LAN Technology

Other Protocols

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Other Protocols

Outlines:

- FDDI: Fiber Distributed Data Interface
- Token Ring: IEEE 802.5 LAN Protocol
- LLC: Logic Link Control (IEEE 802.2)
- SNAP: Sub-Network Access Protocol
- STP: Spanning Tree Protocol (IEEE 802.1D)
- LAB Activity: Protocols on Routers

IEEE 802.5 Token Ring

Proposed in 1969 and initially referred to as a *Newhall ring.*

Token ring :: a number of stations connected by transmission links in a ring topology. Information flows *in **one** direction along the ring* from source to destination and back to source.

Medium access control is provided by a small frame, **the token**, that circulates around the ring when all stations are idle. ***Only** the station possessing the token is allowed to transmit at any given time.*

Token Ring Operation

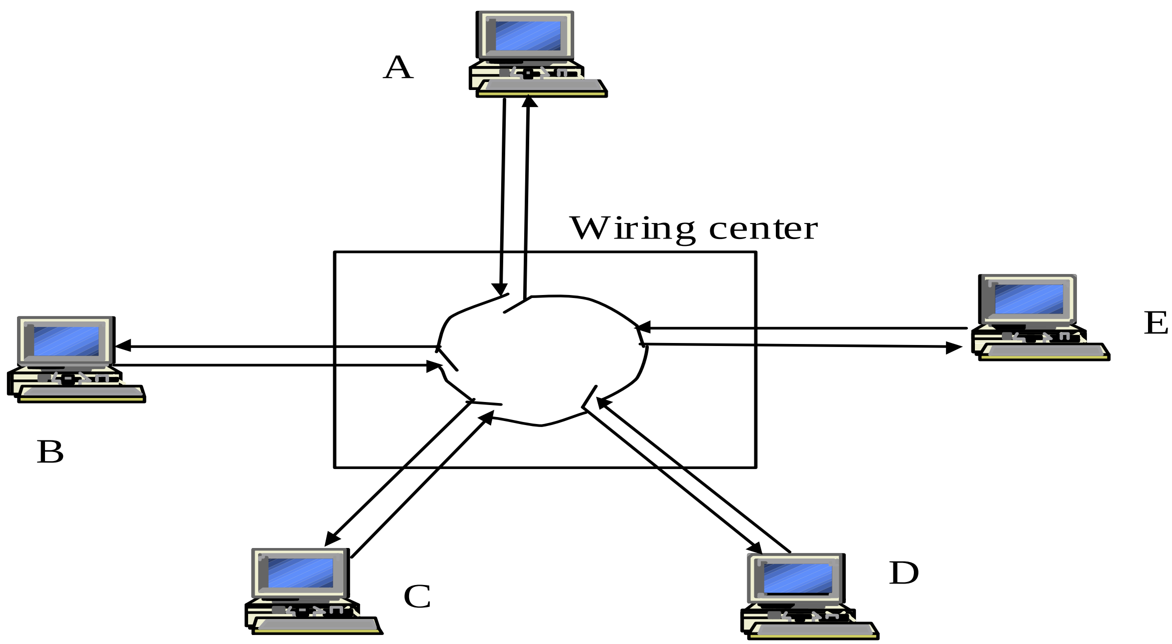
When a station wishes to transmit, it must wait for the token to pass by and ***seize the token***.

- One approach: change one bit in token which transforms it into a *"start-of-frame sequence"* and appends frame for transmission.
- Second approach: station claims token by removing it from the ring.

The data frame circles the ring and is removed by the transmitting station.

Each station interrogates passing frame. If destined for station, it copies the frame into local buffer. **{Normally, there is a one bit delay as the frame passes through a station.}**

