



# Before Configuring SN 5428-2 Storage Router Software

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The Cisco SN 5428-2 Storage Router installation and configuration tasks consist of the following:

- Install the SN 5428-2 Storage Router according to the *Cisco SN 5428-2 Storage Router Hardware Installation Guide*.
- Select how the SN 5428-2 will be deployed: SCSI routing, transparent SCSI routing, or FCIP.
- Configure the SN 5428-2 Storage Router software according to the *Cisco SN 5428-2 Storage Router Software Configuration Guide* (this manual).
- Install and configure iSCSI drivers in IP hosts connected to the storage router. The iSCSI driver is *not* required for FCIP deployment, or in IP hosts that have a TCP/IP Offload Engine (TOE) with embedded iSCSI protocol installed.

This chapter is the starting point for SN 5428-2 Storage Router software configuration. It provides some very basic, abbreviated information as background to help you understand the SN 5428-2 Storage Router features and the software configuration process. It contains the following topics:

- [SN 5428-2 Storage Router Overview, page 1-2](#)
- [SCSI Routing Overview, page 1-4](#)
- [Transparent SCSI Routing Overview, page 1-10](#)
- [FCIP Overview, page 1-15](#)
- [Mixed Mode Overview, page 1-18](#)
- [VLAN Access Overview, page 1-20](#)
- [Zoning Overview, page 1-21](#)
- [Fibre Channel Interface Overview, page 1-23](#)
- [Gigabit Ethernet Interface Overview, page 1-23](#)
- [Authentication Overview, page 1-24](#)
- [SN 5428-2 Cluster Management Overview, page 1-25](#)
- [Interface Naming, page 1-25](#)
- [Where to Go Next, page 1-26](#)

# SN 5428-2 Storage Router Overview

The Cisco SN 5428-2 Storage Router provides universal access to storage over IP networks. The storage router software controls the operation of the Cisco SN 5428-2 Storage Router. You can configure the software to provide the following types of access to storage over IP networks:

- SCSI routing only
- Transparent SCSI routing only
- FCIP only
- SCSI routing and FCIP
- Transparent SCSI routing and FCIP

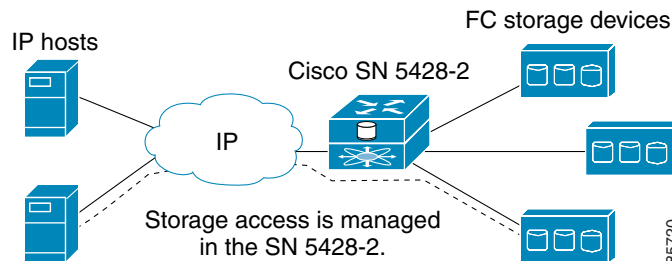
SCSI routing provides IP hosts with access to Fibre Channel (FC) storage devices, using iSCSI protocol. The iSCSI protocol is an IETF-defined protocol for IP storage (ips).


**Note**

For more information about the iSCSI protocol, refer to the IETF standards for IP storage at <http://www.ietf.org>.

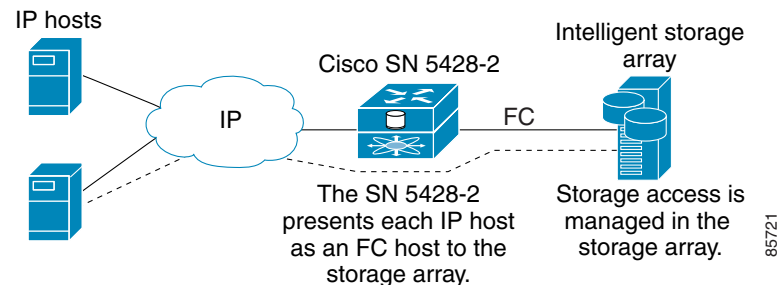
With SCSI routing, storage device access is managed primarily in the SN 5428-2. (See [Figure 1-1](#).)

**Figure 1-1 SCSI Routing**



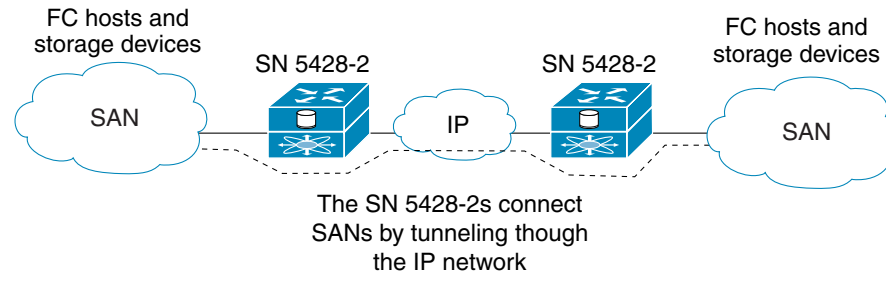
Transparent SCSI routing provides IP hosts with transparent access to intelligent storage arrays using iSCSI protocol; that is, each IP host is presented as an FC host to an intelligent storage array. With transparent SCSI routing, availability of storage devices is managed primarily in the intelligent storage array. (See [Figure 1-2](#).)

**Figure 1-2 Transparent SCSI Routing**



Fibre Channel over IP (FCIP) enables SN 5428-2 Storage Routers to provide connectivity by tunneling through an IP network between storage area networks (SANs). (See [Figure 1-3](#).)

**Figure 1-3 FCIP**



In addition to providing services for accessing storage over IP networks, the SN 5428-2 Storage Router software provides the following services:

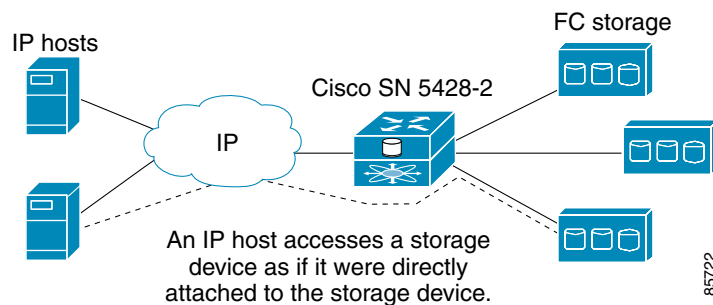
- VLAN Access Control—provides IP access control to storage based on a VLAN identifier (VID) number (in addition to access control through access lists)
- Authentication—provides iSCSI, Enable and Login authentication using AAA authentication methods
- High Availability (HA)—provides the ability to group storage routers in a cluster for intelligent failover and other cluster-related functions (for SCSI routing only)
- E\_Port with FC Fabric Zoning—provides the ability to connect FC ports to FC switches and participate in fabric zoning, manage zoning, and support zone mergers
- SNMP/MIB support—provides network management of the SN 5428-2 through SNMP using selected MIBs
- Gigabit Ethernet Interface features—provides the ability to assign a management IP address per Gigabit Ethernet interface, multiple IP addresses per SCSI routing instance, and an optional secondary Gigabit Ethernet interface per IP address used for SCSI routing or SN 5428-2 management. When the SN 5428-2 is deployed for FCIP, provides primary and optional secondary Gigabit Ethernet interfaces to the FCIP peer.
- FCIP data compression—enables the SN 5428-2 to dynamically compress FCIP data traffic for better channel bandwidth utilization
- Buffer credit extension—enables the SN 5428-2 to donate buffer credits from a donor port to selected FC ports
- Secure Sockets Layer (SSL) support—provides HTTPS connection for secure access through the web-based GUI
- Secure Shell (SSH) protocol version 2 support—provides high encryption and authentication for interactive management sessions, and is a common replacement for Telnet
- Routing Information Protocol (RIP) listening support—allows the SN 5428-2 to learn dynamic routing using RIP (version 1 or version 2) listening
- Service Location Protocol (SLP) support—provides the ability to advertise targets of specified SCSI routing instances to initiators or servers that use SLP
- Internet Storage Name Service (iSNS) support—provides the ability to register iSCSI targets with an iSNS server, allowing iSCSI initiators to dynamically discover available storage targets

- LUN Trespass feature—provides a LUN failover feature for selected storage arrays that operate on the active/passive port model. When enabled, the trespass feature provides a redundant path from the storage router to the storage array by allowing the storage router to detect a path failure to a storage array port and perform the necessary operations to fail LUNs over to the other port on the storage array without using any multi-path software.
- TCP Window Tuning—provides the ability to maximize bandwidth across the network by automatically setting the local TCP receive window size to the remote TCP receive window size without user intervention
- A command-line interface (CLI) and a web-based GUI—provides user interfaces for configuration and maintenance of an SN 5428-2

## SCSI Routing Overview

SCSI routing provides IP hosts with access to FC storage devices as if the storage devices were directly attached to the hosts, with access to devices being managed primarily in the SN 5428-2 Storage Router. An iSCSI target is an arbitrary name for a group of physical storage devices. The iSCSI targets are created and mapped to physical storage devices attached to the SN 5428-2. The storage router presents the iSCSI targets to IP hosts as if the physical storage devices were directly attached to the hosts. (See [Figure 1-4](#).) With SCSI routing, storage devices are not aware of each IP host; the storage devices are aware of the SN 5428-2 and respond to it as if it were one FC host.

