Module
6
Metropolitan Area Networks

Lesson
20
Fibre Distributed Data Interface (FDDI)

LESSON OBJECTIVE

General

The lesson will discuss a popular fiber optic LAN, i.e. the Fiber Distributed Data Interface

Specific

The focus areas of this lesson are:

1. the idea of FDDI
2. cabling concept of FDDI
3. types of stations in FDDI
4. frame format of FDDI
5. Physical and MAC layer specifications

6.2.1 INTRODUCTION

Fiber distributed data interface (FDDI) is a high-performance fiber optic token ring LAN running at 100 Mbps over distances up to 200 km with up to 1000 stations connected. FDDI is used as backbone to connect copper LANs as shown in the figure.

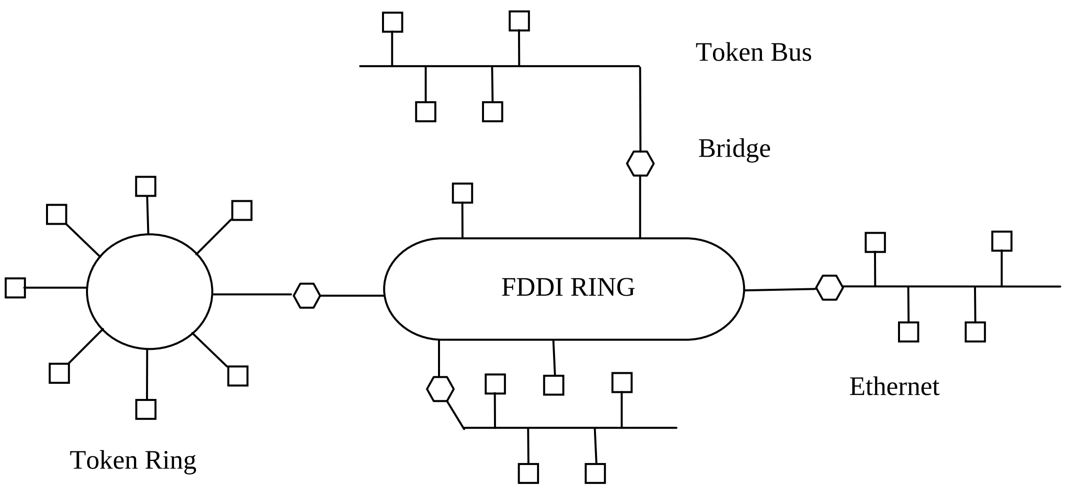

Figure 1 FDDI network structure

FDDI uses a multimode fiber because the cost of single mode fiber is not justified for networks running at only 100 Mbps. It also uses LEDs instead of Lasers not only because of the lower cost but also because FDDI may sometimes be used to connect directly to user workstations, and safety against exposure to LASER radiation is difficult to maintain in that case. The minimum BER required to be maintained is 1 in 2.5 x 10^{10}.

The FDDI cabling consists of two fiber rings, one transmitting clockwise and the other transmitting counterclockwise. If either one breaks the other acts as backup. If both the rings break at the same points, the two rings can be joined to forma new approximately twice as long. This new ring is formed by relays at the two nodes adjoining the broken link.

FDDI defines two classes of stations A and B. Class A stations connect to both rings. The cheaper class B stations only connect to one of the rings. Depending on how important fault tolerance is, an installation can chose class A or class B stations.

The physical layer in FDDI uses **4 out of 5** encoding scheme. i.e. each group of 4 MAC symbols are encoded as a group of 5 bits on the medium. Sixteen of the 32 combinations are for data, 3 are for delimiters, 2 are for control, 3 are for hardware signaling, and 8 are unused. This scheme saves bandwidth but the self clocking property available with Manchester coding is lost. To compensate a long preamble is used to synchronize the receiver to the sender's clock.

The basic FDDI protocols are modeled on the 802.5 protocols. The station must first capture a token, transmit a frame and remove it when it comes around. In FDDI the time spent in waiting for a frame to circumnavigate is reduced by allowing the station to put a new token back onto the ring as soon as it has finished transmitting its frames. In a large ring, several frames may be on the ring at the same time.

FDDI data frames are similar to 802.5 frames as shown below. Frame status byte holds acknowledgement bits, similar to those of 802.5. The frame control field tells what kind of frame this is (data, control, etc.)

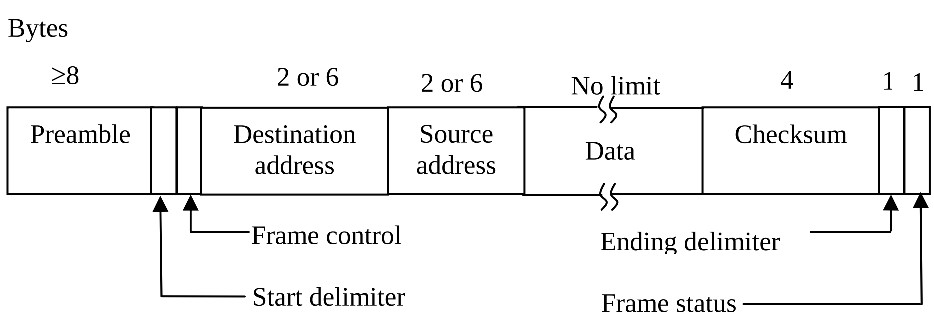

Figure 2 FDDI frame structre

In addition to the regular (asynchronous) frames, FDDI also permits special synchronous frames generated every 125 µs by the master for circuit switched PCM or ISDN data. Each of these frames has header, 16 bytes of non circuit- switched data and up to 96 bytes of circuit-switched data (96 = 4x 24 (4 T1 channel) = 3 x 32 (3 E1 channels)). Once a station has acquired one or more time slots in a synchronous frame, those slots are reserved for it until they are explicitly released. The total bandwidth not used by the synchronous frames is allocated on demand. The non synchronous traffic is divided into classes with the higher priorities getting first shot at the leftover bandwidth.

The FDDI MAC protocol uses three timers. The **token holding timer** determines how long a station may continue to transmit once it has acquired the token. The **token rotation timer** is restarted every time the token is seen. If this time expires, it means that the token has probably been lost and the token recovery procedure is initiated. Finally the **valid transmission timer** is used to time out, and recovers from certain transient ring errors. FDDI also has a priority algorithm similar to 802.4. It determines which priority classes may transmit on a given token pass. If a token is ahead of schedule, all priorities may transmit, but if it is behind schedule, only the highest ones may send.

FDDI is IEEE 802.5 with Optical Fiber Cable

FDDI has two versions - FDDI-I for data only and FDDI-II for voice and data. FDDI very elegantly provides protection against fiber failure. In case of a fault, the traffic is routed through the second fiber in the opposite direction.

FDDI and DQDB led to a rapid evolution of MAN. A MAN can be thought of

- Many LANs together with different physical and logical topologies
- Network spread over larger geographical area.

Objective Questions

20.01 FDDI is a high performance fiber optic token ring LAN running at ________Mbps over distances up to _______km.

20.02 What optical components does a FDDI use and why?

20.03 The physical layer in FDDI uses ___________encoding scheme.

Subjective Questions

20.11 Explain in brief the working of the FDDI protocol.

20.12 What are the different types of stations in FDDI.

20.13 Explain frame structure of the FDDI frame (data and control).

Level 2 Questions

20.21