



Configuring FCIP

Cisco MDS 9000 Family IP storage (IPS) services extend the reach of Fibre Channel SANs by using open-standard, IP-based technology. The switch can connect separated SAN islands using Fibre Channel over IP (FCIP).



Note

FCIP is specific to the IPS module and is available in Cisco MDS 9200 Switches or Cisco MDS 9500 Directors.

The Cisco MDS 9216I switch and the 14/2 Multiprotocol Services (MPS-14/2) module also allow you to use Fibre Channel, FCIP, and iSCSI features. The MPS-14/2 module is available for use in any switch in the Cisco MDS 9200 Series or Cisco MDS 9500 Series.



For information on configuring Gigabit Ethernet interfaces, see the [“Configuring Gigabit Ethernet Interfaces”](#) section on page 37-4.

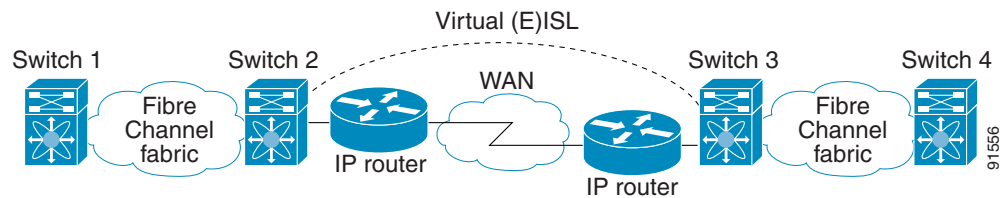
This chapter includes the following sections:

- [About FCIP, page 33-2](#)
- [Enabling FCIP, page 33-4](#)
- [Basic FCIP Configuration, page 33-5](#)
 - [Advanced FCIP Profile Configuration, page 33-7](#)
 - [Advanced FCIP Interface Configuration, page 33-12](#)
 - [Configuring E Ports, page 33-18](#)
 - [Advanced FCIP Features, page 33-19](#)
 - [Displaying FCIP Information, page 33-24](#)
 - [FCIP High Availability, page 33-30](#)
 - [Ethernet PortChannels and Fibre Channel PortChannels, page 33-32](#)
 - [Default Settings, page 33-33](#)

About FCIP

distributed Fibre Channel storage area networks (SAN islands) transparently over IP local area networks (LANs), metropolitan area networks (MANs), and wide area networks (WANs). See [Figure 33-1](#).

Figure 33-1 Fibre Channel SANs Connected by FCIP



FCIP uses TCP as a network layer transport.



For more information about FCIP protocols, refer to the IETF standards for IP storage at <http://www.ietf.org>. Also refer to Fibre Channel standards for switch backbone connection at <http://www.t11.org> (see FC-BB-2).

To configure IPS modules or MPS-14/2 modules for FCIP, you should have a basic understanding of the following concepts:

[FCIP and VE Ports, page 33-2](#)

[FCIP Links, page 33-3](#)

[FCIP Profiles, page 33-4](#)

[FCIP Interfaces, page 33-4](#)

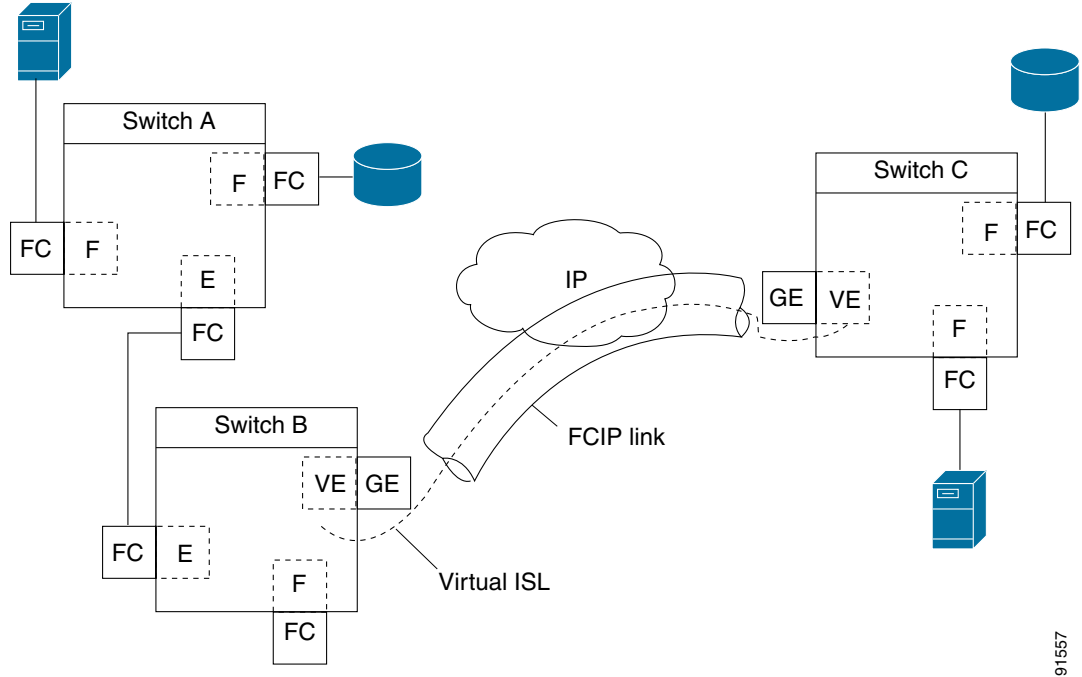
FCIP and VE Ports

(ISLs) and Cisco's enhanced ISLs (EISLs).

FCIP virtual E (VE) ports behave exactly like standard Fibre Channel E ports, except that the transport in this case is FCIP instead of Fibre Channel. The only requirement is for the other end of the VE port to be another VE port.