**Figure 1-4** SCSI Routing Overview



To configure an SN 5428-2 Storage Router for SCSI routing, you should have a basic understanding of the following concepts:

- [Routing SCSI Requests and Responses, page 1-5](#)
- [Basic Network Structure, page 1-6](#)
- [SCSI Routing Mapping and Access Control, page 1-6](#)
- [Available Instances of SCSI Routing, page 1-9](#)



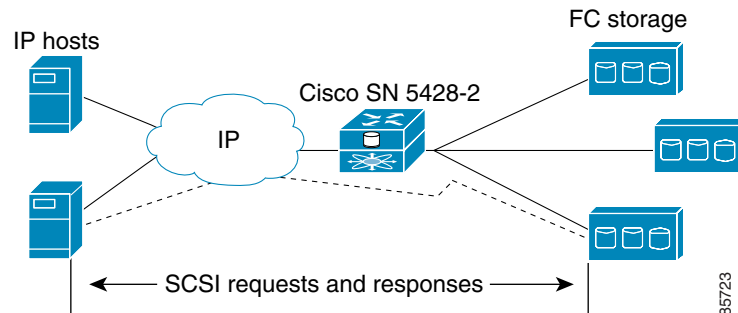
### Note

Along with FC storage, FC host connections and FC switch connections are allowed; however, most of the illustrations in this manual show only storage connections for the purpose of describing the SN 5428-2 Storage Router features.

## Routing SCSI Requests and Responses

SCSI routing consists of routing SCSI requests and responses between hosts in an IP network and FC storage. (See [Figure 1-5](#).)

**Figure 1-5 Routing SCSI Requests and Responses for SCSI Routing**

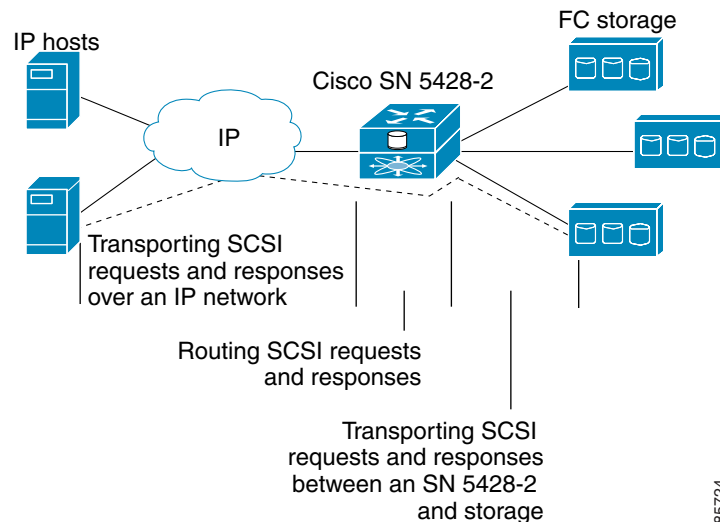


Each host that requires IP access to storage via an SN 5428-2 Storage Router needs to have a compatible iSCSI driver installed. Using the iSCSI protocol, the iSCSI driver allows an IP host to transport SCSI requests and responses over an IP network. From the perspective of a host operating system, the iSCSI drive appears to be a locally attached SCSI or Fibre Channel drive to the host.

SCSI routing consists of the following main actions (See [Figure 1-6](#)):

- Transporting SCSI requests and responses over an IP network between the hosts and the SN 5428-2 Storage Router
- Routing SCSI requests and responses between hosts on an IP network and FC storage
- Transporting SCSI requests and responses between the SN 5428-2 Storage Router and FC storage

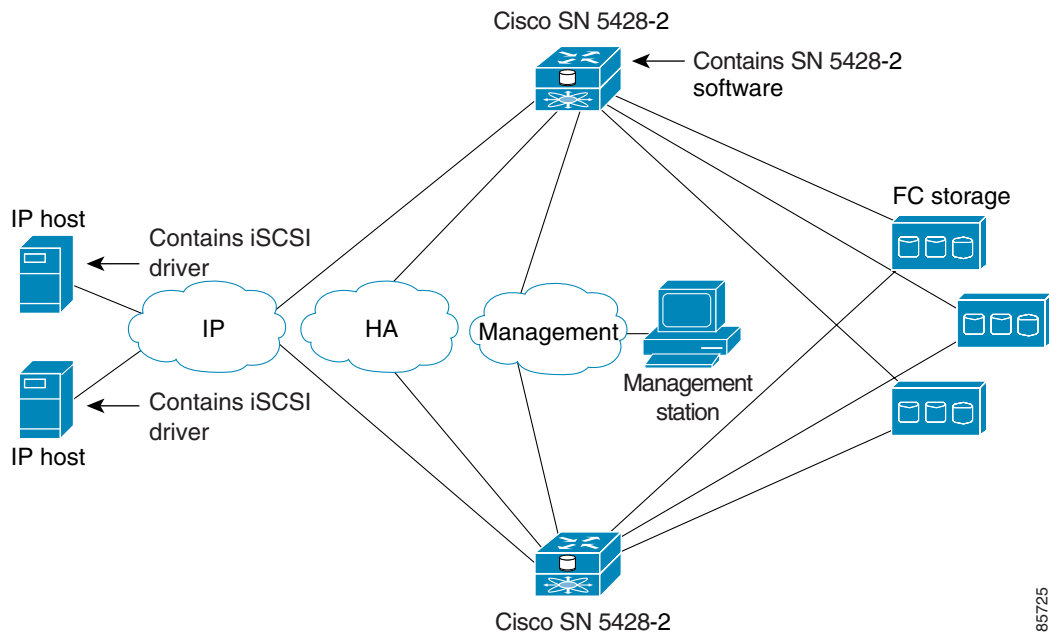
**Figure 1-6 SCSI Routing Actions**



## Basic Network Structure

Figure 1-7 shows the basic structure of a SCSI routing network. IP hosts with iSCSI drivers access the storage routers through an IP network connected to the Gigabit Ethernet interface of each storage router. The storage routers access storage devices connected to the Fibre Channel interfaces of each storage router. A management station manages the storage routers through an IP network connected to the management interface of each storage router. For high availability (HA) operation, the storage routers communicate with each other over two networks: the HA network connected to the HA interface of each storage router and the management network connected to the management interface of each storage router.

**Figure 1-7 SCSI Routing Basic Network Structure**



## SCSI Routing Mapping and Access Control

SCSI routing occurs in the SN 5428-2 Storage Router through the mapping of physical storage devices to iSCSI targets. An iSCSI target is an arbitrary name for a group of physical storage devices. You can map an iSCSI target to multiple physical devices. An iSCSI target always contains at least one Logical Unit Number (LUN). Each LUN on an iSCSI target is mapped to a single LUN on a physical storage target.

You can choose either of two types of storage mapping: target-and-LUN mapping or target-only mapping. Target-and-LUN mapping maps an iSCSI target and LUN combination to a physical storage target and LUN combination. Target-only mapping maps an iSCSI target to a physical storage target and its LUNs.

With target-and-LUN mapping, an iSCSI target name and iSCSI LUN number are specified and mapped to the physical storage address of one LUN; either a WWPN + LUN (World Wide Port Name + LUN) combination, a LUN ID (unique LUN identifier), or a LUN serial number.

If the LUN is available, it is made available as an iSCSI LUN and numbered with the iSCSI LUN number specified. For example, if an iSCSI target and iSCSI LUN specified as *Database*, *LUN 9* were mapped to the physical storage address, *WWPN 3100112233445566*, *LUN 12*, then LUN 12 would be available as one iSCSI LUN. An iSCSI driver would see the iSCSI target named *Database*, with one iSCSI LUN identified as *LUN 9*. The iSCSI LUN would appear as one storage device to a host. (See [Table 1-1](#).)

**Table 1-1 Target-and-LUN Mapping Example**

Apparent to Host as Local Disk	iSCSI Target Name	iSCSI LUN Available	Physical Storage Address	Physical LUN Available
Local Disk (D:)	Database	LUN 9	WWPN 3100112233445566	LUN 12
Apparent as one locally attached storage device.	<i>Database</i> appears as one controller with one LUN available.	iSCSI LUN is numbered as specified and can be different than the physical LUN number.	Specifies the storage address of a storage controller.	The LUN number is specified as the only LUN to be mapped.

With target-only mapping, an iSCSI target name is specified and mapped to the physical storage address of a storage controller only; a WWPN. Any LUNs that are available in the storage controller are made available as iSCSI LUNs and are numbered the same as the LUNs in the storage controller. For example, if an iSCSI target specified as *Webserver2000* were mapped to the physical storage address *WWPN 3100112233445577*, and LUNs 0 through 2 were available in that controller, those LUNs would become available as three iSCSI LUNs. An iSCSI driver would see the iSCSI target named *Webserver2000* as a controller with three iSCSI LUNs identified as *LUN 0*, *LUN 1*, and *LUN 2*. Each iSCSI LUN would appear as a separate storage device to a host. (See [Table 1-2](#).)

**Table 1-2 Target-only Mapping Example**

Apparent to Host as Local Disk	iSCSI Target Name	iSCSI LUNs Available	Physical Storage Address	Physical LUNs Available
Local Disk (D:)	Webserver2000	LUN 0	WWPN 3100112233445577	LUN 0
Local Disk (E:)	Webserver2000	LUN 1	WWPN 3100112233445577	LUN 1
Local Disk (F:)	Webserver2000	LUN 2	WWPN 3100112233445577	LUN 2
Apparent as three locally attached storage devices.	<i>Webserver2000</i> appears as one controller with LUNs 0, 1, and 2 available.	iSCSI LUNs are numbered the same as physical LUNs.	Specifies the storage address of a storage controller.	LUNs 0, 1, and 2 are available for mapping.

