
# Configuring the PA-FC-1G

To continue your port adapter installation, you must configure the fibre channel interface. The instructions that follow apply to all supported platforms.

This chapter contains the following sections:



## Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the EXEC (also called enable mode). You must enter the privileged level of the EXEC command interpreter with the **enable** command before you can use the **configure** command to configure a new interface or change the existing configuration of an interface. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, use the following procedure to enter the privileged level:

**Step 1** At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password as follows:

```
Router> enable

Password:
```

**Step 2** Enter the password (the password is case sensitive). For security purposes, the password is not displayed.

When you enter the correct password, the system displays the privileged-level system prompt (#):

```
Router#
```

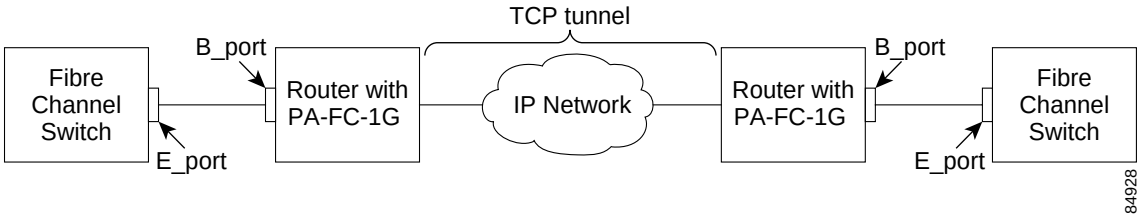
To configure the new fibre channel interface, proceed to the "Configuring the Interfaces" section on page 4-2.

# Configuring the Interfaces

Because a PA-FC-1G interface is one of many components in a fibre channel fabric, configuring a PA-FC-1G requires more than assigning an IP address to the PA-FC-1G. Figure 4-1 indicates the logical connections among the main components in a fibre channel fabric. (For the purposes of this section, only the fibre channel switch component of the fibre channel SAN is shown.)

Figure 4-1 shows the TCP tunnel that connects routers in a fibre channel over IP configuration. It also shows the B_port to E_port fibre channel connection between the routers and fibre channel switches.

***Figure 4-1 Fibre Channel Fabric Logical Connections***




To configure a PA-FC-1G, you must complete a series of tasks in a particular order. The following tasks are presented in the order in which you perform them:

- Connecting a PA-FC-1G to a Fibre Channel Switch, page 4-2
- Enabling a PA-FC-1G, page 4-3
- Setting Fibre Channel Fabric Timeout Values, page 4-5
- Creating and Configuring a TCP Tunnel, page 4-5
- Verifying TCP Tunnel Connectivity, page 4-7
- Verifying PA-FC-1G to Fibre Channel Switch Connectivity, page 4-10
- Verifying End-to-End Fabric Connectivity, page 4-11

## Connecting a PA-FC-1G to a Fibre Channel Switch

The first task in configuring a PA-FC-1G is to establish a physical connection between the PA-FC-1G and the fibre channel switch that connects the PA-FC-1G to a fibre channel SAN. Perform this task for *each* PA-FC-1G in the fibre channel fabric.

To connect a PA-FC-1G to a fibre channel switch, do the following:

**Step 1** Verify that the Status LED on the front of the PA-FC-1G is on. This indicates the PA-FC-1G is installed correctly.

**Step 2** Using a fibre optic cable with an LC connector, connect the PA-FC-1G to the fibre channel switch by inserting one end of the cable into the SFP of the PA-FC-1G and inserting the other end of the cable into a port on the switch. (If the fibre channel switch has a GBIC module, use an LC-to-SC fibre optic cable.)

# Enabling a PA-FC-1G

After verifying a physical connection between a PA-FC-1G and a fibre channel switch, you must assign an IP address to the PA-FC-1G and then enable it. Perform this task for *each* PA-FC-1G in the fibre channel fabric.

To enable a PA-FC-1G, do the following:

**Step 1** Enter the privileged level of the EXEC command interpreter (also called enable mode). (See the "Using the EXEC Command Interpreter" section on page 4-1 for instructions.)

**Step 2** At the privileged-level prompt, enter configuration mode and specify that the console terminal is the source of the configuration commands.

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

**Step 3** Specify the interface to be enabled using the **interface** command followed by the interface type and address. The address consists of the slot number of the router and the port number on the PA-FC-1G. (Because the PA-FC-1G has only one port, the port number is always 0.)

```
Router(config)# interface fcpa 2/0
Router(config-if)#
```

**Step 4** You are now in interface configuration mode. Assign an IP address and subnet mask to the PA-FC-1G using the **ip address** command.

```
Router(config-if)# ip address 10.1.1.1 255.255.255.0
```

**Step 5** Enable the PA-FC-1G using the **no shutdown** command.

```
Router(config-if)# no shutdown
```

**Step 6** Exit interface configuration mode and then configuration mode by pressing **Ctrl-Z**—hold down the **Control** key while you press **Z**—or entering **end** or **exit** to return to the EXEC command interpreter.

```
Router(config-if)# exit
Router(config)# exit
Router#
```

**Step 7** Write the new configuration to NVRAM.

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored in NVRAM.

**Step 8** Verify that the PA-FC-1G and line protocol are up using the **show interfaces** command followed by the interface type and address.

```
Router# show interfaces fcpa 2/0
Fcpa2/0 is up, line protocol is up
Hardware is FC over TCP/IP
```

## Default Configuration Values

When an interface is enabled (taken out of shutdown mode) with no additional arguments, the default interface configuration file parameters are operational. Table 4-1 shows PA-FC-1G default configuration values. The default maximum transmission unit (MTU) is the maximum MTU allowed. Decreasing the MTU is not recommended because it will decrease throughput. IP fragmentation is not supported.