Token Ring Network with Star Topology



Token Insertion Choices

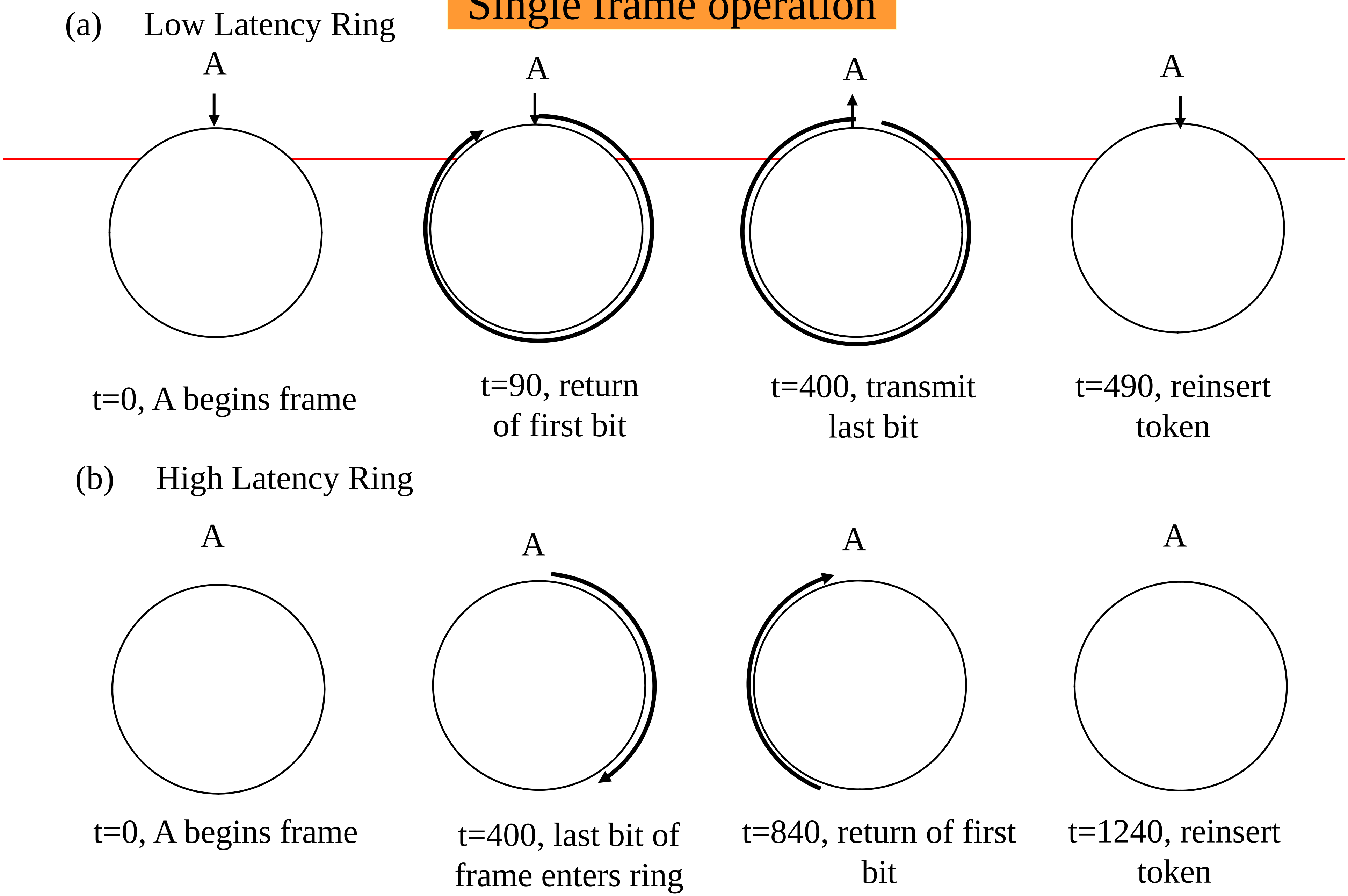
multi-token: insert token after station has completed transmission of the last bit of the frame.

single-token: insert token after last bit of busy token is received and the last bit of the frame is transmitted.

single-frame: insert token after the last bit of the frame has returned to the sending station.