Access for SCSI routing is controlled in the IP hosts and the storage router. In an IP host, the iSCSI driver is configured with the Gigabit Ethernet IP address of the SCSI routing instance in the storage router with which the host is to transport SCSI requests and responses. In a storage router, access is controlled through an access list and a VLAN identifier (VID) number of the hosts. Additionally, access can be further controlled in the SN 5428-2 through authentication. See the [“Authentication Overview” section on page 1-24](#) for more information about authentication.

An access list enables access to storage devices attached to the SN 5428-2 according to any combination of host IP address(es), CHAP user name(s), or iSCSI name(s). An access list contains these combinations of hosts allowed to access the storage devices. Host VID enables access to storage devices according to the VID of each host. See the [“VLAN Access Overview” section on page 1-20](#) for more information about VLAN access.

For each iSCSI target, you can associate one access list allowing read/write access, and one access list allowing read-only access. See [Chapter 6, “Configuring SCSI Routing,”](#) for more information about read/write and read-only access.

You can use a combination of access lists and VIDs to configure access in the SN 5428-2; that is, you can specify that certain hosts according to IP address in a VLAN can access storage devices attached to the SN 5428-2.

Once the access is configured in the hosts and the SN 5428-2, and once the storage mapping is configured in the SN 5428-2, the SN 5428-2 routes SCSI requests and responses between hosts and the mapped storage devices.

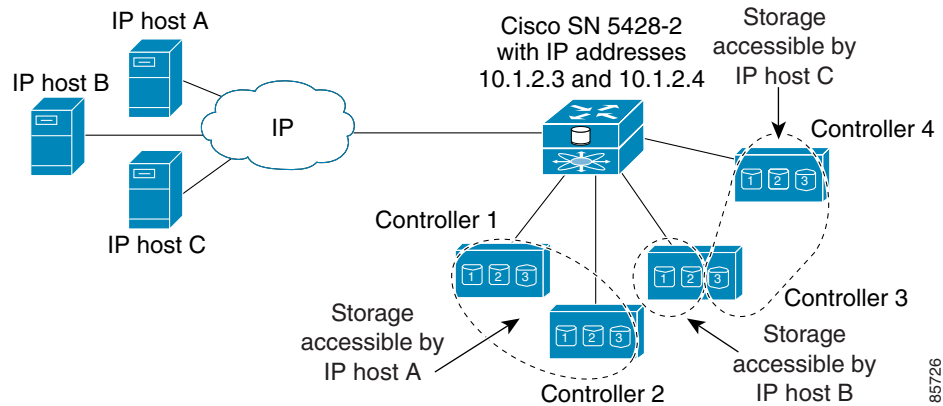
[Figure 1-8](#) represents the concept of storage mapping and access control for SCSI routing. In the figure, the SN 5428-2 Storage Router provides three IP hosts with IP access to disk drives across four disk controllers. The SN 5428-2 contains two SCSI routing instances: one configured with IP address 10.1.2.3 for the Gigabit Ethernet interface and the other with IP address 10.1.2.4. The iSCSI drivers in each IP host are configured to access those SCSI routing instances by their IP addresses through the Gigabit Ethernet interface. An access list in the storage router or VID (or both) specifies that hosts A, B, and C are allowed to access the mapped storage devices. From the perspective of a host, each disk drive mapped to it appears as a locally attached disk drive. [Table 1-3](#) shows the correlation between an access list and/or VID, the Gigabit Ethernet IP addresses of the SCSI routing instances, and the storage device mapping.

**Note**

The purpose of [Figure 1-8](#) and [Table 1-3](#) is only to illustrate the concept of storage mapping and access control. The IP addresses will vary according to each site. Similarly, the type of storage addressing (for example, LUN ID, WWPN + LUN or LUN serial number) will vary according to the types of storage and the types of storage addressing preferred at each site. In addition, the figure and the table exclude any additional SN 5428-2 Storage Routers that could be configured for high availability.



**Figure 1-8 SCSI Routing Storage Mapping and Access Control Concept**



**Table 1-3 SCSI Routing Storage Mapping and Access Control Concept**

Hosts Allowed Access via SN 5428-2 Access List and/or VID	Storage Devices Apparent to Host as Locally Attached Devices	Via GbE IP Addresses of SCSI Routing Instances	Mapped To Controller	Mapped To Drive
Host A	Local Disk (D:)	10.1.2.3	1	1
	Local Disk (E:)	10.1.2.3	1	2
	Local Disk (F:)	10.1.2.3	1	3
	Local Disk (G:)	10.1.2.3	2	1
	Local Disk (H:)	10.1.2.3	2	2
	Local Disk (I:)	10.1.2.3	2	3
Host B	Local Disk (D:)	10.1.2.3	3	1
	Local Disk (E:)	10.1.2.3	3	2
Host C	Local Disk (D:)	10.1.2.4	4	1
	Local Disk (E:)	10.1.2.4	4	2
	Local Disk (F:)	10.1.2.4	4	3
	Local Disk (G:)	10.1.2.4	3	3

## Available Instances of SCSI Routing

You can configure an SN 5428-2 Storage Router with up to 12 instances of SCSI routing services. Each instance needs to be configured with the following:

- One or more unique IP addresses assigned to either one or both Gigabit Ethernet interfaces
- Mapping between iSCSI target names and physical storage addresses
- Access control

When an SN 5428-2 is part of a cluster, an instance of SCSI routing can run on only one storage router in a cluster at any given time. See the “[SN 5428-2 Cluster Management Overview](#)” section on page 1-25 for more information about storage router clusters.

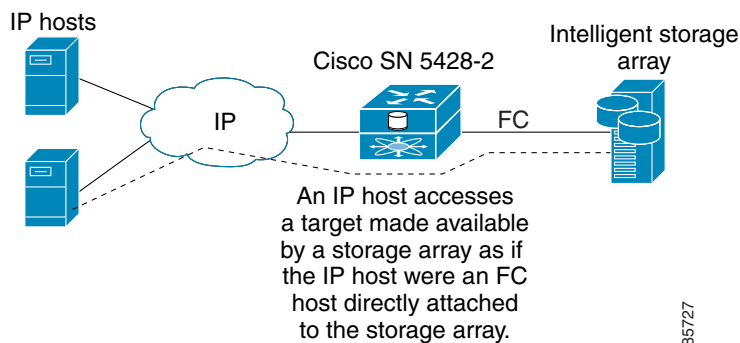
# Transparent SCSI Routing Overview

Transparent SCSI routing provides IP hosts with access to intelligent storage arrays as if each storage array were directly attached to the hosts, with access to the storage devices managed primarily in each storage array. The SN 5428-2 transparently presents each IP host to the storage array as if each host were an FC host.

Typically, transparent SCSI routing is used with an intelligent storage array that is directly connected to the SN 5428-2 Fibre Channel interface. Managing access to storage devices consists of using configuration tools available with an intelligent storage array (to configure, for example, which hosts are granted access and to configure multiple paths between hosts and storage devices). With transparent SCSI routing, an intelligent storage array can manage each IP host as if it were directly attached to the array as an FC host.

Transparent SCSI routing automatically creates iSCSI targets and maps them to physical targets available in the intelligent storage array. The storage router presents the iSCSI targets to IP hosts as if the physical targets were directly attached to the hosts. In conjunction with presenting iSCSI targets to hosts, transparent SCSI routing presents each IP host as an FC host to the intelligent storage array. The intelligent storage array is aware of each IP host and responds to each IP host as if it were an FC host connected to the storage array. (See [Figure 1-9](#).) Transparent SCSI routing can present no more than 62 IP hosts as FC hosts to an intelligent storage array.

**Figure 1-9** Transparent SCSI Routing Overview



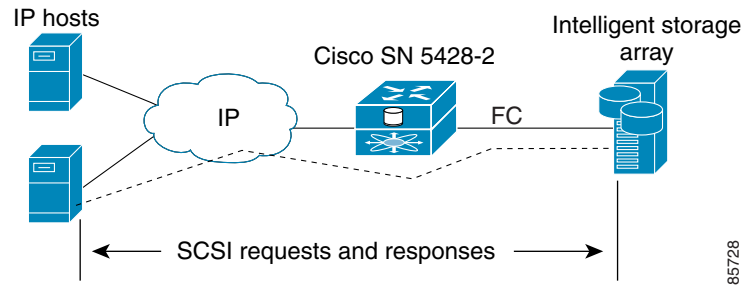
To configure an SN 5428-2 Storage Router that is deployed for transparent SCSI routing, you should have a basic understanding of the following concepts:

- [Routing SCSI Requests and Responses, page 1-11](#)
- [Basic Network Structure, page 1-12](#)
- [Transparent SCSI Routing Mapping and Access Control, page 1-12](#)
- [Available Instances of Transparent SCSI Routing, page 1-15](#)

## Routing SCSI Requests and Responses

Transparent SCSI routing consists of routing SCSI requests and responses between hosts in an IP network and an intelligent storage array that is directly connected to an SN 5428-2 Fibre Channel interface. (See [Figure 1-10](#).)