A virtual ISL is established over an FCIP link and transports Fibre Channel traffic. Each associated virtual ISL looks like a Fibre Channel ISL with either an E port or a TE port at each end (see [Figure 33-2](#)).

Figure 33-2 FCIP Links and Virtual ISLs



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See the “E Port” section on page 11-3.

FCIP Links

- One connection is used for data frames.
- The other connection is used only for Fibre Channel control frames, that is, switch-to-switch protocol frames (all Class F). This arrangement provides low latency for all control frames.

To enable FCIP on the IPS module or MPS-14/2 module, an FCIP profile and FCIP interface (interface FCIP) must be configured.

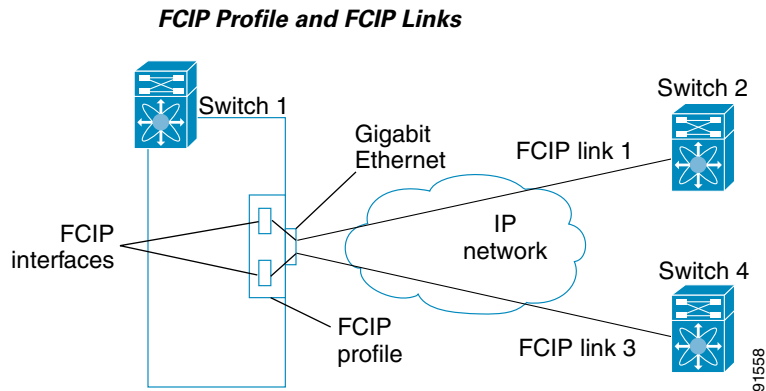
The FCIP link is established between two peers, the VE port initialization behavior is identical to a normal E port. This behavior is independent of the link being FCIP or pure Fibre Channel, and is based on the E port discovery process (ELP, ESC).

Once the FCIP link is established, the VE port behavior is identical to E port behavior for all inter-switch communication (including domain management, zones, and VSANs). At the Fibre Channel layer, all VE and E port operations are identical.

FCIP Profiles

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The FCIP profile's local IP address determines the Gigabit Ethernet port where the FCIP links terminate (see [Figure 33-3](#)).



FCIP Interfaces

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- E port parameters—trunking mode and trunk allowed VSAN list.

Enabling FCIP

(SAN_EXTN_OVER_IP or SAN_EXTN_OVER_IP_IPS4) (see [Chapter 3](#), “[Obtaining and Installing Licenses](#)”).

	Command	Purpose
Step 1	switch# config t	
	switch(config)# fcip enable	
	no fcip enable	

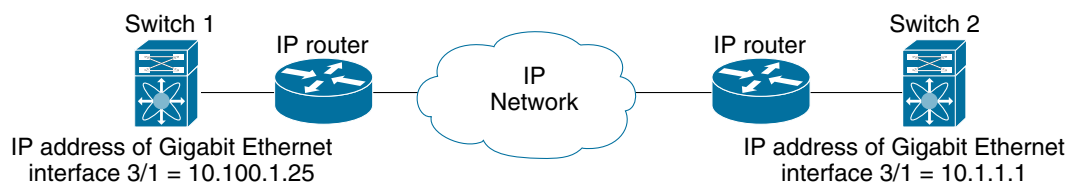
Basic FCIP Configuration

- Step 1
- Step 2
- Step 3
- Step 4
- Step 5

Creating FCIP Profiles

You must assign a local IP address of a Gigabit Ethernet interface or subinterface to the FCIP profile to create an FCIP profile (see [Figure 33-4](#)).

Figure 33-4 Assigning Profiles to Each Gigabit Ethernet Interface

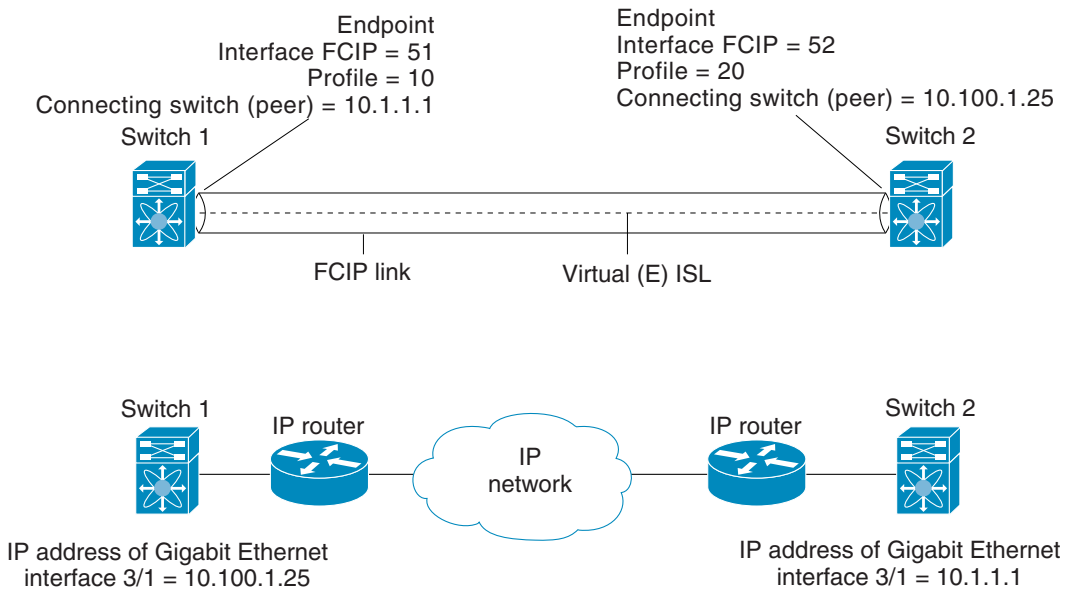


switch1# config terminal	
fcip profile 10	
switch1(config-profile)#	
switch1(config-profile)# ip address	
10.100.1.25	

