

Configuring FICON

Fibre Connection (FICON) interface capabilities enhance the Cisco MDS 9000 Family by supporting both open systems and mainframe storage network environments. The control unit port (CUP) also is supported which allows in-band management of the switch from FICON processors.

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About FICON

The Cisco MDS 9000 Family supports the Fibre Channel Protocol (FCP), FICON, iSCSI, NVMe, and FCIP capabilities within a single, high-availability platform (see Figure 1: Shared System Storage Network, on page 2).

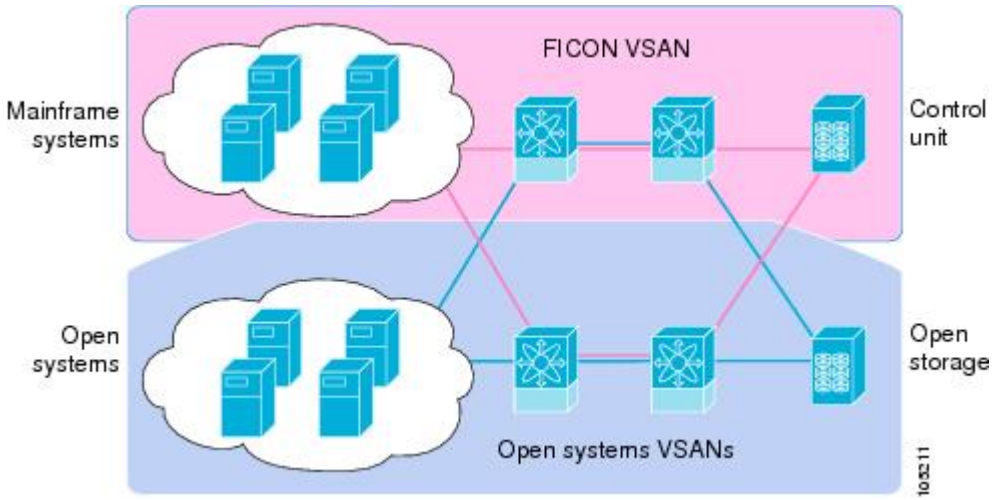
The FICON feature is supported only with the following platforms:

- Cisco MDS 9710 switches
- Cisco MDS 9706 switches
- Cisco MDS 9250i switches
- Cisco MDS 9220i switches
- Cisco MDS 9148V switches

FCP, NVMe, and FICON are different FC4 protocols and their traffic is independent of each other. Devices using these protocols should be isolated using VSANs.

The fabric binding feature helps prevent unauthorized switches from joining the fabric or disrupting current fabric operations (see the *Cisco MDS 9000 Series Security Configuration Guide*). The Registered Link Incident Report (RLIR) application provides a method for a switch port to send an LIR to a registered Nx port.

Figure 1: Shared System Storage Network



This section includes the following topics:

FICON Requirements

The FICON feature has the following requirements:

- You can implement FICON features in the following switches:
  - Cisco MDS 9706 and MDS 9710 switches
  - Cisco MDS 9250i and MDS 9220i switches

Although in earlier releases the MAINFRAME_PKG license was required to configure FICON, beginning with NX-OS Release 9.4(1a), the FICON feature is a base feature of NX-OS and no special license is required.

MDS-Specific FICON Advantages

This section explains the additional FICON advantages in Cisco MDS switches and includes the following topics:

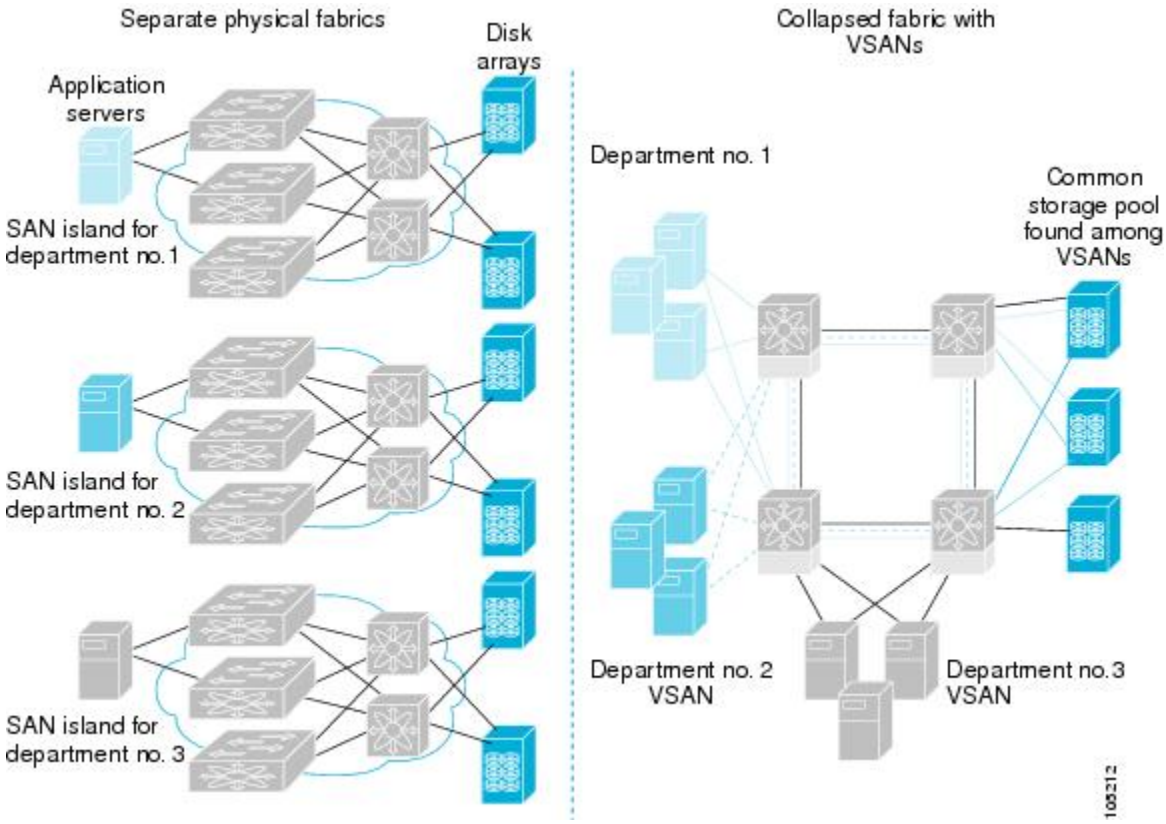
Fabric Optimization with VSANs

Generally, separate physical fabrics have a high level of switch management and have a higher implementation cost. The ports in each island may also be overprovisioned depending on the fabric configuration.

By using the Cisco MDS-specific VSAN technology, you can have greater efficiency between these physical fabrics by lowering the cost of overprovisioning and reducing the number of switches to be managed. VSANs

also help you to move unused ports nondisruptively and provide a common redundant physical infrastructure (see Figure 2: VSAN-Specific Fabric Optimization, on page 3).

Figure 2: VSAN-Specific Fabric Optimization



VSANs enable global SAN consolidation by allowing you to convert existing SAN islands into virtual SAN islands on a single physical network. It provides hardware-enforced security and separation between applications or departments to allow coexistence on a single network. It also allows virtual rewiring to consolidate your storage infrastructure. You can move assets between departments or applications without the expense and disruption of physical relocation of equipment.

Note While you can configure VSANs in any Cisco MDS switch, you can only enable FICON in up to eight of these VSANs on switches that support the FICON feature.

Mainframe users can think of VSANs as being like FICON LPARs in the MDS SAN fabric. You can partition switch resources into FICON LPARs (VSANs) that are isolated from each other, in much the same way that you can partition resources on an IBM Z Systems mainframe server. Each VSAN has its own set of fabric services (such as fabric server, name server, and zone server), FICON CUP, domain ID, Fabric Shortest Path First (FSPF) routing, operating mode, and security profile. FICON VSANs can span line cards and are dynamic in size. For example, one FICON VSAN with 8 ports can span 8 different line cards. FICON VSANs can also include ports on more than one switch in a cascaded configuration. The consistent fairness of the Cisco MDS 9000 switching architecture means that “all ports are created equal,” simplifying provisioning by eliminating the “local switching” issues seen on other vendors’ platforms. Addition of ports to a FICON VSAN is a

nondisruptive process. The maximum number of ports for a FICON VSAN is 254 per switch due to FICON addressing limitations.

FCIP Support

The multilayer architecture of the Cisco MDS 9000 Family enables a consistent feature set over protocol-agnostic switch fabric. Cisco MDS 9700 Series and 9200 Series switches transparently integrate FCP, NVMe, FICON, and Fibre Channel over IP (FCIP) in one system. The FICON over FCIP feature enables cost-effective access to remotely located mainframe resources. With the Cisco MDS 9000 Family platform, storage replication services such as IBM PPRC can be extended over metro to global distances using ubiquitous IP infrastructure which simplifies business continuance strategies.

For more information, see the *Cisco MDS 9000 Series IP Services Configuration Guide*.

PortChannel Support

The Cisco MDS implementation of FICON provides support for efficient utilization and increased availability of Inter-Switch Links (ISLs) necessary to build stable large-scale SAN environments. PortChannels ensure an enhanced ISL availability and performance in Cisco MDS switches.

Refer to the *Cisco MDS 9000 Series Interfaces Configuration Guide* for more information on PortChannels.

VSANs for FICON and FCP Mixing

Cisco MDS 9000 Family FICON-enabled switches simplify deployment of even the most complex mixed environments. Multiple logical FICON, Z-Series Linux/FCP, and Open-Systems Fibre Channel Protocol (FCP) fabrics can be overlaid onto a single physical fabric by simply creating VSANs as required for each service. VSANs provide both hardware isolation and protocol-specific fabric services, eliminating the complexity and potential instability of zone-based mixed schemes.