**Figure 1-10 Routing SCSI Requests and Responses for Transparent SCSI Routing**

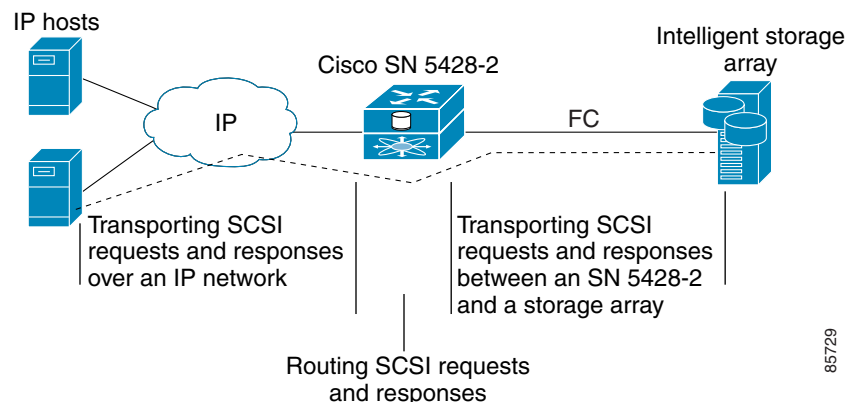


Each host that requires IP access to storage via an SN 5428-2 Storage Router needs to have a compatible iSCSI driver installed. Using the iSCSI protocol, the iSCSI driver allows an IP host to transport SCSI requests and responses over an IP network. From the perspective of a host operating system, the iSCSI drive appears to be a locally attached SCSI or Fibre Channel drive to the host. From the perspective of the storage array, each IP host appears as an FC host (with one Fibre Channel address for each host).

Transparent SCSI routing consists of the following main actions ([Figure 1-11](#)):

- Transporting SCSI requests and responses over an IP network between the hosts and the SN 5428-2 Storage Router.
- Routing SCSI requests and responses between hosts on an IP network and an intelligent storage array.
- Transporting SCSI requests and responses between the SN 5428-2 Storage Router and an intelligent storage array.

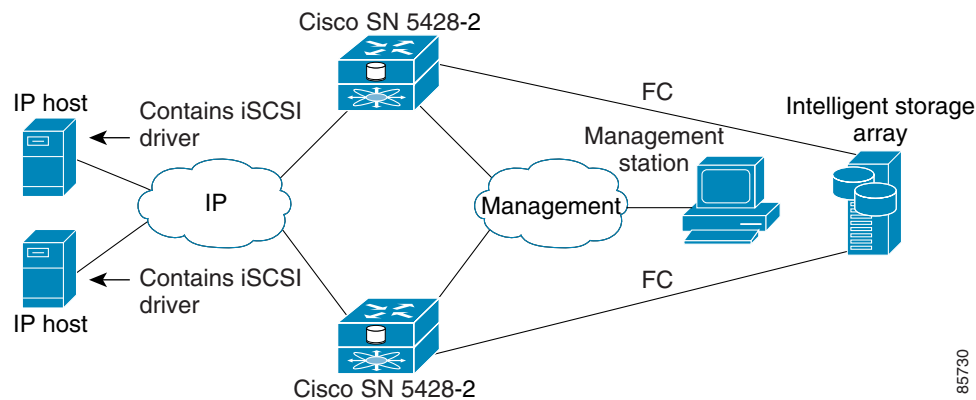
**Figure 1-11 Transparent SCSI Routing Actions**



## Basic Network Structure

Figure 1-12 shows the basic structure of a transparent SCSI routing network. IP hosts with iSCSI drivers access the storage routers through an IP network connected to one of the Gigabit Ethernet interfaces of each storage router. The storage routers access the intelligent storage array through a Fibre Channel interface of each storage router. A management station manages the storage routers through an IP network connected to the management interface of each storage router. High availability operation for transparent SCSI routing is controlled in the intelligent storage array; therefore, an SN 5428-2 HA network is not necessary, and the HA interface on the SN 5428-2 is disabled.

**Figure 1-12 Transparent SCSI Routing Basic Network Structure**



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## Transparent SCSI Routing Mapping and Access Control

Transparent SCSI routing occurs in an SN 5428-2 Storage Router through two types of mapping:

- Mapping iSCSI targets to physical targets
- Mapping each IP host to a Fibre Channel (FC) address

Mapping iSCSI targets to physical targets makes the physical targets accessible to IP hosts. Mapping each IP host to an FC address—which maps the iSCSI client in the IP host to the internal FC initiator WWPN—allows the host to be presented to a storage array as an FC host with its own FC WWPN.

Mapping iSCSI targets to physical targets consists of creating iSCSI targets that represent physical targets in an intelligent storage array. An iSCSI target is an arbitrary name for a group of physical storage devices; one iSCSI target is automatically created for each target made available by the intelligent storage array.

The iSCSI target name is created automatically using the iSCSI extended unique identifier (EUI) format. The EUI format combines the prefix “eui” with each WWPN made available by the intelligent storage array. For example, if the WWPN of a target in a storage array were 3100112233445566, then an iSCSI target would be created in the SN 5428-2 with the iSCSI target name of *eui.3100112233445566*.

Transparent SCSI routing maps iSCSI targets to physical targets using target-only mapping. Target-only mapping maps an iSCSI target to a physical storage target and its LUNs. Any LUNs that are available with a physical WWPN in the storage array are available with the corresponding iSCSI target and are numbered the same as the LUNs in the storage array.

For example, if an iSCSI target were created for WWPN 3100112233445566 in a storage array, and that WWPN contained LUNs 0 through 2, those LUNs would become available to an IP host as LUNs 0 through 2. An iSCSI driver would see the iSCSI target named *eui.3100112233445566* as a controller with three iSCSI LUNs identified as *LUN 0*, *LUN 1*, and *LUN 2*. Each iSCSI LUN would appear as a separate storage device to an IP host.

Mapping each IP host to a Fibre Channel address consists of assigning a WWPN to an IP host that is requesting access to storage; the WWPN is used for presenting the IP host as an FC host to a storage array. The SN 5428-2 maintains a pool of 62 WWPNS that are assigned to IP hosts requesting access to storage. When an IP host is granted access, a WWPN is assigned to the IP host and the SN 5428-2 presents the host as an FC host to the storage array. That host continues using that WWPN until it is finished using the storage. When transparent SCSI routing is deployed in dynamic mode, once the host is finished using the storage (logged out), the WWPN becomes available for assignment to other IP hosts requiring access to storage. In static mode, the IP host/WWPN mapping is retained throughout IP host logins and logouts and throughout storage router reboots.

See [Table 1-4](#) for an example of transparent SCSI routing mapping. In this mapping example, the WWPN, 200100023D000100, is assigned to the IP host. Using that WWPN, the SN 5428-2 presents the IP host as an FC host to the storage array. Three devices are made available as local storage devices: Local Disk (E:), Local Disk (F:), and Local Disk (G:). (Microsoft Windows devices are used as examples.) The iSCSI target, *eui.3100112233445566*, has been automatically created and mapped to a WWPN, 3100112233445566, that was made available by the storage array. To the IP host, the iSCSI target appears as a controller with LUNs 0, 1, and 2 available. The LUNs are apparent as they are with the WWPN in the storage array.

**Table 1-4 Transparent SCSI Routing Mapping Example**

WWPN assigned to IP Host	Apparent to IP Host	iSCSI Target Name	LUNs Apparent with iSCSI Target	WWPN of Storage Array Target	Physical LUNs Available
200100023D000100	Local Disk (E:)	<i>eui.3100112233445566</i>	LUN 0	3100112233445566	LUN 0
	Local Disk (G:)	<i>eui.3100112233445566</i>	LUN 1	3100112233445566	LUN 1
	Local Disk (H:)	<i>eui.3100112233445566</i>	LUN 2	3100112233445566	LUN 2

Access for transparent SCSI routing is controlled in the IP hosts and the intelligent storage array. In an IP host, the iSCSI driver is configured with the Gigabit Ethernet IP address of the SCSI routing instance in the storage router with which the host is to transport SCSI requests and responses. In the intelligent storage array, access is controlled through its storage management tools. Additionally, access can be further controlled in the SN 5428-2 through authentication. See the [“Authentication Overview”](#) section on page 1-24 for more information about authentication.

Once the access is configured in the hosts and the intelligent storage array, the SN 5428-2 transparently routes SCSI requests and responses between hosts and the mapped storage devices.