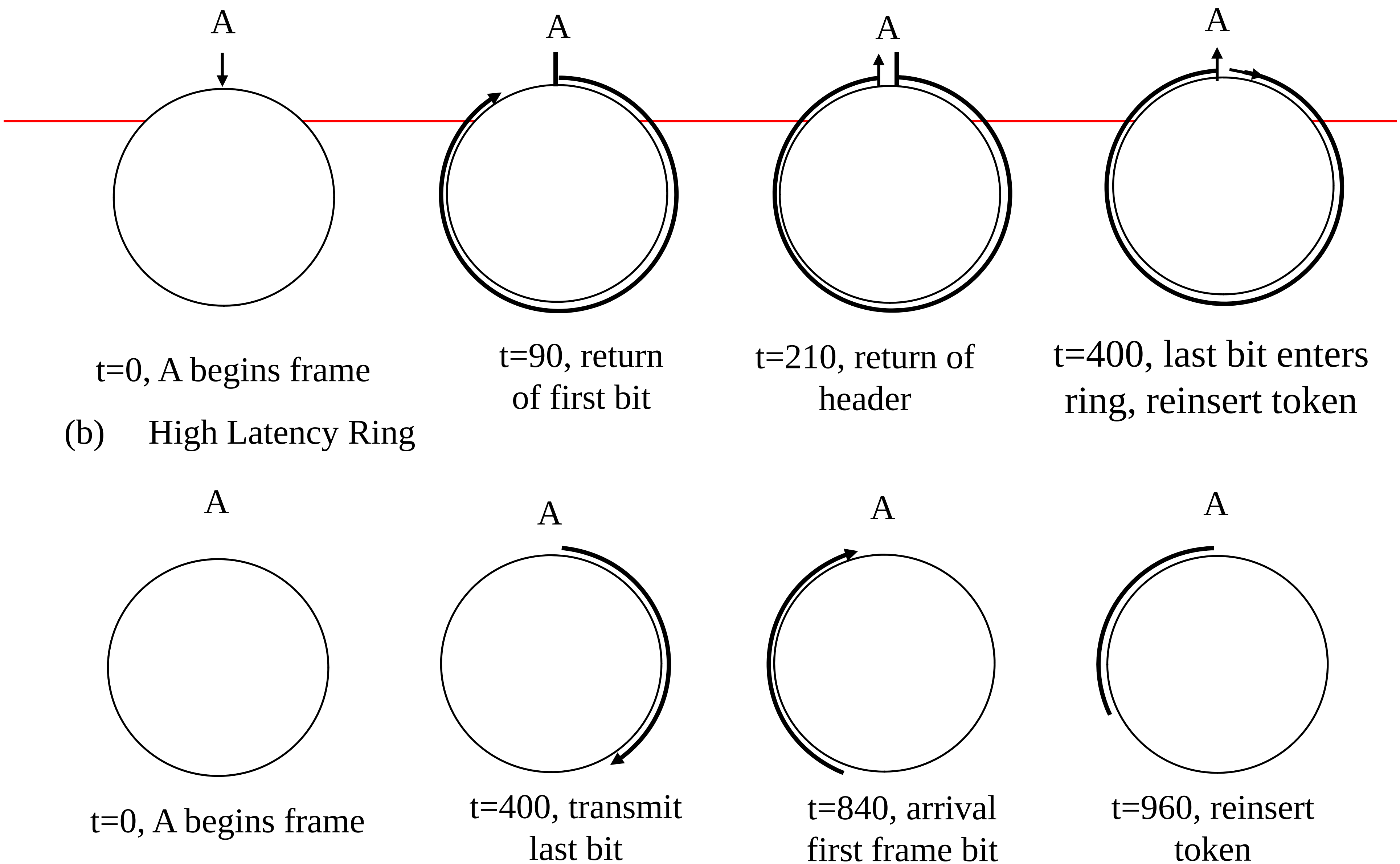
Performance *is determined by whether more than one frame is allowed on the ring at the same time and the relative propagation time.*

Single frame operation



Single token operation

(a) Low Latency Ring



IEEE 802.5 Token Ring

4 and 16 Mbps using twisted-pair cabling with differential Manchester line encoding.

Maximum number of stations is 250.

4Mbps 802.5 token ring uses *single frame operation*.

4 Mbps IBM token ring uses *single token operation*.

Both 802.5 and IBM 16Mbps token rings use *multi-token operation.*

802.5 has 8 priority levels provided via two 3-bit fields (priority and reservation) in data and token frames.

Permits 16-bit and 48-bit addresses (same as 802.3).

Token Ring

- Under light load – delay is added due to waiting for the token {on average delay is one half ring propagation time}.
- Under heavy load – ring is *"round-robin"*.
  - ***Performance is fairer and better than Ethernet!!***
- The ring must be long enough to hold the complete token.
- Advantages – fair access, no collisions.
- Disadvantages – ring is single point of failure, ring maintenance is complex due to token malfunctions.

Token Maintenance Issues

What can go wrong?

Loss of token (no token circulating)

Duplication of token (forgeries or mistakes)

The need to designate one station as the *active ring monitor*.