By default, the FICON feature is disabled in all switches in the Cisco MDS 9000 Family. When the FICON feature is disabled, FC IDs can be allocated seamlessly. Mixed environments are addressed by the Cisco NX-OS software. The challenge of mixing FCP and FICON protocols are addressed by Cisco MDS switches when implementing VSANs.

Switches and directors in the Cisco MDS 9000 Family support FCP and FICON protocol mixing at the port level. If these protocols are mixed in the same switch, you should use VSANs to isolate FCP and FICON ports.

Tip When creating a mixed environment, place all FICON devices in one VSAN (other than the default VSAN) and segregate the FCP switch ports in a separate VSAN (other than the default VSAN). This isolation ensures proper communication for all connected devices. The default VSAN (VSAN 1) should never be used for production services.

Cisco MDS 9000-Supported FICON Features

The Cisco MDS 9000 Family FICON features include:

- Flexibility and investment protection — The Cisco MDS 9000 Family shares common switching and service modules across the Cisco MDS 9700 Modular switches.

See the *Cisco MDS 9700 Series Multilayer Director Hardware Installation Guide*, the *Cisco MDS 9250i Multiservice Fabric Switch Hardware Installation Guide*, and the *Cisco MDS 9220i Fabric Switch Hardware Installation Guide.*

- High-availability FICON-enabled director — Cisco MDS 9700 Series combines nondisruptive software upgrades, stateful process restart and failover, and full redundancy of all major components for a new standard in director-class availability. The Cisco MDS 9710 supports up to 384 autosensing, 64/32/16/10/8/4/2-Gbps Fibre Channel ports for FCP, NVMe, and FICON connections as well as 1/10/25/40 Gbps IP Services ports for FCIP links. The Cisco MDS 9706 supports up to 192 autosensing, 64/32/16/10/8/4/2-Gbps Fibre Channel ports for FCP, NVMe, and FICON connections as well as 1/10/25/40 Gbps IP Services ports for FCIP links. See the *Cisco MDS 9000 Series High Availability Configuration Guide*.
- Infrastructure protection — Common software releases provide infrastructure protection across all Cisco MDS 9000 platforms. See the *Cisco MDS 9000 NX-OS Software Upgrade and Downgrade Guide*.
- VSAN technology — Cisco MDS 9000 Family provides VSAN technology for hardware-enforced, isolated environments within a single physical fabric for secure sharing of physical infrastructure and enhanced FICON mixed support. See Configuring and Managing VSANs
- Port-level configurations — There are BB credits, beacon mode, and port security for each port. See the *Cisco MDS 9000 Series Interfaces Configuration Guide* for information about buffer-to-buffer credits, beacon LEDs, and trunking.
- Alias name configuration — Provides user-friendly aliases instead of the WWN for switches and attached node devices. See the Configuring and Managing Zones.
- Comprehensive security framework — Cisco MDS 9000 Family supports RADIUS and TACACS+ authentication, Simple Network Management Protocol Version 3 (SNMPv3), role-based access control, Secure Shell Protocol (SSH), Secure File Transfer Protocol (SFTP), VSANs, hardware-enforced zoning, ACLs, fabric binding, Fibre Channel Security Protocol (FC-SP), LUN zoning, read-only zones, and VSAN-based access control. See the *Cisco MDS 9000 Series Security Configuration Guide* for information about RADIUS, TACACS+, FC-SP, and DHCHAP.
- Traffic encryption — IPSec is supported over FCIP. You can encrypt FICON, FCP, and NVMe traffic that is carried over FCIP. See the *Cisco MDS 9000 Series Comprehensive security framework Security Configuration Guide*.
- Local accounting log — View the local accounting log to locate FICON events. For more information about MSCHAP authentication, and local AAA services, see the *Cisco MDS 9000 Family NX-OS Security Configuration Guide*.
- Unified storage management — Cisco MDS 9000 FICON-enabled switches are fully IBM CUP standard compliant for FICON in-band communications with the IBM Z Systems mainframe server. See the CUP In-Band Management, on page 40.
- Port address-based configurations — FICON port name attribute can be configured for ports in FICON VSANs. See the Configuring FICON Ports, on page 25.
- You can display the following information:
  - Individual Fibre Channel ports, such as the port name, port number, Fibre Channel address, operational state, type of port, and login data.
  - Nodes attached to ports.
  - Port performance and statistics.

- Configuration files — Store and apply configuration files. See the FICON Configuration Files, on page 32.
- FICON and Open Systems Management Server features if installed. —See the VSANs for FICON and FCP Mixing, on page 4.
- Enhanced cascading support—See the CUP In-Band Management, on page 40.
- Date and time — Enable the IBM Z Systems Server to set the date and time for FICON VSANs on the switch. See the Allowing the Host to Control the Timestamp , on page 22.
- Configure SNMP trap recipients and community names — See the Configuring SNMP Control of FICON Parameters, on page 23.
- Call Home configurations — Configure the director name, location, description, and contact person. See the *Cisco MDS 9000 Series System Management Configuration Guide.*
- Configure preferred domain ID, FC ID persistence, and principal switch priority — For information about configuring domain parameters, see the *Cisco MDS 9000 Series System Management Configuration Guide*.
- Sophisticated SPAN diagnostics — Cisco MDS 9000 Family provides industry-first intelligent diagnostics, protocol decoding, and network analysis tools as well as integrated Call Home capability for added reliability, faster problem resolution, and reduced service costs. For information about monitoring network traffic using SPAN, see the *Cisco MDS 9000 Series System Management Configuration Guide.*
- Configure R_A_TOV, E_D_TOV — See the "Fibre Channel Time-Out Values" section on page 11-1 .
- Director-level maintenance tasks—Perform maintenance tasks for the director including maintaining firmware levels, accessing the director logs, and collecting data to support failure analysis. For information about monitoring system processes and logs refer to the *Cisco MDS 9000 Series System Management Configuration Guide*
- Port-level incident alerts—Display and clear port-level incident alerts. See the Clearing RLIR Information, on page 32.

FICON Cascading

The Cisco MDS NX-OS software allows multiple switches in a FICON network. To configure multiple switches, you must enable and configure fabric binding in each switch. See the *Cisco MDS 9000 Series Security Configuration Guide*).

The FICON topologies supported on the Cisco MDS 9000 Series switches are:

- **Single hop/traditional cascade** – This topology has two switches with a single hop (or set of ISLs between the switches. This support has been around since the introduction of FICON support in 2004.
- **Multi-hop cascade** – This topology allows for up to four (4) switches between the host channels and their associated control units. The ISLs between these switches can be fibre channel ISLs, port channels made of fibre channel ISLs, FCIP ISLs, or port channels made of FCIP ISLs. Multi-hop cascade was introduced in approximately 2017 and begins with the z13 System Z server forward.

FICON VSAN Prerequisites

To ensure that a FICON VSAN is operationally up, be sure to verify the following requirements:

- Set the default zone to permit, if you are not using the zoning feature or create a zoneset and associated zones for the VSAN. See Configuring zoning for FICON VSANs.
- Enable in-order delivery on the VSAN. See Configuring Fibre Channel Routing Services and Protocols.
- Enable (and if required, configure) fabric binding on the VSAN. For more information about Fabric Binding, refer to the *Cisco MDS 9000 Series Security Configuration Guide*.
- Verify that conflicting FC IDs do not exist in the switch by configuring unique static domain IDs for each FICON VSAN on the switch or in the FICON fabric, if using enhanced FICON cascading. For information about configuring domain parameters, seethe *Cisco MDS 9000 Series System Management Configuration Guide*.
- Verify that the configured domain ID and requested domain ID match on the switch and these match what is configured for the switch in the HCD definitions on the IBM Z Systems Server. For information about configuring domain parameters, see the *Cisco MDS 9000 Series System Management Configuration Guide*.
- Add the CUP (area FE) to the zone, if you are using zoning. See the CUP In-Band Management, on page 40.

If any of these requirements are not met, the FICON feature cannot be enabled.

FICON Port Numbering

With reference to the FICON feature, ports in Cisco MDS switches are identified by a statically defined 8-bit value known as the *port number*. A maximum of 255 port numbers are available. You can use the following port numbering schemes:

- Default port numbers
- User Assigned port numbers

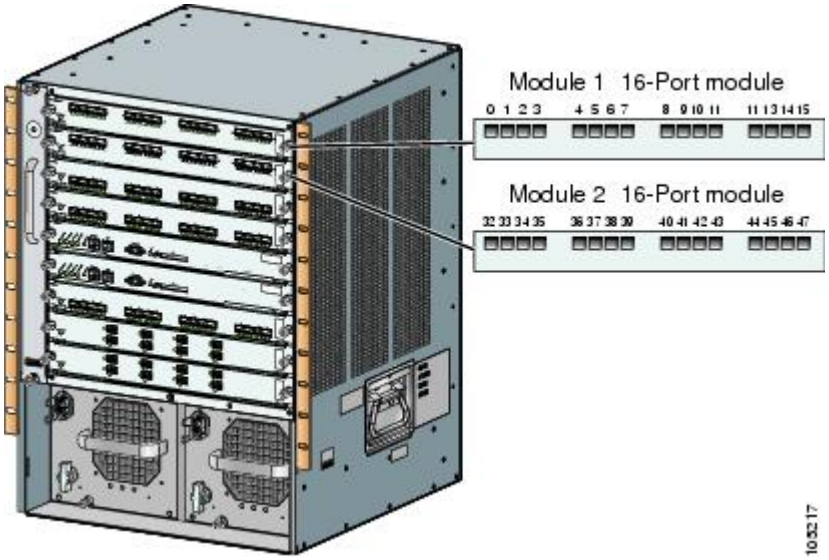
This section includes the following topics:

Note You must enable the FICON feature on the switch assigning FICON port numbers (see the About Enabling FICON on a VSAN, on page 14).

