Computer Network

Lecture-27

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IEEE 802 STANDARDS

- IEEE 802 is a collection of networking standards that cover the physical and data-link layer specifications for technologies such as Ethernet and wireless. These specifications apply to local area networks (LAN) and metropolitan area networks (MAN).
- IEEE stands for Institute of Electrical and Electronics Engineers.

Ethernet(802.3 standard)

It uses CSMA/CD protocol to access the medium.

Frame Format

The Ethernet frame contains seven fields: preamble, SFD, DA, SA, length or type of protocol data unit (PDU), upper-layer data, and the CRC.

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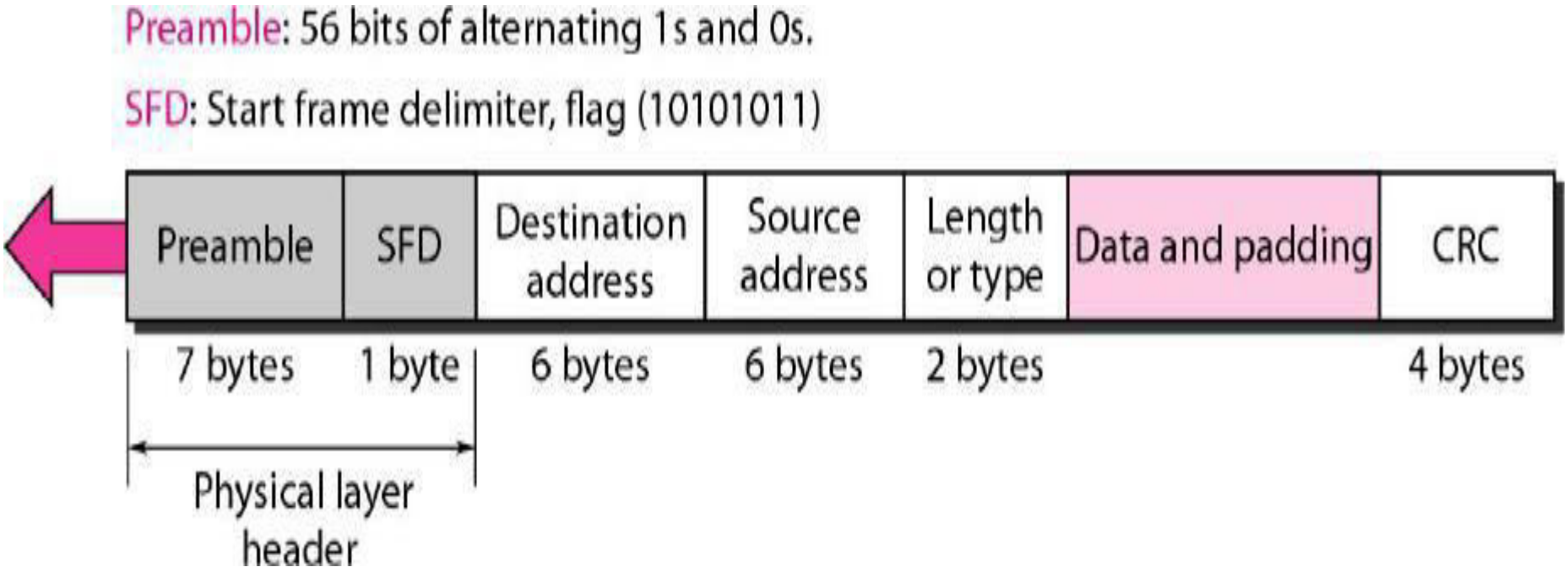

Preamble

This is the first field. It contains 7-bytes of alternating 0's and 1's that alerts the receiving system to the coming frame and enables it to synchronize its input timing. The preamble is actually added at the physical layer and is not part of the frame.

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Start frame delimiter (SFD)

The second field (1 byte: 10101011) signals the beginning of the frame. The SFD warns the station or stations that this is the last chance for synchronization. The last 2 bits is 11 and alerts the receiver that the next field is the destination address.

Destination address (DA)

The DA field is 6 bytes and contains the physical address of the destination station or stations to receive the packet.

Source address (SA)

The SA field is also 6 bytes and contains the physical address of the sender of the packet.

