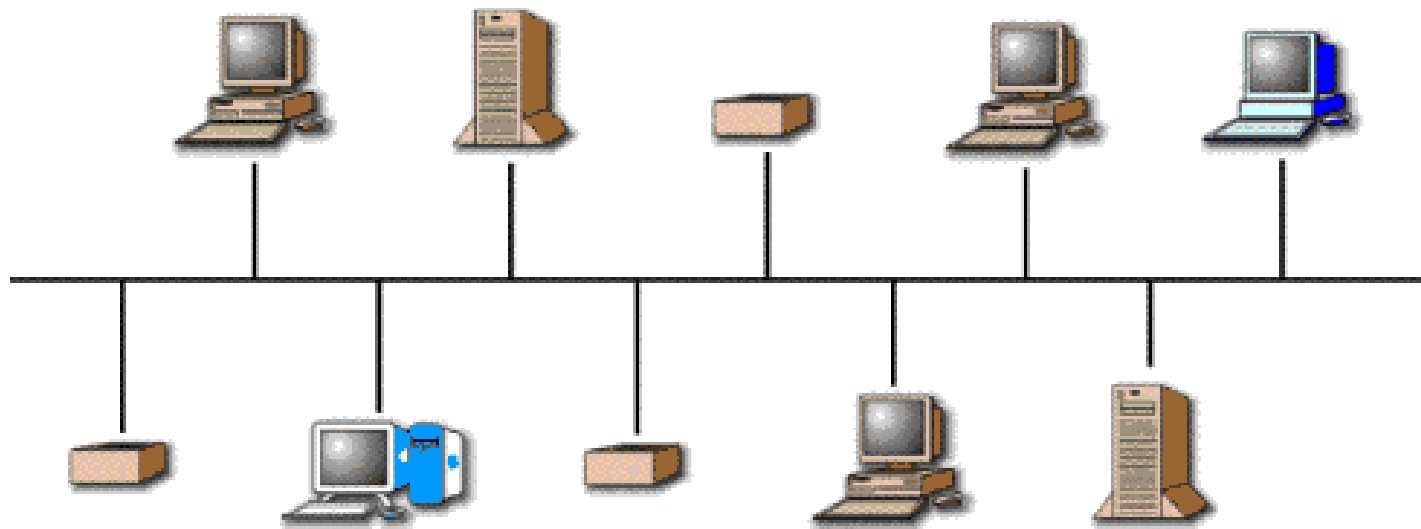
Token Ring / IEEE 802.5 run at 4 and 16 Mbps.



Ethernet / IEEE 802.3

Carrier Sense Multiple Access with Collision Detection CSMA / CD.

Any station on the network can transmit whenever the network is quiet.



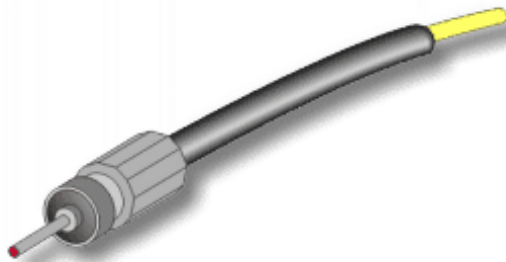
Media Used In Ethernet



Twisted pair cable



• **Coaxial Cable**



• **Fiber Optic**

Frame Format of Ethernet / IEEE 802.3