***Table 4-1 PA-FC-1G Default Configuration Values***

| Parameter | Configuration Commands | Default Value |
|---|---|---|
| MTU | [**no**] **mtu** <*mtu*> | 1500 |
| IP MTU | [**no**] **ip mtu** <*ip-mtu*> | 1500 |

Table 4-2 shows TCP tunnel default configuration values. IP TOS is used as part of the overall QoS design to prioritize traffic. For example, to give fibre channel over IP traffic a higher priority than web traffic, set the IP TOS for fibre channel over IP traffic to a number that is lower than the number assigned to IP TOS for web traffic. The lower the number, the higher the priority.

***Table 4-2 TCP Tunnel Default Configuration Values***

| Parameter | Description | Configuration Commands | Default Value |
|---|---|---|---|
| IP TOS | Type of service for the IP layer of the TCP tunnel | [**no**] **ip tos** <*tos*> | 0 |
| TCP KAD | Keepalive timer for the TCP tunnel | [**no**] **tcp kad** <*kad*> | 7200 seconds |
| TCP MWS | Maximum window size for the TCP tunnel | [**no**] **tcp mws** <*mws*> | 32K |

## Maximum Window Size Recommendations

When you configure the TCP tunnel, you will need to customize the maximum window size (MWS) for the TCP connection based on the delay across the WAN connection. The larger the delay, the larger the window size needs to be.

If there is no delay across the WAN connection, set the MWS based on these guidelines:

- PA-FC-1G installed in an even-numbered slot: MWS of 32K or 64K
- PA-FC-1G installed in an odd-numbered slot: MWS of 32K
- Two PA-FC-1Gs installed in odd-numbered or even-numbered slots: MWS of 32K

If there is delay across the WAN connection, use an MWS appropriate for the delay. Performance is measured in megabytes per second. Table 4-3 shows that increasing the window size when the delay is large has a significant effect on performance.

***Table 4-3 Maximum Window Size Recommendations Based on Delay***

| Delay (RTT) | 32K MWS | 64K MWS | 128K MWS | 256K MWS | 512K MWS |
|---|---|---|---|---|---|
| 2 | 19 MBps | 40 MBps | — | — | — |
| 4 | 11 MBps | 24 MBps | 50 MBps | — | — |
| 10 | 5.5 MBps | 11 MBps | 22 MBps | 46 MBps | — |

*Table 4-3 Maximum Window Size Recommendations Based on Delay (continued)*

| Delay (RTT) | 32K MWS | 64K MWS | 128K MWS | 256K MWS | 512K MWS |
|---|---|---|---|---|---|
| 20 | 2.9 MBps | 6.0 MBps | 11 MBps | 24 MBps | 48 MBps |
| 50 | 1.2 MBps | 2.4 MBps | 5.0 MBps | 10 MBps | 20 MBps |
| 100 | — | 1.2 MBps | 2.5 MBps | 5 MBps | 10 MBps |
| 200 | — | — | 1.2 MBps | 2.5 MBps | 5.1 MBps |

# Setting Fibre Channel Fabric Timeout Values

Timeout values are defined on each fibre channel switch in a fibre channel fabric. The default error detection (E_D_TOV) and resource allocation (R_A_TOV) timeout values are usually low. You might need to increase them; set the timeout values as appropriate for your SAN and applications.

Timeout values *must* be configured identically on each fibre channel switch in the fabric. While the TCP tunnel might come up if the timeout values on the switches are not configured identically, this is an exceptional case, and performance and reliability can suffer.

Failure to establish the TCP tunnel (due to mismatched timeout values or any other reason) means that the PA-FC-1G cannot communicate with any part of the fibre channel fabric.

# Creating and Configuring a TCP Tunnel

After establishing a physical connection between each PA-FC-1G and a fibre channel switch and after enabling the PA-FC-1G, the next task is to create and configure a TCP tunnel between two PA-FC-1G interfaces. Creating a TCP tunnel establishes a fibre channel over IP connection between two routers.

**Note** A PA-FC-1G can support a maximum of one TCP tunnel.

To create and configure the TCP tunnel, do the following:

**Step 1** At the privileged-level prompt, enter configuration mode and specify the interface to be configured using the **interface** command followed by the interface type and address (router slot/interface port).

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface fcpa 2/0
Router(config-if)#
```

**Step 2** Create the TCP tunnel.

```
Router(config-if)# fc-tunnel abc
Router(config-if-fc-tunnel)#
```

**Step 3** Specify the source and destination TCP tunnel IP addresses on each end of the TCP tunnel. The source TCP tunnel IP address must be a host address on the same subnet as the PA-FC-1G. The source and destination IP addresses on one end of the TCP tunnel must match the destination and source IP addresses on the other end of the TCP tunnel, respectively.

On one end of the tunnel:

```
Router(config-if-fc-tunnel)# srp-ip 10.1.1.2
Router(config-if-fc-tunnel)# dest-ip 10.2.2.2
```

On the other end of the tunnel:

```
Router(config-if-fc-tunnel)# srp-ip 10.2.2.2
Router(config-if-fc-tunnel)# dest-ip 10.1.1.2
```

**Step 4** Specify the source and destination TCP tunnel ports on each end of the tunnel. The source and destination ports on one end of the TCP tunnel must match the destination and source ports on the other end of the TCP tunnel, respectively.

On one end of the tunnel:

```
Router(config-if-fc-tunnel)# src-port 2000
Router(config-if-fc-tunnel)# dest-port 3000
```

On the other end of the tunnel:

```
Router(config-if-fc-tunnel)# src-port 3000
Router(config-if-fc-tunnel)# dest-port 2000
```

**Step 5** Customize the maximum window size for the TCP tunnel based on the delay across the WAN connection using the **tcp mws** command. Do this on both ends of the TCP tunnel. See the "Maximum Window Size Recommendations" section on page 4-4.

**Step 6** If required for your TCP tunnel, change the type of service, or keepalive timer using the **ip tos** and **tcp kad** commands, respectively. Do this on both ends of the TCP tunnel.

**Step 7** Activate the TCP tunnel using the **inservice** command.