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Length or type

This field is defined as a type field or length field. The original

Ethernet used this field as the type field to define the upper-layer protocol using the MAC frame. The IEEE standard used it as the length field to define the number of bytes in the data field.

Data

This field carries data encapsulated from the upper-layer protocols. It is a minimum of 46 and a maximum of 1500 bytes.

CRC

The last field contains error detection information. It is of 4 bytes.

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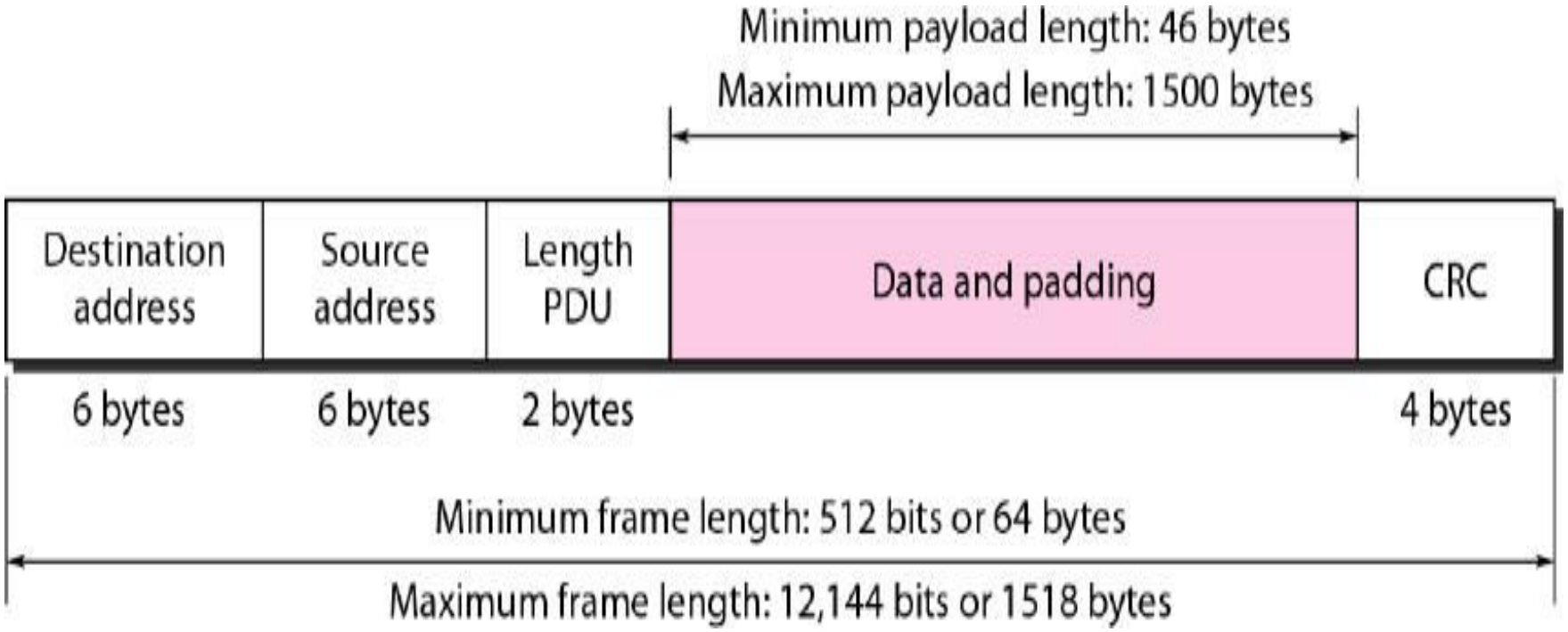
Frame Length

Ethernet has imposed restrictions on both the minimum and maximum lengths of a frame, as shown in below Figure:-



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Addressing

Each station on an Ethernet network has its own network interface card (NIC). The NIC fits inside the station and provides the station with a 6-byte physical address. It is written in hexadecimal notation, with a colon between the bytes.

06:01:02:01:2C:4B

Unicast, Multicast, and Broadcast Addresses

A source address is always a unicast address.

The destination address can be unicast, multicast, or broadcast.

