FDDI Full-Duplex Single-Mode and Multimode Port Adapters

Description

Fiber Distributed Data Interface (FDDI) full-duplex single-mode and multimode port adapters (PA-F/FD-SM and PA-F/FD-MM) are available on Cisco 7200 series routers, on second-generation Versatile Interface Processors (VIP2s) in Cisco 7500 series routers, and on Cisco 7000 series routers with the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI).

These port adapters provide an interface for both single-mode and multimode fiber-optic cable. Two physical ports are available with either single-mode SC-type or multimode MIC receptacles. Each port adapter's FDDI connection allows a maximum aggregate bandwidth of 200 Mbps per the FDDI standard.

Platforms

This feature is supported on these platforms:

- Cisco 7200 series
- Cisco 7500 series
- Cisco 7000 series routers with the RSP7000 and RSP7000CI

Configuration Task

For information on how to configure the PA-F/FD-SM and PA-F/FD-MM port adapters, refer to the "Configure a Fiber Distributed Data Interface (FDDI)" section in the "Configuring Interfaces" chapter of the *Configuration Fundamentals Configuration Guide*.

In addition to the commands in the "Configure a Fiber Distributed Data Interface (FDDI)" section, the PA-F/FD-SM and PA-F/FD-MM port adapters can also be configured for full-duplex. To enable full-duplex mode on the PA-F/FD-SM and PA-F/FD-MM port adapters, perform the following task in interface configuration mode:

Task	Command
Enable full-duplex on the FDDI interface of the PA-F/FD-SM and PA-F/FD-MM port adapter.	**full-duplex** or **no half-duplex**

For information on other commands that can be used by the PA-F/FD-SM and PA-F/FD-MM FDDI port adapters, refer to the Cisco IOS Release 11.2 configuration guides.

Configuration Example

The following example enables full-duplex mode on FDDI interface 0:

```
router(config)# interface fddi 0/1/0
router(config-if)# full-duplex
router(config-if)# exit
router(config)#
```

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 11.2 command references.

- **full-duplex**
- **half-duplex**
- **show interfaces fddi**

full-duplex

To specify full-duplex mode on a Fast Ethernet Interface Processor (FEIP) port, on the FDDI full-duplex, single-mode port adapter (PA-F/FD-SM) and FDDI full-duplex, multimode port adapter (PA-F/FD-MM) on Cisco 7000 series routers with RSP7000, Cisco 7200 series routers, and Cisco 7500 series routers, or on a serial interface port that uses bisynchronous tunneling, use the **full-duplex** interface configuration command. Use the **no** form of this command to restore the default half-duplex mode.

full-duplex
no full-duplex

Syntax Description

This command has no arguments or keywords.

Default

Half-duplex mode

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.1.

This command was modified in Cisco IOS Release 11.2 P and 11.1 CA to include information on FDDI full-duplex, single-mode and multimode port adapters (PA-F/FD-SM and PA-F/FD-MM).

Use this command if your equipment on the other end is capable of full-duplex mode.

To enable half-duplex mode, use the **no full-duplex** or **half-duplex** commands.

If the interface does not support full-duplex, an informational message similar to the one shown below is displayed, and no changes are made to the interface. To determine if the interface supports full-duplex, use the **show interfaces** command. For example, the following message is displayed if the interface does not support full-duplex:

```
% interface does not support full-duplex.
```

Full-duplex on the FDDI full-duplex port adapters (PA-F/FD-SM and PA-F/FD-MM) allows an FDDI ring with exactly two stations to transform the ring into a full-duplex, point-to-point topology. To operate in full-duplex mode, there must be only two stations on the ring, the two stations must be capable of operating in full-duplex mode, and both stations must complete a full-duplex autoconfiguration protocol. There is no FDDI token in full-duplex mode.

Full-duplex autoconfiguration protocol allows an FDDI station to dynamically and automatically operate in either half-duplex (or ring) or full-duplex mode, and ensures that the stations fall back to ring mode when a configuration change occurs, such as a third station joining the ring.

After booting up, the FDDI stations begin operation in half-duplex mode. While the station performs the full-duplex autoconfiguration protocol, the station continues to provide data-link services to its users. Under normal conditions, the transition between half-duplex mode and full-duplex mode is transparent to the data-link users. The data-link services provided by full-duplex mode are functionally the same as the services provided by half-duplex mode.