Persistently circulating frame

Deal with active monitor going down.

Fiber Distributed Data Interface (FDDI)

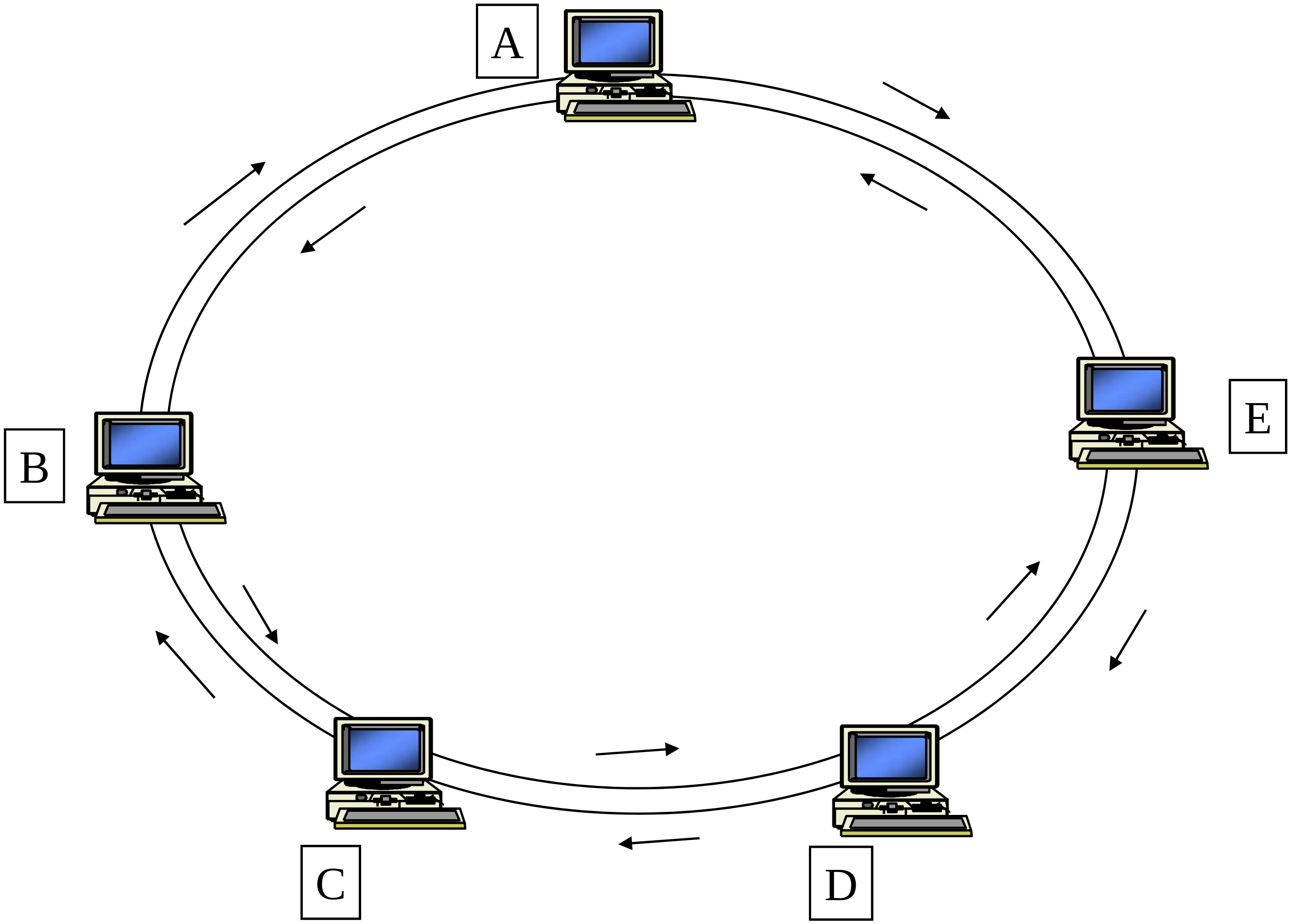
FDDI uses a ring topology of multimode or single mode optical fiber transmission links operating at 100 Mbps to span up to 200 kms and permits up to 500 stations.