If the least significant bit of the first byte in a destination address is 0, then the address is unicast; otherwise, it is multicast.

The broadcast address is a special case of the multicast address. In this case, the recipients are all the stations on the LAN. A broadcast destination address is forty eight 1's.

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Example

Define the type of the following destination addresses:

a) 4A:30:10:21:10:1A

b) 47:20:1B:2E:08:EE

c) FF:FF:FF:FF:FF:FF

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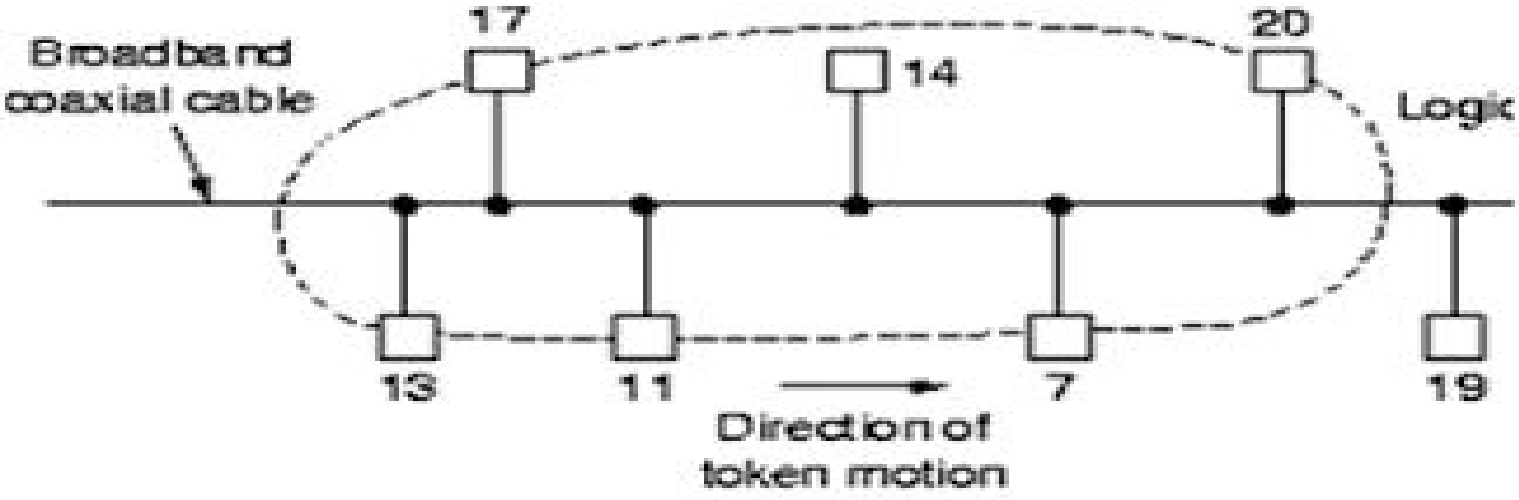
IEEE 802.4 (Token Bus)

- IEEE specifications include physical layer and media access control sublayer for network that uses a bus topology and use token passing as the media access method.
- In this, all nodes are connected in a logical ring. It supports electrical(coaxial) and fiber optic cable.



