IEEE STANDARDS

802.3,802.4,802.5

INTRODUCTION

- **IEEE 802** refers to a family of IEEE standards
  - Dealing with local area network and metropolitan area network.
  - Restricted to networks carrying variable-size packets.
  - Specified in IEEE 802 map to the lower two layers
    - ✓ Data link layer
    - ✓ Physical layer

- The most widely used standards
- .802.3 – Ethernet
- 802.4 – Token Bus
- 802.5 – Token Ring

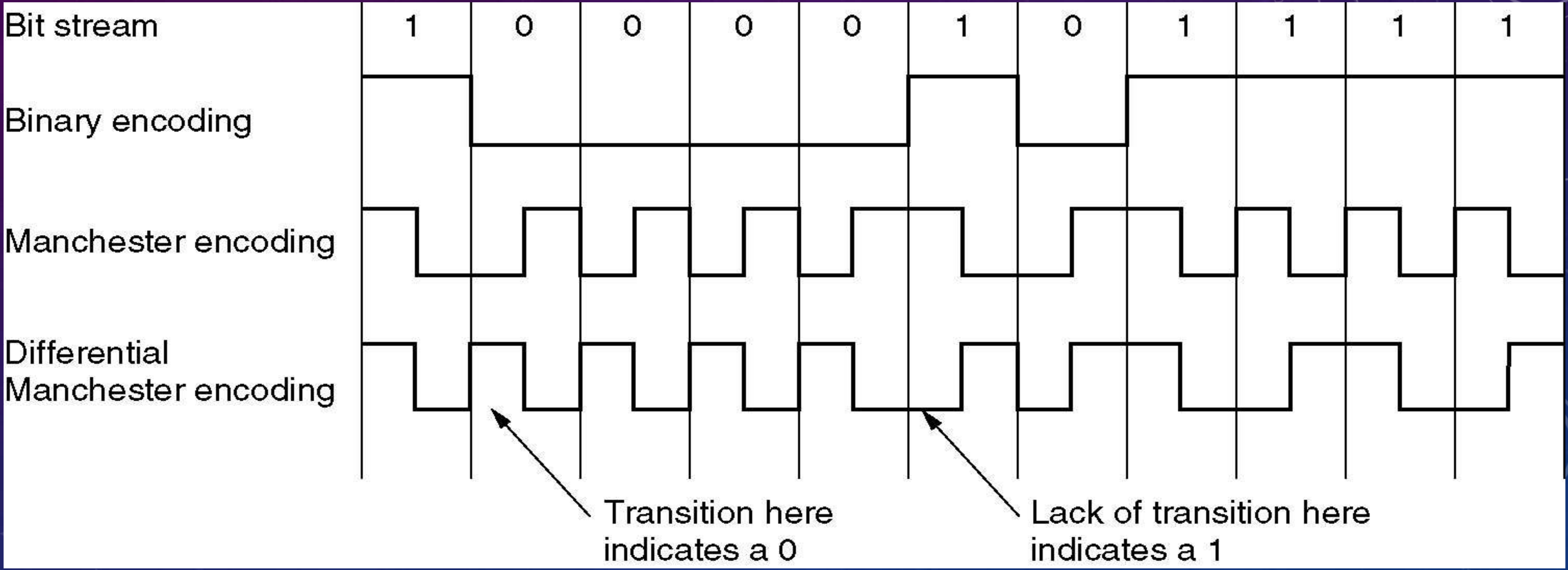
ETHERNET (IEEE 802.3)

- The IEEE 802.3 standard specifies the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) media access control method. CSMA/CD is the most commonly employed access method for LANs using a bus or tree topology. It is the media access control method used by Ethernet[1].
- Most widely type used at present, with a huge installed base and considerable operational experience.
- Protocol is very simple
- Stations can be added without making the network down.
- The delay at low load is practically zero. (no token waiting)

ETHERNET CABLING

Name	Cable	Max. seg.	Nodes/seg.	Advantages
10Base5	Thick coax	500 m	100	Original cable; now obsolete
10Base2	Thin coax	185 m	30	No hub needed
10Base-T	Twisted pair	100 m	1024	Cheapest system
10Base-F	Fiber optics	2000 m	1024	Best between buildings

ETHERNET SIGNALLING



(a) Binary encoding, (b) Manchester encoding,
(c) Differential Manchester encoding.