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switch2#	
switch2(config)#	
switch2(config)#	
switch2(config-profile)#	
switch2(config-profile)#	

Figure 33-5 Assigning Profiles to Each Gigabit Ethernet Interface



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switch1#	
switch(config)#	
switch1(config)#	
switch1(config-if)#	
switch1(config-if)# use-profile 10	
peer-info ipaddr 10.1.1.1	
no shutdown	

	Enters configuration mode.
	Creates an FCIP interface (52).
	Binds the profile (20) to the FCIP interface.
	Assigns the peer IP address information (10.100.1.25 for switch 1) to the FCIP interface.
	Enables the interface.

Advanced FCIP Profile Configuration

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	Enters configuration mode.
	Creates the profile (if it does not already exist) and enters profile configuration submode. The valid range is from 1 to 255.

Configuring TCP Listener Ports

port

	Associates the profile with the local port number (5000).
	Reverts to the default 3225 port.

Configuring TCP Parameters

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- [Keepalive Timeout, page 33-8](#)
[Maximum Retransmissions, page 33-9](#)

- Path MTUs, page 33-9
- Selective Acknowledgments, page 33-9
- Window Management, page 33-9
- Buffer Size, page 33-11
- Monitoring Congestion, page 33-10
- Estimating Maximum Jitter, page 33-11

Minimum Retransmit Timeout

	Command	Purpose
Step 1		

Keepalive Timeout



Note

	Command	Purpose
Step 1	<code>keepalive-timeout 120</code>	
	<code>keepalive-timeout 120</code> <code>no tcp</code>	

Maximum Retransmissions

Command	Purpose
<code>max-retransmissions 6</code>	
<code>max-retransmissions 6 no tcp</code>	

Path MTUs

PMTU discovery is a mechanism by which TCP learns of the PMTU dynamically and adjusts the maximum TCP segment accordingly (RFC 1191).

By default, PMTU discovery is enabled on all switches with a timeout of 3600 seconds. If TCP reduces the size of the maximum segment because of PMTU change, the `reset-timeout` specifies the time after which TCP tries the original MTU.

To configure PMTU, follow these steps:

<code>no tcp pmtu-enable</code>	
<code>tcp pmtu-enable</code>	
<code>reset-timeout 90 tcp pmtu-enable</code>	
<code>reset-timeout 600 no tcp pmtu-enable</code>	

Selective Acknowledgments

<code>no tcp sack-enable</code>	
<code>tcp sack-enable</code>	

Window Management



round-trip-time

round-trip-time

min-available-bandwidth

max-bandwidth-mbps

Step 1

Command	Purpose
<code>900 min-available-bandwidth-mbps 300 round-trip-time-ms 10</code>	
<code>no tcp max-bandwidth-mbps 900 min-available-bandwidth-mbps 300 round-trip-time-ms 10</code>	
<code>tcp max-bandwidth-kbps 2000 min-available-bandwidth-kbps 2000 round-trip-time-us 200</code>	

Congestion

-
-
-



Note



Tip

	Command	Purpose
Step 1		
	<code>tcp cwm burstsize 30</code>	
	<code>no tcp cwm burstsize</code>	
25		

Estimating Maximum Jitter



Note

	Command	Purpose
Step 1	<code>no tcp max-jitter</code>	
	<code>tcp max-jitter</code>	
	<code>tcp max-jitter 300</code>	
	<code>no tcp max-jitter 2500</code>	

Buffer Size



switch(config-profile)#	Configure the advertised buffer size to 5000 KB. The valid range is from 0 to 16384 KB.
switch(config-profile)#	Reverts the switch to its factory default. The default is 0 KB.

[Quality of Service, page 33-18](#)

To establish a peer connection, you must first create the FCIP interface and enter the `config-if` submode.

To enter the `config-if` submode, follow these steps:

switch#	Enters configuration mode.
switch(config)#	Creates an FCIP interface (100).

To establish an FCIP link with the peer, you can use one of two options:

Peer IP address—Configures both ends of the FCIP link. Optionally, you can also use the peer TCP port along with the IP address.

Special frames—Configures one end of the FCIP link when security gateways are present in the IP network. Optionally, you can also use the switch WWN (sWWN) and profile ID along with the IP address.

Peer IP Address

	Command	Purpose
Step 1		
Step 2		
Step 3		

Special Frames



Note



Tip

	Command	Purpose
Step 1	12:12:34:45:ab:bc:cd:00	show wwn switch

	Command	Purpose
Step 2		
Step 3		

Active Connections



Note

	Command	Purpose
Step 1		
Step 2		

Number of TCP Connections

	Command	Purpose
Step 1		
Step 2		

Time Stamp Control

arrives within a 2000 millisecond interval (+ or -2000 ms) from the network time, that packet is accepted.



The default value for packet acceptance is 2000 microseconds.



If the option is enabled, be sure to configure NTP on both switches (see the [“NTP Configuration” section on page 4-18](#)).



