

# Fiber Distributed Data Interface (FDDI)



**Advanced Computer Networks**  
**D12**

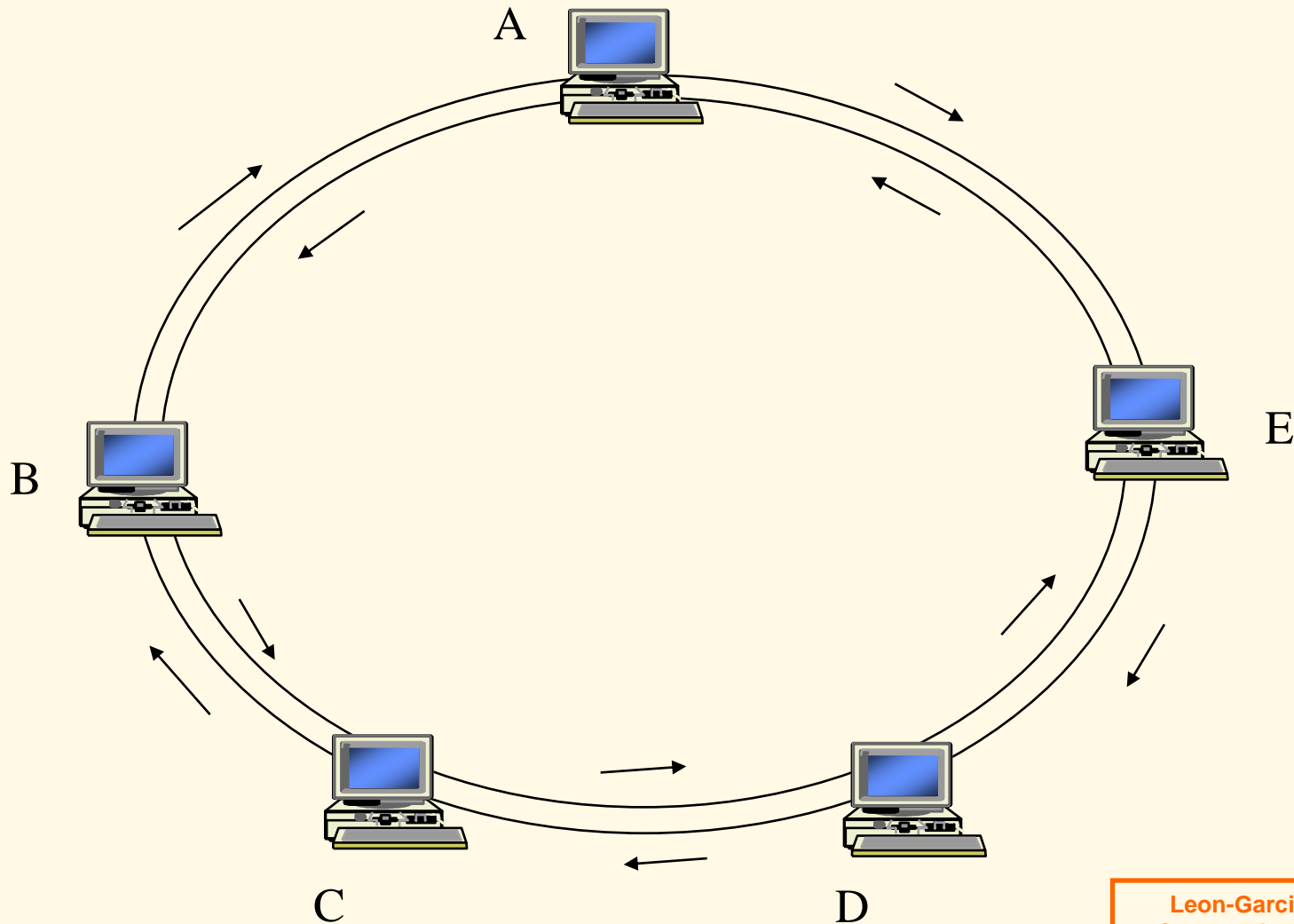
# FDDI Outline

- FDDI
  - 100 Mbps Dual Ring
  - Multiple-Token
  - Self-Healing Ring
- Target Token Rotation Time (TTRT)
- 4B/5B Encoder