```
Router(config-if-fc-tunnel)# inservice
```

**Step 8** Exit tunnel configuration mode, interface configuration mode, and configuration mode by pressing **Ctrl-Z**—hold down the **Control** key while you press **Z**—or entering **end** or **exit** to return to the EXEC command interpreter.

```
Router(config-if-fc-tunnel)# exit
Router(config-if)# exit
Router(config)# exit
Router#
```

**Step 9** Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

## Changing the TCP Tunnel Configuration

If you need to tune or modify the TCP tunnel configuration after the TCP tunnel is established, you must first take the TCP tunnel out of service using the **no inservice** command. The following example shows how to change the IP TOS value from 0 to 1 for an established tunnel.

```
Router(config-if)# fc-tunnel abc
Router(config-if-fc-tunnel)# no inservice
Router(config-if-fc-tunnel)# ip tos 1
Router(config-if-fc-tunnel)# inservice
```

## Configuring for Multiple SANs

Two fibre channel SANs can be connected by establishing a TCP tunnel between two PA-FC-1G interfaces, each residing in a separate router. Additional PA-FC-1G interfaces can be installed in each router and multiple TCP tunnels can be configured, thus allowing multiple fibre channel SANs to be interconnected.

However, additional TCP tunnels must be defined using different PA-FC-1G port adapters, different IP addresses on different subnets, different source and destination TCP tunnel IP addresses, and different source and destination TCP tunnel ports.

# Verifying TCP Tunnel Connectivity

Verifying TCP tunnel connectivity requires checking that the TCP tunnel is correctly configured and verifying that the TCP tunnel is working properly. To verify TCP tunnel connectivity, proceed with the following tasks:

- Checking TCP Tunnel Configuration, page 4-7
- Checking the TCP Tunnel Is Working Properly, page 4-9

## Checking TCP Tunnel Configuration

Check the TCP tunnel configuration using the **show fc-tunnel** command. Verify that the values shown are those you defined. Make sure that the TCP tunnel is in service, the ARP entry is installed, the SM (session manager) state is up, and the FC Link is up.

**ARP entry values**

| Variable | Description |
|---|---|
| Installed | ARP entry is installed. |
| Not installed | ARP entry is not installed. |
| Not installed (admin state DOWN) | ARP entry is not installed and the PA-FC-1G is administratively down. |
| Not installed (protocol state DOWN) | ARP entry is not installed and the line protocol is down. |
| Waiting for adjacency update | Forwarding table has not yet been updated. (When the PA-FC-1G is administratively down or the line protocol is down, the IP adjacencies for the PA-FC-1G are removed.) |

| SM state values | |
|---|---|
| **Variable** | **Description** |
| SM_UP_ST | TCP connection is established and the B_port is up. |
| SM_NULL_ST | TCP tunnel is not in service, the PA-FC-1G is shut, or the line protocol is down. |
| SM_TCP_OPEN_PENDING_ST | TCP is attempting to connect to the peer. |
| SM_CONN_RETRY_WAIT_ST | TCP will try again to connect to the peer after 3 seconds. |
| SM_FC_INIT_PENDING_ST | TCP connection is established and the PA-FC-1G is being initialized. |
| SM_NS_UNLOCK_PENDING_ST | TCP connection is closed and the hardware connection entry is being cleared. |
| SM_FC_CLOSE_PENDING_ST | TCP connection is closed, the hardware connection entry is removed, and the PA-FC-1G is being put into an offline state. |

```
Router# show fc-tunnel
Interface: Fcpa2/0
FC Tunnel name: abc
INSERVICE: configured ARP entry: Installed
Source IP: 10.1.1.2
Destination IP: 10.2.2.2
Source port: 2000
Destination port: 3000
TCP SACK option set
TCP MWS: 32KB
TCP KAD: 7200sec
IP TOS: 0
MTU: 1500
MSS: 1440
SM state: SM_UP_ST
FC Port Type: B_Port
FC Port WWN    : 100000E0B0FFF2CF
Switch Port WWN: 200000C0DD00C248
Switch WWN     : 100000C0DD00C248
FC BB_Credit: 128
FC RA_TOV: 120000msec
FC ED_TOV: 60000msec
FC Link state: UP
```

## Checking the TCP Tunnel Is Working Properly

Check that the TCP tunnel is established using the **show fc-tunnel tcpconn** command. Make sure that t_state is indicated as TCPS_ESTABLISHED. (With the exception of t_state, the output of this command is for debugging purposes only.)

| t_state values | |
|---|---|
| **Variable** | **Description** |
| TCPS_ESTABLISHED | TCP connection is established. |
| TCPS_CLOSED | TCP connection is closed. |
| TCPS_SYN_SENT | TCP connection has been initiated and a SYN has been sent. |
| TCPS_SYN_RECEIVED | TCP connection has been initiated, a SYN has been sent, and a SYN has been received by the peer. |