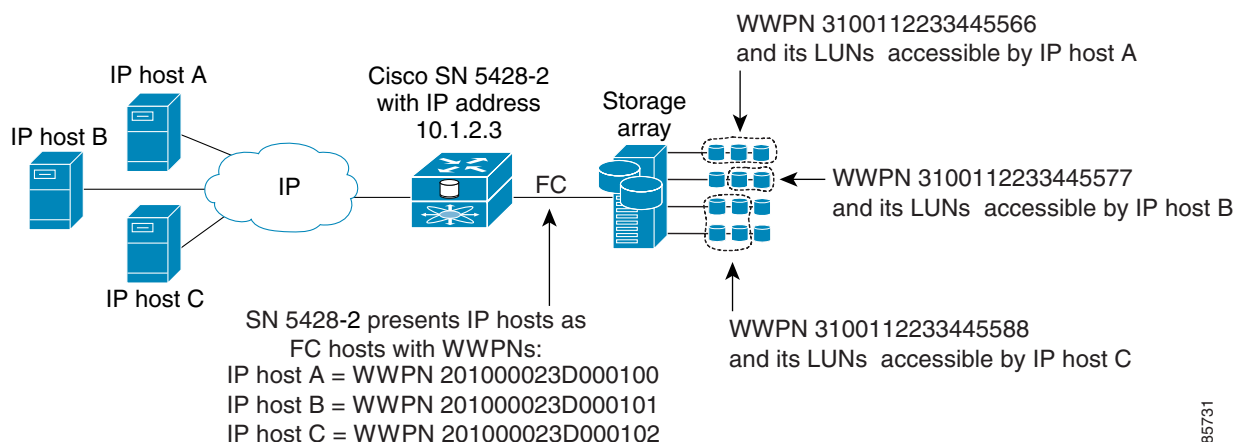
[Figure 1-13](#) represents the concept of storage mapping and access control for transparent SCSI routing. In the figure, the SN 5428-2 Storage Router provides three IP hosts with access to disk drives made available by the intelligent storage array. A single SCSI routing instance in the storage router is configured with IP address 10.1.2.3 for the Gigabit Ethernet interface. The iSCSI driver in each IP host is configured to access that SCSI routing instance by its IP address 10.1.2.3 through the Gigabit Ethernet interface on the storage router. From the perspective of an IP host, each disk drive mapped to it appears as a locally attached disk drive. From the perspective of the storage array, each host is connected directly

to it, with each host having a WWPN. Table 1-5 shows the correlation between the IP hosts, the Gigabit Ethernet IP address of the SCSI routing instance, storage device mapping, and IP-host-to-FC-address (WWPN) mapping.

**Note**

The purpose of Figure 1-13 and Table 1-5 is only to illustrate the concept of storage mapping, FC address mapping, and access control. The IP addresses and WWPNs will vary according to each site. In addition, the figure and the table exclude any additional SN 5428-2 Storage Routers that could be configured for multiple paths between hosts and storage devices.

**Figure 1-13 Transparent SCSI Routing Storage Mapping and Access Control Concept**



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**Table 1-5 Transparent SCSI Routing Storage Mapping and Access Control Concept**

Hosts Allowed Access by Intelligent Storage Array and SN 5428-2 Authentication	Storage Devices Apparent to Host as Locally Attached Devices	Via GbE IP Address of SCSI Routing Instance	Mapped To Storage	
			WWPN	Drive (LUN)
Host A: apparent to storage array as FC host with WWPN 201000023D000100	Local Disk (D:)	10.1.2.3	3100112233445566	0
	Local Disk (E:)	10.1.2.3	3100112233445566	1
	Local Disk (F:)	10.1.2.3	3100112233445566	2
Host B: apparent to storage array as FC host with WWPN 201000023D000101	Local Disk (D:)	10.1.2.3	3100112233445577	0
	Local Disk (E:)	10.1.2.3	3100112233445577	1
Host C: apparent to storage array as FC host with WWPN 201000023D000102	Local Disk (D:)	10.1.2.3	3100112233445588	0
	Local Disk (E:)	10.1.2.3	3100112233445588	1
	Local Disk (F:)	10.1.2.3	3100112233445588	2
	Local Disk (G:)	10.1.2.3	3100112233445588	3

## Available Instances of Transparent SCSI Routing

When an SN 5428-2 Storage Router is deployed for transparent SCSI routing, it is automatically configured for one instance of transparent SCSI routing service; only that one instance can exist in that SN 5428-2.

While the instance of transparent SCSI routing needs to be configured with a Gigabit Ethernet IP address, mapping between iSCSI target names and physical storage addresses is automatic and cannot be configured.

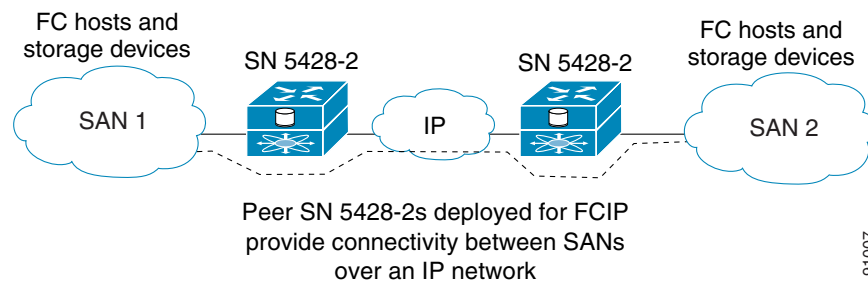
When an SN 5428-2 is deployed for transparent SCSI routing, it cannot participate in a storage router cluster. However, multiple SN 5428-2s can be connected to an intelligent storage array, where it is possible to manage failover and multiple paths. In networks where multiple SN 5428-2 Storage Routers are connected to an intelligent storage array, each SN 5428-2 has one (and only one) instance of transparent SCSI routing; the instance is unique to that storage router and cannot fail over to another storage router.

## FCIP Overview

Fibre Channel over IP (FCIP) enables SN 5428-2 Storage Routers to provide connectivity between FC hosts and FC storage devices over an IP network.

To deploy FCIP, two SN 5428-2 Storage Routers, or one SN 5482-2 Storage Router and one MDS 9000 Series system, are required. Each system is configured for FCIP and connected to a SAN (or to any FC host or FC device). The peer systems are connected to each other through an IP network. (See [Figure 1-14](#).)

**Figure 1-14 FCIP Overview**



An FC host or FC device needs no additional hardware or software to access storage devices via an SN 5428-2 Storage Router deployed for FCIP.

To configure an SN 5428-2 Storage Router deployed for FCIP, you need a basic understanding of the following concepts:

- [Using FCIP to Route Fibre Channel Packets, page 1-15](#)
- [FCIP Network Structures, page 1-16](#)

## Using FCIP to Route Fibre Channel Packets

With FCIP, peer systems transport FC frames over an IP network. From the perspective of the SANs, the storage devices accessed through the peer systems appear to be part of one unified SAN.

Once configured, FCIP instances on each system become active and establish their connectivity via the IP network. The storage devices in one SAN access the storage devices in the connected SAN using FC frames, which are encapsulated in IP packets by the FCIP instance, and transmitted to the peer system. The peer FCIP instance strips the IP packet data and passes only the FC frames over the FC interfaces to the storage devices.

The peer systems deployed for FCIP must be configured to use the same protocol: TCP or raw. TCP protocol uses standard TCP flow control and error recovery algorithms, and should be used if you require a standards-based FCIP implementation or connect to a non-SN 5428-2 peer, such as the MDS 9000 Series system. Raw protocol uses a proprietary connection protocol, but provides more operational control over flow control and error recovery than standard TCP/IP.

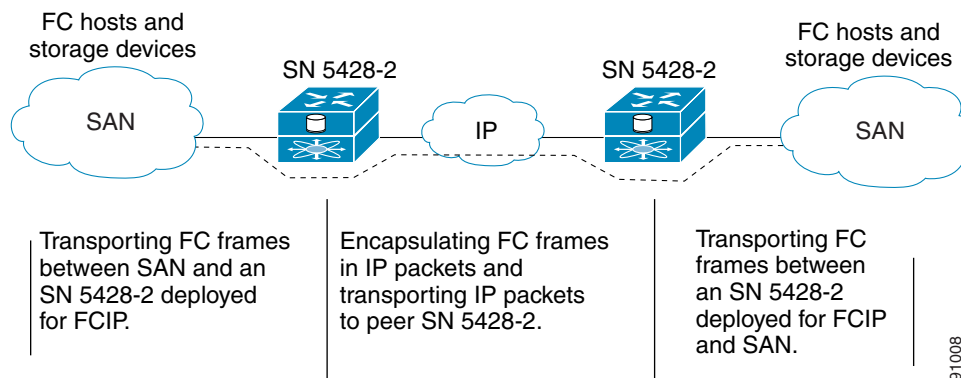
If the selected protocol is TCP, one FCIP instance must be configured as the TCP client; the other FCIP instance must be configured as the TCP server. The only difference between FCIP instances configured as TCP client and TCP server is which FCIP instance initiates the connection: the TCP client initiates the connection.

FCIP transports FC frames between SANs by performing the following actions (Figure 1-15):

- Transporting FC frames between a SAN and an SN 5428-2 that is deployed for FCIP
- Encapsulating FC frames in IP packets and transporting the IP packets to a peer SN 5428-2 or MDS 9000 Series system that is deployed for FCIP
- Receiving IP packets and transporting as FC frames between the peer SN 5428-2 or MDS 9000 Series system and a connected SAN

Note that FC traffic is carried over the IP network in such a way that the FC fabric and all FC devices on the fabric are unaware of the presence of the IP Network.

**Figure 1-15 FCIP Actions**



## FCIP Network Structures

This section describes typical FCIP network structures. In all of these examples, a management station (not shown) manages the storage routers through an IP network connected to the management interface and/or HA interface of each storage router.



Figure 1-14 represents a basic, non-redundant structure of an FCIP network configuration. In this example, an FC host or FC device connects to one or more Fibre Channel interfaces of each peer SN 5428-2 Storage Router deployed for FCIP. Each SN 5428-2 connects to the IP network through one of its Gigabit Ethernet interfaces. Through the IP network, each FCIP instance accesses its peer, thereby connecting the SANs.

Figure 1-16 shows a slightly more complex FCIP network: a redundant WAN FCIP configuration. In this example configuration, an FC host or FC device connects to one or more Fibre Channel interfaces of each peer SN 5428-2 Storage Router deployed for FCIP, and each SN 5428-2 connects to two separate IP networks through each of its Gigabit Ethernet interfaces. Through the IP network, each FCIP instance accesses the peer storage router deployed for FCIP, connecting the SANs. In this configuration, IP A and IP B are redundant paths, so that the loss of connectivity via either path does not cause a loss of connectivity between the SANs.

