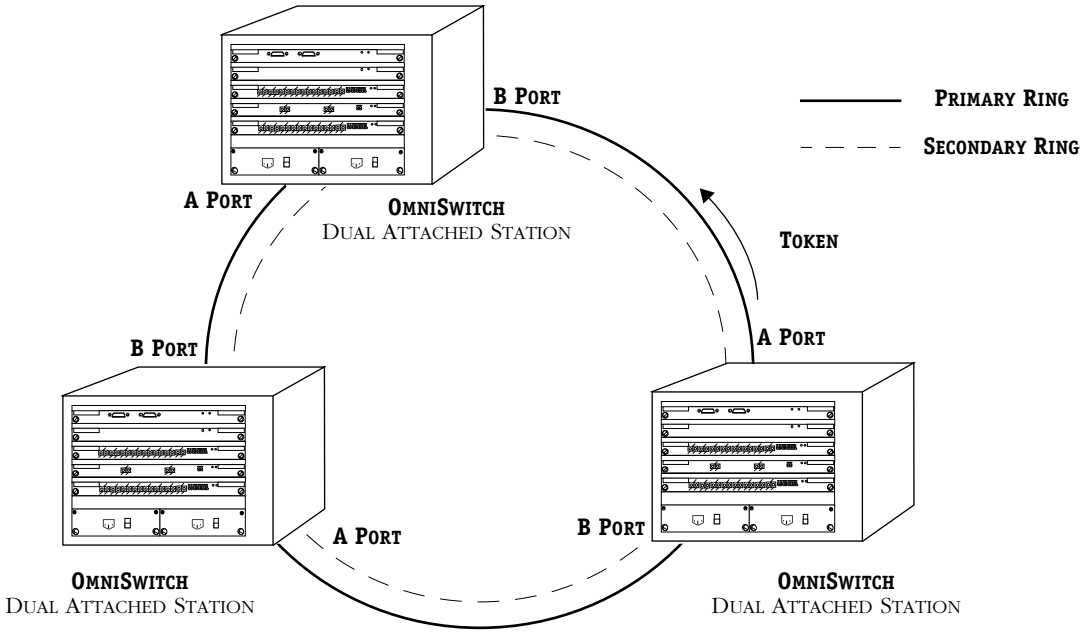
22 Managing FDDI Switching Modules

Fiber Distributed Data Interface (FDDI) technology provides backbone, server, concentrator, and single device connections at 100 Mbps. This chapter describes the software controls used to manage FDDI Switching Modules (FSMs). See Chapter 7, "Switching Modules," for descriptions of FSM hardware.

FDDI Topology Overview

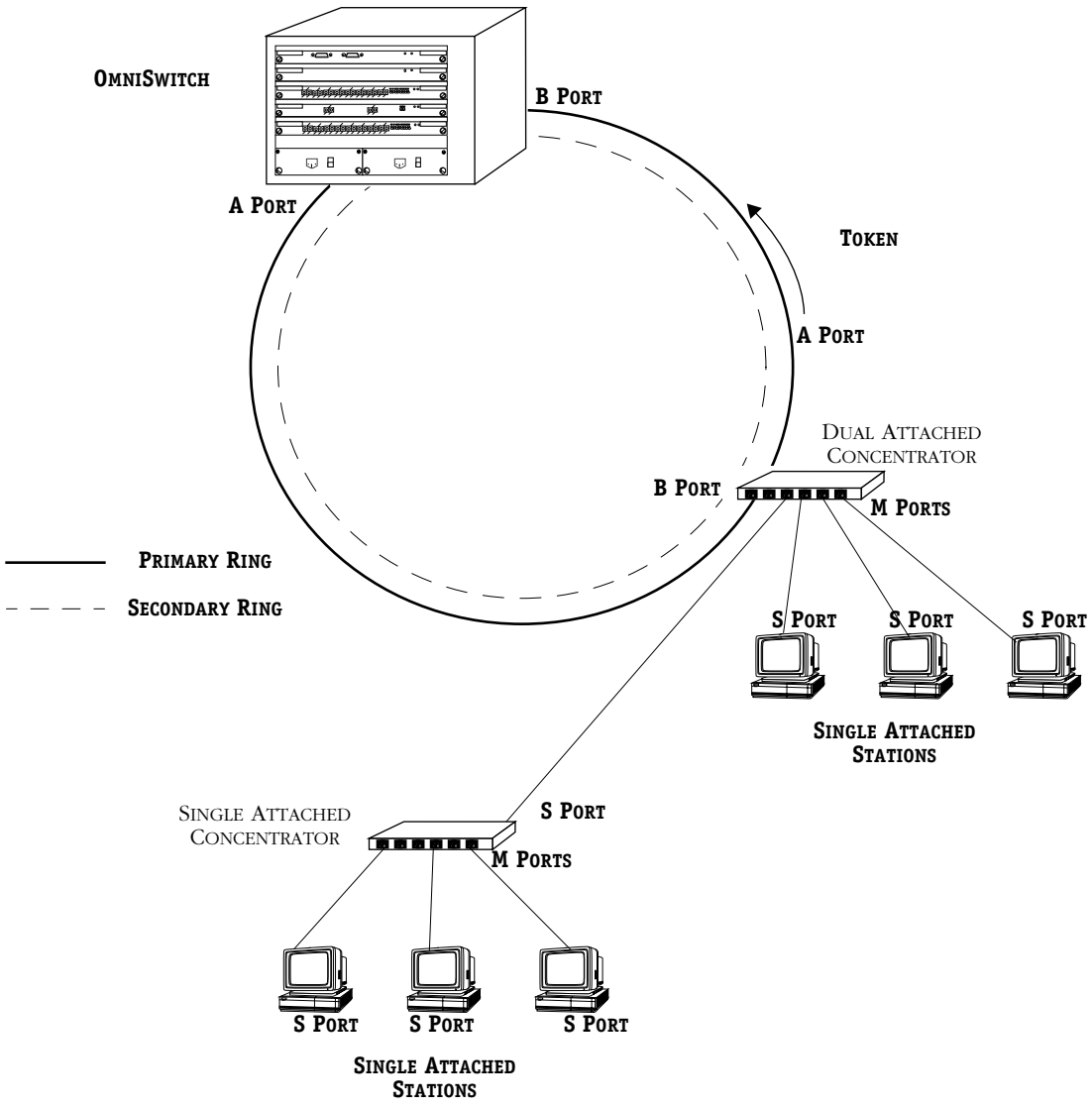
This section contains a brief review of FDDI topology and notes the FDDI configurations supported. The figure below shows an FDDI ring with three switches, each functioning as a dual attached station. As shown below, FDDI ring topology consists of a dual counter-rotating architecture where packets travel in a counterclockwise direction on the primary ring and clockwise on the secondary ring.