# FDDI

- **FDDI** uses a ring topology of multimode or single mode **optical fiber** transmission links operating at 100 Mbps to span up to 200 kms and permits up to 500 stations.
- **Employs dual counter-rotating rings.**
- 16 and 48-bit addresses are allowed.
- In FDDI, token is absorbed by station and released as soon as it completes the frame transmission **{multi-token operation}**.

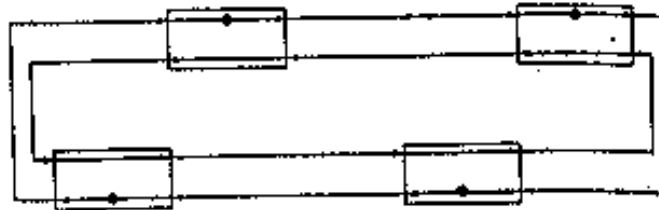
# FDDI: Dual Token Ring



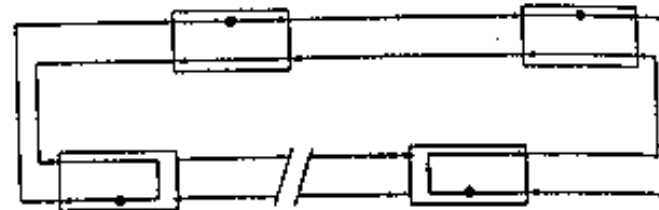
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# FDDI Repair