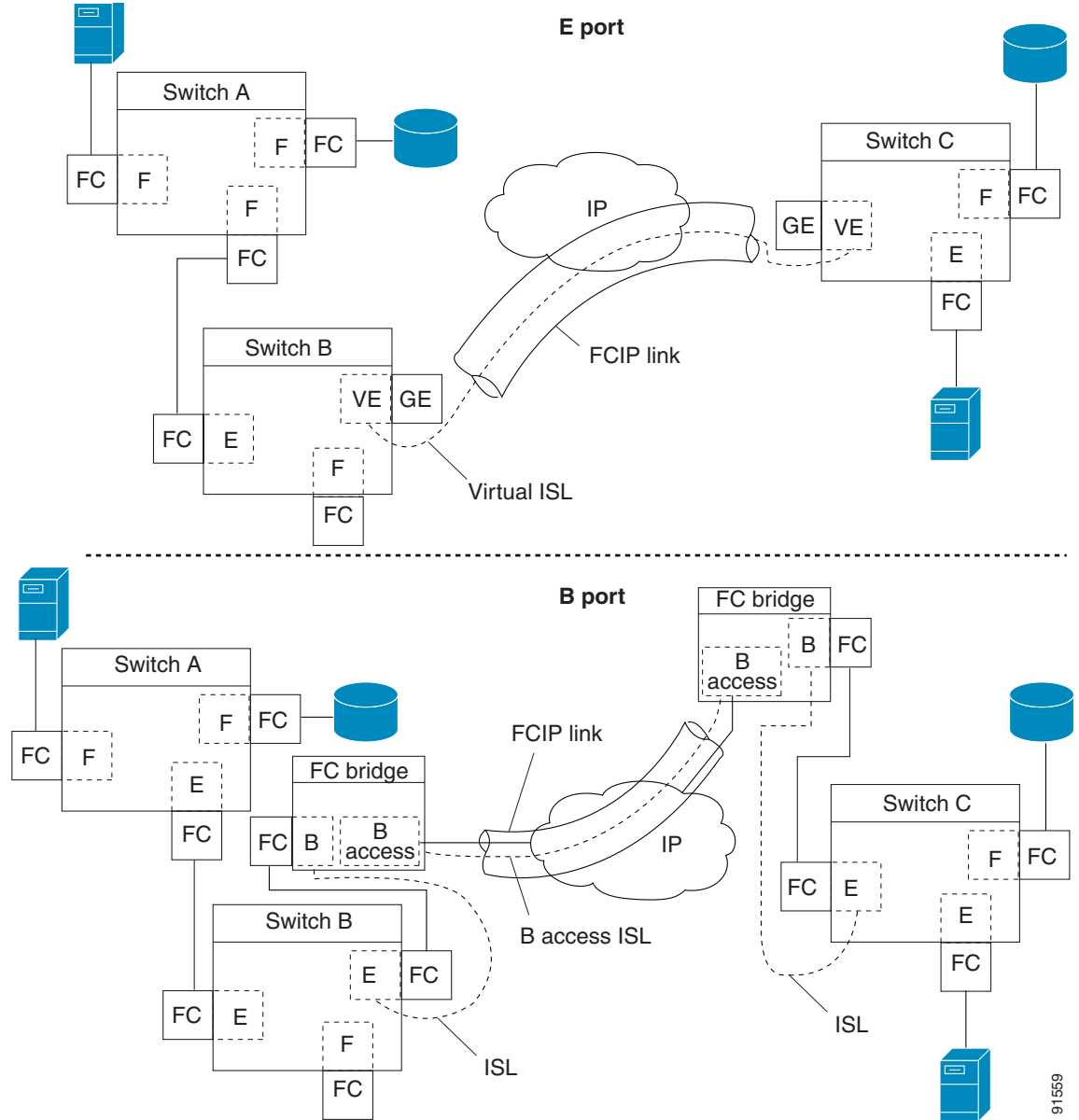
Do not enable time stamp control on an FCIP interface that has tape acceleration or write acceleration configured.

To enable or disable the time stamp control, follow these steps:

Please enable NTP with a common time source on both MDS Switches that are on either side of the FCIP link	
switch(config-if)#	
switch(config-if)#	
switch(config-if)#	
switch(config-if)#	

B Port Interoperability Mode

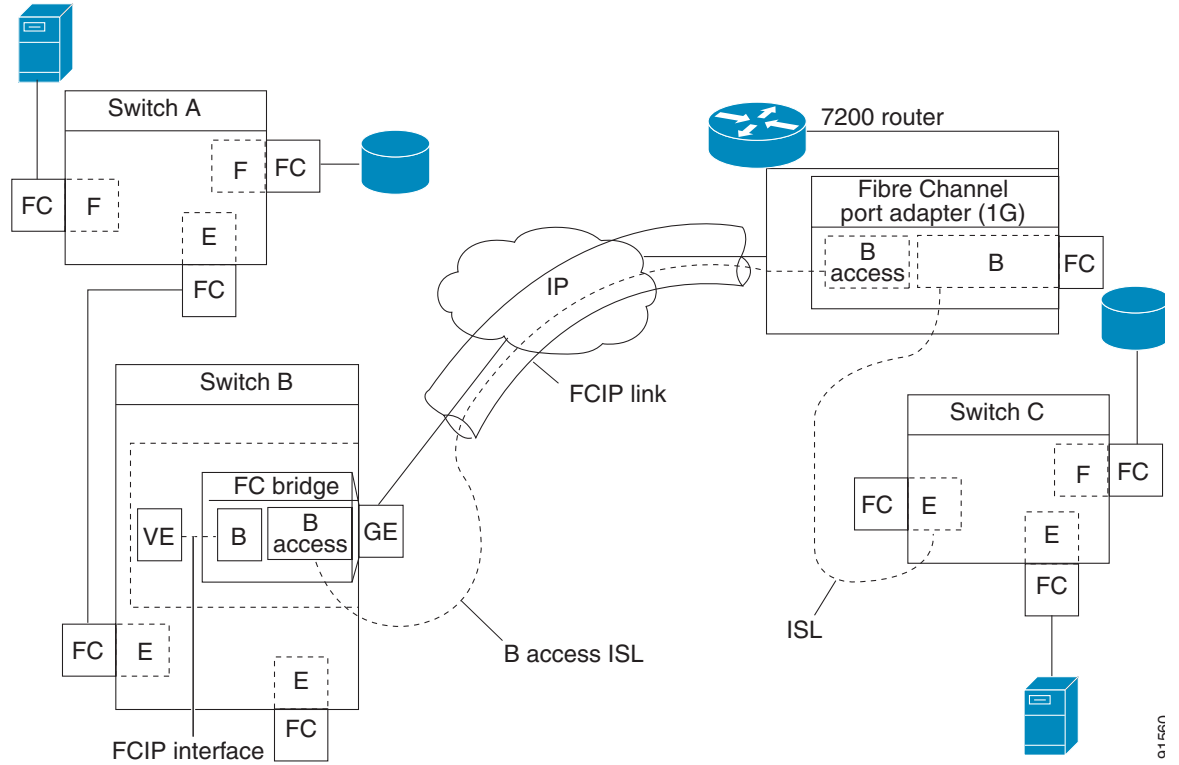
Figure 33-6 FCIP B Port and Fibre Channel E Port