If you change the full-duplex configuration (for example from disabled to enabled) on supported interfaces, the interface resets.

Examples

The following example configures full-duplex mode on the Cisco 7000:

```
interface fastethernet 0/1
 full-duplex
```

The following example specifies full-duplex binary synchronous communications (BSC) mode:

```
interface serial 0
 encapsulation bstun
 full-duplex
```

The following example enables full-duplex mode on FDDI interface 0:

```
interface fddi 0/1/0
 full-duplex
```

Related Commands

half-duplex
interface fastethernet
interface fddi
interface serial

half-duplex

To specify half-duplex mode on an SDLC interface or on the FDDI full-duplex, single-mode port adapter (PA-F/FD-SM) and FDDI full-duplex, multimode port adapter (PA-F/FD-MM) on the Cisco 7000 series routers with RSP7000, Cisco 7200 series, and Cisco 7500 series routers, use the **half-duplex** interface configuration command. Use the **no** form of this command to reset the interface for full-duplex mode.

half-duplex
no half-duplex

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.1.

This command was modified in Cisco IOS Release 11.2 P and 11.1 CA to include information on FDDI full-duplex, single-mode and multimode port adapters (PA-F/FD-SM and PA-F/FD-MM).

For additional information on full-duplex on the PA-F/FD-SM and PA-F/FD-MM port adapters, refer to the **full-duplex** interface configuration command.

The **half-duplex** command is used to configure an SDLC interface for half-duplex mode.

The **half-duplex** command deprecates both the **sdlc hdx** and **media-type half-duplex** commands.

To enable full-duplex mode, use the **no half-duplex** or **full-duplex** commands.

Note The **media-type half-duplex** command exists in Cisco IOS Release 11.0(5). As of Release 11.0(6), the keyword **half-duplex** was removed from the **media-type** command. In Release 11.0(6), the functionality for specifying half-duplex mode is provided by the **half-duplex** command.

Example

In the following example, an SDLC interface has been configured for half-duplex mode:

```
encapsulation sdlc-primary
half-duplex
```

Related Command

full-duplex

show interfaces fddi

To display information about the FDDI interface, use the **show interfaces fddi** EXEC command.

show interfaces fddi *number* [**accounting**]
show interfaces fddi [*slot*/*port*] [**accounting**] (Cisco 7000 series and Cisco 7200 series)
show interfaces fddi [*slot*/*port-adapter*/*port*] [**accounting**] (Cisco 7000 series with RSP700 and Cisco 7500 series routers)

Syntax Description

number	Port number on the selected interface.
accounting	(Optional) Displays the number of packets of each protocol type that have been sent through the interface.
slot	(Optional) Slot location of the interface processor.
port-adapter	(Optional) On Cisco 7000 series routers with RSP700 and on Cisco 7500 series routers, specifies the ports on a VIP2 card. The value can be 0 or 1.
port	(Optional) Port number on the interface.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

This information was modified in Cisco IOS Release 11.2 P and 11.1 CA to include sample output for FDDI full-duplex, single-mode and multimode port adapters (PA-F/FD-SM and PA-F/FD-MM).

Sample Displays

The following is a sample partial display of FDDI-specific data from the **show interfaces fddi** command on a Cisco 7000 series router:

```
Router> show interfaces fddi 3/0
Fddi3/0 is up, line protocol is up
  Hardware is cxBus Fddi, address is 0000.0c02.adf1 (bia 0000.0c02.adf1)
  Internet address is 131.108.33.14, subnet mask is 255.255.255.0
  MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation SNAP, loopback not set, keepalive not set
  ARP type: SNAP, ARP Timeout 4:00:00
  Phy-A state is  active, neighbor is   B, cmt signal bits 008/20C, status ILS
  Phy-B state is  active, neighbor is   A, cmt signal bits 20C/008, status ILS
  ECM is in, CFM is thru, RMT is ring_op
  Token rotation 5000 usec, ring operational 21:32:34
  Upstream neighbor 0000.0c02.ba83, downstream neighbor 0000.0c02.ba83
  Last input 0:00:05, output 0:00:00, output hang never
  Last clearing of "show interface" counters 0:59:10
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 69000 bits/sec, 44 packets/sec
  Five minute output rate 0 bits/sec, 1 packets/sec
     113157 packets input, 21622582 bytes, 0 no buffer
     Received 276 broadcasts, 0 runts, 0 giants
```

```
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     4740 packets output, 487346 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets, 0 restarts
     0 transitions, 2 traces, 3 claims, 2 beacons
```