(a) Normal Operation



(b) Reconfigured After Link Failure



(c) Reconfigured After Station Failure

● = MAC Entry

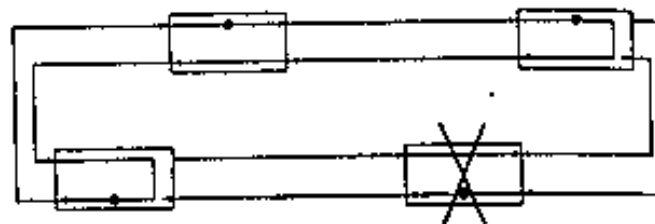
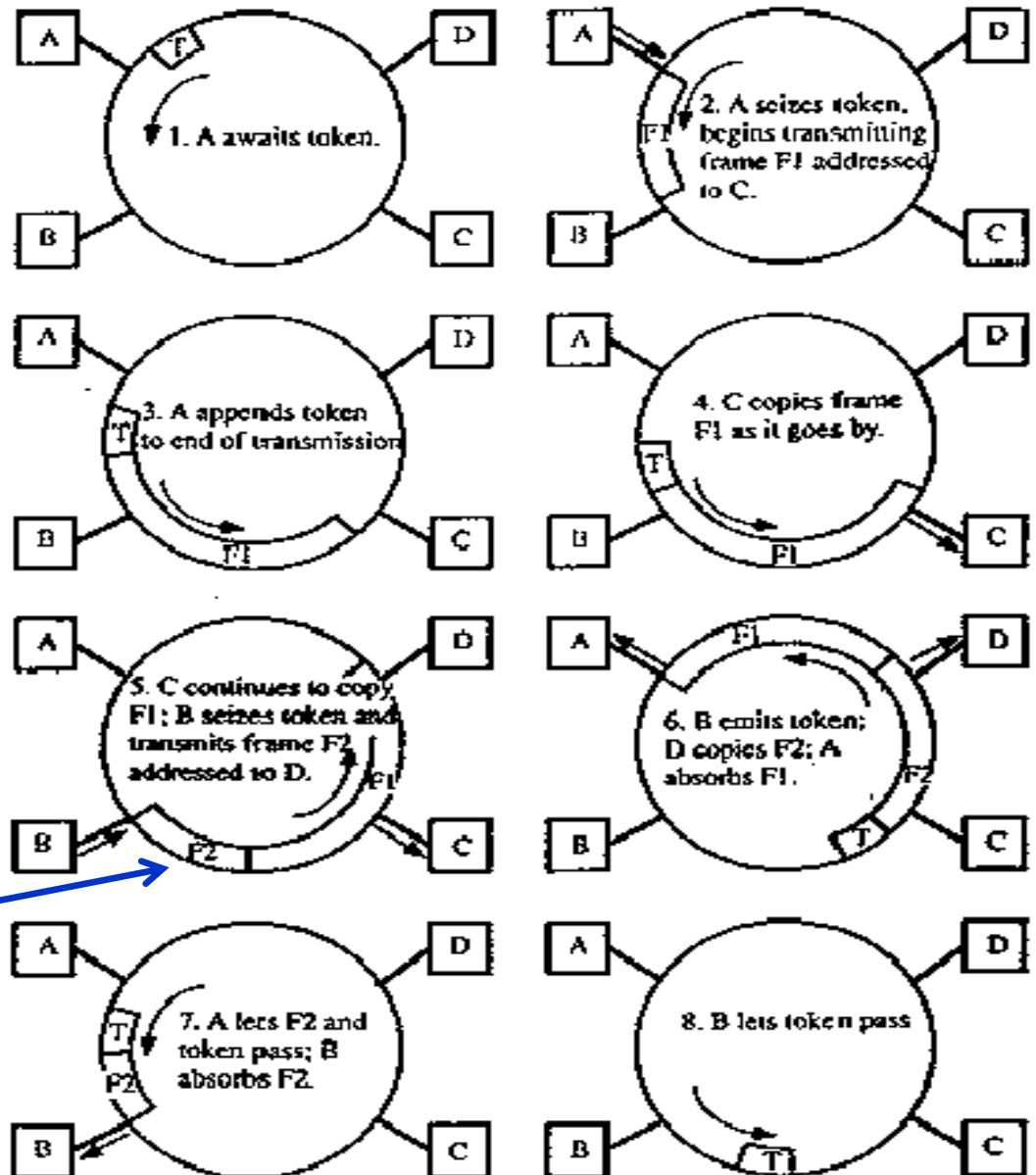


FIGURE 6.7 FDDI Dual-Ring Operation

**Self-healing dual ring**

# FDDI Ring Operation

Multi-token implies more than one frame on the ring at the same time.



# FDDI

- . To accommodate a mixture of stream and bursty traffic, **FDDI** is designed to handle two types of traffic:
  - **Synchronous** frames that typically have tighter delay requirements (e.g., voice and video).
  - **Asynchronous** frames have greater delay tolerances (e.g., data traffic).
- . FDDI uses **TTRT (Target Token Rotation Time)** to ensure that token rotation time is less than some value.

