# Fiber Distributed Data Interface FDDI

In the mid of 1980s, high speed workstations pushed the capabilities of existing Ethernet (standard Ethernet) and Token Ring to their limits. Engineers needed a LAN that could support their workstations, and their new applications. At the same time, system managers became concerned with network reliability issues. For these reasons, Fiber Distributed Data Interface FDDI was found.

In FDDI, we will discuss physical layer specifications, frame format, and media access control mechanism.

# Physical Layer Specifications

Here we will mainly discuss the topology, the networking media and the transmission speeds.

## 1- Topology

FDDI networks can be implemented into two ways, the two ways have a logical ring topology and differs in the physical topology. The two physical topologies are:

### A- Dual ring :

FDDI specifies the use of dual rings for physical connections. Traffic on each ring travels in opposite directions. The outer ring is called the primary ring and the inner ring is called the secondary ring. Normally, traffic flows only on the primary ring. If it fails, then the data automatically flows onto the secondary ring in the opposite direction. When this occurs, the network is said to be in a wrapped state. This provides fault tolerance for the link.

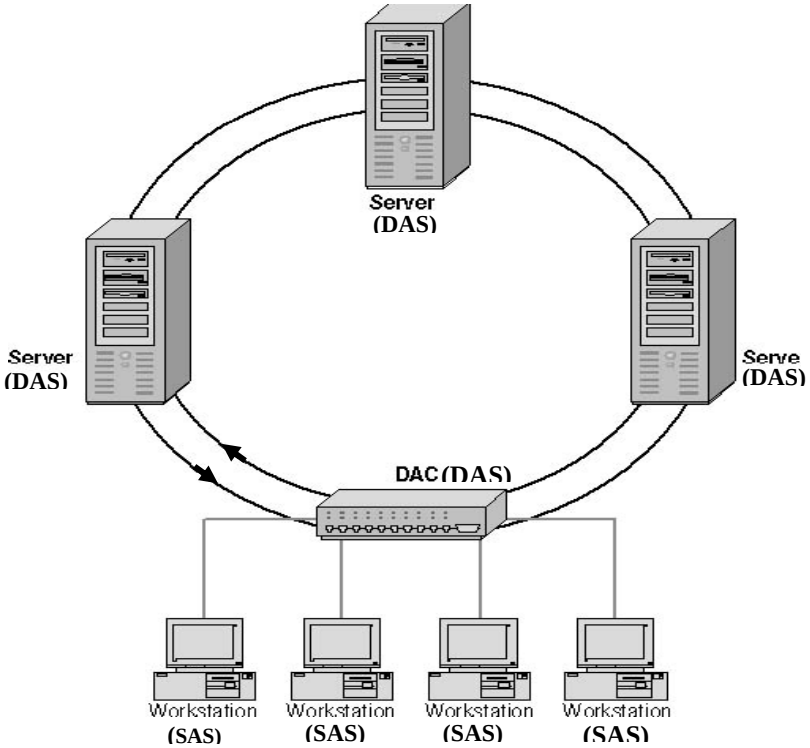
## B- Star

It's also possible to cable a FDDI network in a physical star topology using a hub called a Dual Attachment Concentrator (DAC). The DAC creates a single logical ring, like a Token Ring MAU.

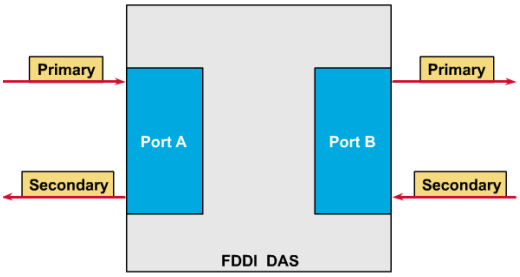
Computers or stations on a FDDI network are divided into two classes, as follows:

- **Class A also called Dual Attachment Station (DAS)**; here computer or station is connected to both rings, DAC is an example of DAS.
- **Class B also called Single Attachment Station (SAS)**; station here connected to only one ring. Examples on SAS are the stations connected to DAC

FDDI network can be deployed using the double ring, the star topology, or both. The double ring is better suited to use as a backbone network, and the star to a segment network connecting desktop computers. To construct an entire enterprise network using FDDI, you create a double ring back- bone, to which you connect your servers and other vital computers as DASs. You then connect one or more DACs to the double ring, which you use to attach your workstations. This is sometimes called a dual ring of trees.