The following is a sample display of the **show interfaces fddi** command for the full-duplex FDDI port adapter on a Cisco 7500 series router:

```
Router# show interfaces fddi 0/1/0
Fddi0/1/0 is up, line protocol is up
  Hardware is cxBus FDDI, address is 0060.3e33.3608 (bia 0060.3e33.3608)
  Internet address is 2.1.1.1/24
  MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation SNAP, loopback not set, keepalive not set
  ARP type: SNAP, ARP Timeout 04:00:00
  FDX supported, FDX enabled, FDX state is operation
  Phy-A state is maintenance, neighbor is Unknown, status HLS
  Phy-B state is active, neighbor is A, status SILS
  ECM is in, CFM is c_wrap_b, RMT is ring_op,
  Requested token rotation 5000 usec, negotiated 4997 usec
  Configured tvx is 2500 usec
  LER for PortA = 0A, LER for PortB = 0A ring operational 00:02:45
  Upstream neighbor 0060.3e73.4600, downstream neighbor 0060.3e73.4600
  Last input 00:00:12, output 00:00:13, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     62 packets input, 6024 bytes, 0 no buffer
     Received 18 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     71 packets output, 4961 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     3 transitions, 0 traces,  100 claims, 0 beacon
```

Table 53 describes the **show interfaces fddi** display fields.

Table 53 Show Interfaces FDDI Field Descriptions

Field	Description
Fddi is {up | down}...is administratively down	Gives the interface processor unit number and tells whether the interface hardware is currently active and can transmit and receive or if it has been taken down by an administrator.
line protocol is {up | down}	Indicates whether the software processes that handle the line protocol consider the interface usable.
Hardware	Provides the hardware type, followed by the hardware address.
Internet address	IP address, followed by subnet mask.
MTU	Maximum transmission unit of the interface.
BW	Bandwidth of the interface in kilobits per second.
DLY	Delay of the interface in microseconds.
rely	Reliability of the interface as a fraction of 255 (255/255 is 100% reliability), calculated as an exponential average over 5 minutes.
load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.

Table 53 Show Interfaces FDDI Field Descriptions (Continued)

Encapsulation	Encapsulation method assigned to interface.
loopback	Indicates whether or not loopback is set.
keepalive	Indicates whether or not keepalives are set.
ARP type	Type of Address Resolution Protocol assigned.
FDX	Displays full-duplex information. Values are: not supported or supported. When the value is supported, the display indicates whether full-duplex is enabled or disabled. When enabled, the state of the FDX negotiation process is displayed. The negotiation states only relate to the full-duplex negotiation process. You must also ensure that the interface is up and working by looking at other fields in the **show interfaces fddi** command such as line protocol and RMT. Negotiation states are: • idle—Interface is working but not in full-duplex mode yet. If persistent, it could mean that the interface did not meet all negotiation conditions (for example, there are more than two stations in the ring). • request—Interface is working but not in full-duplex mode yet. If persistent, it could mean that the remote interface does not support full-duplex or full-duplex is not enabled on the interface. • confirm—Transient state. • operation—Negotiations completed successfully, and both stations are operating in full-duplex mode.
Phy-{A | B}	Lists the state the Physical A or Physical B connection is in; one of the following: off, active, trace, connect, next, signal, join, verify, or break.
neighbor	State of the neighbor: • A—Indicates that the connection management (CMT) process has established a connection with its neighbor. The bits received during the CMT signaling process indicate that the neighbor is a Physical A type dual attachment station (DAS) or concentrator that attaches to the primary ring IN and the secondary ring OUT when attaching to the dual ring. • S—Indicates that the CMT process has established a connection with its neighbor and that the bits received during the CMT signaling process indicate that the neighbor is one Physical type in a single attachment station (SAS). • B—Indicates that the CMT process has established a connection with its neighbor and that the bits received during the CMT signaling process indicate that the neighbor is a Physical B dual attachment station or concentrator that attaches to the secondary ring IN and the primary ring OUT when attaching to the dual ring. • M—Indicates that the CMT process has established a connection with its neighbor and that the bits received during the CMT signaling process indicate that the router's neighbor is a Physical M-type concentrator serving as a Master to a connected station or concentrator. • unk—Indicates that the network server has not completed the CMT process and, as a result, does not know about its neighbor. See the section "Setting Bit Control" for an explanation of the bit patterns.

