Fibre Distributed Data Interface (FDDI)

The **fibre distributed data interface (FDDI)** is a token based technology using fibre optical links. The FDDI specification defines the use of OSI layers 1 and 2 (Physical layer and Data

Link layer). Some characteristics of FDDI are given in Table . FDDI's operation is similar to that of **token ring**.

Table: Some characteristics of FDDI

Dual counter-rotating rings are used to improve reliability. The rings are labelled the **primary ring** and the **secondary ring**. Stations attached to the FDDI may be connected to both rings -- **dual attach stations (DASs)** -- or only to the primary ring -- **single attach station (SASs)**. Although, the stations are logically attached in a ring, the physical connection is more conveniently realised in a hub-star fashion by using wiring concentrators.

The FDDI may be used as a LAN, but is more often used as a backbone and so most of the attached stations will be bridges that are dual attached.

In a token ring, the single active ring monitor encodes the clock signal into the token that it generates, using Manchester encoding. However, for a 100Mb/s rate, Manchester encoding requires 200Mbaud signalling rate. So in an FDDI, NRZI coding is used (signal transition when a 1 is transmitted and no transition when a 0 is transmitted) and all stations have their own **local clock** which is used in data transmission. When receiving frames, stations

synchronise using the incoming signal. The physical interface is depicted in Figure .

Figure: Schematic of FDDI physical interface

The **4B/5B encoder** takes each group of 4 bits and replaces them with a 5-bit symbol (Table

), and the **4B/5B decoder** performs the reverse operation. The use of 4B/5B coding and NRZI ensures a signal transition every 2 bits. The **latency buffer** is where 2 5-bit symbols are used to give correct symbol boundary alingment.

Table: FDDI 4B/5B data symbols

Table: FDDI control code symbols

The FDDI frame formats are shown in Figure . The various fields are as follows (the various control symbols are given in Table):

- **Preamble (PA)**: 16 (or more) IDLE symbols. Causes line signal changes every bit to ensure receiver clock synchronisation at the beginning of a frame.
- **Start delimiter (SD)**: the 2 symbols J and K are used to show the start of the frame and also to allow interpretation of correct symbol boundaries.
- **Frame control (FC)**: 2 symbols indicating whether or not this is an information frame or a MAC frame (e.g. the token), with some additional control information for the station identified by the DA.
- **Destination address (DA)**: 4 or 12 symbols identifying the destination station. 16 symbols are used for a full 48-bit MAC address, 4 symbols for a 16-bit local addressing mechanism. If the first bit of the (decoded) address is a 1 then this identifies a group address.
- **Source address (SA)**: 4 or 12 symbols identifying the source station.
- **Information**: this is usually set to about 9000 symbols (4500 decoded octets) in length and is determined by the maximum length of time that a station can hold the token.
- **Frame check sequence (FCS)**: 8 symbols containing a 32-bit CRC. The FCS covers the fields FC, DA, SA, information and FCS.
- **End delimiter (ED)**: 1 or 2 T control symbols.
- **Frame status (FS)**: 3 symbols which are a combination of R and S symbols indicating if the frame has been seen by the destination station and if it has been copied by the destination station.

Figure: FDDI frame formats

The operation of FDDI is much the same as token ring. A station must be in possession of a token before it can transmit an information frame. Once it has seen the frame go around the ring it can the regenerate the token allowing someone else to transmit. However, the potentially large size of the FDDI ring means that it has a higher latency than token ring and so more than one frame may be circulating around the ring at a given time. The physical interface will then repeat the PA, SD, FC and DA filed before it nows if this is its own frame which it should remove from the ring. If this occurs, the station stops sending any more of the frame and instead sends out IDLE symbols until it receives an SD indicating another frame. This will lead to many frame fragments around the ring which should be removed by receiving stations.

All stations also keep a note of the **token rotation time (TRT)** which is the time elapsed since the station last saw the token. As the load on the FDDI network this time will increase. The TRT can be compared to a preset value called the **target token rotation time (TTRT)** to allow a priority operation scheme: only priority frames can be transmitted if the TRT is greater than the TTRT.

A timer called the **token hold timer (THT)** also controls the normal transmission of data. When a station receives the token it transfers the TRT to the THT which starts to count down.

The station can then continue to transmit frames as long as the THT remains greater than the TTRT. In fact the THT determines the maximum number of octets/symbols that can be sent in one FDDI frame, as the the THT determines the maximum time that a station can remain transmitting data.

FDDI is a connectionless system and is designed for data purposes only. **FDDI II** is an evolution of FDDI which can be seen as a superset of FDDI. It was developed a standards project that proposed adding isochronous transmission services to FDDI so that it was possible to support real-time applications such as multimedia. The proposal includes a mechanism for dividing the the 100Mb/s into 16 channels, each of which would be allocated for a certain use, e.g.\ video, bursty data, etc. However, because existing FDDI hardware would be unable to have plug-in upgrades and with the advent of ATM LANs and DQDB, this option of FDDI may not be so heavily deployed.