*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



FDDI Repair

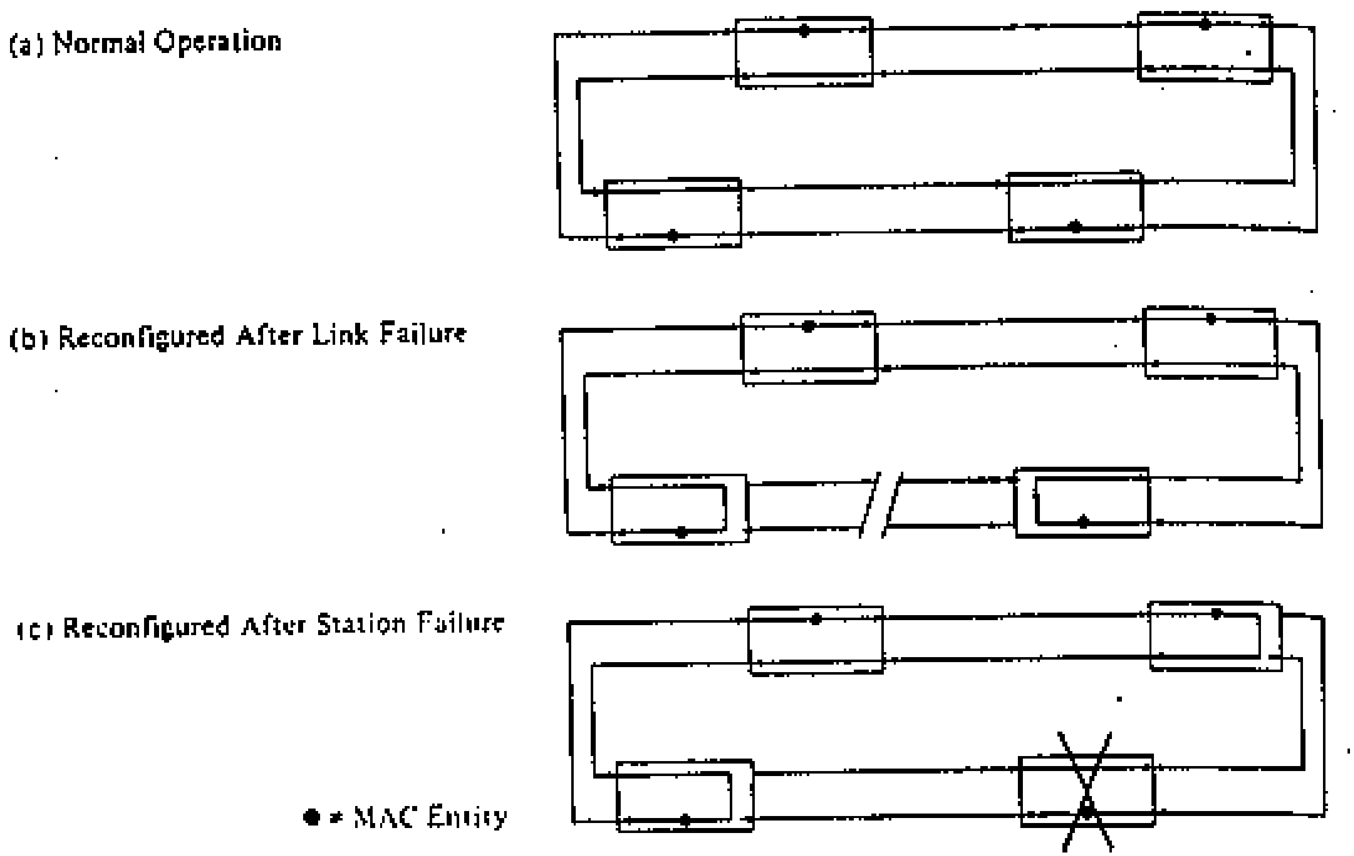


FIGURE 6.7 FDDI Dual-Ring Operation

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 5-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).

More FDDI Details

FDDI Transmission on optical fiber requires ASK.

The simplest case: 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 and FDDI Differences

Token Ring	FDDI
Shielded twisted pair	Optical Fiber
4, 16 Mbps	100 Mbps
No reliability specified	Reliability specified (dual ring)
Differential Manchester	4B/5B encoding
Centralized clock	Distributed clocking
Priority and Reservation bits	Timed Token Rotation Time
All three token operations possible	Multi-token operation

LAB:

Protocols on Routers
by Packet Tracer

Questions

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