FDDI Ring Topology

FDDI Ring of Trees

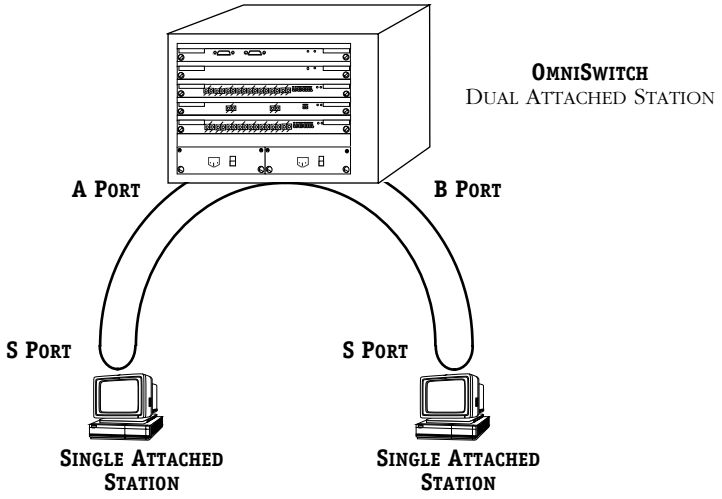
The figure below shows an FDDI ring of trees, where a dual attached concentrator is used to connect multiple stations to a token ring.



FDDI Ring of Trees

FDDI Wrapped Ring

The figure below shows an alternate configuration in which a wrapped ring is created by attaching two S ports to an A and B port. In this configuration, the single attached stations (SASs) appear to the dual attached stations to be wrapped.



FDDI Wrapped Ring

FDDI Station Modes

An OmniSwitch FDDI module (FDDI station) can be configured as either a Dual-Attached Station (DAS) or a Null-Attached Concentrator (NAC). In station mode, FDDI ports are "A/B" ports. In concentrator mode, FDDI ports can only be "M" ports.

DAS mode is the default mode for OmniSwitch FDDI modules. The NAC mode is used when you want the redundancy features of a concentrator (e.g., dual-homing). To change the OmniSwitch FDDI module to NAC mode, use the **fsmtc** command, which is described in *Configuring Station Information* on page 22-8.

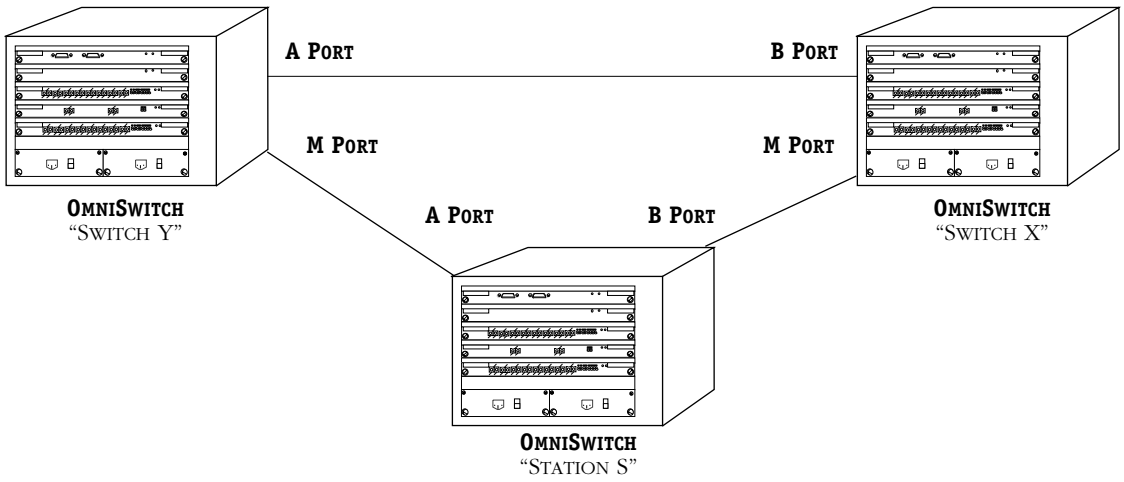
Note

Selecting NAC or DAS mode from the current configuration will require a restart.

Dual-Homing in Concentrator (NAC) Mode

Optionally, the M port can be configured to flush the FDDI module's CAM associated with this port. This hastens the switch's ability to learn the MAC address of the port that has just gone through a dual-homing switchover from the B to A ports (or vice versa). However, flushing the CAM generally causes flooding.

The figure below shows a typical example of switches used as concentrators in an FDDI ring. If, for example, the cable connecting Station S's B port to Switch X's M port disconnects, dual-homing will cause a switchover connecting Station S's A port to Switch Y's M port. This, in turn, will cause the CAM on Switch X (on the slot with the M port) to be flushed, forcing flooding of frames destined for Station S to the other ports in the same group on that switch. If the CAM on Switch X was not flushed, it would continue sending frames from its M port until Station S actually transmitted a frame (forcing re-learning of Station S's MAC on Switch Y's M port). In other words, switchover will not occur unless Station S sends a frame.



FDDI NAC Mode

Note: In certain configurations where there is an intermediate switch, that switch's CAM won't be flushed, even though the FDDI module's CAMs are flushed. This will cause the FDDI module to continue to send frames to the wrong switch until Station S sends a frame.

Interface Menu

This submenu contains commands for interface-specific configuration. Enter **interface** at the system prompt to get to the interface menu. Press **?** and then press **<Return>** to display the interface menu, as shown below.