**Figure 1-16 FCIP Redundant WAN Configuration**

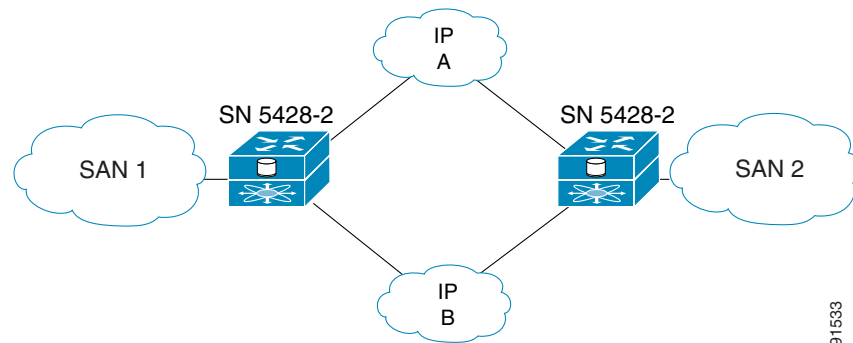
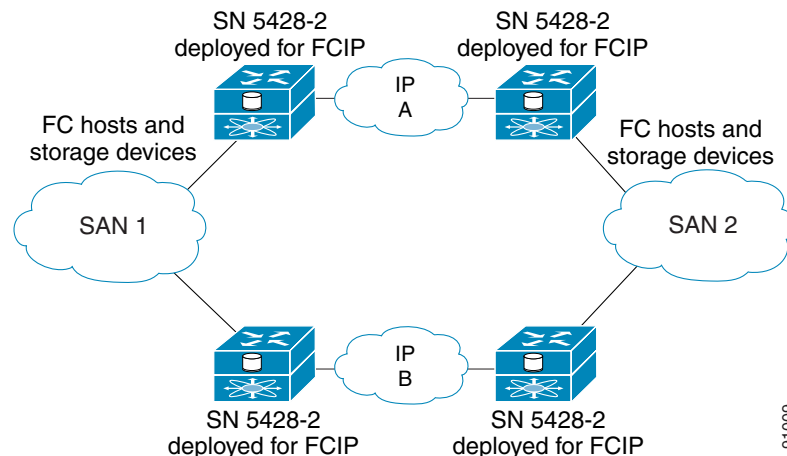


Figure 1-17 shows an even more reliable FCIP configuration, in which pairs of SN 5428-2s provide full redundancy. In this configuration, loss of an SN 5428-2 or loss of connectivity through one of the IP networks can be tolerated with no loss of connectivity between the SANs.

**Figure 1-17 FCIP Fully Redundant Configuration**

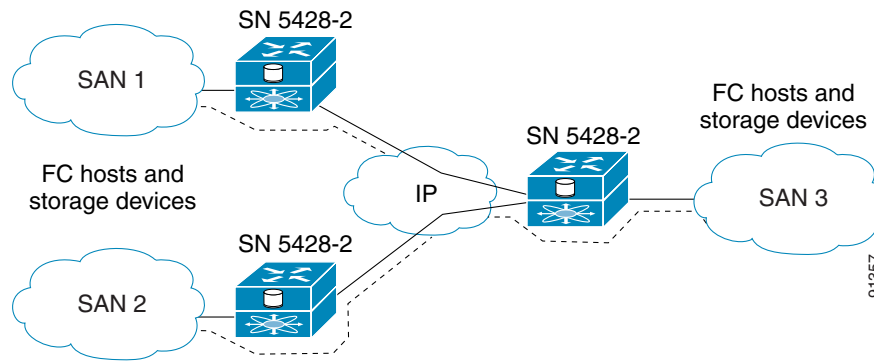


**Note**

For multiple paths between SANs, multiple pairs of systems deployed for FCIP need to be connected to the FC hosts or FC devices. However, multiple SN 5428-2 Storage Routers deployed for FCIP cannot be configured in an HA cluster. It is assumed that the multipath management is being done by an entity outside the SN 5428-2s (for example, by management applications on the FC host or storage devices).

Figure 1-18 shows an alternative network structure for FCIP, in which FCIP tunnels are established from two SANs aggregated to a central site. The SN 5428-2 at the central site has one FCIP instance set up for SAN 1, and the other FCIP instance set up for SAN 2.

**Figure 1-18 Multisite FCIP Configuration**



## Mixed Mode Overview

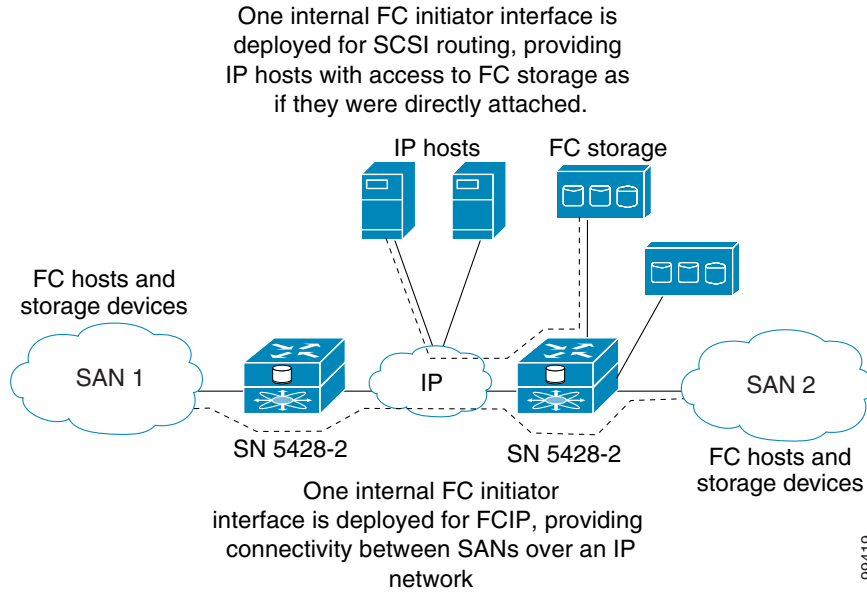
When the SN 5428-2 is deployed for SCSI routing or transparent SCSI routing, you can optionally configure one of the internal FC initiator interfaces for FCIP. When it is deployed for FCIP, one of the internal FC initiator interfaces can be configured for SCSI routing. This mixed mode deployment allows the storage router to provide IP hosts with access to the FC storage via one initiator interface, and FCIP connectivity for FC hosts and FC storage devices via the other initiator interface.

Figure 1-19 shows a storage router deployed for mixed mode, with one internal FC initiator interface dedicated to SCSI routing and the other internal interface dedicated to FCIP.

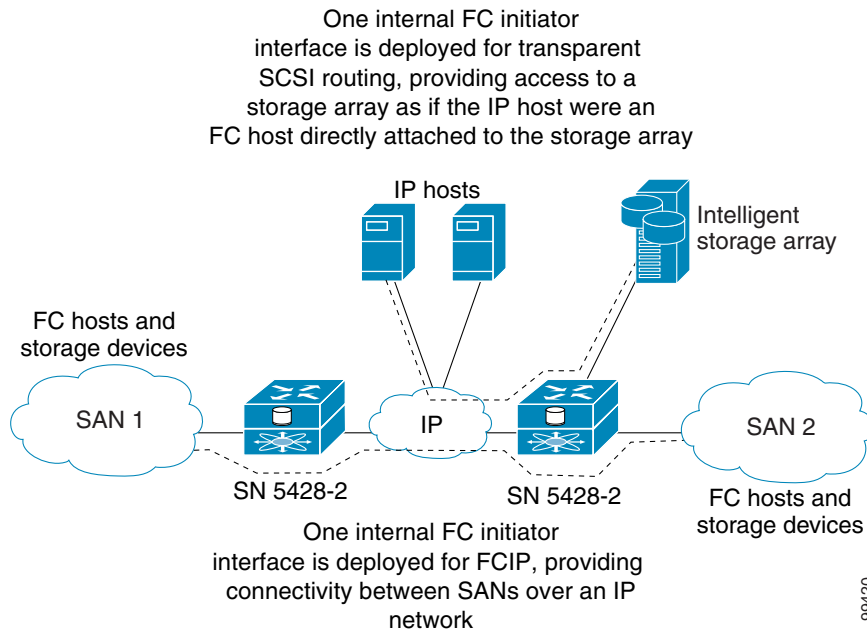
Figure 1-20 shows a storage router deployed for mixed mode, with one internal FC initiator interface dedicated to transparent SCSI routing and the other internal interface dedicated to FCIP.

When the storage router is deployed for mixed mode, all of the features and functionality of the primary deployment mode (SCSI routing, transparent SCSI routing or FCIP), and the additional mode, are available.

**Figure 1-19 Mixed Mode Overview (SCSI routing and FCIP)**



**Figure 1-20 Mixed Mode Overview (Transparent SCSI routing and FCIP)**



## Basic Network Structure

When a storage router is deployed for SCSI routing or transparent SCSI routing and FCIP, IP hosts with iSCSI drivers access the storage router through the IP network connected to the storage router's Gigabit Ethernet interfaces. The storage router accesses the storage devices or intelligent storage array connected to the Fibre Channel interfaces. Access to the FC interfaces is made through the internal FC initiator interface configured for iSCSI traffic.

