## Lecture 6

**IEEE 802.3 10-Mbps Specification**

There is wide variety of options available for the physical medium to be used in 10 Mbps specification for IEEE 802.3. There is a concise notation:

<Data rate in Mbps><signaling method><maximum segment length in hundreds>

The defined specifications are

1. 10 Base 5
2. 10 Base 2
3. 10 Base-T
4. 10 Base-F

*<u>10 Base F specification</u>* enables the user to take advantage of the distance and transmission characteristics with the use of optical fiber. This standard actually contains three specifications

- 10 Base FP (passive): A passive-star topology for interconnecting stations and repeaters with up to 1 Km per segment.
- 10 Base FL (link): Defines a point-to-point link that can be used to connect stations or repeaters at up to 2 Km.
- 10 Base FP (backbone): Defines a point-to-point link that can be used to connect repeaters at up to 2 Km.

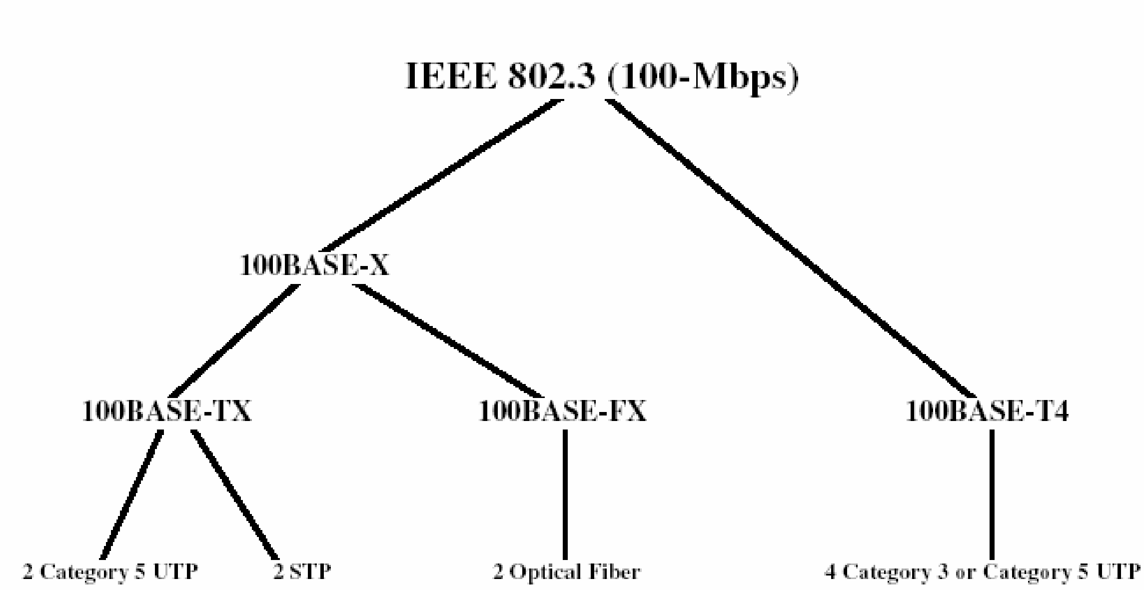
All three of these specifications make use of optical fibers for each transmission link, one for transmission in each direction. The signaling or encoding method is Manchester Encoding. Each Manchester signal element is then converted to an optical signal element. Thus a 10 Mbps specification actually requires 20 Mbps on the fiber.

The 10 Base FP uses a passive star topology which means, it can store up to 33 stations attached to a central passive star. Also 10 Base FP makes use of synchronous transmission.

The 10 base FL or FP defines point to point connections that can be used to extend the length of a network. Here asynchronous transmission is used.