Command	Physical Interface Menu
slipc	Configure SLIP (Serial Line IP) on a TTY Port
atm	Enter the ATM Management sub-menu
eth100	Enter the 100BaseT sub-menu
10/100	Enter the 10/100BaseT sub-menu
tok	Enter the Token Ring Management sub-menu
fddi	Enter the FDDI Management sub-menu

FDDI Commands

You control FDDI switching modules by using the FDDI commands. To list the FDDI commands, enter **fddi** at the system prompt to enter the FDDI sub-menu. Press a **?** and then press **<Return>** to display the FDDI sub-menu, as shown below.

Command	FDDI Management sub-menu
fsmt	Display SMT station configuration data
fsid	Display SMT station information from the SMT Table
fsmtc	Configure SMT Station information, paths and policies
fsstatus	Summarize SMT status
fmac	Current FDDI MAC status (all stations)
fmaddr	SMT MAC address information (all stations)
fmstats	MAC statistics
fmctrs	MAC counters
ftimerc	Configure SMT Station Timers
fport	View the SMT Port Configuration Table
fportstatus	View the SMT Port Status Table
fportctrs	View the SMT Port Counters Table
fportc	Configure SMT Port Parameters

Viewing the FDDI Configuration Table

To display configuration information about the switch acting as a station management (SMT) station, enter

fsmt

at the system prompt. The following is a typical example.

FDDI SMT Configuration Table

Slot Stn	Num MACs	Available Num A,B,S	Num Master	Bypass Presnt	Attachmnt Configrtn	Path Types Pri	Sec	Local
2/ 1	1	2	0	False	Isolated	X	X	

The fields displayed by the **fsmt** command are described below.

Num Macs. The number of MACs in this station.

Num A,B,S. The number of A, B, and S ports in this station.

Num Master. The number of master (M) ports in this station. If the node is not a concentrator, then the number is 0.

Bypass Presnt. Flag indicating if the station has an optical bypass attached.

Attachmnt Configrtn. The attachment configuration for the station. Values are **Thru**, **C_Wrap A**, **C_Wrap B**, and **Isolated**.

Path Types / Pri Sec Local. The path types available, indicated by an X, in the FDDI station. Values are **Pri** (primary), **Sec** (secondary), and **Local**.

Viewing the FDDI Configuration Table

To display information about the SMT Table, enter

fsid

at the system prompt. The following is a typical example.

FDDI SMT Configuration Table

Slot Stn	Station ID (Canonical Fmt)	Oper Ver ID (MIB Ver)	Hi Ver (Lo Ver)	User Data
2/ 1	00000004 5b401406	2	2	FDDI SMT 7.3
	(00000020 da022860)	(1)	(2)	

The fields displayed by the **fsid** command are described below.

Station ID (Canonical Fmt). The unique identifier of an FDDI station.

Oper Ver ID. The current version of SMT that the FDDI station on this switch is using.

(MIB Ver). The current version of the FDDI MIB that the FDDI station on this switch supports.

Hi Ver ID. The highest version of SMT that the FDDI station on this switch supports.

(Low Ver). The lowest version of SMT that the FDDI station on this switch supports.

User Data. An ASCII string of 32 octets containing user-defined information.

Configuring Station Information

The **fsmtc** command allows you to configure SMT Station information, paths, and policies. To use this command, enter **fsmtc** followed by the slot and port number of the FDDI port you want to modify. For example, to modify the settings for Port 1 on the FDDI module in Slot 2, you would enter

```
fsmtc 2/1
```

at the system prompt. The following is a typical example.

```
                        FDDI Slot 5 Station 1 SMT Configuration

1) User Data                        :  FDDI SMT 7.3
2) Status Reporting Enabled         :  Yes
3) T_Notify                         :  30 seconds
4) Trace_Max                        :  7.000000 seconds
5) Operation Mode                   :  FDDI Station

Command {Item=Value/?/Help/Quit/Redraw/Save} (Redraw) :
```

To change any of the values above, enter the line number, followed by an equal sign, and followed by the new value. For example, to change the **T_Notify** field to 10 seconds, enter:

```
3=10
```

The question mark option (**?**) and the **Help** option provide reference and instructional information on using this command. The **Redraw** option refreshes the screen.

To update the values you have changed, enter **save**. If you do not want to save the changes enter **quit** or **Ctrl-D**.

The fields displayed by the **fsmtc** command are described below:

1) User Data. Usually, this contains a description of the station. It can be up to 32 characters long.

2) Status Reporting Enabled. If this field is set to **Yes** (the default), the station will generate Status Reporting Frames for conditions and events.

3) T_Notify. The value, in seconds, of the time between neighbor notification protocol frames. The value can be set from 2 to 30 seconds (the default value is 30 seconds).

4) Trace_Max. The amount of time, in seconds, a trace will transmit without an acknowledgment. This timer can be set from 6 to 60 seconds (the default value is 7 seconds). To modify the **Trace_Max** field, enter **4=<time> <unit>** where **<time>** is a number and **<unit>** is one of the following: ns (nanoseconds), us (microseconds), ms (milliseconds), sec (seconds), or ft (fddi-time: 80ns per tick). To change the **Trace_Max** timer to 10 seconds, for example, you would enter the following:

```
4=10sec
```

5) Operation Mode. This field can be set to either FDDI **Station** (DAS mode), which is the default setting, or FDDI **Concentrator** (NAC mode). If you set this field to concentrator by entering **5=c** (only the first letter is necessary), two more fields, **Restart SMT on save** and **Flush MACs on disconnect**, are displayed as shown below. Note that if you switch to concentrator (NAC) mode, a restart of SMT is required due to the extensive number of internal data structures modified. Enter **5=s** to put the port into station (DAS) mode.

FDDI Slot 5 Station 1 SMT Configuration

1) User Data	:	**FDDI SMT 7.3**
2) Status Reporting Enabled	:	**Yes**
3) T_Notify	:	**30 seconds**
4) Trace_Max	:	**7.000000 seconds**
5) Operation Mode	:	**FDDI Concentrator**
51) Restart SMT on save	:	**Yes**
52) Flush MACs on disconnect	:	**No**

Command {Item=Value/?/Help/Quit/Redraw/Save} (Redraw) :

51) Restart SMT on save. All stations must come down to change the operation mode. The default is **Yes**.