# FDDI Data Encoding

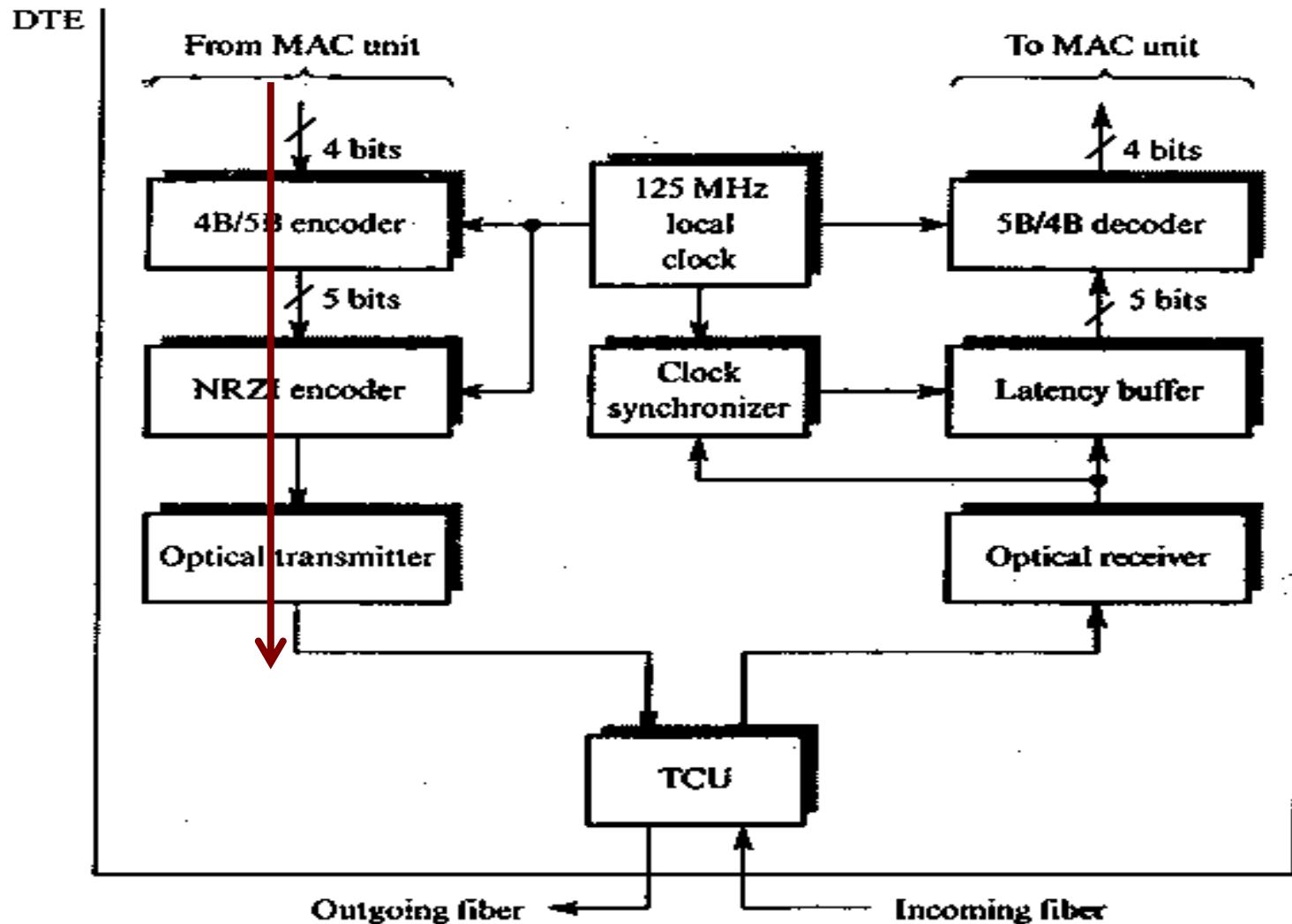
- Cannot use **differential Manchester** because 100 Mbps FDDI would require 200 Mbaud!
- Instead each ring interface has its own **local clock**.
  - Outgoing data is transmitted using this clock.
  - Incoming data is received using a clock that is frequency and phase locked to the transitions in the incoming bit stream.