The DAS servers have full advantage of the double ring's fault tolerance, as do the DACs, whereas SASs are attached to the primary ring through a concentrator (the DAC), which provides connections for multiple SASs. The concentrator ensures that a failure, or power down, of any given SAS, does not interrupt the ring. This is particularly useful when PCs, or similar devices that frequently power on and off, connect to the ring. Each FDDI DAS has two ports, designated A and B. These ports connect the station to the dual FDDI ring. Therefore, each port provides a connection for both the primary and the secondary ring.




FDDI NIC

To expand the network further, you can connect additional DACs to ports in existing DACs without limit, as long as you remain within the maximum number of computers permitted on the network.

## 2- Media

As its name implies, FDDI runs on fiber-optic cable. FDDI supports several different types of fiber optic cable, including the 62.5/125 micron multimode cable which provides for network segments up to 100 kilometers long with up to 500 workstations placed as far as 2 kilometers apart. Singlemode fiber optic cables provide even longer segments, with up to 60 kilometers between workstations.

### Note

Due to the use of fiber optic FDDI is often used for larger LANs and MANs

## 3- Bandwidth

FDDI supports a maximum speed (transfer rate) of 100 Mbps, this speed was unprecedented at the time of its introduction (there was the standard Ethernet and Token Ring which operates at maximum speeds of 10 Mbps and 16 Mbps relatively)

## 4- Encoding

FDDI uses an encoding scheme called 4B/5B. The signal sources in FDDI transceivers are LEDs (for multimode fibers) or lasers (for singlemode fibers).

# Frame format

Like Token Ring, FDDI uses several different types of frames in its communications. these are

1- data frame
2- token frame
3- station management frame

## 1-Data Frame

| 8-Bytes | 1-Byte | 1-Byte | 6-Bytes | 6- Bytes | 4478-B | 4-Bytes | 4-bits | 12-bits |
|---|---|---|---|---|---|---|---|---|
| Preamble | Starting Delimiter | Frame Control | Destination Address | Source Address | Information (Data) | Frame Check Sequence | End Delimiter | Frame Status |

The functions of the fields in the FDDI data frame are as follows:

- Preamble ( 8 bytes): Contains series of alternating 0s and 1s, used for clock synchronization.
- Starting Delimiter ( 1 byte): Indicates the beginning of the frame.
- Frame Control (1 byte): Indicates the type of data found in the Data field.

- **Destination Address (6 bytes):** Specifies the hardware address of the computers that will receive the frame.
- **Source Address (6 bytes):** Specifies the hardware address of the system sending the frame.
- **Data (variable):** Contains network layer protocol data, or control information depending on the type of the frame.
- **Frame Check Sequence (4 bytes):** Contains a Cyclical Redundancy Check (CRC) value (utilizes CRC-32) , used for error detection.
- **Ending Delimiter (4 bits**): Indicates the end of the frame.
- **Frame status (12 bits):** Contains three indicators that may be modified by intermediate systems when they retransmit the packet, the functions of which are as follows:
    - **Error** Indicates that an error has been detected.
    - **Acknowledge** Indicates that the intermediate system has determined that the frame's destination address applies to itself.
    - **Copy** Indicates that the intermediate system has successfully copied the contents of the frame into its buffers.

## 2- Token frame

FDDI have a token frame, which contains only a Preamble, plus the Starting Delimiter, Frame Control, and Ending Delimiter fields, for a total of 3 bytes.

| 4-Bits | 1-Byte | 1-Byte | 4-bits |
|---|---|---|---|
| Preamble | Starting Delimiter | Frame Control | End Delimiter |

## 3- Station management frame

The third type of frame used on FDDI networks is the station management frame, which is responsible for ring maintenance and network diagnostics.

# MAC mechanism

FDDI uses a token passing strategy similar to Token Ring. The token passing mechanism used by FDDI is virtually identical to that of Token Ring, except that the early token release feature that is optional in Token Ring is standard equipment for the FDDI protocol.

Due to the use of token passing, FDDI networks have no collisions. If early token release is supported, a new token can be released when the frame transmission has finished.

Unlike CSMA/CD networks, such as Ethernet, token passing networks are deterministic. This means you can calculate the maximum time that will pass before any end station will be able to transmit.

# FDDI Features

FDDI combines the advantages of token passing on the ring topology with the high speed of fiber-optic transmission. The dual ring topology provides redundancy and fault tolerance. The fiber-optic cable is not susceptible to electromagnetic interference (EMI) and noise, and it is more secure than copper wiring. It can send data for greater distances between repeaters than Ethernet and traditional Token Ring.

# FDDI drawbacks

As always, high speed and reliability come with a price. FDDI is relatively expensive to implement, and the distance limitations, though less restrictive than those of other LAN links, but still unsuitable for true WAN communications.