CSMA/CD TRANSMISSION FRAME

Preamble (7 bytes)	Start of Frame Delimiter (1 byte)	Dest. Address (6 bytes)	Source Address (6 bytes)	Length (2 bytes)	Data (0-1500 bytes)	Pad (0-46 bytes)	Frame Checksum (4 bytes)

FIGURE 1: CSMA/CD (IEEE 802.3) FRAME FORMAT

❖ Preamble

The preamble is responsible for providing the synchronization between the sending and receiving device.It is a series of 56 bits (7 bytes) of alternating 1s and 0s found at the beginning of the frame[2]

❖ Start of Frame Delimiter

The start frame delimiter follows the preamble. As its name implies, it indicates the start of the data frame. The start frame delimiter is 1 byte in length—made up of the following 8-bit sequence—10101011[3].

❖ Address Fields

Each of the address fields—the destination address and the source address—can be either 2 bytes or 6 bytes in length. If universal addressing is used, the addresses must be 6 bytes each. But if local addressing is used they may be either 2 or 6 bytes long. Both destination and source addresses must be of the same length for all devices on a given network[2].

❖ Length Count

This is a 2-byte field indicating the length of the data field that follows. It is needed to determine the length of the data field in those cases when a pad field is used[2].

❖Information Field

The information field contains the actual data packet to be transmitted. Its length is variable[2].

❖ Pad Field

A pad field is used to ensure that the frame meets a minimum length requirement. A frame must contain a minimum number of bytes in order for stations to detect collisions accurately[2].

❖Frame Check Sequence

The frame check field is used as an error-control mechanism. When the transmitting device assembles a frame, it performs a calculation on the bits in the frame. The algorithm used to perform this calculation always results in a 4-byte value. The sending device stores this value in the frame check sequence field[2].

TOKEN BUS (IEEE 802.4)

- The IEEE 802.4 standard specifies the Token-bus media access control method. It is one of two token passing access methods. IEEE 802.4 is based on a physical bus or tree topology. The Token-bus approach requires a station to have possession of a token in order to transmit. The token is passed from station to station in a logical ring[3].
- Uses highly reliable cable television equipments.
- It is more deterministic than 802.3, although repeated loss of token at critical times can introduce the uncertainness.
- Can easily handle shorter frames. (no limitation on frame size)
- It supports priorities and hence suitable for Real Time traffic.
- It also has excellent throughput and efficiency at high load.

TOKEN-BUS TRANSMISSION FRAME

Preamble (1 bytes)	Start of Frame (1 byte)	Frame Control (1 byte)	Destination Address (2/6 bytes)	Source Address (2/6 bytes)	Data (0-8182bytes)	Frame Checksum (4 bytes)	End of Frame (1 byte)

FIGURE2 : Token Bus (IEEE 802.4) FRAME FORMAT

❖ Preamble

The preamble is responsible for providing the synchronization between the sending and receiving device. The length of this field and its contents depend on the modulation method being used and the speed of the network.

❖ Start of Frame

The start delimiter follows the preamble. As its name implies, it indicates the start of the data frame. The start frame delimiter is 1 byte in length and contains a signaling pattern that is always different from the data—the actual signaling pattern varies with the encoding scheme used[5].

❖ Frame Control

This field identifies the type of frame being sent—Logical Link Control data frames, token control frames, Media Access Control management data frames, or special-purpose data frames.

❖ Address Fields

Each of the address fields—the destination address and the source address—can be either 2 bytes (16-bit addresses) or 6 bytes (48-bit addresses) in length. If universal addressing is used, the addresses must be 6 bytes each. But if local addressing is used they may be either 2 or 6 bytes long. Both destination and source addresses must be of the same length for all devices on a given network. The source address must be for an individual device. The destination address can be an individual address, a group address or a broadcast address[5].

❖ Information Field

The information field contains the actual data packet to be transmitted. Its length is variable. It may contain a Logical Link protocol data unit, token control data, management data or special-purpose data—as indicated in the frame control field.