Default FICON Port Numbering Scheme

Default FICON port numbers are assigned by the Cisco MDS NX-OS software based on the module and the slot in the chassis. The first port in a switch always starts with a zero (0) (see Figure 3: Default FICON Port Number in Numbering on the Cisco MDS 9000 Family Switch, on page 8).

Figure 3: Default FICON Port Number in Numbering on the Cisco MDS 9000 Family Switch



The default FICON port numbering is assigned based on the front panel location of the port and is specific to the slot in which the module resides. Forty-eight (48) port numbers are assigned to each slot on all Cisco MDS 9000 Family switches. These default numbers are assigned regardless of the module's physical presence in the chassis, the port status (up or down), or the number of ports on the module (24 or 48). If a module has fewer ports than the number of port numbers assigned to the slot, then the excess port numbers are unused. If a module has more ports than the number of port numbers assigned to the slot, the excess ports cannot be used for FICON traffic unless you manually assign the port numbers.

Note You can use the **ficon slot assign port-numbers** command to make use of excess ports mapped to a slot by default that are not addressable due to the module not having ports for them by manually assigning more port numbers to other slots. Before doing this, however, we recommend that you review the default port number assignments for Cisco MDS 9000 switches shown in Table 3: Default FICON Settings , on page 46 and Table 1: Default FICON Port Numbering in the Cisco MDS 9000 Family, on page 9, and that you read the following sections to gain a complete understanding of FICON port numbering: About the Reserved FICON Port Numbering Scheme, on page 10, FICON Port Numbering Guidelines, on page 11, and Assigning FICON Port Numbers to Slots, on page 11.

Note Only Fibre Channel, Port Channel, and FCIP ports are mapped to FICON port numbers. Other types of interfaces do not have a corresponding port number.

The following table lists the default port number assignment for the Cisco MDS 9000 Family of switches and directors.

Table 1: Default FICON Port Numbering in the Cisco MDS 9000 Family

Product	Slot Number	Port Number Allocation	To Port Channel/FCIP	Special (not assignable) Port Numbers
Cisco MDS 9250i Series	Slot 1	0 through 39	240 through 253	254 through 255
Cisco MDS 9220i Series	Slot 1	0 through 11	240 through 253	254 through 255
Cisco MDS 9710 Director	Slot 1	0 through 47	240 through 253	254 through 255
	Slot 2	48 through 95		
	Slot 3	96 through 143		
	Slot 4	144 through 191		
	Slot 5 - Supervisor	None		
	Slot 6 - Supervisor	None		
	Slot 7	192 through 239		
	Slot 8	None		
	Slot 9	None		
	Slot 10	None		
Cisco MDS 9706	Slot 1	0 through 47	240 through 253	254 through 255
	Slot 2	48 through 95		
	Slot 3 – Supervisor	None		
	Slot 4 – Supervisor	None		
	Slot 5	96 through 143		
	Slot 6	144 through 191		

Port Addresses

Following the deprecation of FICON Port Swap in NX-OS 9.4(1a), the port address is always the same as the port number.

Implemented and Unimplemented Port Addresses

An implemented port refers to any port address that is either assigned by default or is assignable using the **ficon slot x assign port-numbers** command. On the MDS 9000 Series switches, all port numbers from 0 to 253 are implemented giving customers flexibility for what values are used. The only unimplemented port is 255 while the value of 254 is always reserved for the CUP device.

About the Reserved FICON Port Numbering Scheme

A range of 254 port numbers are available for you to assign to all the ports on a switch. On the Cisco MDS 9710, you can have more than 254 physical ports on a switch and the excess ports do not have port numbers in the default numbering scheme. When you have more than 254 physical ports on your switch, you can have ports without a port number assigned if they are not in a FICON VSAN, or you can assign duplicate port numbers if they are not used in the same FICON VSAN. For example, you can configure port number 1 on interface fc1/1 in FICON VSAN 10 and fc10/1 in FICON VSAN 20.



Note A VSAN can have a maximum of 254 port numbers (0-253) and always has the FICON CUP device with port number 254 (0xFE).



Note FICON port numbers are not changed for ports that are active. You must first disable the interfaces using the **shutdown** command.



Note You can configure port numbers even when no module is installed in the slot.

Installed and Uninstalled Ports

An installed port refers to a port for which all required hardware is present. A specified port number in a VSAN can be implemented, and yet not installed, if any of the following conditions apply:

- The module is not present—For example, if module 1 is not physically present in slot 1 in a Cisco MDS 9710 Director, ports 0 to 47 are considered uninstalled.
- The small form-factor pluggable (SFP) port is not present—For example, if a 48-port module is inserted in slot 2 in a Cisco MDS 9710 Director and no SFPs are inserted into the module, ports 48 to 95 are considered uninstalled.
- For slot 1, ports 0 to 47 have been assigned by default. Only the physical port fc1/5 with port number 4 is in VSAN 2. The rest of the physical ports are not in VSAN 2. The port numbers 0 to 254 are considered implemented for any FICON-enabled VSAN. Therefore, VSAN 2 has port numbers 0 to 254 and one physical port, fc1/4. The corresponding physical ports 0 to 3, and 5 to 254 are not in VSAN 2. When the FICON VSAN port address is displayed, those port numbers with the physical ports not in VSAN 2 are not installed (for example, ports 0 to 3, or 5 to 254).

Another scenario is if VSANs 2 through 5 are FICON-enabled, and trunking-enabled interface fc1/1 has VSANs 4 through 10, then port address 0 is uninstalled in VSAN 2 and 3.

- The port is part of a PortChannel—For example, if interface fc 1/1 is part of PortChanne1 5, port address 0 is uninstalled in all FICON VSANs. See Default Settings, on page 46.

FICON Port Numbering Guidelines

The following guidelines apply to FICON port numbers:

- Supervisor modules do not have port number assignments.
- Port numbers do not change based on TE ports. As TE ports appear in multiple VSANs, chassis-wide unique port numbers should be reserved for TE ports.
- Each PortChannel must be explicitly associated with a FICON port number from the pool of assigned logical port numbers.
- When a Fibre Channel ISL becomes a member of a PortChannel, the FICON Port number for this physical interface becomes uninstalled for this VSAN as it is now part of the FICON Port number assigned to the PortChannel.
- When a Fibre Channel ISL is removed from a PortChannel, the FICON port number for this physical interface becomes installed for this VSAN(s) that is it a part of.
- Each FCIP interface must be explicitly associated with a logical FICON port number.
- When an FCIP interface becomes a member of a PortChannel (which will have its own logical FICON port number), it also retains the logical FICON Port number associated with the FCIP interface itself.
- If logical port numbers are not assigned for PortChannels or FCIP interfaces, then these interfaces will not come up for the FICON VSAN(s).

See the About Port Numbers for FCIP and PortChannel, on page 12.

Assigning FICON Port Numbers to Slots

You can use the **show ficon port-number assign** and **show ficon first-available port-number** commands to determine which port numbers to use.

Caution When you assign, change, or release a port number, the port reloads.

To assign FICON port numbers to a slot, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon slot 3 assign port-numbers 0-15, 48-63**

Reserves FICON port numbers 0 through 15 and 48 through 63 for up to 32 interfaces in slot 3.

If there are more interfaces in slot 3, they are not usable for FICON with this configuration.

Step 3 switch(config)# **ficon slot 3 assign port-numbers 0-15, 17-48**

Reserves FICON port numbers 0 through 15 for the first 16 interfaces and 17 through 48 for the next 32 interfaces in slot 3.

Step 4 switch(config)# **ficon slot 3 assign port-numbers 0-63**

Reserves FICON port numbers 0 through 63 for up to 64 interfaces in slot 3.

Step 5 switch(config)# **ficon slot 3 assign port-numbers 0-15, 56-63**

Changes the reserved FICON port numbers for up to 24 interfaces in slot 3.

Step 6 (Optional) switch(config)# **no ficon slot 3 assign port-numbers 0-15, 56-63**

Releases the FICON port numbers.

Displaying the FICON Port Number Assignments

Use the **show ficon port-numbers assign** command to display the port numbers assigned on the switch.

```
switch# show ficon port-numbers assign
ficon slot 1 assign port-numbers 0-47
ficon slot 2 assign port-numbers 48-95
ficon slot 3 assign port-numbers 96-143
ficon slot 4 assign port-numbers 144-191
ficon logical-port assign port-numbers 240-253
```

Use the **show ficon port-numbers assign slot** command to display the port numbers assigned to a specific slot.

```
switch# show ficon port-numbers assign slot 2
ficon slot 2 assign port-numbers 48-95
```

Use the **show ficon port-numbers assign** command to display the port numbers reserved for logical ports.

```
switch# show ficon port-numbers assign logical-port
ficon logical-port assign port-numbers 240-253
```

About Port Numbers for FCIP and PortChannel

FCIP and PortChannels cannot be used in a FICON-enabled VSAN unless they are explicitly bound to a port number.

See the Configuring FICON Ports, on page 25, and the Reserving FICON Port Numbers for FCIP and PortChannel Interfaces, on page 13, and the Binding Port Numbers to FCIP Interfaces , on page 26.

You can use the default port numbers if they are available (see Table 1: Default FICON Port Numbering in the Cisco MDS 9000 Family, on page 9) or if you reserve port numbers from the pool of port numbers that are not reserved for Fibre Channel interfaces (see the About the Reserved FICON Port Numbering Scheme, on page 10).

To find the first available port number to bind an FCIP or PortChannel interface, use the **show ficon first-available port-number** command (see Displays the Available Port Numbers, on page 42).

Tip The **show ficon vsan portaddress brief** command displays the port number to interface mapping. You can assign port numbers in the PortChannel/FCIP range that are not already assigned to a PortChannel or FCIP interface (see Displays Port Address Information in a Brief Format, on page 42).

Reserving FICON Port Numbers for FCIP and PortChannel Interfaces

You must reserve port numbers for logical interfaces, such as FCIP and PortChannels, if you plan to use them.