52) Flush MACs on disconnect. This option is only available in concentrator mode. This is typically useful while doing dual-homing. When the active to standby occurs, flushing the MACs on disconnect will force the MAC addresses learned on the formerly active port to be removed. Frames destined for the original port will be flooded, lessening any network discontinuity experienced after the switch to the standby port. The default is **No**.

Viewing the Station Status

To display a summary of SMT status, enter

fsstatus

at the system prompt. The following is a typical example.

FDDI SMT Station Status

Slot Stn	Remote Disconnect Flag	Station Prim. & Secondary Path Status	Peer Wrap Flag	ECM Current State	TimeStamp (Transition Timestamp)
2/ 1	False	Separated	False	In	9 days 22:43:59.500000000 sec 207.0000000000000284 msec

The fields displayed by the **fsstatus** command are described below.

Remote Disconnect Flag. If true, it means that the FDDI station was remotely disconnected from the network.

Station Prim. & Secondary/ Path Status. The current status of the primary and secondary paths within this station.

Peer Wrap Flag. **True** or **False**. A peer is either an upstream or downstream neighbor. If this flag is **True**, it means that at least one of these peers is in a wrapped condition.

ECM Current State. The current state of the ECM state machine. Entity Coordination Management oversees Connection Management components. The valid states of an ECM are described below.

In. Normal state, connection completed.

Trace. Fault trace state. Initiated by a trace propagation from an ECM or RMT.

Leave. Break connection, initiated by a disconnect request from upper management.

Path_Test. Testing data paths.

Insert. Optical bypass.

Check. Optical bypass.

Deinsert. Optical bypass.

TimeStamp. The current timestamp.

Transition Timestamp. Timestamp at the last event, condition assertion, or condition deassertion.

Viewing the MAC Status Table

To display the MAC status for all stations, enter

fmac

at the system prompt. The following is a typical example.

FDDI MAC Status Table

Slot Stn	Dupl Addr Test	Upstr Dup Addr	Frm Err	RMT State	RMT Dup Adr	MAC UD Ava	Token Timing T_Req (T_Neg)	Token Timing T_Max (Tvx)
2/ 1	none	f	f	Ring-Op	f	t	164.987 msec	167.772 msec
							164.987 msec	167.772 msec

The fields displayed by the **fmac** command are described below.

Dupl Addr Test. The status of the duplicate MAC address test. Values are **none**, **pass**, or **fail**. These values are described below.

none. There is not enough information to perform the test.

pass. The test completed and no duplicate MAC addresses were found.

fail. The test found a duplicate MAC address. In this case, this station will take itself off the ring.

Upstr Dup Addr. If true, indicates that the upstream neighbor has reported a duplicate address condition.

Frm Err. Frame Error Condition. If true, indicates that a MAC Frame Error condition has occurred.

RMT State. The current state of the Ring Management State machine.

RMT Dup Adr. The Ring Management duplicate address flag.

MAC UD Ava. The Ring Management availability flag.

Token Timing T_Req. The requested token rotation time.

Token Timing T_Neg. The negotiated token rotation time.

Token Timing T_Max. The maximum token rotation time.

Token Timing Tvx. The valid transmission timer.

Viewing the MAC Address Table

To display the SMT MAC address information for all stations, enter

fmaddr

at the system prompt. The following is a typical example.

FDDI MAC Address Table

Slot Stn	Upstream Neighbor	Old Upstream Neighbor	Downstream Neighbor	Old Downstream Neighbor	Downstream Port Type
2/ 1	00001f:000000	00001f:000000	00001f:000000	00001f:000000	None

The fields displayed by the **fmaddr** command are described below.

Upstream Neighbor. The MAC address of this FDDI station's upstream neighbor.

Old Upstream Neighbor. The previous value of the upstream neighbor's MAC address.

Downstream Neighbor. The MAC address of this FDDI station's downstream neighbor.

Old Downstream Neighbor. The previous value of the downstream neighbor's MAC address.

Downstream Port Type. The PC-Type of this FDDI station's downstream neighbor.

Viewing the MAC Statistics Table

To display FDDI MAC statistics, enter

fmstats

at the system prompt. The following is a typical example.

FDDI MAC Statistics Table

Slot Stn	Frames Received	Frames Copied	Frames Transmittd	Frames Errors	Format Errors (Lost Frms)	Error Thresh	Error Ratio
2/ 1	3	0	0	0	0	0	0

The fields displayed by the **fmstats** command are described below.

Frames Received. The number of frames received by this FDDI MAC.

Frames Copied. The number of frames successfully copied into this station's receive buffers. Does not include MAC frames.

Frames Transmittd. The number of frames successfully transmitted by this station. Does not include MAC frames.

Frames Errors. The number of errors that were detected by this MAC *and* not detected by another MAC.

Format Errors (Lost Frms). The number of lost frames caused by a format error.

Error Thresh. The number of frame errors that must occur before this station will generate a MAC Condition Report.

Error Ratio. The ratio of errors to the total number of frames received.

Viewing the MAC Counters Table

To display SMT MAC counters information, enter

fmctrs

at the system prompt. The following is a typical example.

FDDI MAC Counters Table

Slot Stn	Tokens	Tvx Expires	TRT Expires	Ring Operational Entries	Not Copied Frames	Not Copied Ratio	Not Copied Fl	Not Copied Thresh
2/ 1	1756065107	0	0	1	0	0	F	0

The fields displayed by the **fmctrs** command are described below.

Tokens. The number of times this slot/station has received a token.

Tvx Expires. The number of Tvx expirations.

TRT Expires. The number of TRT expirations since this MAC was reset or a token was received.

Ring Operational Entries. The number of times the ring has become operational from a non-operational state.

Not Copied Frames. The number of frames received but not copied to receive buffers.

Not Copied Ratio. The ratio of frames not copied to buffers, to the total amount of frames received.

Not Copied Fl. If true, indicates a not-copied condition is present.

Not Copied Thresh. The number of frame not copied errors that occur before this station generates a MAC Condition Report.