❖ Frame Checksum

The frame check field is used as an error control mechanism. When the transmitting device assembles a frame, it performs a calculation on the bits in the frame. The algorithm used to perform this calculation always results in a 4-byte value. The sending device stores this value in the frame check sequence field. When the destination device receives the frame, it performs the same calculation and compares the result to that in the frame check sequence field. If the two values are the same, the transmission is assumed to be correct. If the two values are different, the destination device can request a retransmission of the frame[5].

❖ End of Frame

The end delimiter marks the end of the frame and shows the position of the frame check sequence field. Just as with the start delimiter, the signaling value is always different from the data.

TOKEN RING (IEEE 802.5)

- IEEE 802.5 is the second of the token passing access control methods. Token-ring is most commonly used in a network structure following both a logical and physical ring topology. The right to transmit is controlled by a token[3].
- It uses point-to-point connections and hence the engineering is easy.
- Any transmission media can be used.
- The use of wire centers make the token ring the only LAN that can detect and eliminate cable failures automatically.
- Like 802.4, priorities also possible, although the scheme is not as fair.
- Very short and very large frames both are possible.
- At very high load, the throughput and efficiency are excellent.

TOKEN-RING TRANSMISSION FRAME

Start of Frame (1 byte)	Access Control (1 byte)	Frame Control (1 byte)	Source Address (6 bytes)	Destination Address (6 bytes)	Data (unlimited)	Frame Checksum (4 bytes)	Frame Status (1 byte)	End of Frame (1 byte)

FIGURE 3: Token-Ring (IEEE 802.5) FRAME FORMAT

- **Start of frame**

The starting delimiter indicates the start of the data frame. It uses a unique signal pattern that does not correspond to either a 0 or 1 bit. These are known as nondata values and ensure that no data sequence will ever be mistaken for a delimiter.

- **Access Control Field**

This field identifies whether the frame is a data frame or a token. It contains a bit used to identify a constantly busy token, a priority bit and reservations bits.

- **Frame Control Field**

This field identifies the frame type and for certain types of control frames, the function it is to perform.

- **Address Fields**

Each of the address fields—the destination address and the source address—can be either 2 bytes (16-bit addresses) or 6 bytes (48-bit addresses) in length. If universal addressing is used, the addresses must be 6 bytes each. But if local addressing is used they may be either 2 or 6 bytes long. Both destination and source addresses must be of the same length for all devices on a given network.

The source address must be for an individual device. The destination address can be an individual address, a group address or a broadcast address.

- **Information Field**

The information field contains the actual data packet to be transmitted. This can be either a protocol data unit being passed from the logical link control sublayer or control information supplied by the media access control sublayer. Its length is variable anywhere from 0 to 17800 bytes in length.

- **Frame Check Sequence**

The frame check field is used as an error control mechanism. When the transmitting device assembles a frame, it performs a calculation on the bits in the frame. The algorithm used to perform this calculation always results in a 4 byte value. The sending device stores this value in the frame check sequence field. When the destination device receives the frame, it performs the same calculation and compares the result to that in the frame check sequence field. If the two values are the same, the transmission is assumed to be correct. If the two values are different, the destination station can request a retransmission of the frame.

- **Ending Delimiter**

This identifies the end of the frame by containing nondata values. It also contains bits used to identify whether or not it is the last frame in a multiframe transmission and if an error has been detected by any station.

- **Frame Status Field**

The frame status field contains the address recognized and frame copied control bits.

REFERENCE

[1]. http://www.erg.abdn.ac.uk/users/gorry/course/lan-pages/csma-cd.html

[2]. http://www.erg.abdn.ac.uk/users/gorry/course/lan-pages/enet.html

[3]. G. Watson, A. Albrecht, J. Curcio, D. Dove, S. Goody, J. Grinham, M.P. Spratt, and P.A. Thaler. The demand priority MAC protocol. IEEE Network, 9(1):28–34, Jan./Feb. 1995.

[4]. R. Yavatkar, P. Pai, and R. Finkel. A reservation-based CSMA protocol for inte-grated manufacturing networks. IEEE Transactions on Systems, Man, and Cybernet-ics, 24(8):1247–1258, Aug. 1994.

[5]. Q. Zheng and K.G. Shin. On the ability of establishing real-time channels in point-to-point packet-switched networks. IEEE Transactions on Communications, 42(2/3/4):1096–1105, Feb./Mar./Apr. 1994.

THANK YOU