To reserve FICON port numbers for logical interfaces, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon logical-port assign port-numbers 230-249**

Reserves port numbers 230 through 249 for FCIP and PortChannel interfaces.

Step 3 switch(config)# **ficon logical-port assign port-numbers 0xe6-0xf9**

Reserves port numbers 0xe6 through 0xf9 for FCIP and PortChannel interfaces.

Note You cannot change port numbers that are active. You must disable the interfaces using the **shutdown** command and unbind port numbers using the **no ficon portnumber** command. See the Configuring FICON Ports, on page 25.

Step 4 switch(config)# **no ficon logical-port assign port-numbers 230-249**

Releases the port numbers. Releasing the logical port numbers is particularly useful for switches that are not cascaded – thus allowing all 254 ports to be used for FICON channel and control unit connectivity.

Note You cannot release port numbers for interfaces that are active. You must disable the interfaces using the **shutdown** command and unbind port numbers using the **no ficon portnumber** command. See the Configuring FICON Ports, on page 25.

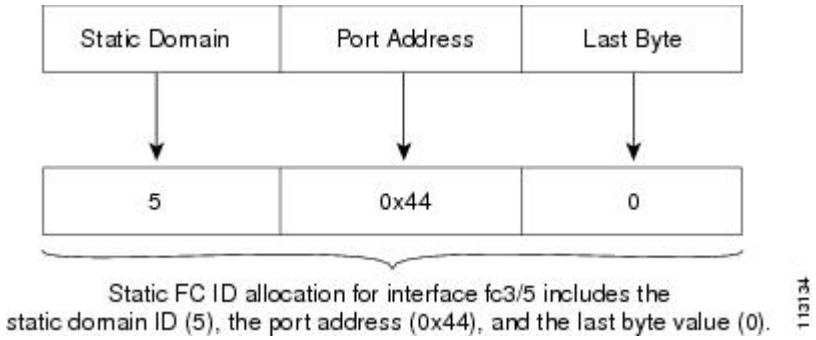
FC ID Allocation

FICON requires a predictable and static FC ID allocation scheme. When FICON is enabled, the FC ID allocated to a device is based on the port address of the port to which it is attached. The port address forms the middle byte of the fabric address. Additionally, the last byte of the fabric address should be the same for all devices in the fabric. By default, the last byte value is 0 and can be configured.

Note As the domain ID for FICON VSANs must be static, you cannot configure persistent FC IDs in FICON-enabled VSANs.

Cisco MDS switches have a dynamic FC ID allocation scheme. When FICON is enabled or disabled on a VSAN,all the ports are shut down and restarted to switch from the default dynamic allocation scheme to use static FC IDs and vice versa (see Figure 4: Static FC ID Allocation for FICON, on page 14).

Figure 4: Static FC ID Allocation for FICON



Configuring FICON

By default FICON is disabled in all switches in the Cisco MDS 9000 Family. You can enable FICON on a per VSAN basis by using the Device Manager.

This section includes the following topics:

About Enabling FICON on a VSAN

By default FICON is disabled in all VSANs on the switch.

You can enable FICON on a per VSAN basis in one of the following ways:

- Use the automated **setup ficon** command.

  See the Setting Up a Basic FICON Configuration, on page 16.

- Manually address each prerequisite.

  See the About FICON, on page 1.

- Use Device Manager.

- When you enable the FICON feature in Cisco MDS switches, the following restrictions apply:
  - You cannot disable in-order delivery for the FICON-enabled VSAN.
  - You cannot disable fabric binding or static domain ID configurations for the FICON-enabled VSAN.
  - The load balancing scheme is changed to Source ID (SID)—Destination ID (DID). If all of the hosts and devices in this FICON VSAN support FICON Dynamic Routing (FDR), you can change the load balancing scheme to Source ID (SID) – Destination ID (DID) – Exchange ID (OXID).
  - The IPL configuration file is automatically created.

  See the About FICON Configuration Files, on page 33.



Tip Using Device Manager, FICON auto-save can be invoked by multiple users logged on to the same FICON-enabled switch. Device Manager performs a periodic auto-save on any FICON-enabled switch causing increments in the FICON key counter. These increments highlight a change that has actually not occurred. To avoid this we recommend that only one instance of Device Manager monitor a FICON-enabled switch.

Enabling FICON on the Switch

By default, FICON is disabled in all switches in the Cisco MDS 9000 Family. You can enable FICON on the switch either explicitly or implicitly by enabling FICON on a VSAN. However, disabling FICON on all VSANs does not disable FICON on the switch. You must explicitly disable FICON.

To explicitly enable or disable FICON globally on the switch, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **feature ficon**

Enables FICON globally on the switch.

Step 3 switch(config)# **no feature ficon**

Disables FICON globally on the switch and removes all FICON configuration.

Setting Up a Basic FICON Configuration

This section steps you through the procedure to set up FICON on a specified VSAN in a Cisco MDS 9000 Family switch.

Note Press **Ctrl-C** at any prompt to skip the remaining configuration options and proceed with what is configured until that point.

Tip If you do not want to answer a previously configured question, or if you want to skip answers to any questions, press **Enter**. If a default answer is not available (for example, switch name), the switch uses what was previously configured and skips to the next question.

To enable and set up FICON, follow these steps:

Procedure

Step 1 Enter the **setup ficon** command at the EXEC command mode.

```
switch# setup ficon
                --- Ficon Configuration Dialog ---
This setup utility will guide you through basic Ficon Configuration
on the system.
Press Enter if you want to skip any dialog. Use ctrl-c at anytime
to skip all remaining dialogs.
```

Step 2 Enter **yes** (the default is **yes**) to enter the basic FICON configuration setup.

```
Would you like to enter the basic configuration dialog (yes/no) [yes]: yes
```

The FICON setup utility guides you through the basic configuration process. Press **Ctrl-C** at any prompt to end the configuration process.

Step 3 Enter the VSAN number for which FICON should be enabled.

```
Enter vsan [1-4093]:2
```

Step 4 Enter **yes** (the default is **yes**) to create a VSAN.

```
vsan 2 does not exist, create it? (yes/no) [yes]: yes
```

Step 5 Enter **yes** (the default is **yes**) to confirm your VSAN choice:

```
Enable ficon on this vsan? (yes/no) [yes]: yes
```

Note At this point, the software creates the VSAN if it does not already exist.

Step 6 Enter the domain ID number for the specified FICON VSAN.

```
Configure domain-id for this ficon vsan (1-239):2
```

Step 7 Enter **yes** (the default is **no**) to set up FICON in cascaded mode. If you enter **no**, skip to step 8 (see the CUP In-Band Management, on page 40).

```
Would you like to configure ficon in cascaded mode: (yes/no) [no]: yes
```

a) Assign the peer WWN for the attached FICON switch.

```
Configure peer wwn (hh:hh:hh:hh:hh:hh:hh:hh): 11:00:02:01:aa:bb:cc:00
```

b) Assign the peer domain ID for the attached FICON switch.

```
Configure peer domain (1-239) :4
```

c) Enter **yes** if you wish to configure additional peers (and repeat Steps 7a and 7b). Enter **no**, if you do wish to configure additional peers.

```
Would you like to configure additional peers: (yes/no) [no]: no
```

Step 8 Enter **yes** (the default is **yes**) to allow SNMP permission to modify existing port connectivity parameters (see the Configuring SNMP Control of FICON Parameters, on page 23).

```
Enable SNMP to modify port connectivity parameters? (yes/no) [yes]: yes
```

Step 9 Enter **no** (the default is **no**) to allow the host (mainframe) to modify the port connectivity parameters, if required (see the Allowing the Host to Change FICON Port Parameters, on page 21).

```
Disable Host from modifying port connectivity parameters? (yes/no) [no]: no
```

Step 10 Enter **yes** (the default is **yes**) to enable the **active equals saved** feature (see the Automatically Saving the Running Configuration, on page 24).

```
Enable active=saved? (yes/no) [yes]: yes
```

Step 11 Enter **yes** (the default is **yes**) if you wish to configure additional FICON VSANs.

```
Would you like to configure additional ficon vsans (yes/no) [yes]: no
```

Step 12 Review and edit the configuration that you have just entered.

Step 13 Enter no (the default is **no**) if you are satisfied with the configuration.

Note For documentation purposes, the following configurations shows three VSANs with different FICON settings. These settings provide a sample output for different FICON scenarios.

The following configuration will be applied:

```
fcdomain domain 2 static vsan 2
fcdomain restart disruptive vsan 2
fabric-binding database vsan 2
swwn 11:00:02:01:aa:bb:cc:00 domain 4
fabric-binding activate vsan 2
zone default-zone permit vsan 2
ficon vsan 2
no host port control
fcdomain domain 3 static vsan 3
fcdomain restart disruptive vsan 3
fabric-binding activate vsan 3 force
zone default-zone permit vsan 3
ficon vsan 3
no host port control
no active equals saved
vsan database
vsan 4
fcdomain domain 5 static vsan 4
fcdomain restart disruptive vsan 4
fabric-binding activate vsan 4 force
zone default-zone permit vsan 4
ficon vsan 4
no snmp port control
no active equals saved
Would you like to edit the configuration? (yes/no) [no]: no
```

Step 14 Enter yes (the default is **yes**) to use and save this configuration. The implemented commands are displayed. After FICON is enabled for the specified VSAN, you are returned to the EXEC mode switch prompt.

```
Use this configuration and apply it? (yes/no) [yes]: yes
`fcdomain domain 2 static vsan 2`
`fcdomain restart disruptive vsan 2`
`fabric-binding database vsan 2`
`swwn 11:00:02:01:aa:bb:cc:00 domain 4`
`fabric-binding activate vsan 2`
`zone default-zone permit vsan 2`
`ficon vsan 2`
`no host port control`
`fcdomain domain 3 static vsan 3`
`fcdomain restart disruptive vsan 3`
`fabric-binding activate vsan 3 force`
`zone default-zone permit vsan 3`
`ficon vsan 3`
`no host port control`
`no active equals saved`
```

Note If a new VSAN is created, two additional commands are displayed— **vsan database** and **vsan** *number*.

```
`vsan database`
`vsan 4`
`in-order-guarantee vsan 4`
`fcdomain domain 2 static vsan 4`
```

```
`fcdomain restart disruptive vsan 4`
`fabric-binding activate vsan 4 force`
`zone default-zone permit vsan 4`
`ficon vsan 4`
`no snmp port control`
Performing fast copy config...done. switch#
```

Manually Enabling FICON on a VSAN

Note This section describes the procedure to manually enable FICON on a VSAN. If you have already enabled FICON on the required VSAN using the automated setup (recommended), skip to the Automatically Saving the Running Configuration, on page 24.