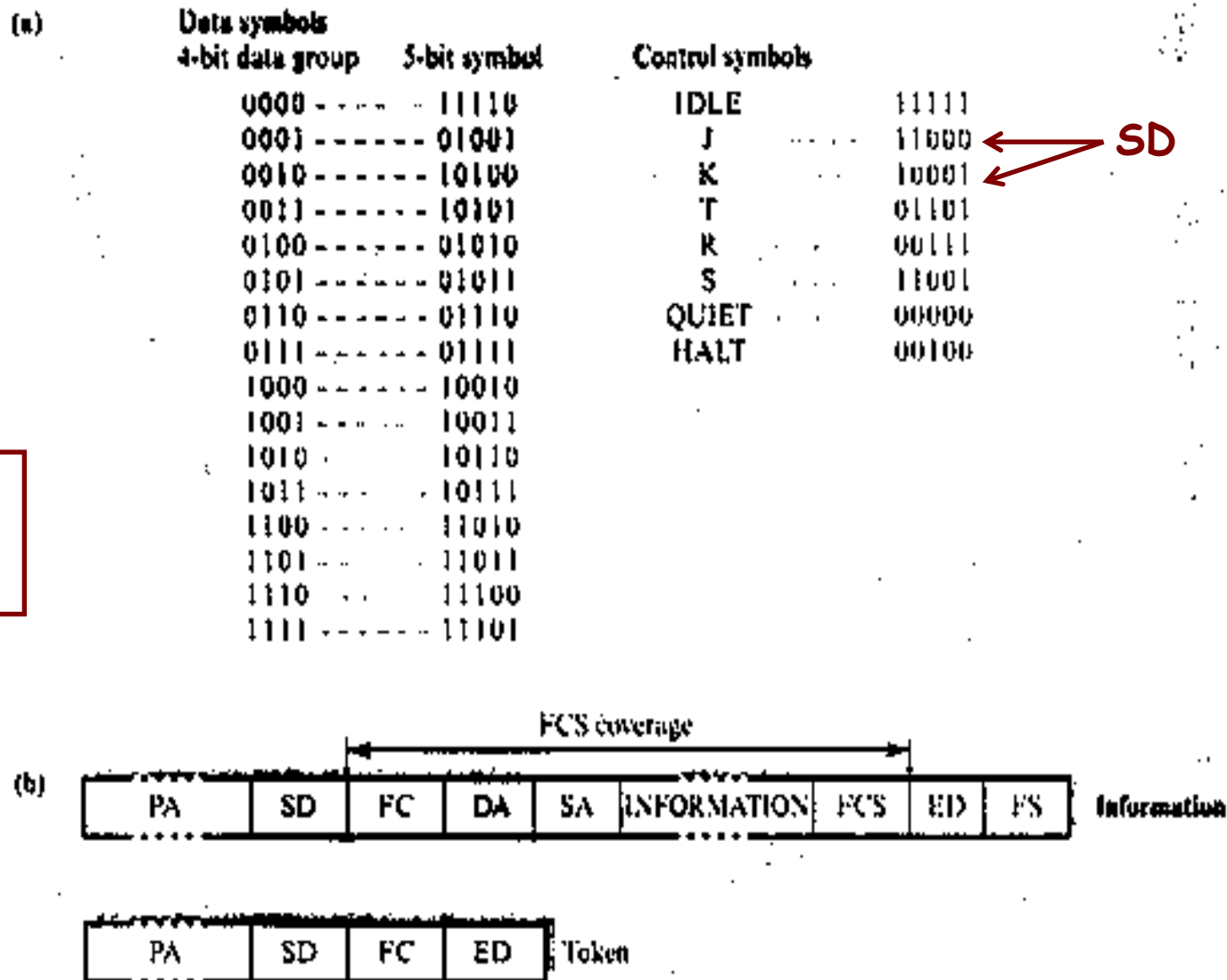
# FDDI Data Encoding

- Data is encoded using a **4B/5B encoder**.
  - For each **four bits** of data transmitted, a corresponding **five-bit** codeword is generated by the encoder.
  - There is a maximum of two consecutive zero bits in each symbol.
- The symbols are then shifted out through a **NRZI encoder** which produces a signal transition whenever a 1 bit is being transmitted and no transition when a 0 bit is transmitted.
- Local clock is 125MHz. This yields 100 Mbps (80% due to 4B/5B).