The internal FC initiator interface configured for FCIP allows the FC hosts or FC devices to connect to one or more Fibre Channel interfaces of the peer systems, which are connected to the IP network through a Gigabit Ethernet interface. Through the IP network, each FCIP instance accesses its peer, thereby connecting the SANs. Redundant network structures are also supported.

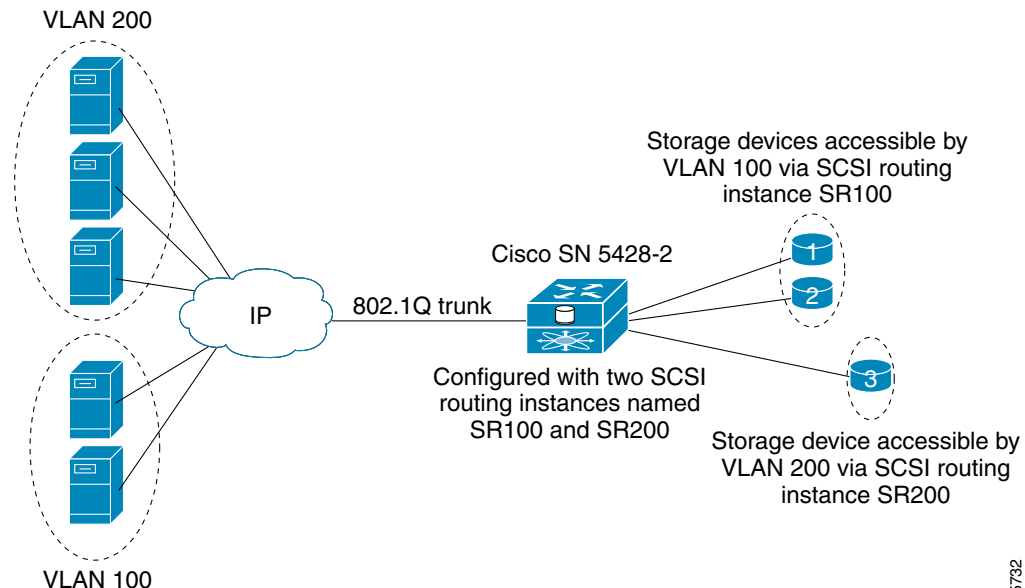
A management station manages the storage router through an IP network connected to the management interface. A storage router deployed for SCSI routing and FCIP can also participate in a cluster to provide HA operations for SCSI routing. When the storage router is deployed for transparent SCSI routing and FCIP, the HA operations for SCSI routing are controlled in the intelligent storage array, and the HA interface on the storage router is disabled.

## VLAN Access Overview

SN 5428-2 VLAN access provides IP hosts with access to storage devices according to the VLAN to which each host belongs.

[Figure 1-21](#) shows a sample network that employs SN 5428-2 VLAN access. In the figure, an SN 5428-2 Gigabit Ethernet interface is connected to an IP network through an IEEE 802.1Q trunk; the SN 5428-2 Fibre Channel interfaces are connected to storage devices 1, 2, and 3. The SN 5428-2 is configured with two SCSI routing instances named SR100 and SR200. The IP network contains two VLANs: VLAN 100 and VLAN 200. The SCSI routing instance, SR100, is configured to allow the hosts in VLAN 100 to access storage devices 1 and 2. The SCSI routing instance, SR200, is configured to allow the hosts in VLAN 200 to access storage device 3.

Figure 1-21 VLAN Access Overview



If the SN 5428-2 is used in a Cisco switched network environment, configure the SN 5428-2 to use the Cisco proprietary VLAN Trunking Protocol (VTP). With VTP, the SN 5428-2 will exchange VTP packets with an externally attached switch to dynamically learn about the VLANs that are accessible in the IP network. The SN 5428-2 then uses VTP to propagate VLAN information around the switched network using layer 2 multicast packets.

If the SN 5428-2 is used in a non-Cisco switched network environment, configure the SN 5428-2 for VLAN without using VTP. The SN 5428-2 does not exchange VTP packets to learn about the VLANs in the network. Instead, you must manually assign VLANs in the network with a VLAN identifier (VID) number. You can optionally assign each VLAN with a unique name and manually set the MTU size.

If the SN 5428-2 participates in a cluster, the VLAN information configured for the SN 5428-2 is propagated to all storage routers in the cluster.

The SN 5428-2 uses IEEE 802.1Q standard for VLAN encapsulation. With 802.1Q encapsulation, VLAN information is carried in packets sent and received through the SN 5428-2 Gigabit Ethernet interface. These packets contain the VID and other VLAN information needed for VLAN members to participate in a VLAN.

A VLAN is granted access to storage devices via a SCSI routing instance configured in the SN 5428-2. The iSCSI targets assigned to the SCSI routing instance determine which storage devices the VLAN can access.

## Zoning Overview

The SN 5428-2 supports FC fabric zoning. Zoning enables you to divide the devices of the fabric into zones for more efficient and secure communication among functionally grouped nodes.



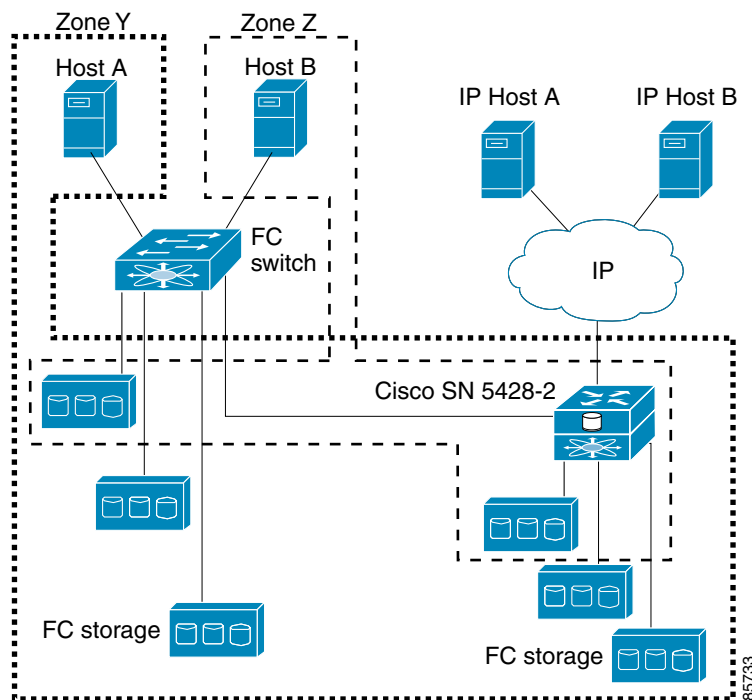
**Note**

FC fabric zoning participation is not supported in SN 5428-2s deployed for transparent SCSI routing.

Once initiator WWPN1 and initiator WWPN2 are configured, the SN 5428-2 will support fabric zoning using the WWPNs of each FC storage device attached, either directly or on a fabric. The IP hosts participate in zoning via the access list. See the “[SCSI Routing Mapping and Access Control](#)” section on page 1-6 for more information about access lists.

Figure 1-22 shows an example network that employs SN 5428-2 FC fabric zoning. In the figure, the SN 5428-2 is connected to IP hosts A and B through the Gigabit Ethernet interface; the SN 5428-2 Fibre Channel interfaces are connected to FC storage and a zoned FC switched fabric. The IP hosts are allowed access to storage devices in both zones (Y and Z) and storage devices attached to the SN 5428-2. Zone Y has access to all the SN 5428-2 storage devices and zone Z has access to one storage device on the SN 5428-2.

**Figure 1-22 FC Fabric Zoning Overview**



Zoning comprises zones, zone sets, aliases, and zone databases.

A zone is a named group of devices that can communicate with each other. Membership in a zone is defined by the device WWPN. Zone members can communicate only with members of the same zone. The SN 5428-2 supports the soft zone type. Soft zones can overlap; that is, a device can be a member of more than one soft zone.

To make it easier to add devices to one or more zones, you can create an alias. An alias is a named set of devices that are grouped together for convenience. You can add an alias to one or more zones. However, you cannot add a zone to an alias, nor can an alias be a member of another alias.

You can also use an alias to name a single device. This allows you to refer to the device by the alias name rather than the WWPN of the device.

A zone set is a named group of zones. A zone can be a member of more than one zone set.

To apply zoning to a fabric, enable the appropriate zone set. When you enable (or “activate”) a zone set, the system compiles zone sets of the same name from all SN 5428-2s and switches in the fabric, and then redistributes this merged active zone set back to every SN 5428-2 and switch in the fabric. Therefore, every SN 5428-2 and switch in the fabric will have identical active zone sets.

The SN 5428-2 supports multiple zone sets, but only one zone set can be active in the fabric at any given time.

Each SN 5428-2, like other switches in the zoned FC switched fabric, has its own zoning database. The zoning database is made up of all aliases, zones, and zone sets that have been created on the SN 5428-2 or received from other switches in the fabric. When you modify aliases, zone or zone sets, the changes are immediately saved to the SN 5428-2 bootable configuration.

The Auto Save zoning configuration parameter controls whether zoning changes received from other SN 5428-2s or switches in the fabric are automatically saved to the SN 5428-2s zoning database.

See [Chapter 5, “Configuring Fibre Channel Interfaces,”](#) for more information about configuring the SN 5428-2 for FC fabric zoning.