To manually enable FICON on a VSAN, follow these steps:

Procedure

Step 1 switch# **config t**

```
switch(config)#
```

Enters configuration mode.

Step 2 switch(config)# **vsan database**

```
switch(config-vsan-db)# vsan 5
switch(config-vsan-db)# show vsan usage
4 vsan configured
configured vsans:1-2,5,26
vsans available for configuration:3-4,6-25,27-4093
switch(config-vsan-db)# exit
```

Enables VSAN 5.

Step 3 switch(config)# **in-order-guarantee vsan 5**

Activates in-order delivery for VSAN 5.

See Configuring Fibre Channel Routing Services and Protocols

Step 4 switch(config)# **fcdomain domain 20static vsan 5**

Configures the domain ID for VSAN 5.

For information about configuring domain parameters, refer to the *Cisco MDS 9000 Series System Management Configuration Guide*.

Step 5 switch(config)# **fabric-binding activate vsan 5 force**

Activates fabric binding on VSAN 5.

Refer to the *Cisco MDS 9000 Series Security Configuration Guide*.

Step 6 switch(config)# **zone default-zone permit vsan 5**

Sets the default zone to permit for VSAN 5.

Step 7 switch(config)# **ficon vsan 5**

switch(config-ficon)#

Enables FICON on VSAN 5.

Step 8 switch(config)# **no ficon vsan 6**

Disables the FICON feature on VSAN 6.

Step 9 switch(config-ficon)# **no host port control**

Prohibits mainframe users from moving the switch to an offline state.

See the Allowing the Host to Move the Switch Offline, on page 21.

Configuring the code-page Option

FICON strings are coded in Extended Binary-Coded Decimal Interchange Code (EBCDIC) format. Refer to the IBM System Z Server documentation for details on the code page options.

Cisco MDS switches support **international-5**, **france**, **brazil**, **germany**, **italy**, **japan**, **spain-latinamerica**, **uk**, and **us-canada** (default) EBCDIC format options.



Tip This is an optional configuration. If you are not sure of the EBCDIC format to be used, we recommend retaining the **us-canada** (default) option.

To configure the **code-page** option in a VSAN, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **code-page italy**

Configures the **italy** EBCDIC format.

Step 4 switch(config-ficon)# **no code-page**

(Optional) Reverts to the factory default of using the **us-canada** EBCDIC format.

Allowing the Host to Move the Switch Offline

By default, hosts are allowed to move the switch to an offline state. To do this, the host sends a "Set offline" command (x'FD') to the CUP.

To allow the host to move the switch to an offline state, follow these steps:

Procedure

Step 1 switch# **config terminal**
switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**
switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **no host control switch offline**

Prohibits mainframe users from moving the switch to an offline state.

Step 4 switch(config-ficon)# **host control switch offline**

Allows the host to move the switch to an offline state (default) and shuts down the ports.

Allowing the Host to Change FICON Port Parameters

By default, mainframe users are not allowed to configure FICON parameters on Cisco MDS switches—they can only query the switch.

Use the **host port control** command to permit mainframe users to configure FICON parameters.

To allow the host (mainframe) to configure FICON parameters on the Cisco MDS switch, follow these steps:

Procedure

Step 1 switch# **config terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **no host port control**

Prohibits mainframe users from configuring FICON parameters on the Cisco MDS switch.

Step 4 switch(config-ficon)# **host port control**

Allows mainframe users to configure FICON parameters on the Cisco MDS switch (default).

Allowing the Host to Control the Timestamp

By default, the clock in each VSAN is the same as the switch hardware clock. Each VSAN in a Cisco MDS 9000 Family switch represents a virtual director. The clock and time present in each virtual director can be different. To maintain separate clocks for each VSAN, the Cisco NX-OS software maintains the difference of the VSAN-specific clock and the hardware-based director clock. When a IBM System Z Server sets the time, the Cisco NX-OS software updates this difference between the clocks. When a host reads the clock, it computes the difference between the VSAN-clock and the current director hardware clock and presents a value to the mainframe.

The VSAN-clock current time is reported in the output of **show ficon vsan** *vsan-id*, **show ficon**, and **show accounting log** commands.

To configure host control of the timestamp, follow these steps:

Procedure

Step 1 switch# **config terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **no host set-timestamp**

Prohibits mainframe users from changing the VSAN-specific clock.

Step 4 switch(config-ficon)# **host set-timestamp**

Allows the host to set the clock on this switch (default).

Clearing the Time Stamp

Note You can clear time stamps only from the Cisco MDS switch—not the mainframe.

Use the **clear ficon vsan** *vsan-id* **timestamp** command in EXEC mode to clear the VSAN clock.

```
switch# clear ficon vsan 20 timestamp
```

Configuring SNMP Control of FICON Parameters

To configure SNMP control of FICON parameters, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **no snmp port control**

Prohibits SNMP users from configuring FICON parameters.

Step 4 switch(config-ficon)# **snmp port control**

Allows SNMP users to configure FICON parameters (default).

About FICON Device Allegiance

FICON requires serialization of access among multiple mainframes, CLI, and SNMP sessions be maintained on Cisco MDS 9000 Family switches by controlling device allegiance for the currently executing session. Any other session is denied permission to perform configuration changes unless the required allegiance is available.

Caution This task discards the currently executing session.

Clearing FICON Device Allegiance

You can clear the current device allegiance by issuing the **clear ficon vsan** *vsan-id* **allegiance** command in EXEC mode.

```
switch# clear ficon vsan 2 allegiance
```

Automatically Saving the Running Configuration

Cisco MDS NX-OS provides an option to automatically save any configuration changes to the startup configuration. This ensures that the new configuration is present after a switch reboot. By default, the Active=Saved **active equals saved** option is automatically enabled on any FICON VSAN.

Table 2: Saving the Active FICON and Switch Configuration , on page 24 displays the results of the **Active = Saved** option **active equals saved** command and the implicit copy from the running configuration to the startup configuration (**copy running start**)**copy running-config startup-config** command in various scenarios.

When the Active=Saved option **active equals saved** command is enabled in any FICON-enabled VSAN in the fabric, then the following apply (see Number 1 and 2 in Table 2: Saving the Active FICON and Switch Configuration , on page 24):

- All configuration changes (FICON-specific or not) are automatically saved to persistent storage (implicit **copy running start**) and stored in the startup configuration.
- FICON-specific configuration changes are immediately saved to the IPL file (see the FICON Configuration Files, on page 32).

If the Active=Saved option **active equals saved** command is not enabled in any FICON-enabled VSAN in the fabric, then FICON-specific configuration changes are not saved in the IPL file and an implicit **copy running startup** command is not issued, you must explicitly save the running configuration to the startup configuration. Use the **copy running start** command explicitly (see number 3 in Table 2: Saving the Active FICON and Switch Configuration , on page 24).

Table 2: Saving the Active FICON and Switch Configuration

Number	FICON-enabled VSAN?	active equals saved Enabled?	Implicit copy running start Issued?	Notes
1	Yes	Yes (in all FICON VSANs)	Implicit	FICON changes written to the IPL file. Non-FICON changes saved to startup configuration and persistent storage.
2	Yes	Yes (even in one FICON VSAN)	Implicit	FICON changes written to IPL file for only the VSAN that has **active equals saved** option enabled. Non-FICON changes saved to startup configuration and persistent storage.
3	Yes	Not in any FICON VSAN	Not implicit	FICON changes are not written to the IPL file. Non-FICON changes are saved in persistent storage—only if you explicitly issue the **copy running start** command.

Number	FICON-enabled VSAN?	active equals saved Enabled?	Implicit copy running start Issued?	Notes
4	No	Not applicable	—	—

Note If **active equals saved** is enabled, the Cisco NX-OS software ensures that you do not have to perform the **copy running startup** command for the FICON configuration as well. If your switch or fabric consists of multiple FICON-enabled VSANs, and one of these VSANs have **active equals saved** enabled, changes made to the non-FICON configuration results in all configurations being saved to the startup configuration.

To automatically save the running configuration, follow these steps:

Procedure

Step 1 switch# **config terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **active equals saved**

Enables the automatic save feature for all VSANs in the switch or fabric.

Step 4 switch(config-ficon)# **no active equals saved**

(Optional) Disables automatic save for this VSAN.

Configuring FICON Ports

You can perform FICON configurations on a per-port address basis in the Cisco MDS 9000 Family switches.

Even if a port is not installed, the port address-based configuration is accepted by the Cisco MDS switch. This configuration is applied to the port when the port becomes installed.

This section includes the following topics:

Binding Port Numbers to PortChannels

Caution All port number assignments to PortChannels or FCIP interfaces are lost (cannot be retrieved) when FICON is disabled on all VSANs.

You can bind (or associate) a PortChannel with a FICON port number to bring up that interface.

To bind a PortChannel with a FICON port number, follow these steps:

Procedure

Step 1 switch# **config terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **interface Port-channel 1**

switch(config-if)#

Enters the PortChannel interface configuration mode.