**IEEE 802.3 100 Mbps Specification (Fast Ethernet)**

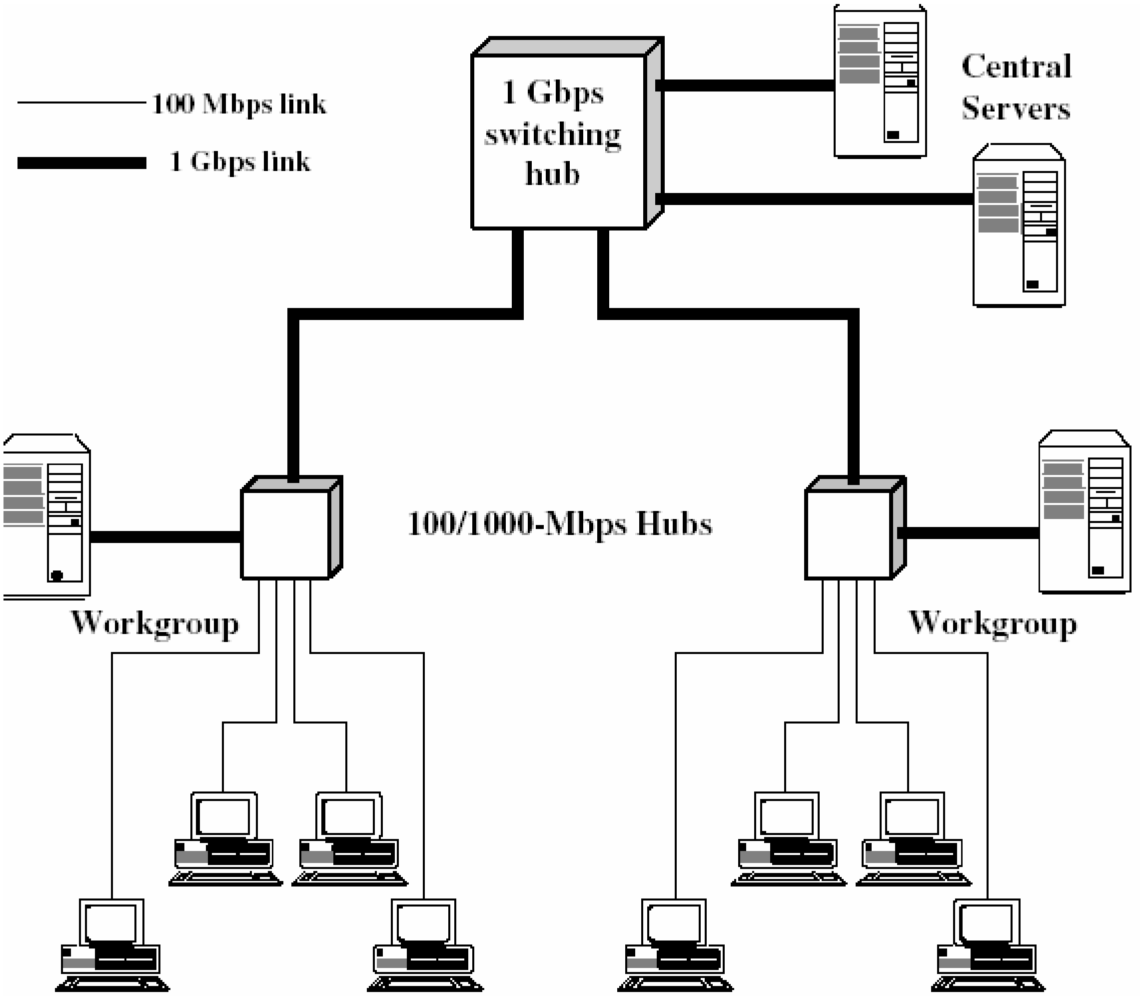
Fast Ethernet is a set of specification developed by IEEE 802.3 to develop a low cost, Ethernet compatible LAN operating at 100 Mbps.




All of the 100 Base X schemes uses two physical links between nodes; one for transmission and one for reception. 100 Base T4 specifies that the data stream to be transmitted is split up into three separate data streams, each with an effective data rate of 33.3 Mbps, four twisted pair are used. Data are transmitted using three pairs and received using three pairs. Thus two of the pairs must be configured for bidirectional transmission.

**IEEE 802.3 1000 Mbps Specification (Gigabit Ethernet)**

In 1995, IEEE 802.3 committee formed a study group to explore possibilities for transmitting packets in Ethernet at speeds in the gigabits per second. This exploration gave rise to Gigabit Ethernet. Figure below shows a 1-Gbps switching hub provides backbone connectivity for central servers and high speed work-group hubs. Each workgroup hub supports up to 1-Gbps links, to connect to the backbone hub and to support high performance workgroup servers, and 100 Mbps links to support workstations.