Table 53 Show Interfaces FDDI Field Descriptions (Continued)

cmt signal bits	Shows the transmitted/received CMT bits. The transmitted bits are 0x008 for a Physical A type and 0x20C for Physical B type. The number after the slash (/) is the received signal bits. If the connection is not active, the received bits are zero (0); see the line beginning Phy-B in the display. This applies to FIP interfaces only.
status	Status value displayed is the actual status on the fiber. The FDDI standard defines the following values: • LSU—Line State Unknown, the criteria for entering or remaining in any other line state have not been met. • NLS—Noise Line State is entered upon the occurrence of 16 potential noise events without satisfying the criteria for entry into another line state. • MLS—Master Line State is entered upon the receipt of eight or nine consecutive HQ or QH symbol pairs. • ILS—Idle Line State is entered upon receipt of four or five idle symbols. • HLS—Halt Line State is entered upon the receipt of 16 or 17 consecutive H symbols. • QLS—Quiet Line State is entered upon the receipt of 16 or 17 consecutive Q symbols or when carrier detect goes low. • ALS—Active Line State is entered upon receipt of a JK symbol pair when carrier detect is high. • OVUF—Elasticity buffer Overflow/Underflow. The normal states for a connected Physical type are ILS or ALS. If the report displays the QLS status, this indicates that the fiber is disconnected from Physical B, or that it is not connected to another Physical type, or that the other station is not running.
ECM is...	ECM is the SMT entity coordination management, which overlooks the operation of CFM and PCM. The ECM state can be one of the following: • out—Router is isolated from the network. • in—Router is actively connected to the network. This is the normal state for a connected router. • trace—Router is trying to localize a stuck beacon condition. • leave—Router is allowing time for all the connections to break before leaving the network. • path_test—Router is testing its internal paths. • insert—Router is allowing time for the optical bypass to insert. • check—Router is making sure optical bypasses switched correctly. • deinsert—Router is allowing time for the optical bypass to deinsert.

Table 53 Show Interfaces FDDI Field Descriptions (Continued)

CFM is...	Contains information about the current state of the MAC connection. The Configuration Management state can be one of the following: • isolated—MAC is not attached to any Physical type. • wrap_a—MAC is attached to Physical A. Data is received on Physical A and transmitted on Physical A. • wrap_b—MAC is attached to Physical B. Data is received on Physical B and transmitted on Physical B. • wrap_s—MAC is attached to Physical S. Data is received on Physical S and transmitted on Physical S. This is the normal mode for a single attachment station (SAS). • thru—MAC is attached to Physical A and B. Data is received on Physical A and transmitted on Physical B. This is the normal mode for a dual attachment station (DAS) with one MAC. The ring has been operational for 1 minute and 42 seconds.
RMT is...	RMT (Ring Management) is the SMT MAC-related state machine. The RMT state can be one of the following: • isolated—MAC is not trying to participate in the ring. This is the initial state. • non_op—MAC is participating in ring recovery, and ring is not operational. • ring_op—MAC is participating in an operational ring. This is the normal state while the MAC is connected to the ring. • detect—Ring has been nonoperational for longer than normal. Duplicate address conditions are being checked. • non_op_dup—Indications have been received that the address of the MAC is a duplicate of another MAC on the ring. Ring is not operational. • ring_op_dup—Indications have been received that the address of the MAC is a duplicate of another MAC on the ring. Ring is operational in this state. • directed—MAC is sending beacon frames notifying the ring of the stuck condition. • trace—Trace has been initiated by this MAC, and the RMT state machine is waiting for its completion before starting an internal path test.
token rotation	Token rotation value is the default or configured rotation value as determined by the **fddi token-rotation-time** command. This value is used by all stations on the ring. The default is 5000 microseconds. For FDDI full-duplex, this indicates the value in use prior to entering full-duplex operation.
negotiated	Actual (negotiated) target token rotation time.
ring operational	When the ring is operational, the displayed value will be the negotiated token rotation time of all stations on the ring. Operational times are displayed by the number of hours:minutes:seconds the ring has been up. If the ring is not operational, the message “ring not operational” is displayed.
Configured tvx	Transmission timer.
LER	Link error rate.