Step 3 switch(config-if)# **ficon portnumber 234**

Assigns the FICON port number to the selected PortChannel port.

Binding Port Numbers to FCIP Interfaces

You can bind (or associate) an FCIP interface with a FICON port number to bring up that interface.

To bind an FCIP interface with a FICON port number, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch1(config)# **interface fcip 51**

switch1(config-if)#

Creates an FCIP interface (51).

Step 3 switch(config-if)# **ficon portnumber 208**

Assigns the FICON port number to the selected FCIP interface.

Configuring Port Blocking

FICON port blocking attribute has been deprecated from NX-OS 9.4(1a) forward. You can use the **shutdown**/ **'no' shutdown** commands to accomplish similar results. Port blocking was deprecated because the Z Systems Software that communicated with the switch over the FICON CUP interface to perform this function has long gone End of Support.

Port Prohibiting

FICON Port Prohibit attribute has been deprecated from NX-OS Release NX-OS 9.4(1a). If specific port to port protections are desired within FICON VSANs (above the protections implicitly given by the static routing nature of the System Z HCD configuration), zoning can be used.

Assigning a Port Address Name

To assign a port address name, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **portaddress 7**

switch(config-ficon-portaddr)#

Selects port address 7 for further configuration.

Step 4 switch(config-ficon-portaddr)# **name SampleName**

Assigns a name to the port address.

Note The port address name is restricted to 24 alphanumeric characters.

Step 5 switch(config-ficon-portaddr)# **no name SampleName**

Deletes a previously configured port address name.

About RLIR

The Registered Link Incident Report (RLIR) application provides a method for a switch port to send an Link Incident Record (LIR) to a registered Nx port.

When an LIR is detected in FICON-enabled switches in the Cisco MDS 9000 Family from a RLIR Extended Link Service (ELS), the switch sends that record to the members in its Established Registration List (ERL).

In case of multiswitch topology, a Distribute Registered Link Incident Record (DRLIR) Inter-Link Service (ILS) is sent to all reachable remote domains along with the RLIR ELS. On receiving the DRLIR ILS, the switch extracts the RLIR ELS and sends it to the members of the ERL.

The Nx ports interested in receiving the RLIR ELS send the Link Incident Record Registration (LIRR) ELS request to the management server on the switch. The RLIRs are processed on a per-VSAN basis.

The RLIR data is written to persistent storage when you enter the **copy running-config startup-config** command.

The RLIR data is written to persistent storage when you **copy** the running configuration to the startup configuration.

Specifying an RLIR Preferred Host

You can specify a preferred host to receive RLIR frames. The MDS switch sends RLIR frames to the preferred host only if it meets the following conditions:

- No host in the VSAN is registered for RLIR with the registration function set to “always receive.” If one or more hosts in the VSAN are registered as “always receive,” then RLIR sends only to these hosts and not to the configured preferred host.
- The preferred host is registered with the registration function set to “conditionally receive.”

Note If all registered hosts have the registration function set to “conditionally receive,” then the preferred host receives the RLIR frames.

You can specify only one RLIR preferred host per VSAN. By default, the switch sends RLIR frames to one of the hosts in the VSAN with the register function set to “conditionally receive” if no hosts have the register function set to “always receive.”

To specify the RLIR preferred host for a VSAN, follow these steps:

Procedure

Step 1 switch# **config terminal**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **rlir preferred-cond fcid 0x772c00 vsan 5**

Specifies FC ID 0x772c00 as the RLIR preferred host in VSAN 5. (FC ID 0x772c00 is used here as an example.)

Step 3 (Optional) switch(config)# **no rlir preferred-cond fcid 0x772c00 vsan 5**

Removes FC ID 0x772c00 as the RLIR preferred host for VSAN 5.

Example

To display the RLIR preferred host configuration, use the **show rlir erl** command.

```
switch# show rlir erl
Established Registration List for VSAN: 5
------------------------------------------------
FC-ID LIRR FORMAT REGISTERED FOR
------------------------------------------------
0x772c00 0x18 conditional receive(*)
0x779600 0x18 conditional receive
0x779700 0x18 conditional receive
0x779800 0x18 conditional receive
Total number of entries = 4
(*) - Denotes the preferred host
```

Displaying RLIR Information

The **show rlir statistics** command displays the complete statistics of LIRR, RLIR, and DRLIR frames. It lists the number of frames received, sent, and rejected. Specify the VSAN ID to obtain VSAN statistics for a specific VSAN. If you do not specify the VSAN ID, then the statistics are shown for all active VSANs (see Examples Displays RLIR Statistics for All VSANs, on page 29 and Displays RLIR Statistics for a Specified VSAN, on page 30).

Displays RLIR Statistics for All VSANs

```
switch# show rlir statistics
Statistics for VSAN: 1
-----------------------
Number of LIRR received      = 0
Number of LIRR ACC sent      = 0
Number of LIRR RJT sent      = 0
Number of RLIR sent          = 0
Number of RLIR ACC received  = 0
Number of RLIR RJT received  = 0
Number of DRLIR received     = 0
Number of DRLIR ACC sent     = 0
Number of DRLIR RJT sent     = 0
Number of DRLIR sent         = 0
Number of DRLIR ACC received = 0
Number of DRLIR RJT received = 0
Statistics for VSAN: 100
-----------------------
Number of LIRR received      = 26
```

```
Number of LIRR ACC sent      = 26
Number of LIRR RJT sent      = 0
Number of RLIR sent          = 815
Number of RLIR ACC received  = 815
Number of RLIR RJT received  = 0
Number of DRLIR received     = 417
Number of DRLIR ACC sent     = 417
Number of DRLIR RJT sent     = 0
Number of DRLIR sent         = 914
Number of DRLIR ACC received = 828
Number of DRLIR RJT received = 0
```

Displays RLIR Statistics for a Specified VSAN

```
switch# show rlir statistics vsan 4
Statistics for VSAN: 4
------------------------
Number of LIRR received      = 0
Number of LIRR ACC sent      = 0
Number of LIRR RJT sent      = 0
Number of RLIR sent          = 0
Number of RLIR ACC received  = 0
Number of RLIR RJT received  = 0
Number of DRLIR received     = 0
Number of DRLIR ACC sent     = 0
Number of DRLIR RJT sent     = 0
Number of DRLIR sent         = 0
Number of DRLIR ACC received = 0
Number of DRLIR RJT received = 0
```

The **show rlir erl** command shows the list of Nx ports that are registered to receive the RLIRs with the switch. If the VSAN ID is not specified, the details are shown for all active VSANs (see Examples Displays All ERLs, on page 30 and Displays ERLs for the Specified VSAN, on page 31).

Displays All ERLs

```
switch# show rlir erl
Established Registration List for VSAN: 2
-----------------------------------------
FC-ID       LIRR FORMAT    REGISTERED FOR
-----------------------------------------
0x0b0200    0x18           always receive
Total number of entries = 1
Established Registration List for VSAN: 100
-----------------------------------------
FC-ID       LIRR FORMAT    REGISTERED FOR
-----------------------------------------
0x0b0500    0x18           conditional receive
0x0b0600    0x18           conditional receive
Total number of entries = 2
```

In Displays All ERLs, on page 30, if the Registered For column states that an FC ID is conditional receive, the source port is registered as a valid recipient of subsequent RLIRs. This source port is selected as an RLIR recipient only if no other ERL recipient is selected.

In Displays All ERLs, on page 30, if the Registered For column states that an FC ID is always receive, the source port is registered as a valid recipient of subsequent RLIRs. This source port is always selected as an LIR recipient.

Note If an always receive RLIR is not registered for any N port or if the delivery of an RLIR fails for one of those ports, then the RLIR is sent to a port registered to conditional receive RLIRs.

Displays ERLs for the Specified VSAN

```
switch# show rlir erl vsan 100
Established Registration List for VSAN: 100
-----------------------------------------------
FC-ID       LIRR FORMAT    REGISTERED FOR
-----------------------------------------------
0x0b0500    0x18           conditional receive
0x0b0600    0x18           conditional receive
Total number of entries = 2
```

Displays the LIR History

```
switch# show rlir history
Link incident history
-------------------------------------------------------------------------------------------------------------------

 Host Time Stamp         Switch Time Stamp       VSAN   Domain   Port    Intf        Link
Incident       Loc/Rem
-------------------------------------------------------------------------------------------------------------------

 Sep 20 12:42:44 2006    Sep 20 12:42:44 2006    ****    ****    0x0b    fc1/12      Loss
of sig/sync     LOC
 Reported Successfully to: [0x640001] [0x640201]
 Sep 20 12:42:48 2006    Sep 20 12:42:48 2006    ****    ****    0x0b    fc1/12      Loss
of sig/sync     LOC
 Reported Successfully to: [0x640001] [0x640201]
 *** ** **:**:** ****    Sep 20 12:42:51 2006    1001    230     0x12    ****        Loss
of sig/sync     REM
 Reported Successfully to: [0x640001] [0x640201]
 Sep 20 12:42:55 2006    Sep 20 12:42:55 2006    ****    ****    0x0b    fc1/12      Loss
of sig/sync     LOC
 Reported Successfully to: None [No Registrations]
 *** ** **:**:** ****    Sep 20 12:45:56 2006    1001    230     0x12    ****        Loss
of sig/sync     REM
 Reported Successfully to: None [No Registrations]
 *** ** **:**:** ****    Sep 20 12:45:56 2006    1001    230     0x12    ****        Loss
of sig/sync     REM
 Reported Successfully to: None [No Registrations]
 Sep 20 12:52:45 2006    Sep 20 12:52:45 2006    ****    ****    0x0b    fc1/12      Loss
of sig/sync     LOC
 Reported Successfully to: None [No Registrations]
**** - Info not required/unavailable
```