Configuring the Station Timers

The **ftimerc** command allows you to configure SMT station timers. To use this command, enter **ftimerc** followed by the slot and port number of the FDDI port you want to modify. For example, to modify the settings for Port 1 on the FDDI module in Slot 2, you would enter

```
ftimerc 2/1
```

at the system prompt. The following is a typical example.

```
FDDI Slot 2 Station 1 Timer Configuration

1) T_Request Timer    :        165 msec
2) T_Vx Timer         :    2.62144 msec
3) T_Max Timer        :        165 msec

    [When changing any of these values, enter the time followed by units:
    {ns, fs, us, ms, sec, min, hr} (For example 1=343.4323968sec). The
    fs refers to the number of 80ns ticks most FDDI counters utilize. The
    default is seconds.]
save     -  to save current configuration and quit
quit     -  to quit without saving
```

To change any of the values above, enter the line number, followed by an equal sign, followed by the new value, and followed by a unit which is one of the following: ns (nanoseconds), fs (fdditime: 80ns per tick), us (microseconds), ms (milliseconds), sec (seconds), min (minutes), or hr (hours). The default is **sec**. For example, to change the **T_Max Timer** field to 100 seconds, enter:

```
3=100sec
```

The fields displayed by the **ftimerc** command are described below:

1) T_Request Timer. The value of TRT (token-rotation-time) requested by this station. The FDDI standard default is 165 ms.

2) T_Vx Timer. TVX is the valid transmission timer. If no token or valid frames are seen after this interval, a claim is started. The default value is 2.5 ms.

3) T_Max Timer. The station has two limits of the TRT that can be used, T_Min and T_Max. The negotiated TRT must be between these two points for the station to operate correctly.

Viewing the Port Configuration Table

To display the SMT port configuration table, enter

fport

at the system prompt. The following is a typical example.

FDDI SMT Port Configuration Table

Slot/ Statn/ Port	Local Port Type	Neigh Port Type	PMD Class	H/W ?	BS ?	Connectn Capabils LCT	Connectn Capabils LOOP	Connectn Policies LCT	Connectn Policies LOOP	MAC Indicated T_Val	MAC Indicated R_Val
2/ 1/A	A	None	Multimode	y	n					F	F
2/ 1/B	B	None	Multimode	y	n					F	F

The fields displayed by the **fport** command are described below:

Local Port Type. The type of connection on the local port. Values are:

- **A**. Primary in, Secondary out.
- **B**. Secondary in, Primary out.
- **S**. Single.
- **M**. Master.

Neigh Port Type. The type of connection on the remote port. Values are:

- **A**. Primary in, Secondary out.
- **B**. Secondary in, Primary out.
- **S**. Single
- **M**. Master

The table below describes the port type combinations you can have.

Local Port	Neighbor Port			
	A	B	S	M
A	Not Recommended	Valid	Not Recommended	B takes precedence over A
B	Yes	Not Recommended	Not Recommended	B takes precedence over A
S	Not Recommended	Not Recommended	Valid	Valid
M	Valid	Valid	Valid	**Illegal**

PMD Class. The type of PMD entity associated with this port.

H/W?. Flag that indicates the presence of underlying hardware support for this port (y or n).

BS?. Break State. True if PCM state machine is not leaving the break state in the expected time interval (y or n).

Connectn Capabils LCT. Whether or not the system is capable of performing the Link Confidence Test (LCT).

Connectn Capabils LOOP. Whether or not the system is capable of performing the MAC local loop. The loop test is performed before the connection is made active.

Connectn Policies LCT. The port connection policies. Whether or not the system is capable of performing the LCT.

Connectn Policies LOOP. Whether or not the system is capable of performing the MAC local loop. The loop test is performed before the connection is made active.

MAC Indicated T_Val. Indicates the local end of the connection intends to place a MAC in the output token path of this port.

MAC Indicated R_Val. Indicates the remote end of the connection intends to place a MAC in the output token path of this port.

Viewing the Port Status Table

To display the SMT port status table, enter

fportstatus

at the system prompt. The following is a typical example.

FDDI SMT Port Status Table

Slot/ Stn/ Port	Connect State	PCM State	PC Withhold	LER Flag
2/ 1/A	Connecting	Connect	None	f
2/ 1/B	Connecting	Connect	None	f

The fields displayed by the **fportstatus** command are described below.

Connect State. The current connect state of this port. Values are **Disabled**, **Connecting**, **Standby**, and **Active**.

PCM State. The state of this port's PCM state machine. Values are **Off**, **Break**, **Trace**, **Connect**, **Next**, **Signal**, **Join**, **Verify**, **Active**, and **Maint**.

PC Withhold. Reason for withholding a connection. Values are **None**, **M-M**, **Other**, and **Path Not Available**.

None. Connection has not been withheld

M-M. An attempt to make a connection from an M type port to another M type port was made.

Other. Port incompatibility

Path Not Available. Failed LCT (link) test.

LER Flag. Set to true when the Average Error Rate (as shown in the **fportctrs** command, which is described in *Viewing the Port Counters Table* on page 22-19) reaches the value defined in Alarm Threshold (set in the **fportc** command, which is described in *Configuring the Port Parameters* on page 22-20).

Viewing the Port Counters Table

To display the SMT port counters table, enter

fportctrs

at the system prompt. the following is a typical example.

FDDI SMT Port Counters Table

Slot/ Stn/ Port	Link Confidence Failures	Avg Err Rate n=10^(-n)	Link Rejects	Aggregate Link Error Count
2/ 1/A	0	9	0	0
2/ 1/B	0	9	0	0

Link Confidence Failures. The number of consecutive times the link confidence test has failed. This link confidence test is performed three times. Once in 50ms, again in 5 seconds, and again in 50 seconds.

Avg Err Rate n=10^(-n). The long term average link error rate. The actual formula for this calculation is:

$$AverageErrorRate = 10^{-n}$$

Link Rejects. The number of times that a link has been rejected.

Aggregate Link Error Count. The aggregate link error monitor error count.