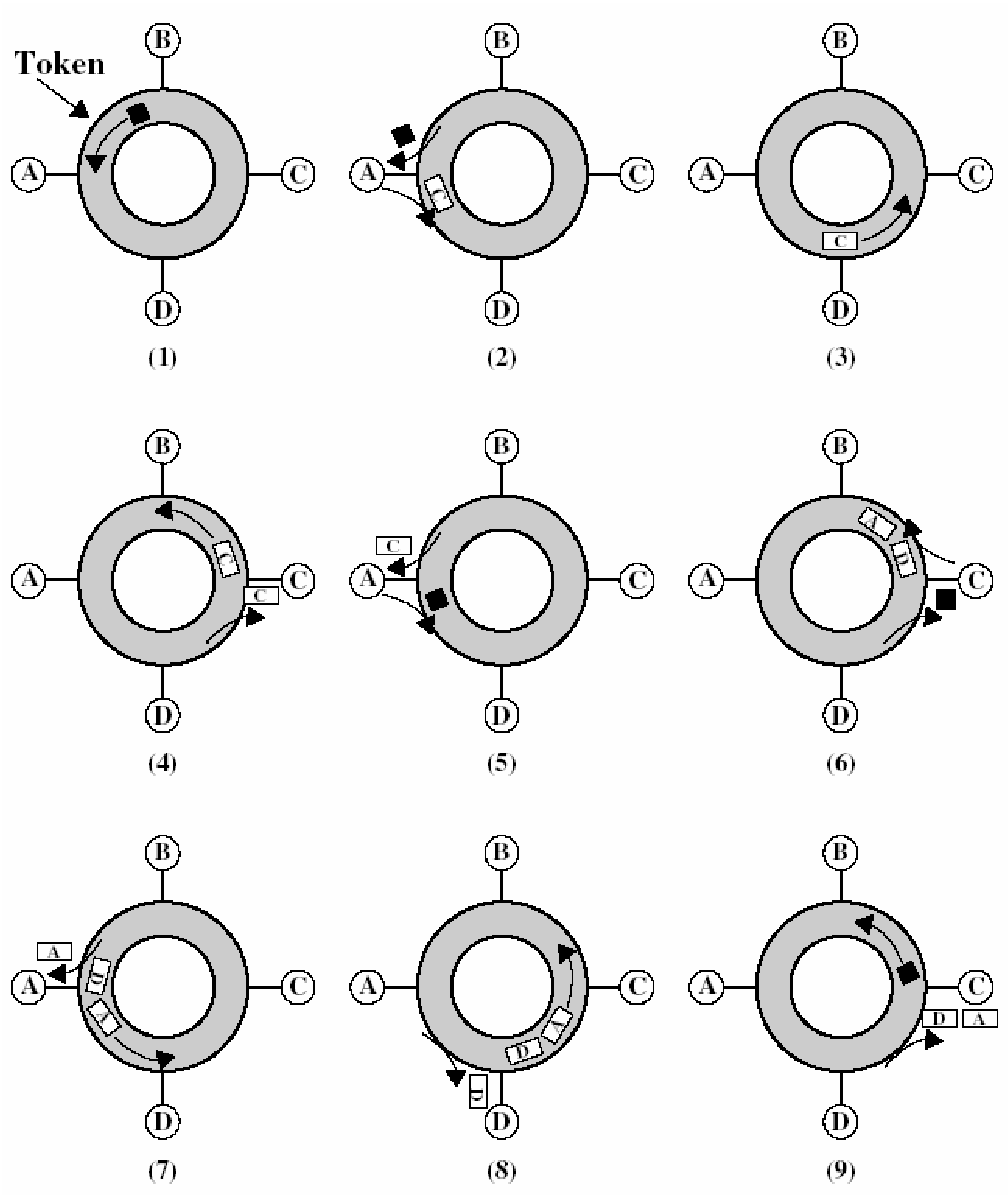



The current 1Gbps specification for IEEE 802.3 includes the following physical layer alternatives:

- 1000 Base SX: This short wavelength option supports duplex links of up to 275m using 62.5 $\mu$m multimode. Wavelengths are in the range 770 to 860 nm.
- 1000 Base LX: This long wavelength option supports duplex links of up to 550m of 62.5 $\mu$m multimode. Wavelengths are in the range of 1270 to 1355 nm.
- 1000 Base CX: This option supports 1-Gbps links among devices located within a single room or equipment rack. Each link is composed of a separate shielded twisted pair running in each direction.
- 1000 Base T: This option makes use of Category 5 unshielded twisted pair to support devices over a range of up to 100m.

**Token Ring MAC Sub layer Protocol (IEEE 802.5)**

In a Token Ring, stations are physical placed in a ring topology. IEEE 802.5 is based on **token passing** access method. A special bit pattern, called the token, circulates around the ring whenever all stations are idle.