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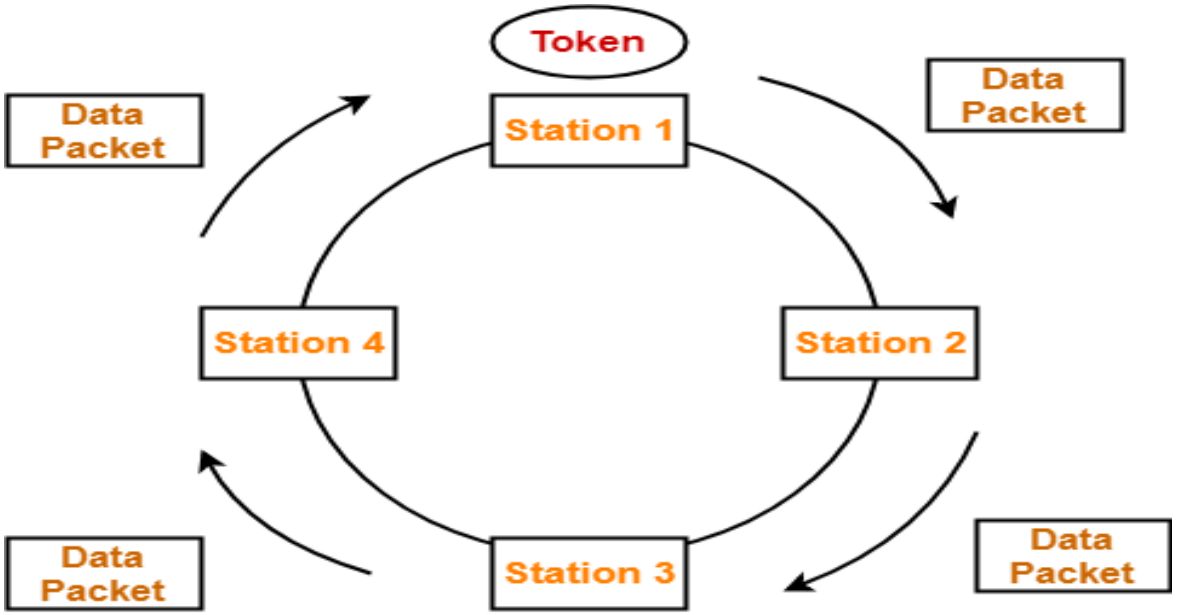
IEEE 802.5 (Token Ring)

- A token ring network consists of a set of nodes connected in a ring. Data always flows in a particular direction around the ring.
- It uses token passing as the media access method.



Delayed Token Reinsertion Token Passing

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Fiber Distributed Data Interface(FDDI)

Fiber Distributed Data Interface (FDDI) is a set of ANSI and ISO standards for transmission of data in local area network (LAN) over fiber optic cables. It is applicable in large LANs that can extend up to 200 kilometers in diameter.

Features

- FDDI uses optical fiber as its physical medium.
- It operates in the physical and medium access control (MAC layer) of the Open Systems Interconnection (OSI) network model.
- It provides high data rate of 100 Mbps and can support thousands of users.
- It is used in LANs up to 200 kilometers for long distance voice and multimedia communication.

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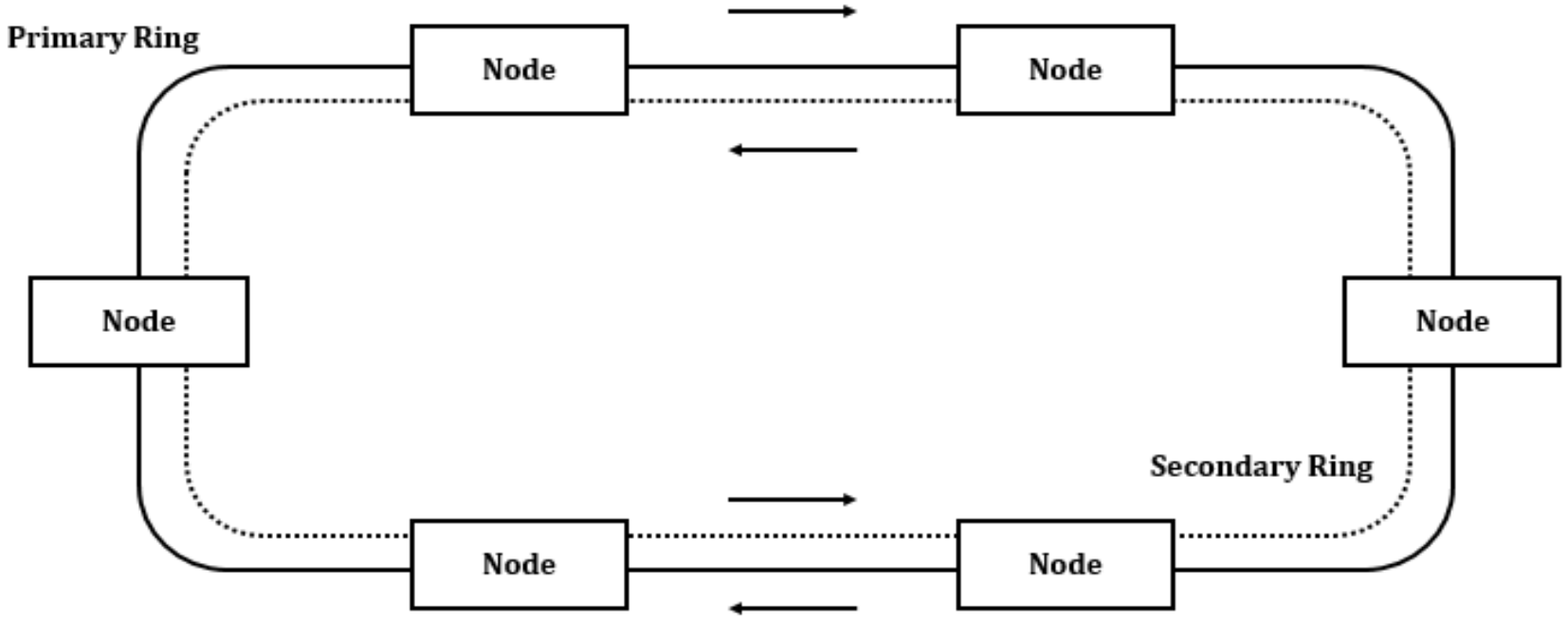
- It uses ring based token passing mechanism.
- It contains two token rings, a primary ring for data and token transmission and a secondary ring that provides backup if the primary ring fails.
- FDDI technology can also be used as a backbone for a wide area network (WAN).