Configuring the Port Parameters

The **fportc** command allows you to configure SMT port parameters. To use this command, enter **fportc** followed by the slot number, followed by the station number, and followed by the port number of the FDDI port you want to modify. For example, to modify the settings for Port 1, Station 1 on the FDDI module in Slot 2, you would enter

```
fportc 2/1/1
```

At the system prompt. the following is a typical example.

```
                    SMT Port Configuration
                (FDDI Slot 2 Station 1 Port 1)
1) Connection break Threshold      :  7
   (LerCutoff: 10^-n)  {4-15}
2) Alarm Threshold                 :  8
   (LerAlarm: 10^-n) {4-15}
3) Port Enabled                    :  Yes (Connecting)

save    -  to save current configuration and quit
quit    -  to quit without saving
```

To change any of the values above, enter the line number, followed by an equal sign, followed by the new value. For example, to change the **Alarm Threshold** to 4, enter:

```
2=4
```

To update the values you have changed, enter **save**. If you do not want to save the changes enter **quit** or **Ctrl-D**.

The fields displayed by the **fportc** command are described below.

Connection break Threshold. The number of link errors that must occur before this station will break the connection.

Alarm Threshold. The number of link errors that must occur before this station will generate an alarm.

Port Enabled. This allows the user to disable a particular FDDI port for maintenance purposes (e.g., if a bad station is on that port, and they want to shut him off without physically unplugging him.).

Introduction to FDDI Services

The OmniSwitch has several unique and powerful services available. A service provides the ability to extend Groups and AutoTracker VLANs across backbones. Services run over an FDDI backbone. On FDDI, services provide the capability to multiplex Groups over a single shared media.

Services Menu

To view the Services Menu, type **services** at any prompt. Then type **?** to see the list of commands.

Command	Services Menu
cas	Create a service (PTOP bridging/Classical IP/Trunking/LANE)
mas	Modify a service
das	Delete a service
vas	View a service

Group Multiplexing/Trunking

Group multiplexing allows a Group to be extended across a backbone network. In addition, AutoTracker VLANs can be carried transparently within a Group while maintaining their VLAN segregation by AutoTracker rules. An OmniSwitch port can be classified as a Trunk Port, which can support Groups distributed across multiple switches connected by LANs. The trunking service encapsulates the bridged frame and includes information required to reproduce the frame on the remote end of the trunk and to maintain group separation. FDDI ports can be configured as Trunk Ports. A single trunking service per switch connected to an FDDI LAN allows for full Group connectivity between all switches on that Group. Each switch will only participate in those Groups to which it is assigned.

FDDI Group Multiplexing

Group multiplexing for FDDI is a mechanism for multiplexing groups over a single FDDI shared media. Three types of Group multiplexing are supported for FDDI: Trunking, 802.10, and Domain Bridging. The switch software commands for creating and managing all three types are the same.

Trunking is the recommended method. It encapsulates, rather than tagging and translating, frames before they are sent on the FDDI backbone. In Trunking, media type and source routing information are retained in the packet.

The 802.10 service is a proprietary mechanism used by Cisco for multiplexing Groups over backbones. 802.10 does not support source routing.

Domain bridging is a proprietary mechanism used by Storage Technology Corporation (STK) to multiplex multiple domains—which are equivalent to Alcatel groups—over an FDDI backbone. It is recommended for connections to STK bridge/routers. Like the Trunking method, domain bridging encapsulates, rather than tagging and translating frames, before sending them over the backbone. In addition, source routing information is retained in frames.

FDDI Trunk Ports

When a switch is powered up, there is a virtual bridge port assigned to each physical port, including FDDI ports. In other words, there is a one-to-one mapping between virtual ports and physical ports for LAN interfaces.

A Group multiplexing service (Trunking, 802.10, or Domain Bridging) creates a virtual trunk port for each Group that is multiplexed on a physical FDDI port. A virtual trunk port will transmit frames with a trunk header to maintain separation of Group traffic. FDDI physical ports can support multiple trunk ports (up to 32 per physical port) and a single virtual bridge port.

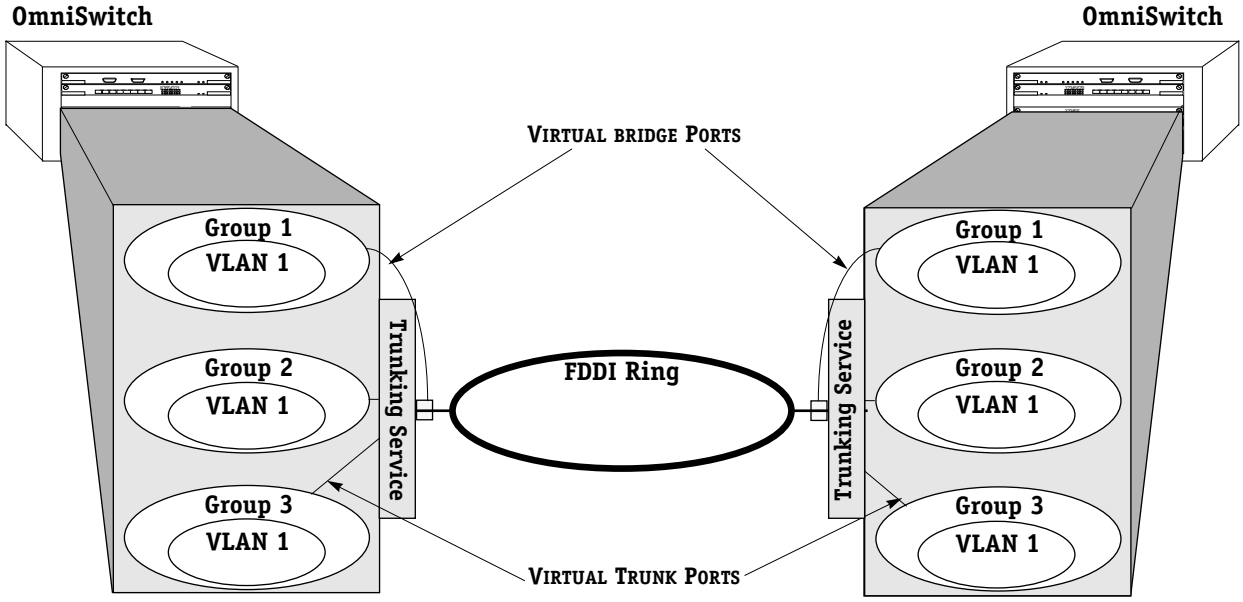
The Trunk ports created for FDDI Trunking, 802.10, and domain bridging are different. Frames transmitted on an FDDI Trunk port or a domain bridging port are not translated, only encapsulated. Frames transmitted on an 802.10 Trunk port are translated, then tagged using an 802.10 header containing Group information. In addition, each type of trunk is identified differently through switch software commands, such as **vi** and **fwt**. FDDI trunk ports are labelled **Trk**, 802.10 Trunk ports are labelled **T10**, and domain bridging ports are labelled **DBr**.