while VE

ports establish a virtual ISL over an FCIP link, B ports use a B access ISL

Figure 33-7 FCIP Link Terminating in a B Port Mode



01560

	Enables the reception of keepalive responses sent by a remote peer.
	Disables the reception of keepalive responses sent by a remote peer (default).

Quality of Service

-
-

<code>qos control 24 data 26</code>	
<code>no qos control 24 data 26</code>	

Configuring E Ports

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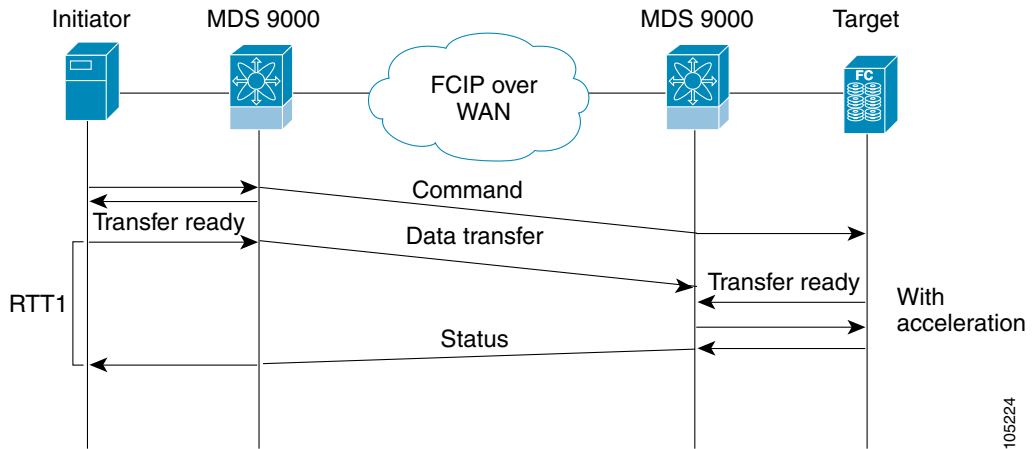
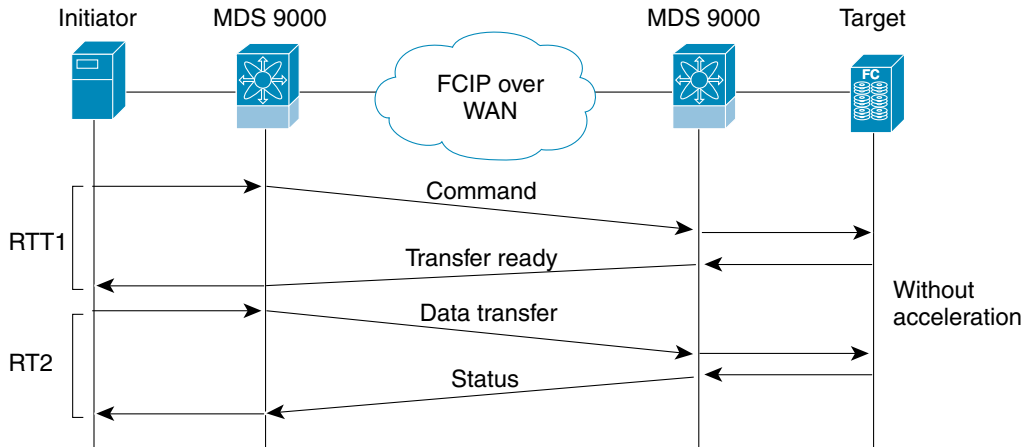
and Managing Zones”).