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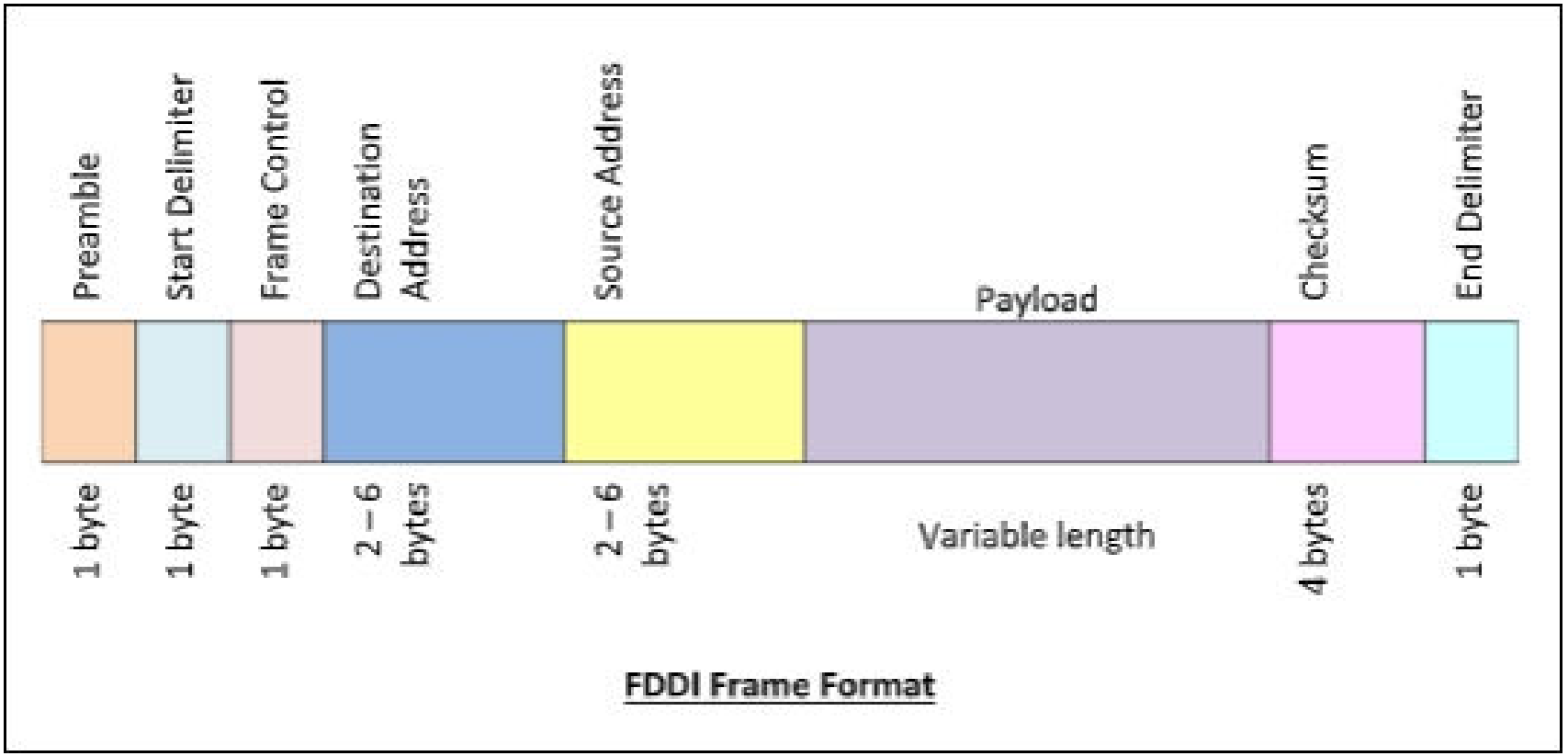
Frame Format

