Token Ring/IEEE 802.5

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Token Ring

- The Token Ring network was originally developed by IBM in the 1970s

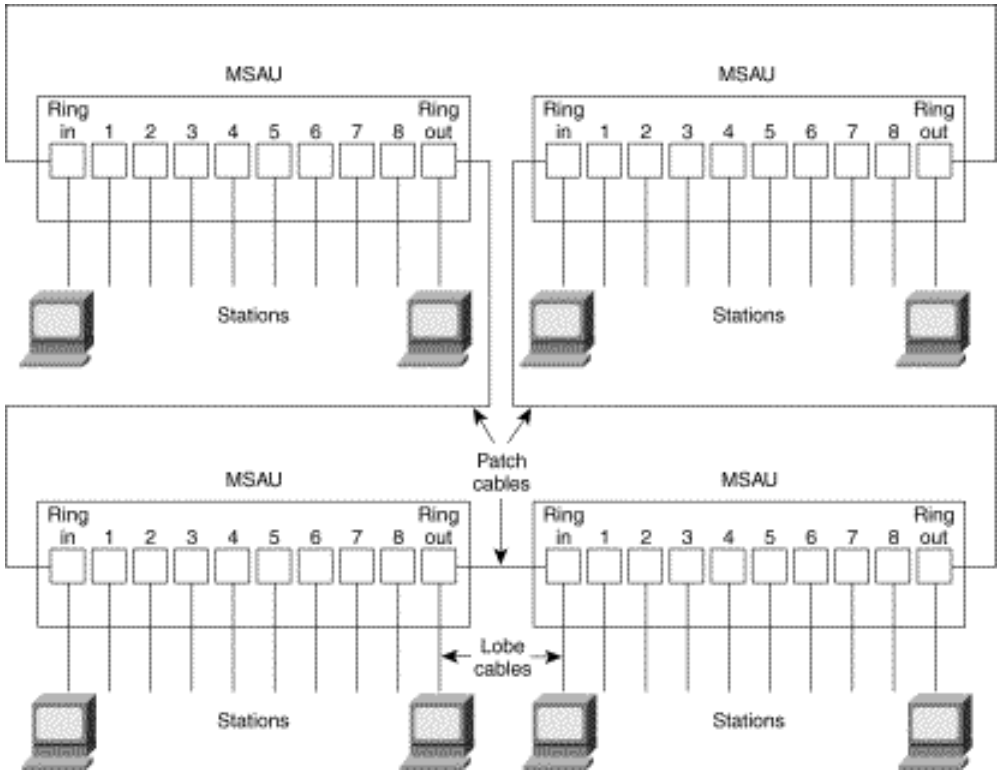
IBM's Token Ring Network and IEEE 802.5

	IBM Token Ring network	IEEE 802.5
Data rates	4.16 Mbps	4.16 Mbps
Stations/segment	260 (shielded twisted pair) 72 (unshielded twisted pair)	250
Topology	Star	Not specified
Media	Twisted pair	Not specified
Signaling	Baseband	Baseband
Access method	Token passing	Token passing
Encoding	Differential manchester	Differential manchester

Token Ring

Physical Connections

IBM Token Ring network stations are directly connected to MSAUs,



Token Ring Operation

- Token Ring and IEEE 802.5 are two principal examples of token-passing networks (FDDI is the other). *Token-passing networks* move a small frame, called a token, around the network.
- Possession of the token grants the right to transmit. If a node receiving the token has no information to send, it passes the token to the next end station. Each station can hold the token for a maximum period of time
- If a station possessing the token does have information to transmit, it seizes the token, alters 1 bit of the token (which turns the token into a start-of-frame sequence), appends the information that it wants to transmit, and sends this information to the next station on the ring. While the information frame is circling the ring, no token is on the network (unless the ring supports early token release), which means that other stations wanting to transmit must wait. Therefore, collisions cannot occur in Token Ring networks. If early token release is supported, a new token can be released when frame transmission is complete

Priority System

- Token Ring networks use a sophisticated priority system that permits certain user-designated, high-priority stations to use the network more frequently. Token Ring frames have two fields that control priority: the priority field and the reservation field.
- Only stations with a priority equal to or higher than the priority value contained in a token can seize that token. After the token is seized and changed to an information frame, only stations with a priority value higher than that of the transmitting station can reserve the token for the next pass around the network. When the next token is generated, it includes the higher priority of the reserving station. Stations that raise a token's priority level must reinstate the previous priority after their transmission is complete.

Frame Format

- Token Ring and IEEE 802.5 support two basic frame types:
    - tokens
    - data/command frames.
- Tokens are 3 bytes in length and consist of a start delimiter, an access control byte, and an end delimiter.
- Data frames carry information for upper-layer protocols
- Command frames contain control information and have no data for upper-layer protocols.

Frame Format

Start Deli miter	Access Control	Frame Control	Dest Address	Src Address	Data	FCS	End Deli miter	Frame Status
1	1	1	6	6	>=0	4	1	1

bytes

Data/Command

Start Deli miter	Access Control	End Deli miter
1	1	1

Token

Token Frame Fields

- **Start delimiter—**Alerts each station of the arrival of a token (or data/command frame). This field includes signals that distinguish the byte from the rest of the frame by violating the encoding scheme used elsewhere in the frame.
- **Access-control byte**—Contains the Priority field (the most significant 3 bits) and
  the Reservation field (the least significant 3 bits), as well as a token bit (used to differentiate a token from a data/command frame) and a monitor bit (used by the active monitor to determine whether a frame is circling the ring endlessly).
- **End delimiter**—Signals the end of the token or data/command frame. This field also contains bits to indicate a damaged frame and identify the frame that is the last in a logical sequence.

Data/Command Frame Fields

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  the Reservation field (the least significant 3 bits), as well as a token bit (used to differentiate a token from a data/command frame) and a monitor bit (used by the active monitor to determine whether a frame is circling the ring endlessly).
- **Frame-control bytes**—Indicates whether the frame contains data or control information. In control frames, this byte specifies the type of control information.

Data/Command Frame Fields

- **Destination and source addresses**—Consists of two 6-byte address fields that identify the destination and source station addresses.
- **Data**—Indicates that the length of field is limited by the ring token holding time, which defines the maximum time a station can hold the token.
- **Frame-check sequence (FCS)**—Is filed by the source station with a calculated value dependent on the frame contents. The destination station recalculates the value to determine whether the frame was damaged in transit. If so, the frame is discarded.
- **End Delimiter**—Signals the end of the token or data/command frame. The end delimiter also contains bits to indicate a damaged frame and identify the frame that is the last in a logical sequence.
- **Frame Status**—Is a 1-byte field terminating a command/data frame. The Frame Status field includes the address-recognized indicator and frame-copied indicator.