Table 53 Show Interfaces FDDI Field Descriptions (Continued)

Upstream | downstream neighbor	Displays the canonical MAC address of outgoing upstream and downstream neighbors. If the address is unknown, the value will be the FDDI unknown address (0x00 00 f8 00 00 00).
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface. Useful for knowing when a dead interface failed.
output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Last clearing	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates the elapsed time is too large to be displayed. 0:00:00 indicates the counters were cleared more than 2^{31}ms (and less than 2^{32}ms) ago.
Queueing strategy	First-in, first-out queuing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
Output queue, input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped due to a full queue.
Five minute input rate Five minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. The five-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes, including data and MAC encapsulation, in the error free packets received by the system.
no buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernets and bursts of noise on serial lines are often responsible for no input buffer events.
broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the medium's minimum packet size.
giants	Number of packets that are discarded because they exceed the medium's maximum packet size.
CRC	Cyclic redundancy checksum generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data.

Table 53 Show Interfaces FDDI Field Descriptions (Continued)

frame	Number of packets received incorrectly that have a CRC error and a noninteger number of octets. On a LAN, this is usually the result of collisions or a malfunctioning Ethernet device. On an FDDI LAN, this also can be the result of a failing fiber (cracks) or a hardware malfunction.
overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different from the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be increased.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of transmit aborts (when the router cannot feed the transmitter fast enough).
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this might not balance with the sum of the enumerated output errors, because some datagrams can have more than one error, and others can have errors that do not fall into any of the specifically tabulated categories.
collisions	Because an FDDI ring cannot have collisions, this statistic is always zero.
interface resets	Number of times an interface has been reset. The interface may be reset by the administrator or automatically when an internal error occurs.
restarts	Should always be zero for FDDI interfaces.
output buffer failures	Number of no resource errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.
transitions	The number of times the ring made a transition from ring operational to ring nonoperational, or vice versa. A large number of transitions indicates a problem with the ring or the interface.
traces	Trace count applies to both the FCI, FCIT, and FIP. Indicates the number of times this interface started a trace.
claims	Pertains to FCIT and FIP only. Indicates the number of times this interface has been in claim state.
beacons	Pertains to FCIT and FIP only. Indicates the number of times the interface has been in beacon state.

The following is an example that includes the **accounting** option. When you use the **accounting** option, only the accounting statistics are displayed.

```
Router> show interfaces fddi 3/0 accounting

Fddi3/0
       Protocol    Pkts In   Chars In   Pkts Out  Chars Out
             IP       7344    4787842       1803    1535774
      Appletalk      33345    4797459      12781    1089695
        DEC MOP          0          0        127       9779
            ARP          7        420         39       2340
```

Table 54 describes the **show interfaces fddi** display fields.

Table 54 Show Interfaces FDDI Field Descriptions—Accounting

Field	Description
Protocol	Protocol that is operating on the interface.
Pkts In	Number of packets received for that protocol.
Chars In	Number of characters received for that protocol.
Pkts Out	Number of packets transmitted for that protocol.
Chars Out	Number of characters transmitted for that protocol.

Supported MIB

The PA-F/FD-SM and PA-F/FD-MM port adapters can be monitored with the Cisco Full-Duplex FDDI Interface MIB (CISCO-FDX-FDDI-MIB.my). For information on accessing Cisco MIB files, refer to the *Cisco MIB User Quick Reference.*

What to Do Next

For more information on the PA-F/FD-SM and PA-F/FD-MM port adapters, refer to the *PA-F/FD-SM and PA-F/FD-MM Full-Duplex FDDI Port Adapter Installation and Configuration* publication.