FCIP Write Acceleration



Note

Figure 33-8 FCIP Link Write Acceleration



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Caution



Note



Caution

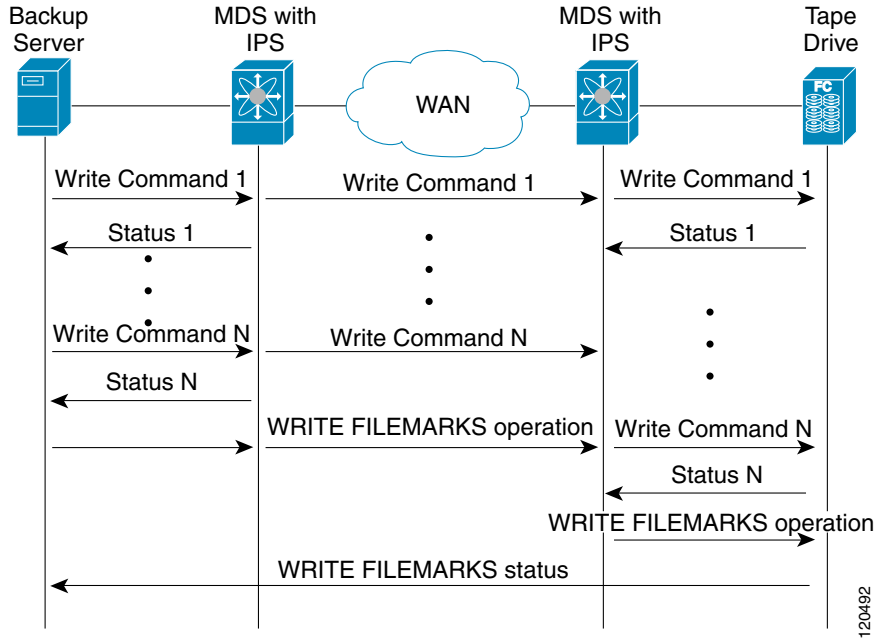
	Command	Purpose
Step 1		
Step 2		
Step 3		

FCIP Tape Acceleration



Note

Figure 33-9 FCIP Link Tape Acceleration









		Enters configuration mode.
		Creates an FCIP interface (5).
		Enables tape acceleration (and write acceleration—if not already enabled).
		Enables tape acceleration with automatic flow control (default)
2048	no write-accelerator	
	tape-accelerator	
	no write-accelerator	
	tape-accelerator flow-control-buffer-size	
	2048	
	no write-accelerator	

mode1 is a fast compression mode for high bandwidth links (> 25 Mbps)

mode2

mode3 is a high compression mode for low bandwidth links (< 10 Mbps)

auto (default) mode picks the appropriate compression scheme based on the bandwidth of the link (the bandwidth of the link configured in the FCIP profile's TCP parameters)

The IP compression feature behavior differs between the IPS module(s) or MPS-14/2 module(s) and MPS-14/2 module—while **mode2** and **mode3** perform software compression in both modules, **mode1** performs hardware-based compression in MPS-14/2 modules, and software compression in IPS-4 and IPS-8 modules.



The Cisco MDS 9216i Switch also supports IP compression feature. The integrated supervisor module has the same hardware components that are available in the MPS-14/2 module.



switch#	
switch(config)#	
switch(config)#	
switch(config-if)#	
switch(config-if)#	
switch(config-if)#	
switch(config-if)#	

Displaying FCIP Information

show interface

Example 33-1 Displays the FCIP Summary

show fcip summary

Tun	prof	Eth-if	peer-ip	Status	T	W	T	Enc	Comp	Bandwidth	rtt
					E	A	A			max/min	(us)
10	91	GE4/1	3.3.3.2	UP	N	N	N	N	N	1000M/1000M	2000
11	11	GE3/1.601	30.1.1.2	DOWN	N	N	N	N	N	1000M/500M	1000
12	12	GE3/1.602	30.1.2.2	DOWN	N	N	N	N	N	1000M/500M	1000
13	0		0.0.0.0	DOWN	N	N	N	N	N		
14	0		0.0.0.0	DOWN	N	N	N	N	N		
15	0		0.0.0.0	DOWN	N	N	N	N	N		
16	0		0.0.0.0	DOWN	N	N	N	N	N		
17	0		0.0.0.0	DOWN	N	N	N	N	N		
18	0		0.0.0.0	DOWN	N	N	N	N	N		

19	0		0.0.0.0	DOWN	N	N	N	N	N			
20	92	GE4/2	3.3.3.1	UP	N	N	N	N	N	1000M/1000M	2000	
21	21	GE3/2.601	30.1.1.1	DOWN	N	N	N	N	N	1000M/500M	1000	
22	22	GE3/2.602	30.1.2.1	DOWN	N	N	N	N	N	1000M/500M	1000	

Specified Host End FCIP Link.

MAP TABLE (5 entries TOTAL entries 5)

OXID	RXID	HOST FCID	TARG FCID	VSAN	Index
0xd490	0xffff	0x00690400	0x00620426	0x0005	0x0000321f
0xd4a8	0xffff	0x00690400	0x00620426	0x0005	0x00003220
0xd4c0	0xffff	0x00690400	0x00620426	0x0005	0x00003221
0xd4d8	0xffff	0x00690400	0x00620426	0x0005	0x00003222
0xd4f0	0xffff	0x00690400	0x00620426	0x0005	0x00003223

switch#

MAP TABLE (3 entries TOTAL entries 3)

OXID	RXID	HOST FCID	TARG FCID	VSAN	Index
0xc308	0xffff	0x00690400	0x00620426	0x0005	0x00003364
0xc320	0xffff	0x00690400	0x00620426	0x0005	0x00003365
0xc338	0xffff	0x00690400	0x00620426	0x0005	0x00003366

Displays Information About Tapes for which Exchanges are Tape Accelerated at the Host End FCIP Link

switch#

HOST TAPE SESSIONS (1 entries TOTAL entries 1)

```

Host Tape Session #1
  FCID 0xef0001, VSAN 1, LUN 0x0002
  Outstanding Exchanges 0, Outstanding Writes 0
  Target End Buffering 0 Bytes, Auto Max Writes 1
  Flags 0x0, FSM state Non TA Mode
  First index 0xffffffff7, Last index 0xffffffff7
  Current index=0xfffffff7e, Els Oxid 0xffff7, Seq-Id 0x0000
  Hosts 1
    FCID 0x20300

```

switch#

TARGET TAPE SESSIONS (1 entries TOTAL entries 1)