# FDDI



# FDDI



**Figure 7.15**

FDDI line coding and framing detail:

(a) 4B5B codes;

(b) frame formats.

PA = Preamble (16 or more symbols)  
 SD = Start delimiter (2 symbols)  
 FC = Frame control (2 symbols)  
 DA = Destination address (4 or 12 symbols)

SA = Source address (4 or 12 symbols)  
 FCS = Frame check sequence (8 symbols)  
 ED = End delimiter (1 or 2 symbols)  
 FS = Frame status (3 symbols)

# 4B/5B Codes

Table 16.5 4B/5B Code Groups (page 1 of 2)

Data Input (4 bits)	Code Group (5 bits)	NRZI pattern	Interpretation
0000	11110		Data 0
0001	01001		Data 1
0010	10100		Data 2
0011	10101		Data 3
0100	01010		Data 4
0101	01011		Data 5
0110	01110		Data 6
0111	01111		Data 7
1000	10010		Data 8
1001	10011		Data 9
1010	10110		Data A
1011	10111		Data B
1100	11010		Data C

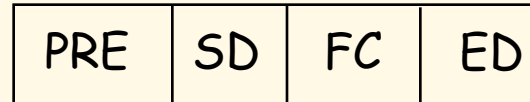
Table 16.5 4B/5B Code Groups (page 2 of 2)

1101	11011		Data D
1110	11100		Data E
1111	11101		Data F
	11111		Idle
J	11000		Start of stream delimiter, part 1
K	10001		Start of stream delimiter, part 2
T	01101		End of stream delimiter, part 1
R	00111		End of stream delimiter, part 2
	00100		Transmit error
	other		invalid codes

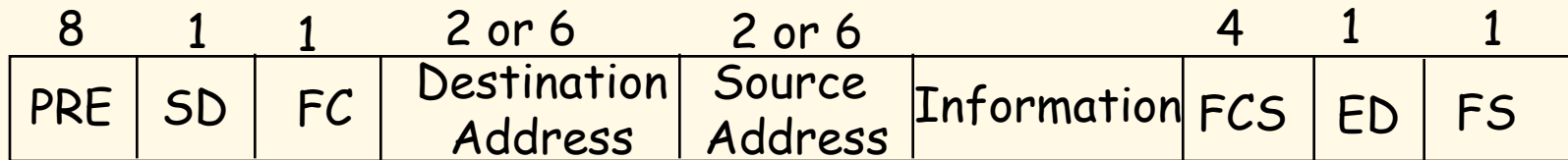
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# FDDI Frame Structure

Token Frame Format



Data Frame Format



Preamble

Frame  
Control

CLFFZZZZ

C = Synch/Asynch

L = Address length (16 or 48 bits)

FF = LLC/MAC control/reserved frame type

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# More FDDI Details

- FDDI Transmission on optical fiber requires **ASK** (e.g., coding is done via the absence or presence of a carrier signal **{Intensity Modulation}**.)
- Specific 5-bit codeword patterns chosen to guarantee no more than **three zeroes in a row** to provide for adequate synchronization.
- 1300 nm wavelength specified.
- Dual rings (primary and secondary) – transmit in opposite directions.
- Normally, second ring is **idle** and used for **redundancy** for automatic repair (self-healing).

# IEEE 802.5 versus FDDI

## 802.5 Token Ring

- Shielded twisted pair
- 4, 16 Mbps
- No reliability specified
- Differential Manchester
- Centralized clock
- Priority and Reservation bits
- Three distinct token operations are possible.

## FDDI

- Optical Fiber
- 100 Mbps
- Reliability specified (dual ring)
- 4B/5B encoding
- Distributed clocking
- Timed Token Rotation Time (TTRT)
- Multi-token operation

# FDDI Summary

- FDDI
  - 100 Mbps Dual Ring
  - Multiple-Token
  - Self-Healing Ring
- Target Token Rotation Time
  - Two classes of traffic
- 4B/5B Encoder