```
Router# show fc-tunnel tcpconn
Interface:Fcpa2/0
TCP variables for Connection Fcpa4/0:
=====================================
snd_una: 831125, snd_nxt: 831125, snd_up: 813868, snd_wnd: 65535
snd_max: 863892, snd_cwnd: 65535, snd_retx_max: 831125, snd_ssthresh: 2176
t_unack_datasz: 0, t_flags: 612, t_state: TCPS_ESTABLISHED,
rcv_wnd: 32767, rcv_nxt: 888667, rcv_adv: 921434
 TCP Timers: REXMT=0 PERSIST=0 KEEP=7159 2MSL=0
```

Check the TCP tunnel TCP statistics for errors using the **show fc-tunnel tcp-statistics** command.

| Router# **show fc-tunnel tcp-statistics** | **Description** |
|---|---|
| Interface:Fcpa2/0 | |
| Rto Min = 500 | Minimum TCP retransmission timeout in msecs |
| Rto Max = 60000 | Maximum TCP retransmission timeout in msecs |
| Max Conn = 1 | TCP connections PA-FC-1G can support |
| Active Opens = 1 | TCP connections initiated |
| Attempt Fails = 0 | TCP connections failed to initiate |
| Estab Resets = 1 | TCP connections closed due to Reset |
| Curr Estab = 1 | TCP connections established up to now |
| Out Rsts = 1 | TCP Resets sent by PA-FC-1G |
| In Segs = 2 | Segments received, including in error |
| Out Segs = 15324 | Segments sent, excluding retransmissions |
| Retrans Segs = 0 | Segments retransmitted |
| In Errs = 0 | Segments received in error |

Check the TCP tunnel fibre channel statistics for errors using the **show fc-tunnel fc-statistics** command.

| Router# **show fc-tunnel fc-statistics** | **Description** |
|---|---|
| Interface:Fcpa2/0 | |
| Link failure events = 0 | Port link failures |
| Sync loss events = 1 | Word Sync loss occurrences |
| Signal loss events = 0 | Signal loss occurrences |
| Pseq error events = 0 | Primitive error sequence occurrences |
| Rx inv words = 2 | Invalid transmission words |
| rx crc error frames = 0 | Fibre channel frames received with CRC errors |
| Delim error frames = 0 | Fibre channel frames received with invalid EOF/length |
| Rx class2 frames = 0 | Fibre channel class 2 frames received |
| Rx class2 octets = 0 | Fibre channel class 2 bytes received |
| Rx class3 frames = 0 | Fibre channel class 3 frames received |
| Rx class3 octets = 0 | Fibre channel class 3 bytes received |
| Rx class2 frames = 0 | Fibre channel class 2 frames sent |
| Rx class2 octets = 0 | Fibre channel class 2 bytes sent |
| Rx class3 frames = 0 | Fibre channel class 3 frames sent |
| Rx class3 octets = | Fibre channel class 3 bytes sent |

# Verifying PA-FC-1G to Fibre Channel Switch Connectivity

Check the connectivity between each PA-FC-1G and the fibre channel switch by using the **show fc-tunnel detail** command. Make sure that elp_completed is indicated as 1. This means that an exchange link parameter has been received by the router from the fibre channel switch and that the B_port on the router has been successfully initialized.

Note that in addition to the information shown in the **show fc-tunnel** command output, the **show fc-tunnel detail** command output indicates a reason why the connection between the PA-FC-1G and the fibre channel switch was closed (Last close reason) and port information.

**Last close reason values**

| Variable | Description |
|---|---|
| REASON_CLI_CLOSED | **no inservice** command was issued by the user. |
| REASON_CLI_RESET | **no fc-tunnel** command was issued by the user. |
| REASON_PEER_CLOSED | Connection was closed by the peer. |
| REASON_TCP_CLOSED | Connection was closed by TCP because an error was detected. |
| REASON_ICMP_UNFRAG_CLOSED | Connection was closed because an ICMP unreachable packet was received with UNFRAG code. |
| REASON_NS_TCP_RESET | Connection was closed by hardware TCP because of multiple retransmissions. |
| REASON_FC_ERROR | Connection was closed because of a fibre channel protocol error. |
| REASON_IF_SHUT | Connection was closed because the PA-FC-1G was shut. |
| REASON_LINE_PROTOCOL_DOWN | Connection was closed because the line protocol is down. |
| REASON_CLEAR_INTERFACE_ISSUED | **clear interface** command issued by the user. |
| REASON_CARD_REMOVED | PA-FC-1G was removed from the router. |

| Router# **show fc-tunnel detail** | **Description** |
|---|---|
| Interface: Fcpa2/0 | |
| FC Tunnel name: abc | |
| INSERVICE: configured ARP entry: Installed | TCP tunnel is in service, ARP entry is installed |
| Source IP: 10.1.1.2 | Source IP address |
| Destination IP: 10.2.2.2 | Destination IP address |
| Source port: 2000 | Source port |
| Destination port: 3000 | Destination port |
| TCP SACK option set | Selective acknowledgement set |
| TCP MWS: 32KB | Maximum window size |
| TCP KAD: 7200sec | Keepalive timer |
| IP TOS: 0 | Type of service |
| MTU: 1500 | Maximum transmission unit |
| MSS: 1440 | |
| SM state: SM_UP_ST | TCP connection and B_port are up |
| FC Port Type: B_Port | Fibre channel port on the PA-FC-1G is a B_port |
| FC Port WWN : 100000E0B0FFF2CF | World wide name of the B_port on the PA-FC-1G |
| Switch Port WWN: 200000C0DD00C248 | World wide name of the E_port on the fibre channel switch |
| Switch WWN : 100000C0DD00C248 | World wide name of the fibre channel switch |
| FC BB_Credit: 128 | Buffer-to-buffer credits of the PA-FC-1G |
| FC RA_TOV: 120000msec | Resource allocation timeout value (ELP) |
| FC ED_TOV: 60000msec | Error detection timeout value (from ELP) |
| FC Link state: UP | B_port is up |
| Last close reason: REASON_IF_SHUT | Last reason why connection between PA-FC-1G and fibre channel switch was closed |
| ========== port info ========== | |
| port_type: B | Fibre channel port on the PA-FC-1G is a B_por |
| FC Link: UP | B_port is up |
| Negotiation: Forced | 1 Gbps speed forced on the switch E_port |
| link_status: 0x00000081 | Fibre channel link status from hardware (active) |
| op_state: 0x00000008 | Fibre channel port status from software (link reset complete) |
| elp_completed: 1 | Exchange link parameter received from the fibre channel switch |
| CPU credits: 29 (remaining off of 32) | Credits remaining for packets from the CPU to NS TCP |
| ELS ECHO: Enabled | B_port to B_port TCP keepalive |
| no_of_tcp_ssn: 1 | |
| sm_prt_op: 0x82DB | History of fibre channel events |
| Our BB_CRDT: 128 | Buffer-to-buffer credits of the PA-FC-1G |
| Our RA_TOV: 20000 | Resource allocation timeout value (same as in ELP) |
| Our ED_TOV: 10000 | Error detection timeout value (same as in ELP) |
| Peer BB_crdt: 27 | Fibre channel switch E_port buffer-to-buffer credits |
| Peer RA_TOV: 20000 | Fibre channel switch E_port resource allocation timeout value |
| Peer ED_TOV: 10000 | Fibre channel switch E_port error detection timeout value |

## Verifying End-to-End Fabric Connectivity

Check that the fibre channel fabric is complete by making sure any fibre channel switch can see all other switches in the fibre channel fabric. On most fibre channel switches, this can be done using a type of **show** command. For example, on the Cisco SN 5428, use the **show fcswitch fabric brief** command. On an MDS 9000 fibre channel switch, use the **show fspf database** and **show fcdomain** commands.

# Closing or Removing a TCP Tunnel

Table 4-4 summarizes the commands you can use to close or remove a TCP tunnel.

*Table 4-4 Commands for Closing or Removing a TCP Tunnel*

| Command | Closes a TCP Tunnel | Removes a TCP Tunnel | Shuts the PA-FC-1G Interface | Resets the PA-FC-1G Interface |
|---|---|---|---|---|
| **clear interface fcpa** <*slot/port*> | Closes the tunnel; opens a new tunnel. | no | Shuts the interface; brings up the interface | yes |
| **no fc-tunnel** | yes | yes | no | no |
| **no inservice** | yes | no | no | no |
| **shut** | yes | no | yes | yes |

Command examples are based on the following configuration for a TCP tunnel called abc:

```
Router# show runn int fcpa 2/0
Building configuration...
Current configuration : 262 bytes
!
interface Fcpa2/0
mtu 1500
ip address 10.1.1.1 255.255.255.0
no ip route-cache
no ip mroute-cache
fc-tunnel abc
src-ip 10.1.1.2
dest-ip 10.2.2.2
src-port 2000
dest-port 3000
tcp sack
tcp mws 32
tcp kad 7200
ip tos 0
inservice
end
Router#

Router# config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# int fcpa 1/0
Router(config-if)# no fc-tunnel
Router#

Router(config-if)# fc-tunnel abc
Router(config-if-fc-tunnel)# no inservice
Router#

Router(config)# int fcpa 1/0
Router(config-if)# shut

Router# clear interface fcpa 1/0
Router#
```

# Checking the Configuration

After configuring the new interface, use **show** commands to display the status of the new interface or all interfaces, and use the **ping** command to check connectivity. This section includes the following subsections:



## Using show Commands to Verify the New Interface Status

This section demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the port adapter appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the "Related Documentation" section on page viii.

If an interface is shut down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the interface is properly connected and terminated. If you still have problems bringing up the interface, contact a service representative for assistance. This section includes the following subsections:



### Using the show controllers Commands

Display all the current interface processors and their interfaces using the **show controllers** command.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.:

The following is an example of the **show controllers** command:

```
Router# show controllers fcpa 3/0
Interface Fcpa3/0
Hardware is Fiber Channel over TCP
NS idb=0x62DF785C ds=0x62DF9904
Counters Info :
Cordova o/p pkts = 0, bytes = 0
Cordova i/p pkts = 0, bytes = 0
Northstar Tx fc pkts = 0, bytes = 0
Northstar Rx punted pkts = 0, bytes = 0
Base Addresses :
NS PCI=0x3D800000, NS Register=0x3D800C00,
```

```
Rx Desc=0x07166C80, Rx Stat=0x07167B80,
Tx Desc=0x07167840, Tx Stat=0x071F9940
Rx ring :
Current Index=0, Desc Avail=32, Stat Index=0
Tx ring :
Current Index=0, Desc Avail=32, Stat Index=0
Counters :
Rx int count=0, Tx int count=0,No buffer errors=0,
NS fatal errors=0, Tx completion errors=0
NS Rx status full=0, NS Tx status full=0
Int mask=0xFFFE787F, Int status=0x10000000,
Line protocol is UP
TCB index: 0
SDRAM 0 Layout :
Pkt memory start address=0x00000100, Pkt memory end address=0x010000FF,
Buf table start address=0x01000100, Buf table end address=0x010400F8,
TCB start address=0x01040100, TCB end address=0x01040300,
ROB start address=0x01040300, Pback start address=0x01040700,
Pprobe start address=0x01040800, PendQ start address=0x01040880,
PendQ end address=0x0105CFC0
SDRAM 1 Layout :
Pkt memory start address=0x00000100, Pkt memory end address=0x010000FF,
Buf table start address=0x01000100, Buf table end address=0x010400F8
Hardware is i82544 (Cordova) A2
network link is up
Config is 1000MB, Full Duplex
loopback type is none
10/100/1000 PHY is NOT enabled
i82543 MAC registers:
CTRL =0x183C1A41, STATUS=0x0000C383, CTRL_X=0x000040D0, IMS =0x00000092
RCTL =0x00428022, RDBAL =0x07700000, RDBAH =0x00000000, RDLEN =0x00004000
RDH =0x00000000, RDT =0x000003FF, RDTR =0x00000000
TCTL =0x000400FA, TDBAL =0x07705000, TDBAH =0x00000000, TDLEN =0x00004000
TDH =0x00000000, TDT =0x00000000, TIPG =0x00602008
ETT =0x00000000, TXDMAC=0x00000001
TXCW =0x00000000, RXCW =0x0C000000, FCRTH =0x0000AFF0, FCRTL =0x80001200
FCAH =0x00000100, FCAL =0x00C28001, FCT =0x00008808, FCTTV =0x00000080
RDFH =0x00000000, RDFT =0x00000000, RDFPC =0x00000000
TDFH =0x00001800, TDFT =0x00001800, TDFPC =0x00000000
RX is normal, enabled TX is normal, enabled
Device status = full-duplex, link up
Device Speed = 1000Mbps
PHY registers:
PHY is UNKNOWN (0x0)
Link is Unknown, Speed is Unknown, Duplex Mode is Unknown PCI
configuration registers:
bus_no=6, device_no=1
DeviceID=0x1008, VendorID=0x8086, Command=0x0156, Status=0x0230
Class=0x02/0x00/0x00, Revision=0x02, LatencyTimer=0xFC, CacheLineSize=0x10
BaseAddr0=0x49400004, BaseAddr1=0x00000000, MaxLat=0x00, MinGnt=0xFF
SubsysDeviceID=0x1008, SubsysVendorID=0x8086
Cap_Ptr=0x000000DC Retry/TRDY Timeout=0x00000000
PMC=0x0022E401 PMCSR=0x00000000
i82543 Internal Driver Information:
lc_ip_turbo_fs=0x605CDC74, ip_routecache=0x11(dfs=0/mdfs=0)
i82543_ds=0x62F9D268, registers=0x3DC00000
rx cache size=1000, rx cache end=0, rx_nobuffer=0
max_mtu=1524
ring sizes: RX=1024, TX=1024
rxring=0x77700000, shadow=0x62F9D63C, head=0, rx_buf_size=512
txring=0x07705000, shadow=0x62F9E668, head=0, tail=0
chip_state=2, pci_rev=2
tx_count=0, tx_limited=0 (1024)
rx_overrun=0, rx_seq=0, rx_no_enp=0, rx_discard=0
```