The FDDI Virtual Bridge Port

The FDDI virtual bridge port by default is part of the default Group (Group1). The virtual bridge port *must* belong to a Group other than the Groups associated with the virtual trunk ports. So, if you want to multiplex switched traffic for Group 1, you must move the FDDI virtual bridge port to some other Group that is not already being multiplexed. If there is no such Group, then you must create one.

The virtual bridge port cannot be deleted and will transmit data in the raw MAC format without encapsulation or tagging. This port supports SMT for the FDDI interface. Note that frames being transmitted over the primary port are subject to translation as defined in Chapter 24, "Configuring LAN Switch Translations."

The figure below shows Groups 1, 2, and 3, where Group 1 is attached to the virtual bridge port and Groups 2 and 3 are attached to the trunking service. Traffic transmitted on the virtual bridge port will be MAC frames that are subject to translation. Traffic transmitted on the trunk ports will be sent with a trunk header to maintain separation of group traffic.



FDDI Virtual Bridge Port

The following sections describe unique aspects of the three types of Group multiplexing.

FDDI Trunking

In FDDI Trunking, each Group participating in a separate Spanning Tree is extended across a trunked network. FDDI Trunking is an implicit tagging mechanism, meaning that Spanning Tree BPDUs are encapsulated inside trunked frames and treated as data by the trunking server.

A switch sends out trunking hello messages every 30 seconds to announce which Groups are supported on the trunking service. Conversely, when the switch receives a trunking hello message, it learns which Groups are supported by that remote service. It ignores those groups in the trunking hello message which are not supported by this port's trunking service. Data separation is maintained.

You can view MACs learned from remote trunking stations through the **rts** command (see Chapter 23, "Configuring Bridging Parameters"). The addresses of these stations are the MAC addresses of the virtual trunk ports as shown by the **vi** command (see Chapter 25, "Managing Groups and Ports").

When an FDDI Trunking service receives frames from the trunked network, the switch will learn the source MAC address of the encapsulated bridged frame and it will associate that MAC with the source MAC address of the remote trunk service. If a trunk frame is received for a Group that is not active on this trunk service, it is dropped.

When a frame is sent out on a trunked network, the switch checks to see if the destination MAC of the frame has been learned. If so, the frame will be encapsulated and directed to the remote trunk service. If not, the frame is broadcast to all remote trunk services. The switch sends frames onto the trunk in the same format as the original LAN type. Any required translation is done at the destination switch.

802.10

In 802.10, each Group participating in a separate Spanning Tree is extended across a trunked network.

The 802.10 protocol is an explicit tagging mechanism. It does not use hello messages to announce the Groups that it supports. Instead, it inserts Group information directly into the packets that it sends across the FDDI backbone. When a remote switch receives an 802.10 frame, it can identify the Group to which that packet belongs by examining the Group ID. If the remote switch does not support the Group, then it discards the frame; otherwise, it strips the 802.10 header and sends the frame onto the switch backplane.

Before a frame is sent out on the trunked network, the switch first makes sure it can multiplex the Group to which the frame belongs. If it can, it translates the frame to FDDI format and adds a 16-byte 802.10 header containing Group ID information. Finally, the frame is sent out on the FDDI backbone.

Domain Bridging

In domain bridging, each Group participating in a separate Spanning Tree is extended across a trunked network. In general domain bridging operates like the FDDI Trunking method, but it differs in the following ways:

- Hello messages are not used by a domain bridging service since frames are explicitly tagged.
- Domain bridging uses a different port type for virtual ports than FDDI Trunking.

Domain bridging also provides source routing. However, unlike FDDI Trunking, source routing with domain bridging requires a ring and bridge number for each multiplexed domain. You enter a ring and bridge number through the **src** command, which is described in Chapter 21, “Managing Token Ring Modules.” (FDDI Trunking provides source routing but the FDDI backbone is collapsed, meaning a ring and bridge number are not required.)

Domain bridging for transparent and source routed frames performs no translation, only encapsulation. Therefore switch translations cannot be set up for domain bridging virtual ports.

Creating an FDDI Group Multiplexing Service

You can set up all three types of Group multiplexing services—FDDI Trunking, 802.10, and Domain Bridging—using the same command. You can also set up more than one type of service on the same FDDI port. In addition, more than one type of multiplexing service can be used to trunk the same Group. To create a Group multiplexing service, follow these directions:

1. Type **cas** followed by the slot and port number of the FDDI interface where you want to create the Trunking service.

   ```
   cas 5/1
   ```

2. The system displays a prompt asking for the type of service:

   ```
   Service Type (1=Trunk, 2=802.10, 3=DBr) (1) :
   ```

   Select the type of Trunking Service you want to create. Enter a **1** to set up FDDI Trunking (the default), a **2** to set up an 802.10 service, or a **3** to set up Domain Bridging.

3. A screen displays the current values for Trunking services on this port:

   ```
   Slot 5 Station 1 FDDI Trunk Service

   1) Description (30 chars max)          :
   2) Group IDs                           : none
   ```

   The colon prompt (:) allows you to make changes to the existing values. At the colon prompt, enter a **1** followed by an equal sign (=) and a description for this service. (This description is optional. If you do not provide a name, the system will provide a default.) The sample below provides an example:

   ```
   1=Trunk on FDDI Port 5/1
   ```

4. The screen re-displays the current values for this service. The description you just entered will be included. At the colon prompt, enter a **2** followed by an equal sign along with the Group number(s) that you want to multiplex across the FDDI backbone. You can enter more than one Group number at a time.

   ```
   2=3 4
   ```

   The Groups you enter must exist locally. In addition, the virtual bridge port for this FDDI cannot be part of any Group that is multiplexed.