The frame format of FDDI is similar to that of token bus as shown in the following diagram –



FDDI Frame Format

AKTU Examination Questions

1. A bit string 0001111111001111101000 needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing?
2. Explain the working of pure ALOHA and slotted ALOHA protocols. How slotted ALOHA improve the performance of pure ALOHA?
3. List different carrier sense protocols. How CSMA/CD protocol is different from other CSMA/CA protocol?
4. What is piggybacking?
5. Measurement of slotted ALOHA channel with infinite number of users such that the 10 percent of slots are idle.

   (i) What is the channel load?

   (ii) What is the throughput?

AKTU Examination Questions

6. If a binary signal is sent over a 3KHZ channel. Whose signal to noise ratio is 20db. What is the maximum achievable data rate?
7. Discuss the issues in the data link layer and about its protocol on the basis of layering principle.
8. Discuss different carrier sense protocols. How are they different than collisions protocols?
9. Write short notes on following:

   i. Stop and Wait ARQ

   ii. Sliding Window Protocol

   iii. Go Back N ARQ

AKTU Examination Questions

10. An ALOHA network uses 9.2 kbps channel for sending message packets of 100 bits long size. Calculate the maximum throughput for pure ALOHA network.
11. What is the total delay (latency) for a frame size of 10 million bits that is being set up on link with 15 routers, each having queuing time of 2μs and a processing time of 1μs? The length of link is 3000km The speed of light inside the link is $2x10^8$ m/sec. The link has bandwidth of 6 Mbps.
12. What is hamming code? Explain its working with suitable example.
13. What are header and trailers and how do they get added and removed?

AKTU Examination Questions

14. A large FDDI ring has 100 stations & a token rotation time of 40 msec. The token holding time is 10 msec. What is the maximum achievable efficiency of the ring?
15. A channel has a bit rate of 20 kbps. The stop and wait protocol with frame size 4500 bits is used. The delay for error detection and sending ACK by the receiver is 0.25 seconds because of a fault. Find the maximum efficiency of the channel if the destination is 30000 km away and the speed of the propagation of the signal is $2.8X10^8$ m/s. Find the decrease in efficiency due to the fault.
16. A slotted ALOHA network transmits 400-bit frames on a shared channel of 400 kbps. What is the throughput if the system (all stations together) produces –

    (i) 1000 frames per second

    (ii) 500 frames per second

    (iii) 250 frames per second

AKTU Examination Questions

17. Explain ARQ Error Control technique, in brief.
18. Compare ALOHA with slotted ALOHA.
19. State the requirements of CRC.
20. Discuss the issues in the data link layer and about its protocol on the basis of layering principle.
21. Consider the use of 10 K-bit size frames on a 10 Mbps satellite channel with 270 ms delay. What is the link utilization for stop-and-wait ARQ technique assuming $P=10^{-3}$?
22. Brief about how line coding implemented in FDDI and describe its format.
23. Illustrate the performance issues for GO-BACK-N data link protocol.