```
throttled=0, enabled=0, disabled=0, bypassed=0
reset=2(init=1, check=0, restart=1, pci=0), auto_restart=2
link_reset=0, tx_carrier_loss=0, fatal_tx_err=0
isl_err=0, wait_for_last_tdt=0, rx_stuck=0
tx_stuck=0, rx_max_spin=1
HW addr filter: 0x62DF9E80, ISL disabled, Promiscuous mode disabled
Entry= 0: Addr=000A.8B63.2C06
(All other entries are empty)
i82543 Statistics
CRC error 0 Symbol error 0
Missed Packets 0 Single Collision 0
Excessive Coll 0 Multiple Coll 0
Late Coll 0 Collision 0
Defer 0 Receive Length 0
Sequence Error 0 XON RX 0
XON TX 0 XOFF RX 0
XOFF TX 0 FC RX Unsupport 0
Packet RX (64) 0 Packet RX (127) 0
Packet RX (255) 0 Packet RX (511) 0
Packet RX (1023) 0 Packet RX (1522) 0
Good Packet RX 0 Broadcast RX 0
Multicast RX 0 Good Packet TX 0
Good Octets RX.H 0 Good Octets RX.L 0
Good Octets TX.H 0 Good Octets TX.L 0
RX No Buff 0 RX Undersize 0
RX Fragment 0 RX Oversize 0
RX Octets High 0 RX Octets Low 0
TX Octets High 0 TX Octets Low 0
TX Packet 0 RX Packet 0
TX Broadcast 0 TX Multicast 0
Packet TX (64) 0 Packet TX (127) 0
Packet TX (255) 0 Packet TX (511) 0
Packet TX (1023) 0 Packet TX (1522) 0
TX Underruns 0 TX No CSR 0
RX Error Count 0 RX DMA Underruns 0
RX Carrier Ext 0
TCP Segmentation 0 TCP Seg Failed 0
Router#
```

## Using the show protocols Command

Display protocols configured for the entire system and for specific interfaces using the **show protocols** command.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

The following is an example of the **show protocols** command:

```
Router# show protocols fcpa 6/0
Fcpa6/0 is up, line protocol is up
Internet address is 10.1.1.1/24
Router#
```

## Using the show running-config Command

Display the running configuration file using the **show running-config** command.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

The following is an example of the **show running-config** command for the PA-FC-1G in slot 2:

```
Router# show running-config interface fcpa 2/0

interface fcpa2/0
 ip address 10.1.1.1 255.255.255.0
 fc-tunnel abc
   src-ip 10.1.1.2
   dest-ip 10.2.2.2
   src-port 2000
   dest-port 3000
   tcp sack
   tcp mws 64
   tcp kad 7200
   ip tos 0
   no inservice
```

## Using the show startup-config Command

Display the configuration stored in the NVRAM using the **show startup-config** command.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

The following is an example of the **show startup-config** command:

```
Router# show startup-config
Current configuration : 1090 bytes
!
version 12.2
no parser cache
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname hw-5.14-7401asr-a
!
boot system disk0:c7400-js-mz.ggnear
!
ip subnet-zero
!
!
no ip domain lookup
!
ip cef
mpls ldp log-neighbor-changes
!
!
!
!
!
!
!
!
```

```
!
no voice hpi capture buffer
no voice hpi capture destination
!
!
!
!
!
!
interface GigabitEthernet0/0
 ip address 9.1.1.10 255.255.255.0
 duplex full
 speed 1000
 media-type gbic
 negotiation auto
!
interface GigabitEthernet0/1
 no ip address
 shutdown
 duplex full
 speed 1000
 media-type gbic
 negotiation auto
!
interface Fcpa1/0
ip address 10.1.1.1 255.255.255.0
 fc-tunnel GGPA
   src-ip 10.1.1.10
   dest-ip 10.2.1.11
   src-port 5200
   dest-port 2000
   tcp sack
   tcp mws 32
   tcp kad 7200
   ip tos 0
   inservice
!
ip classless
ip route 10.2.1.0 255.255.255.0 9.1.1.11
no ip http server
!
!
!
!
!
!
call rsvp-sync
!
!
mgcp profile default
!
dial-peer cor custom
!
!
!
!
gatekeeper
 shutdown
!
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
```