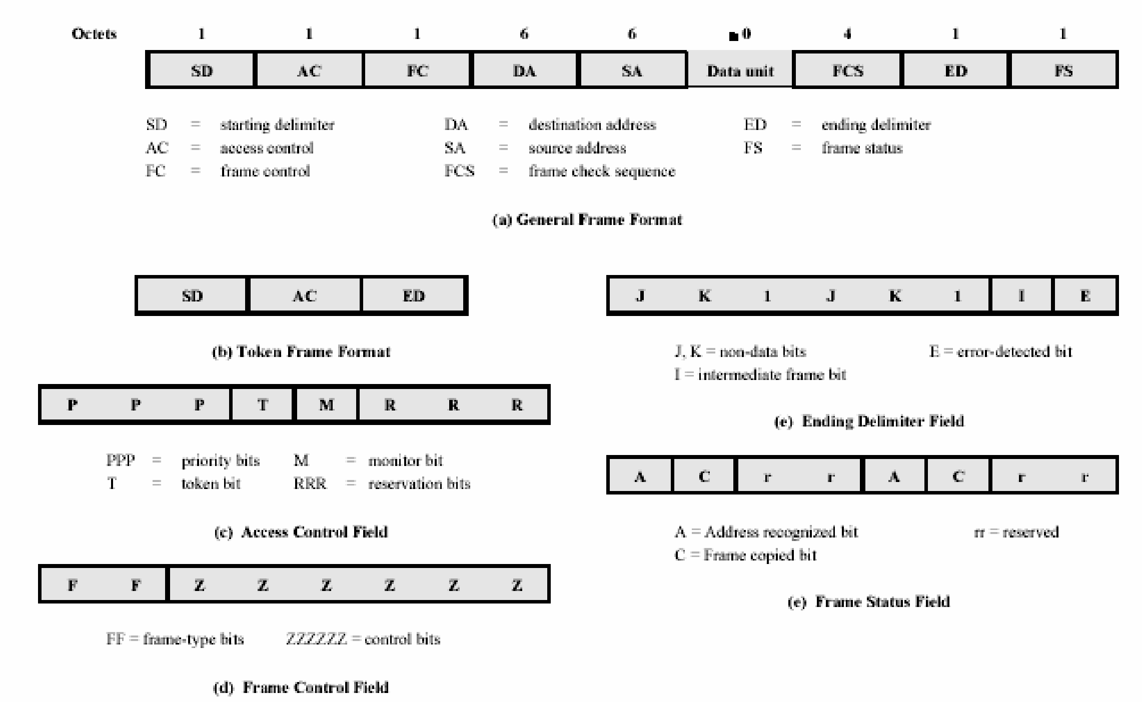

When a station wants to transmit a frame, it is required to seize the token and remove it from the ring before transmitting. This action of converting a token into frame is done by inverting a single bit in the 3-byte token, and since there is only one token, so only one

station can transmit at a moment, hence no collisions, thus solving the channel allocation problem.
The transmitting station will insert a new token on the ring when both of the following conditions have been met

1. The station has completed transmission of its frame.
2. The leading edge of the transmitted frame has returned (after a complete circulation of the ring) to the station.

Token ring uses Differential Manchester encoding and supports data rate of 1 to 16 Mbps.

### Frame Format of Token Ring (IEEE 802.5)




**Start Delimiter:** The first field SD, alerts the receiver about the arrival of frame, in a way it marks the beginning of the frame. It also allows the receiver to synchronize himself. The contents of SD are JK0JK000, so no bit stuffing is required.

**Access Control**: This field is further divided into four subfields. It serves the purpose of defining the priority of the frame, reservation for future. The four subfields are token bit (as we discussed above), monitor bit, priority bit, reservation bit. Since one of the stations among all the station, act as the monitor, so this bit is required at the time of choosing the monitor. Priority bit is used, when a station want to transmit a priority n frame, it must wait until it can capture a token whose priority is less than or equal to n.
Each station has its own priority code, as a frame passes by, a station waiting to transmit may reserve the token for the next transmission by entering its priority code in the access control field (reservation bit subfield). A station with a higher priority may remove a lower priority reservation and replace it with its own. Through this mechanism, the station holding the reservation gets the token as soon as the current transmission is over.

**Frame Control:** It distinguishes data frame from the various possible control frame and also provide information of the type of control frame if any.

**Destination Address**: This field contains the address of the destination node.

**Source Address**: This field contains the address of the source node.

**Data**: This field contains the actual data that need to be transmitted; there is no limit on the length of the data, which was not the case with 802.3.

**Checksum**: It contains the CRC, which is required for error detection at the receiver end.

**Ending Delimiter:** The second last field ED, alerts the receiver about the end of frame. It also allows the receiver to synchronize himself. The contents of ED are JK1JK11E, so no bit stuffing is required. This field also has a subfield of 1 bit called as E bit, which is set if any interface detects an error in the frame.

**Frame Status**: This field is for the purpose of acknowledgment. It consists of two bits A and C. If the indented receiver is there, and he receives the frame, then A is set to 1, if the receiver is able to copy the frame then C is also set to 1.
When sender sends the frame both A and C are set to 0. When receiver receives the frame, it sets A=1, and C=1, when this frame is received again by the sender (after whole cycle of the ring is completed), he sees the value of A and C, and decides upon.

If the values received are
A=0 and C=0, means receiving station not present and hence unable to copy
A=1 and C=0, means receiving station is present but unable to copy, may be frame is Damaged.
A=1 and C=1, means receiving station is present and successfully copied the frame.