Target Tape Session #1

FCID 0xef0001, VSAN 2, LUN 0x0002
Outstanding Exchanges 0, Outstanding Writes 0
Estimated IO Time 0x0
Flags 0x0, Timer Flags 0x0
First index 0xffffffff7, Last index 0xffffffff7
Current index=0xffffffffe, Els Oxid 0xfff7, Seq-Id 0x0000
Hosts 1
FCID 0x20300

switch#

fcip10 is up

Hardware is GigabitEthernet
Port WWN is 20:d0:00:0c:85:90:3e:80
Peer port WWN is 20:d4:00:0c:85:90:3e:80
Admin port mode is auto, trunk mode is on
Port mode is E, FCID is 0x720000
Port vsan is 91
Speed is 1 Gbps
Using Profile id 91 (interface GigabitEthernet4/1)
Peer Information
Peer Internet address is 3.3.3.2 and port is 3225
Write acceleration mode is off
Tape acceleration mode is off
Tape Accelerator flow control buffer size is 256 KBytes
IP Compression is disabled
Special Frame is disabled
Maximum number of TCP connections is 2
Time Stamp is disabled
QOS control code point is 0
QOS data code point is 0
B-port mode disabled
TCP Connection Information
50529025 Active TCP connections
Local 0.0.0.7:6, Remote 0.0.0.200:0
0 host table full 0 target entries in use
211419104 Attempts for active connections, 1500 close of connections
TCP Parameters
Path MTU 124160 bytes
Current retransmission timeout is 124160 ms
Round trip time: Smoothed 127829 ms, Variance: 14336
Advertized window: Current: 0 KB, Maximum: 14 KB, Scale: 14336
Peer receive window: Current: 0 KB, Maximum: 0 KB, Scale: 51200
Congestion window: Current: 14 KB, Slow start threshold: 49344 KB
Current Send Buffer Size: 206463 KB, Requested Send Buffer Size: 429496728
3 KB
CWM Burst Size: 49344 KB
5 minutes input rate 491913172779207224 bits/sec, 61489146597400903 bytes/sec, 0 frames/sec
5 minutes output rate 491913175298921320 bits/sec, 61489146912365165 bytes/sec, 14316551 frames/sec
5702 frames input, 482288 bytes
5697 Class F frames input, 481736 bytes

```
5 Class 2/3 frames input, 552 bytes
0 Reass frames
0 Error frames timestamp error 0
5704 frames output, 482868 bytes
5698 Class F frames output, 482216 bytes
6 Class 2/3 frames output, 652 bytes
0 Error frames
```

```
switch#
fcip4
TCP Connection Information
...
5 minutes input rate 207518944 bits/sec, 25939868 bytes/sec, 12471 frames/sec
5 minutes output rate 205340328 bits/sec, 25667541 bytes/sec, 12340 frames/sec
2239902537 frames input, 4658960377152 bytes
18484 Class F frames input, 1558712 bytes
2239884053 Class 2/3 frames input, 4658958818440 bytes
0 Reass frames
0 Error frames timestamp error 0
2215051484 frames output, 4607270186816 bytes
18484 Class F frames output, 1558616 bytes
2215033000 Class 2/3 frames output, 4607268628200 bytes
0 Error frames
```

Displays Detailed FCIP Interface Compression Information, if Enabled

```
switch#
fcip4
TCP Connection Information
...
IP compression statistics
208752 rxbytes, 208752 rxbytes compressed
5143584 txbytes
0 txbytes compressed, 5143584 txbytes non-compressed
1.00 tx compression ratio
```

Example 33-9 Displays Detailed FCIP Interface Write Acceleration Counter Information, if Enabled

```
switch#
fcip4
TCP Connection Information
...
Write Accelerator statistics
6091 packets in      5994 packets out
0 frames dropped  0 CRC errors
0 rejected due to table full
0 ABTS sent      0 ABTS received
0 tunnel synchronization errors
37 writes recd    37 XFER_RDY sent (host)
0 XFER_RDY rcvd (target)
37 XFER_RDY rcvd (host)
0 XFER_RDY not proxied due to flow control (host)
0 bytes queued for sending
0 estimated bytes queued on the other side for sending
```

```
0 times TCP flow ctrl(target)
0 bytes current TCP flow ctrl(target)
```

Example 33-10 Displays Detailed FCIP Interface Tape Acceleration Counter Information, if Enabled

```
switch#
fcip4
  TCP Connection Information
...
  Tape Accelerator statistics
    1 (host) tape sessions      0 (target) tape sessions
    37 writes recd      33 STATUS proxied (host)
    37 write good STATUS rcvd (host)
    0 write good STATUS rcvd (target)
    0 write bad STATUS rcvd (host)
    0 write bad STATUS rcvd (target)
    4 writes not TAed      8 queued flow ctrl (host)
    0 recovery REC sent Got 0 ACCs  0 Rejects (host)
    0 ABTS sent Got 0 ACCs (host)
    0 REC Accs  0 REC Rjts      14 REC fwded (host)
    0 SRR Accs  0 SRR Rjts      0 SRR fwded(host)
    0 XferRdy retries      0 Status retries (host)
    0 recovery REC sent Got 0 ACCs  0 Rejects (target)
    0 recovery SRR sent Got 0 ACCs (target)
    0 ABTS sent Got 0 ACCs (target)
    0 tmf cmds rcvd (host)
    0 tmf cmds rcvd (target)
```