```
 login
line vty 5 15
 login
!
!
end
```

## Using the show version or show hardware Commands

Display the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images using the **show version** (or **show hardware**) command.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Following is an example of the **show version** command from a Cisco 7401ASR router:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7400 Software (C7400-JS-M), Experimental Version 12.2(20021230:084514)
[BLD-ggnear.ios-nightly 103]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Mon 30-Dec-02 03:31 by irvrel
Image text-base: 0x60008954, data-base: 0x61ED4000

ROM: System Bootstrap, Version 12.2(1r)DD1, RELEASE SOFTWARE (fc1)
BOOTLDR: 7400 Software (C7400-KBOOT-M), Version 12.2(4)B4, EARLY DEPLOYMENT RELEASE
SOFTWARE (fc1)

hw-5.14-7401asr-a uptime is 4 hours, 50 minutes
System returned to ROM by power-on
System image file is "disk0:c7400-js-mz.ggnear"

cisco 7401ASR (NSE) processor (revision A) with 491520K/32768K bytes of memory.
Processor board ID 0
R7000 CPU at 375Mhz, Implementation 39, Rev 3.3, 256KB L2, 2000KB L3 Cache
1 slot ASR midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc is running.
5 Gigabit Ethernet/IEEE 802.3 interface(s)
1 Fiber Channel over IP interface(s)
509K bytes of non-volatile configuration memory.

125440K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2102
Router#
```

## Using the show diag Command

Display the types of port adapters installed in your system (and specific information about each) using the **show diag** *slot* command, where *slot* is the *port adapter slot*.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Following is an example of the **show diag** *slot* command that shows a PA-FC-1G in slot 1 of a Cisco 7401ASR router:

```
Router# show diag 1
Slot 1:
    FCIP Single Width Port adapter, 1 port
    Port adapter is analyzed
    Port adapter insertion time 2d17h ago
    EEPROM contents at hardware discovery:
    Hardware Revision : 1.2
    PCB Serial Number : JAB06490529
    Part Number : 73-8429-03
    Board Revision : A0
    RMA Test History : 00
    RMA Number : 0-0-0-0
    RMA History : 00
    Deviation Number : 0-0
    Product Number : PA-FC-1G
    Top Assy. Part Number : 800-22343-03
    Chassis MAC Address : 1122.2233.4455
    MAC Address block size : 1
    EEPROM format version 4
    EEPROM contents (hex):
    0x00: 04 FF 40 03 D6 41 01 02 C1 8B 4A 41 42 30 36 34
    0x10: 39 30 35 32 39 82 49 20 ED 03 42 41 30 03 00 81
    0x20: 00 00 00 00 04 00 80 00 00 00 00 CB 94 50 41 2D
    0x30: 46 43 2D 31 47 20 20 20 20 20 20 20 20 20 20 20
    0x40: 20 C0 46 03 20 00 57 47 03 C3 06 11 22 22 33 44
    0x50: 55 43 00 01 FF FF FF FF FF FF C4 82 FF FF FF FF
    0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
    0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

## Using the show interfaces Command

The **show interfaces** command displays status information (including the physical slot and interface address) for the interfaces you specify.

For complete descriptions of interface commands and the configuration options available for specific interfaces, refer to the publications listed in the "Related Documentation" section on page viii.

**Note** The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Using the **show interfaces** *type port-adapter-slot-number/interface-port-number* command displays status information about a specific type of interface—in this example, a fibre channel interface—on a Cisco 7401ASR router.

Following is an example of the **show interfaces** command for a Cisco 7401ASR router. In this example, the PA-FC-1G is in slot 1.

```
Router# show interfaces fcpa 1/0
Fcpa1/0 is up, line protocol is up
Hardware is FC over TCP/IP
Internet address is 10.1.1.1/8
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
reliability 255/255, txload 195/255, rxload 17/255
Encapsulation ARPA, loopback not set
Full-duplex, 1000Mb/s, media type is unknown 0
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:00:02, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/233/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 2122360000 bits/sec, 44192148 packets/sec
5 minute output rate 18200000 bits/sec, 20181 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 233 ignored, 0 abort
0 watchdog, 0 multicast, 0 pause input
99 packets output, 5940 bytes, 0 underruns
0 output errors, 0 collisions, 13 interface resets
0 output buffer failures, 0 output buffers swapped out
Router#
```

# Using the ping Command to Verify Network Connectivity

Using the **ping** command, you can verify that an interface port is functioning properly. This section provides a brief description of this command. Refer to the publications listed in the "Related Documentation" section on page viii for detailed command descriptions and examples.

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

Following is an example of a successful **ping** command to a remote server with the address 10.0.0.10:

```
Router# ping 10.0.0.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination and that the device is active (powered on), and repeat the **ping** command.

## Pinging the PA-FC-1G

After the PA-FC-1G is enabled using the **no shut** command, pinging the PA-FC-1G IP address should be successful. Pinging the TCP tunnel source and destination IP addresses is successful only after the TCP tunnel has been brought into service using the **inservice** command.