Displays Recent LIRs for a Specified Interface

```
switch# show rlir recent interface fc1/1-4
Recent link incident records
-------------------------------------------------------------------------------
Host Time Stamp          Switch Time Stamp        Port Intf   Link Incident
-------------------------------------------------------------------------------
Thu Dec 4 05:02:29 2003  Wed Dec 3 21:02:56 2003   2   fc1/2  Implicit Incident
Thu Dec 4 05:02:54 2003  Wed Dec 3 21:03:21 2003   4   fc1/4  Implicit Incident
```

Displays Recent LIRs for a Specified Port Number

```
switch# show rlir recent portnumber 1-4
Recent link incident records
-------------------------------------------------------------------------------
Host Time Stamp          Switch Time Stamp        Port Intf    Link Incident
-------------------------------------------------------------------------------
Thu Dec 4 05:02:29 2003  Wed Dec 3 21:02:56 2003   2   fc1/2   Implicit Incident
Thu Dec 4 05:02:54 2003  Wed Dec 3 21:03:21 2003   4   fc1/4   Implicit Incident
```

Clearing RLIR Information

Use the **clear rlir statistics** command to clear all existing statistics for a specified VSAN.

```
switch#
clear rlir statistics vsan 2
```

Use the **clear rlir history** command to clear the RLIR history where all link incident records are logged for all interfaces.

```
switch# clear rlir history
```

Use the **clear rlir recent interface** command to clear the most recent RLIR information for a specified interface.

```
switch# clear rlir recent interface fc 1/2
```

Use the **clear rlir recent portnumber** command to clear the most recent RLIR information for a specified port number.

```
switch# clear rlir recent portnumber 16
```

FICON Configuration Files

You can save up to 16 FICON configuration files on each FICON-enabled VSAN (in persistent storage). The file format is proprietary to IBM. These files can be read and written by IBM hosts using the in-band CUP protocol. Additionally, you can use the Cisco MDS CLI to operate on these FICON configuration files.

Note Multiple FICON configuration files with the same name can exist in the same switch, provided they reside in different VSANs. For example, you can create a configuration file named XYZ in both VSAN 2 and VSAN 3.

When you enable the FICON feature in a VSAN, the switches always use the startup FICON configuration file, called IPL. This file is created with a default configuration as soon as FICON is enabled in a VSAN.

Caution When FICON is disabled on a VSAN, all the FICON configuration files are irretrievably lost.

FICON configuration files contain the following configuration for each implemented port address:

- Port address name

Note Normal configuration files used by Cisco MDS switches include FICON-enabled attributes for a VSAN, port number mapping for PortChannels and FCIP interfaces, port number to port address mapping, port and trunk allowed VSAN configuration for ports, in-order guarantee, static domain ID configuration, and fabric binding configuration.

Refer to the *Cisco MDS 9000 Series Fundamentals Configuration Guide* for details on the normal configuration files used by Cisco MDS switches.

This section includes the following topics:

About FICON Configuration Files

Only one user can access the configuration file at any given time:

- If this file is being accessed by user 1, user 2 cannot access this file.
- If user 2 does attempt to access this file, an error is issued to user 2.
- If user 1 is inactive for more than 15 seconds, the file is automatically closed and available for use by any other permitted user.

FICON configuration files can be accessed by any host, SNMP, or CLI user who is permitted to access the switch. The locking mechanism in the Cisco NX-OS software restricts access to one user at a time per file. This lock applies to newly created files and previously saved files. Before accessing any file, you must lock the file and obtain the file key. A new file key is used by the locking mechanism for each lock request. The key is discarded when the lock timeout of 15 seconds expires. The lock timeout value cannot be changed.

Applying the Saved Configuration Files to the Running Configuration

You can apply the configuration from the saved files to the running configuration using the **ficon vsan** *number* **apply file** *filename* command.

```
switch# ficon vsan 2 apply file SampleFile
```

Editing FICON Configuration Files

The configuration file submode allows you to create and edit FICON configuration files. If a specified file does not exist, it is created. Up to 16 files can be saved. Each file name is restricted to eight alphanumeric characters.

To edit the contents of a specified FICON configuration file, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **ficon vsan 2**

switch(config-ficon)#

Enables FICON on VSAN 2.

Step 3 switch(config-ficon)# **file IplFile1**

switch(config-ficon-file)#

Accesses the FICON configuration file called IplFile1 for VSAN 2. If this file does not exist, it is created.



Note All FICON file names are restricted to eight alphanumeric characters.

Step 4 switch(config-ficon)# **no file IplFileA**

(Optional) Deletes a previously created FICON configuration file.

Step 5 switch(config-ficon-file)# **portaddress 3**

switch(config-ficon-file-portaddr)#

Enters the submode for port address 3 to edit the contents of the configuration file named IplFile1.



Note The running configuration is not applied to the current configuration. The configuration is only applied when the **ficon vsan***number***aply file***filename* command is issued

Step 6 switch(config-ficon-file-portaddr)#**name P3**

Edits the content of the configuration file named IplFile1 by assigning the name P3 to port address 3. If the name did not exist, it is created. If it existed, it is overwritten.

Displaying FICON Configuration Files

Use the **show ficon vsan** *vsan-id* **file all** command to display the contents of all FICON configuration files.

```
switch# show ficon vsan 69 file all
File IPL      is locked
FICON configuration file IPL3     in vsan 69
Description:
  Port address 0(0)
   Port name is
   Port is not blocked
   Prohibited port addresses are 255(0xff)

  Port address 1(0x1)
   Port name is
   Port is not blocked
   Prohibited port addresses are 255(0xff)

  Port address 2(0x2)
   Port name is
   Port is not blocked
   Prohibited port addresses are 255(0xff)
```

Use the **show ficon vsan** *vsan-id* **file name** command to display the contents of a specific FICON configuration file.

```
switch# show ficon vsan 69 file name IPL3
FICON configuration file IPL3     in vsan 69
 Description:
 Port address 0(0)
  Port name is
  Port is not blocked
  Prohibited port addresses are 255(0xff)

 Port address 1(0x1)
  Port name is
  Port is not blocked
  Prohibited port addresses are 255(0xff)

 Port address 2(0x2)
  Port name is
  Port is not blocked
  Prohibited port addresses are 255(0xff)
```

Use the **show ficon vsan** *vsan-id* **filename** *filename* **portaddress** command to display the FICON configuration file information for a specific FICON port.

```
switch# show ficon vsan 69 file name IPL3 portaddress 2
FICON configuration file IPL3     in vsan 69
Description:
 Port address 2(0x2)
  Port name is
  Port is not blocked
  Prohibited port addresses are 255(0xff)
```

Copying FICON Configuration Files

Use the **ficon vsan** *vsan-id* **copy file** *existing-file-name save-as-file-name* command in EXEC mode to copy an existing FICON configuration file.

```
switch#
ficon vsan 69 copy file IPL IPL3
```

You can see the list of existing configuration files by issuing the **show ficon vsan** *vsan-id* command.

```
switch# show

ficon vsan 69
Ficon information for VSAN 69
  Ficon is online
  VSAN is active
  Host port control is Enabled
  Host offline control is Enabled
  User alert mode is Disabled
  SNMP port control is Enabled
  Host set director timestamp is Enabled
  Active=Saved is Enabled
  Loadbalance is srcid-dstid
  Number of implemented ports are 254
  Key Counter is 11
  FCID last byte is 0

  Date/Time is set by host to Fri Jan 26 21:28:56.122170 2024
  Device Allegiance not locked
  Codepage is us-canada
  Saved configuration files
    IPL
    IPL3
```

Port Swapping

The FICON Port Swapping ability has been deprecated from NX-OS Release 9.4(1a). If there is a need to move the FICON port address from one physical port to another, the **ficon slot x assign port-numbers** command can be used. This will move both the port number and port address.

FICON Tape Acceleration

The sequential nature of tape devices causes each I/O operation to the tape device over an FCIP link to incur the latency of the FCIP link. Throughput drastically decreases as the round-trip time through the FCIP link increases, leading to longer backup windows. Also, after each I/O operation, the tape device is idle until the next I/O arrives. Starting and stopping of the tape head reduces the lifespan of the tape, except when I/O operations are directed to a virtual tape.

Cisco MDS NX-OS software provides acceleration for the following FICON tape write operations:

- The link between Z System and native tape drives (both IBM and Oracle)
- The link between Z System and Virtual Tape Systems (both IBM and Oracle)
- The back-end link between the VSM (Oracle VSM) and tape drive (Oracle)

FICON tape acceleration over FCIP provides the following advantages:

- Efficiently utilizes the tape device by decreasing idle time
- More sustained throughput as latency increases

- Similar to FCP tape acceleration, and does not conflict with it

Note FICON tape read acceleration over FCIP is supported from Cisco MDS NX-OS Release 5.0(1). For more information refer to the Configuring FICON Tape Read Acceleration, on page 38.

The following images show the supported configurations.

Note For information about FCIP tape acceleration, refer to the *Cisco MDS 9000 Series IP Services Configuration Guide*.

Configuring FICON Tape Acceleration

FICON tape acceleration has the following configuration considerations:

- In addition to the normal FICON configuration, FICON tape acceleration must be enabled on both ends of the FCIP interface. If only one end has FICON tape acceleration enabled, acceleration does not occur.
- FICON tape acceleration is enabled on a per VSAN basis.
- FICON tape acceleration cannot function if multiple ISLs are present in the same VSAN (PortChannels or FSPF load balanced).
- You can enable both Fibre Channel write acceleration and FICON tape acceleration on the same FCIP interface.
- Enabling or disabling FICON tape acceleration disrupts traffic on the FCIP interface.

To configure FICON tape acceleration, follow these steps:

Procedure

Step 1 switch# **config t**

switch(config)#

Enters configuration mode.

Step 2 switch(config)# **interface fcip 2**

switch(config-if)#

Specifies an FCIP interface and enters interface configuration submode.

Step 3 switch(config-if)# **ficon-tape-accelerator vsan 100**

```
This configuration change will disrupt all traffic on the FCIP interface in all
VSANs.  Do you wish to continue? [no] y
```

Enables FICON tape acceleration over an FCIP interface.