   The screen re-displays the current values:

   ```
   Slot 5 Station 1 FDDI Trunk Service

   1) Description (30 chars max)          : FDDI Trunking
   2) Group IDs                           : 3 4
   ```

5. At the colon prompt, type **save** to create the service with these settings. You could also cancel these settings by entering **quit** or by entering **Ctrl-d** at the colon prompt. A message confirming each Group's Trunking service displays:

```
Created trunking service for Group 3 on 5/1 (slot/station)
Created trunking service for Group 4 on 5/1 (slot/station)
```

These messages confirm an FDDI Trunking service. If this had been an 802.10 service, the messages would display as follows:

```
Created 802.10 service for Group 3 on 5/1 (slot/station)
Created 802.10 service for Group 4 on 5/1 (slot/station)
```

If this had been a Domain Bridging service, the messages would display as follows:

```
Created DBr service for Group 3 on 5/1 (slot/station)
Created DBr service for Group 4 on 5/1 (slot/station)
```

Modifying an FDDI Group Multiplexing Service

You can modify an existing FDDI Group multiplexing service. Follow these directions:

1. Type **mas** followed by the slot number and port number for the FDDI Group multiplexing service that you want to modify.

   ```
   mas 5/1
   ```

2. The system displays a prompt asking for the type of service:

   ```
   Service Type (1=Trunk, 2=802.10, 3=DBr) (1) :
   ```

   Select the type of multiplexing Service you want to modify. Enter a **1** for FDDI Trunking (the default), a **2** for an 802.10 service, or a **3** for a Domain Bridging service. More than one type may exist on a single FDDI port, so you need to specify which one you are modifying.

3. A screen displays the current values for Group multiplexing services on this port:

   ```
   Slot 5 Station 1 FDDI 802.10 Service

   1) Description (30 chars max)        : FDDI Trunking
   2) Group IDs                         : 3 4
   ```

   The colon prompt (:) allows you to make changes to the existing values. To change the description, enter a **1** followed by an equal sign (=) and a new description for this service. To change the Groups that are multiplexed over this FDDI backbone, enter a **2**, the equal sign (=), and the Group numbers to multiplex.

   Adding Groups. If you wanted to add Group 5 to the list of multiplexed Groups, you would enter:

   ```
   2=5
   ```

   at the colon prompt (:). The system re-displays the current list of Groups.

   ```
   Slot 5 Station 1 FDDI Trunk Service

   1) Description (30 chars max)        : FDDI Trunking
   2) Group IDs                         : 3 4 5
   ```

   Deleting Groups. You can also delete Groups from the list of multiplexed Groups. To delete a Group, you enter its number preceded by a minus sign (-). For example, if you wanted to delete Group 3, you would enter:

   ```
   2=-3
   ```

   at the colon prompt (:). The system re-displays the current list of Groups.

   ```
   Slot 5 Station 1 FDDI Trunk Service

   1) Description (30 chars max)        : FDDI Trunking
   2) Group IDs                         : 4 5
   ```

Adding and Subtracting Groups in the Same Command. You can add and subtract groups in the same command. For example, if you wanted to add Group 6 and delete Group 4, you would enter:

```
2=6 -4
```

at the colon prompt (:). The system re-displays the current list of Groups.

```
Slot 5 Station 1 FDDI Trunk Service

1) Description (30 chars max)          : FDDI Trunking
2) Group IDs                           : 5 6
```

1. At the colon prompt, type **save** to save the service with these changes. You could also cancel these settings by entering **quit** or by entering **Ctrl-d** at the colon prompt. A message confirming all your changes displays. The changes performed in Step 3 would display the following messages:

```
Deleting Virtual Trunk port 25 for Group 3.
Deleting Virtual Trunk port 26 for Group 4.
Created trunking service for Group 5 on 5/1 (slot/station)
Created trunking service for Group 6 on 5/1 (slot/station)
```

Deleting an FDDI Group Multiplexing Service

You can delete a Group multiplexing service on a given FDDI port. To delete a service, follow these directions.

1. Type **das** followed by the slot and port number for the Group multiplexing service that you want to delete.

   ```
   das 5/1
   ```

2. The system displays a prompt asking for the type of service:

   ```
   Service Type (1=Trunk, 2=802.10, 3=DBr) (1) :
   ```

   Select the type of multiplexing Service you want to delete. Enter a **1** for FDDI Trunking (the default), a **2** for an 802.10 service, or a **3** for a Domain Bridging service. More than one type may exist on a single FDDI port, so you need to specify which one you are deleting.

3. A screen displays the current values for Group multiplexing services on this port along with a prompt confirming the deletion:

   ```
   Slot 5 Station 1 FDDI Trunk Service

   1) Description (30 chars max)          : FDDI Trunking
   2) Group IDs                           : 3 4
   Delete trunk service on 5/1 (slot/station)? (n):
   ```

   Enter a **Y** to confirm the deletion or press <Enter> to cancel the deletion. Messages display describing the deletion:

   ```
   Deleting Virtual Trunk port 17 for Group 3
   Deleting Virtual Trunk port 18 for Group 4
   Trunk service deleted for 5/1 (slot/station)
   ```

Viewing Information on All FDDI Group Multiplexing Services

You can obtain information on all Group multiplexing services configured for a given FDDI port. This display shows FDDI Trunking, 802.10, and domain bridging services information. To obtain information for all FDDI services on a port, follow these directions:

1. Type **vas** followed by the slot and port number for the multiplexing service that you want to view.

   ```
   vas 5/1
   ```

   If you do not include the slot and port number, information on all services (ATM, FDDI, Frame Relay) will display. The following screen shows a sample display.

   ```
   FDDI Services

   Slot 5 Station 1 FDDI Trunk Service

   1) Description (30 chars max)          : FDDI Trunking
   2) Group IDs                           : 4

   Slot 5 Station 1 FDDI 802.10 Service
   1) Description (30 chars max)          : 802.10 Service
   2) Group IDs                           : 2 4
   ```

   This display shows both FDDI Trunking and 802.10 services on the same FDDI port. Also note that Group 4 is included in both services.

   The following is an example of how the **vas** command displays information on a Domain Bridging service:

   ```
   Slot 5 Station 1 FDDI DBr Service

   1) Description (30 chars max)          : DBr Service
   2) Group IDs                           : 2
   ```