## Fibre Channel Interface Overview

The SN 5428-2 has an integrated switch component with Fibre Channel interfaces that support the following port types: E\_Port, F\_Port, FL\_Port, G\_Port, GL\_Port, TL\_Port, and donor port. The storage router supports a maximum of 7 FC Interswitch Link (ISL) hops.

The SN 5428-2 FC interfaces support GS-3 management server commands. This allows management of the SN 5428-2 integrated switch component through the Fibre Channel interfaces (in-band management). See the **interface fc? ms-enable** command in the *Cisco SN 5400 Series Storage Router Command Reference* for more information about enabling the FC interfaces for GS-3 commands.

See [Chapter 5, “Configuring Fibre Channel Interfaces,”](#) for more information about configuring FC ports.

## Gigabit Ethernet Interface Overview

Each of the two 1-Gigabit Ethernet interfaces on the SN 5428-2 (GE 1 and GE 2) provide the following capabilities:

- Multiple IP addresses per SCSI routing instance—allows IP hosts to connect to SCSI routing instances via one or more IP addresses. Each Gigabit Ethernet interface can be configured with up to 12 unique IP addresses, which provides a maximum of 24 unique IP addresses per SN 5428-2 Storage Router. If VLAN access is used, the maximum number of unique IP addresses per Gigabit Ethernet interface increases to 16. This provides a maximum of 32 unique IP addresses per SN 5428-2 Storage Router when configured with VLAN.
- Assignment of a secondary interface per SCSI routing instance—allows the same IP address to be assigned to each Gigabit Ethernet interface; one interface is assigned as primary and one interface is assigned as secondary. If the primary Gigabit Ethernet interface loses connection to the host and if the secondary connection is assigned and still connected, the IP address moves to the secondary Gigabit Ethernet interface, which then becomes active.
- Assignment as an interface to an FCIP peer—allows assignment of an IP address as a primary Gigabit Ethernet interface between an FCIP instance and an FCIP peer. Each SN 5428-2 can be configured with up to two FCIP instances, and each FCIP instance can be configured with one peer, for a maximum of two FCIP peers per SN 5428-2 Storage Router when configured for FCIP.

- Assignment of a secondary interface per FCIP instance—allows the same IP address to be assigned to each Gigabit Ethernet interface configured for an FCIP instance; one interface is assigned as primary and one interface is assigned as secondary. If the primary interface loses connection to the network and remains down for two seconds, the IP address moves to the secondary Gigabit Ethernet interface, which then becomes active.
- Assignment as a management IP address—allows each Gigabit Ethernet interface to have one IP address assigned per logical interface, as a management interface. This IP address is in addition to any multiple IP address(es) per SCSI routing instance or FCIP instance assigned.
- Assignment of a secondary management IP address—allows the same IP address to be assigned to each Gigabit Ethernet interface configured as a management interface; one interface is assigned as primary and one interface is assigned as secondary. If connection to the primary Gigabit Ethernet maintenance interface is lost and if the secondary maintenance interface connection is assigned and connected, the IP address moves to the secondary Gigabit Ethernet interface, which then allows management access.

## Authentication Overview

Authentication is a software service that is available in each SN 5428-2. It provides a method of identifying users (including login and password dialog, challenge and response, and messaging support) prior to receiving access to the requested object, function, or network service. The SN 5428-2 supports three types of authentication:

- iSCSI authentication—provides an authentication mechanism to authenticate IP hosts that request access to storage. An IP host, acting as an iSCSI initiator, can also verify the identity of an iSCSI target assigned to a SCSI routing instance, which responds to the request, resulting in a two-way authentication.
- Enable authentication—provides a mechanism to authenticate users requesting Administrator mode access to an SN 5428-2 management session via the CLI **enable** command or an FTP session.
- Login authentication—provides a mechanism to authenticate users requesting access to the SN 5428-2 in Monitor mode via the login process from a Telnet session, SSH session or the SN 5428-2 console.

Authentication is provided by an AAA (authentication, authorization, and accounting) subsystem configured in each SN 5428-2. AAA is Cisco's architectural framework for configuring a set of three independent security functions in a consistent and modular manner: authentication, authorization, and accounting. The SN 5428-2 Storage Router software implements the authentication function.

AAA authentication is configured by defining a list of authentication services. iSCSI authentication, which uses a AAA authentication services list, can be enabled for specific SCSI routing instances in an SN 5428-2.

When iSCSI authentication is enabled, IP hosts (with iSCSI drivers) must provide user name and password information each time an iSCSI TCP connection is established. With two-way authentication, the SCSI routing instance to which an iSCSI target has been assigned responds to the authentication request with an assigned username and password. iSCSI authentication uses the iSCSI CHAP (Challenge Handshake Authentication Protocol) authentication method.

See [Chapter 9, "Configuring Authentication,"](#) for more information about configuring authentication services.



# SN 5428-2 Cluster Management Overview

You can configure Cisco SN 5428-2 Storage Routers in a cluster to allow the storage routers to back each other up in case of failure.

**Note**

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A storage router can participate in a cluster only if it is deployed for SCSI routing.

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An SN 5428-2 Storage Router can be configured in a cluster with one other SN 5428-2, or with an SN 5428, connected as follows:

- Connected to the same hosts
- Connected to the same storage systems
- Connected to each other through their management and high availability (HA) interfaces

In a cluster, storage routers continually exchange HA information to propagate configuration data to each other and to detect failures in the cluster. The storage routers exchange HA information through two separate networks: one connected to the management interface of each storage router and the other connected to the HA interface of each storage router. To make sure that HA information is exchanged reliably between storage routers, the storage routers balance the transmission of HA information between the management and the HA interfaces.

A storage router cluster supports up to 12 active instances of SCSI routing. For example, if one storage router is already running two instances, it is eligible to run up to ten additional instances. At any given time, an instance of SCSI routing can run on only one storage router in a cluster. The instance continues running on the storage router where it was started until one of the following actions occurs:

- The instance is explicitly stopped or failed over to the other storage router in the cluster.
- The instance automatically fails over to another storage router because an interface is unavailable or another software or hardware problem occurs. This automatic fail over uses intelligent eligibility guidelines to determine fail over.

See [Chapter 10, “Configuring a High Availability Cluster,”](#) for more information about configuring a high availability cluster.

## Interface Naming

Configuring the SN 5428-2 Storage Router software requires that you understand hardware interface naming. This section describes the interface naming system used with the SN 5428-2 Storage Router hardware.

Each storage router interface is assigned a three-character name consisting of two lower-case letters followed by a number. The letters designate the interface type; the number designates the chassis slot occupied by the interface (See [Figure 1-23](#)).

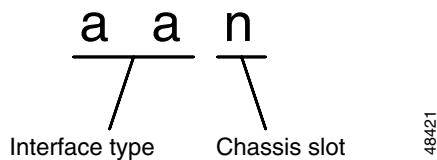
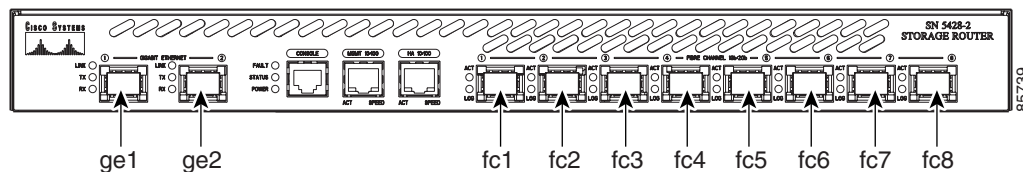
**Figure 1-23 SN 5428-2 Interface Naming System**

Table 1-6 shows valid interface type designators for the SN 5428-2; Figure 1-24 shows each interface location and interface name on the SN 5428-2.

**Table 1-6 Interface Type Designators**

Interface Type	Description
fc	Fibre Channel
ge	Gigabit Ethernet

**Figure 1-24 SN 5428-2 Chassis-Slot Numbering**

## Where to Go Next

When you are ready to configure the SN 5428-2 software, proceed to one of the following chapters in this configuration guide according to your needs:

- [Chapter 2, “First-Time Configuration”](#)—For initial setup or after configuration has been reset to factory default configuration
- [Chapter 3, “Configuring System Parameters”](#)—Using the CLI for setting up and modifying system parameters
- [Chapter 4, “Configuring for VLAN”](#)—Using the CLI for setting up and modifying VLAN configurations
- [Chapter 5, “Configuring Fibre Channel Interfaces”](#)—Using the CLI for setting up and modifying FC interface and zoning configurations
- [Chapter 6, “Configuring SCSI Routing”](#)—Using the CLI for setting up and modifying SCSI routing configurations
- [Chapter 7, “Configuring Transparent SCSI Routing”](#)—Using the CLI for setting up and modifying transparent SCSI routing configurations
- [Chapter 8, “Configuring FCIP”](#)—Using the CLI for setting up and modifying FCIP configurations
- [Chapter 9, “Configuring Authentication”](#)—Using the CLI for setting up and modifying authentication configurations

- [Chapter 10, “Configuring a High Availability Cluster”](#)—Using the CLI for setting up and modifying cluster configurations
- [Chapter 11, “Maintaining and Managing the SN 5428-2 Storage Router”](#)—Downloading software, backing up and restoring configurations, and other related maintenance and management tasks

**Note**

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This guide does not describe how to configure iSCSI drivers. Install and configure iSCSI drivers according to readme files for each driver.

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