Example 33-11 Displays the Compression Engine Statistics for the MPS-14/2 Module

Example 33-12 Displays Brief FCIP Interface Counter Information

Example 33-13 Displays the FCIP Interface Description

Example 33-14 Displays FCIP Profiles

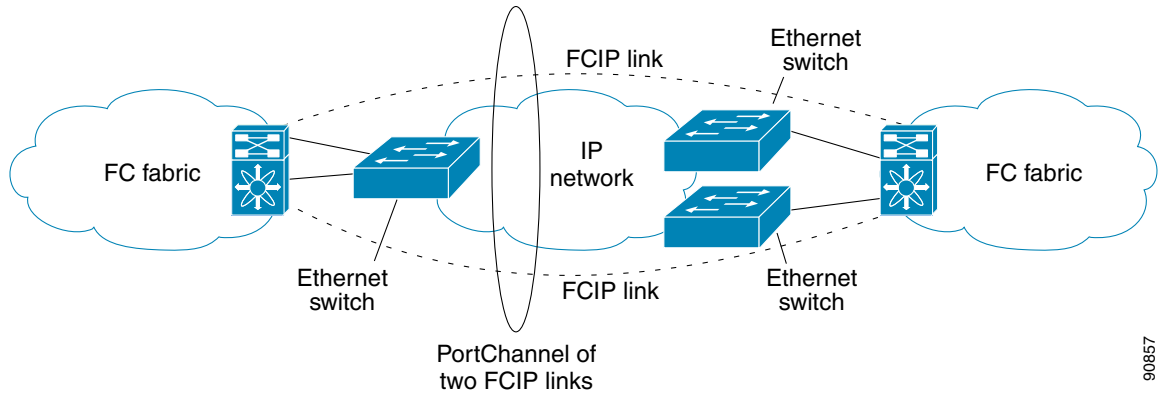
Example 33-15 Displays the Specified FCIP Profile Information

```
show fcip profile 7
```

FCIP High Availability

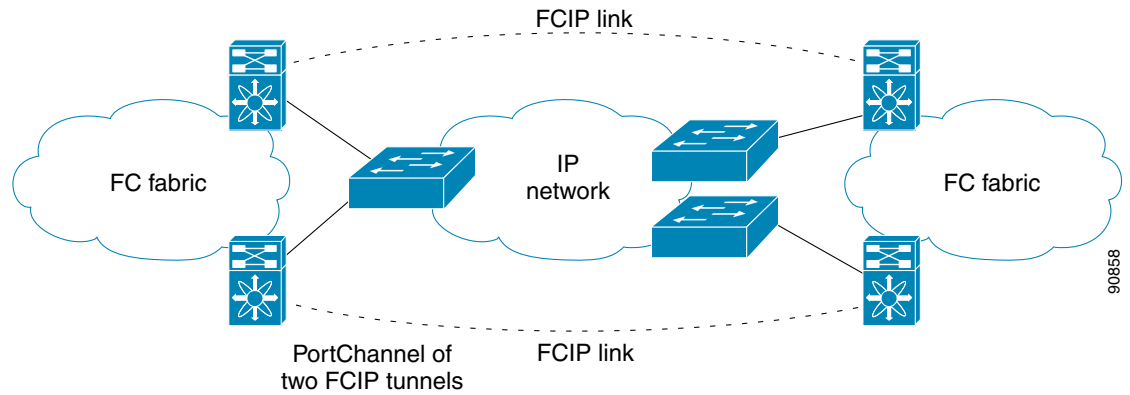
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Fibre Channel PortChannels



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FSPF



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VRRP

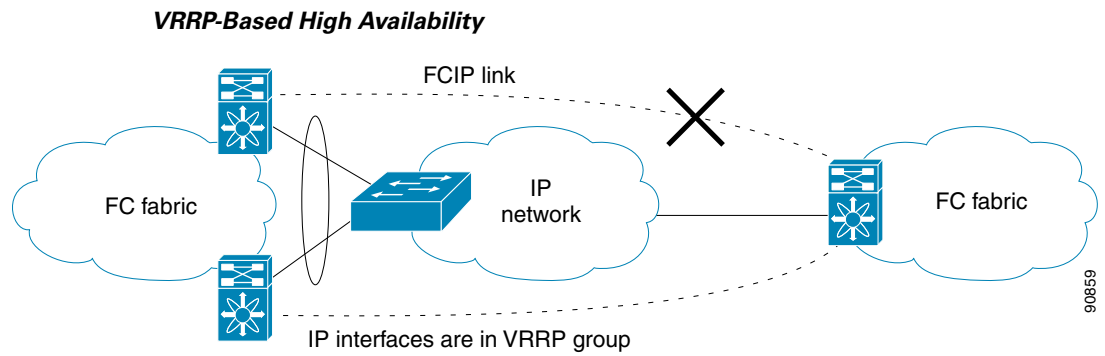
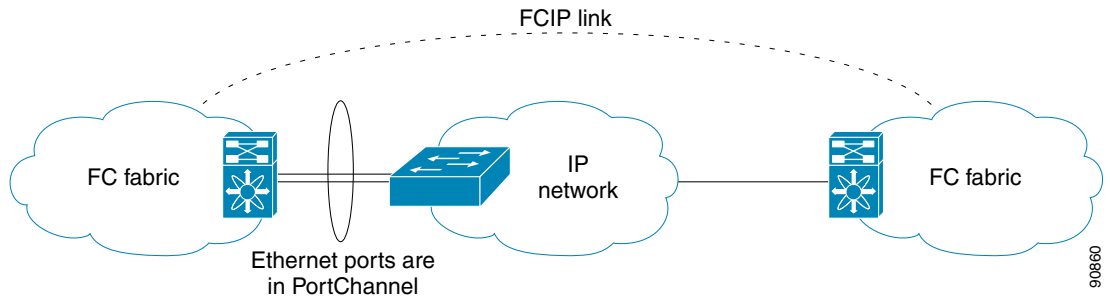


Figure 33-13 Ethernet PortChannel-Based High Availability



Default FCIP Parameters (continued)