**Note** The TCP tunnel source IP address cannot be the source address of a **ping** command.

**Note** The TCP tunnel source and destination IP addresses cannot be reached using the **telnet** command.

# Troubleshooting

This section describes troubleshooting the physical connectivity between the fibre channel switch and the PA-FC-1G. Possible problems, observations and comments, and solutions are indicated for the following troubleshooting symptoms:

- PA-FC-1G is down and the line protocol is down
- B_port is not initialized
- TCP tunnel is not established
- Fibre channel fabric is segmented
- Lower than expected performance

**PA-FC-1G Is Down and the Line Protocol Is Down**

| Possible Problem | Observations and Comments | Solutions |
|---|---|---|
| Loss of physical connectivity or optical signal | FC Link LED is off or amber | Make sure the SFP is inserted properly in the fibre channel switch or the PA-FC-1G.<br>Check for a faulty fibre channel cable by using a different fibre channel cable.<br>Make sure the fibre channel cable is correctly connected to the fibre channel switch or the PA-FC-1G. |
| Speed mismatch between the fibre channel switch and the PA-FC-1G | PA-FC-1G currently supports 1 Gbps | Make sure the speed of the port on the fibre channel switch to which the PA-FC-1G is connected is manually set to 1 Gbps. |
| PA-FC-1G is administratively shut down | | Use the **no shut** command to bring up the PA-FC-1G. |

| B_Port Is Not Initialized | | |
|---|---|---|
| **Possible Problem** | **Observations and Comments** | **Solutions** |
| Exchange Link Parameter (ELP) is not being received from the connecting fibre channel switches | Output of the **show fc-tunnel detail** command | Enable fibre channel debug commands:<br>**debug fcpa all errors**<br>**debug fcpa fd events**<br>**debug fcpa fcap events**<br>**debug fcpa fcap extras**<br>**debug fcpa fd states** |

| TCP Tunnel Is Not Established | | |
|---|---|---|
| **Possible Problem** | **Observations and Comments** | **Solutions** |
| Configuration mismatch between the peers | Output of **show running-config interface** *slot/port* command | Make sure the TCP tunnel source IP address is in the same subnet as the PA-FC-1G IP address.<br>Make sure the source and destination IP addresses and port numbers match the destination and source IP addresses and port numbers, respectively.<br>Make sure the source and destination IP addresses and port numbers are unique on each peer. |
| No static ARP entry for either the PA-FC-1G IP address or the TCP tunnel source IP address | Output of **show arp** command | Make sure the port on the fibre channel switch to which the PA-FC-1G is connected, is enabled.<br>Make sure the line protocol is up by verifying the fibre channel cable is connected at both ends.<br>Use the **no shut** command to bring up the PA-FC-1G. |
| No IP connectivity between the two peers | Output of the **show ip route** command | Use the **ping** or **traceroute** commands to verify that the PA-FC-1G IP address and the TCP tunnel source and destination IP addresses are reachable. |
| Path MTU is lower than 850 bytes | Console messages<br>Minimum supported MTU is 850<br>MTU less than 850 causes the TCP tunnel to be brought out of service | Use the **ip mtu** command to increase the path MTU. Then use the **inservice** command to put the TCP tunnel back in service. |
| Retransmissions and TCP-related errors | Output of **show fc-tunnel tcp-statistics** command<br>Can be due to drops in the path between the peer routers | If pings to the remote TCP tunnel IP addresses are successful and the configuration is verified, use the **shut/no shut** commands or the **clear interface** command to reset the PA-FC-1G. |
| TCP tunnel connection toggling | Counters in the **show fc-tunnel tcp-statistics** command | Make sure fibre channel cables are firmly connected.<br>Make sure the SFP is firmly seated in the PA-FC-1G.<br>Make sure the maximum window size is adjusted for the delay across the WAN connection.<br>Enable **debug fcpa fd events**, **debug fcpa fd states**. |

**Fibre Channel Fabric Is Segmented**

| Possible Problem | Observations and Comments | Solutions |
|---|---|---|
| Overlap in the domain IDs of the fibre channel switches | Fabric segmentation does not occur when you add a switch to a fabric with a conflicting domain ID.<br>In this case, the existing switch assigns a new domain ID to the conflicting switch from its address space (if it is not statically configured). | Assign unique domain IDs to the fibre channel switches. |

**Lower Than Expected Performance**

| Possible Problem | Observations and Comments | Solutions |
|---|---|---|
| Path MTU is less than 1500 bytes | | Use the **ip mtu** command to increase the path MTU. |
| Maximum window size is too small for the delay in the IP network | | Use the **tcp mws** command to adjust the maximum window size. |
| Drops on the outgoing interface, which are causing retransmissions | Bursty traffic | Try a lower maximum window size. |
| Errors in the show **fc-tunnel tcp-statistics** and **show fc-tunnel fc-statistics** counters | Errors are increasing gradually. | Use the **shut/no shut** commands or the **clear interface** command to reset the PA-FC-1G. |
| Errors in the **show fc-tunnel gmac-statistics** counters. ( Northstar Asic statistics) | CRC > 0 | Call TAC to determine if the PA-FC-1G is faulty and needs to be replaced. |
| Drops in the network | | Make sure all network devices in the fabric and the network as a whole are functional. |

# Debug Commands

There are many debug command options to review the status of the PA-FC-1G. The debug command has the format **debug fcpa** {module} {submodule}

- Module options
  - **all**: all modules
  - **cli**: command line interface — PA-FC-1G interface configuration commands
  - **cordova-driver**: Gigabit Ethernet driver that interfaces with PA-FC-1G GMAC
  - **fcap**: fibre channel application — module that maintains the B_port state machine
  - **fd**: fibre channel frame distributor module that provides services to fcap and checks TCP connection status periodically
  - **northstar-driver**: driver that interfaces with Northstar ASIC and provides services to fibre channel and TCP
  - **sm**: session manager, the module responsible for TCP connection, configuration, and timer management
  - **tcp**: TCP library
- Submodule options
  - **all**: all submodules
  - **errors**: errors that occurred in the selected module
  - **events**: specific events information in the selected module
  - **extra**: not generally required, quite verbose
  - **packets**: packets handled by the selected module
  - **states**: information for the fibre channel, session manager, and TCP states

**Note** Under heavy traffic, do not enable **debug fcpa cordova-driver packets**, **debug fcpa northstar-driver events**, or **debug fcpa northstar-driver extra**. These debug commands degrade performance and make the console unusable.