Step 4 switch(config-if)# **no ficon-tape-accelerator vsan 100**

```
This configuration change will disrupt all traffic on the FCIP interface in all
VSANs.  Do you wish to continue? [no] y
```

Disables (default) FICON tape acceleration over an FCIP interface.

What to do next

Use the **show running-config** command to verify the FICON tape acceleration over FCIP configuration.

```
switch# show running-config | begin "interface fcip"
interface fcip2
  ficon-tape-accelerator vsan 100
  no shutdown
...
```

Configuring FICON Tape Read Acceleration

All the configuration guidelines and restrictions applicable for FICON tape acceleration are also applicable for FICON tape read acceleration. FICON tape acceleration and FICON tape read acceleration can coexist.

To configure FICON tape read acceleration, follow these steps:

Procedure

Step 1 switch# **config t**
switch(config)#

Enters configuration mode.

Step 2 switch(config)# **interface fcip 2**
switch(config-if)#

Specifies an FCIP interface and enters interface configuration submode.

Step 3 switch(config-if)# **ficon-tape-read-accelerator**

```
This configuration change will disrupt all traffic on the FCIP interface in all
VSANs.  Do you wish to continue? [no]
```

Enables FICON tape read acceleration over an FCIP interface.

Step 4 switch(config-if)# **no ficon-tape-read-accelerator**

```
This configuration change will disrupt all traffic on the FCIP interface in all
VSANs.  Do you wish to continue? [no]
```

Disables (default) FICON tape read acceleration over an FCIP interface.

Configuring Zoning in a FICON VSAN

FICON Environments have an implicit method for controlling which FICON ports are allowed to talk to each other – the IOCDS on the System Z Server. This is why in many cases, actually coding zoning is not needed in FICON environments and by default FICON VSANs are configured to use a setting where all ports in the VSAN can talk each other without configuring zones. This setting is the configuration command **zonedefault-zone permit vsan xx.**

It is supported, however, to configure more traditional zoning for FICON VSANs. When this is done, it is disruptive and should likely be done at initial setup. If this is done later, it needs to be carefully planned so as not to create an outage of the environment.

First, the default behavior of zoning needs to be changed from permit. This is done by the following command.

```
switch# config terminal
switch(config)#no zonedefault-zone permit vsan 20
```

Next a Zoneset is defined within the FICON VSAN and then zones within this zoneset. The exact configuration of these zones is discussed elsewhere but below are a few recommendations / guidelines for how to configure zoning for FICON environments.

- Do not configure one large zone with all of the FICON ports in it. This is NOT the same as running with default zone permit.
- The most recommended zoning configuration for FICON is one that closely mirrors the IOCDS and that can be maintained in-sync with IOCDS changes as they occur. Creating zones for each CHPID or even small group of CHPIDs and then adding to this all of the Control Units that are mapped to these CHPIDs in the IOCDS. Once this is in place, any change that is made to the IOCDS can be mirrored to the zoning database in the associated FICON VSAN and everything then stays working and in-sync.
- Remember to configure the FICON VSAN CUP device in the VSAN with the CHPIDs that access it per the IOCDS. The WWN and FCID for the CUP(s) in the FICON VSAN by using the **show fcns database vsan xx**command.

```
switch# show fcns database vsan 69
VSAN 69:
--------------------------------------------------------------------------
FCID        TYPE  PWWN                    (VENDOR)        FC4-TYPE:FEATURE
--------------------------------------------------------------------------
0x103000    N     c0:50:76:c7:6c:88:13:81 (IBM)           fcsb2-ch-cu fcsb2-cu-ch
0x103100    N     c0:50:76:c7:6c:88:13:91 (IBM)           fcsb2-ch-cu fcsb2-cu-ch
0x103200    N     c0:50:76:c7:6c:88:16:01 (IBM)           fcsb2-ch-cu fcsb2-cu-ch
0x103300    N     c0:50:76:c7:6c:88:16:11 (IBM)           fcsb2-ch-cu fcsb2-cu-ch
..

0x104200    N     c0:50:76:c7:6c:80:2e:c1 (IBM)           FICON:CU
0x104300    N     c0:50:76:c7:6c:80:2e:d1 (IBM)           FICON:CU
0x104400    N     c0:50:76:c7:6c:80:2f:01 (IBM)           FICON:CU
..

0x10aa00    N     c0:50:76:c9:10:80:15:41 (IBM)           FICON:CU
0x10ab00    N     c0:50:76:c9:10:80:15:51 (IBM)           FICON:CU
0x10fe00    N     21:01:00:2a:6a:a4:37:02 (Cisco)         FICON:CUP
```

Zoning can be done by WWN or by FCID (or any of the other supported methods) but usually WWN will be the best so that if CHPIDs need to move around, a change to the zoning database is not needed.

No zoning for the CUP device in the switch is needed for FICON VSANs that use default permit for zoning.

For more detailed information on the process of creating and maintaining zonesets and zones, refer to seethe *Cisco MDS 9000 Series Fabric Configuration Guide.*

Moving a FICON VSAN to an Offline State

Issue the **ficon vsan** *vsan-id* **offline** command in EXEC mode to log out all ports in the VSAN that need to be suspended.

Issue the EXEC-level **ficon vsan** *vsan-id* **online** command in EXEC mode to remove the offline condition and to allow ports to log on again.

Note This command can be issued by the host if the host is allowed to do so (see the Allowing the Host to Move the Switch Offline, on page 21).

CUP In-Band Management

The CUP protocol configures access control and provides unified storage management capabilities from a mainframe computer. Cisco MDS 9000 FICON-enabled switches are fully IBM CUP standard compliant for in-band management.

Note The CUP specification is proprietary to IBM.

CUP is supported by switches and directors in the Cisco MDS 9000 Family. The CUP function allows the mainframe to manage the Cisco MDS switches as well as send in asysnchronous information to the switch for things like port performance and device topology discovery.

Displaying Control Unit Information

Displays Control Unit Information, on page 40 displays configured control device information.

Displays Control Unit Information

```
switch# show ficon control-device sb3
Control Unit Image:0x80b9c2c
VSAN:20 CU:0x20fe00 CUI:0 CUD:0 CURLP:(nil)
ASYNC LP:(nil) MODE:1 STATE:1 CQ LEN:0 MAX:0
PRIMARY LP:   VSAN:0 CH:0x0 CHI:0 CU:0x0 CUI:0
ALTERNATE LP: VSAN:0 CH:0x0 CHI:0 CU:0x0 CUI:0
Logical Path:0x80b9fb4
VSAN:20 CH:0x200600 CHI:15 CU:0x20fe00 CUI:0 STATE:1 FLAGS:0x1
LINK: OH:0x0 OC:0x0 IH:0x0 IC:0x0
DEV:  OH:0x0 OC:0x0 IH:0x0 IC:0x0
SENSE: 00 00 00 00 00 00 00 46
       30 20 00 00 00 00 00 00
       00 00 00 00 00 00 00 00
```

```
       00 00 00 00 00 00 00 00
IUI:0x0 DHF:0x0 CCW:0x0 TOKEN:0x0 PCCW:0x0 FCCW:0x0 PTOKEN:0x0 FTOKEN:0x0
CMD:0x0 CCW_FLAGS:0x0 CCW_COUNT:0 CMD_FLAGS:0x0 PRIO:0x0 DATA_COUNT:0
STATUS:0x0 FLAGS:0x0 PARAM:0x0 QTP:0x0 DTP:0x0
CQ LEN:0 MAX:0 DESTATUS:0x0
```

Displaying FICON Information

This section includes the following topics:

Receiving FICON Alerts

In Displays Configured FICON Information, on page 41, the user alert mode is Enabled output confirms that you will receive an alert to indicate any changes in the FICON configuration.

Displays Configured FICON Information

```
switch# show ficon
  Ficon information for VSAN 69
  Ficon is online
  VSAN is active
  Host port control is Enabled
  Host offline control is Enabled
  User alert mode is Enabled
  SNMP port control is Enabled
  Host set director timestamp is Enabled
  Active=Saved is Disabled
  Number of implemented ports are 254
  Key Counter is 73723
  FCID last byte is 0(0)
  Serial number is 04.002A6A64AF85
  Date/Time is set by host to Fri Jan 26 21:38:10.991999 2024
  Device allegiance is locked by Host
  Codepage is us-canada
  Saved configuration files
    IPL
```

Displaying FICON Port Address Information

Examples Displays Port Address Information, on page 41 to Displays Port Address Counter Information, on page 42 display FICON Port Address information.

Displays Port Address Information

```
switch# show ficon vsan 69 portaddress
Port Address 4(0x4) is up in vsan 69
 Port number is 4(0x4), Interface is fc1/5
 Port name is
 Admin port mode is auto
 Port mode is F, FCID is 0xc00400
 Peer is type 008561 model T01 manufactured by IBM
 Serial num is 00000007AFB8, FICON tag is 0x80A8

Port Address 5(0x5) is up in vsan 69
```

```
 Port number is 5(0x5), Interface is fc1/6
 Port name is
 Admin port mode is auto
 Port mode is F, FCID is 0xc00500
 Peer is type 008561 model T01 manufactured by IBM
 Serial num is 00000007AFB8, FICON tag is 0x80A9

Port Address 6(0x6) is up in vsan 69
 Port number is 6(0x6), Interface is fc1/7
 Port name is
 Admin port mode is auto
 Port mode is F, FCID is 0xc00600
 Peer is type 008561 model T01 manufactured by IBM
 Serial num is 00000007AFB8, FICON tag is 0x80AA
```

Displays the Available Port Numbers

```
switch# show ficon first-available port-number
Port number 129(0x81) is available
```

In Displays Port Address Information in a Brief Format, on page 42, the interface column is populated with the corresponding interface if the port number is installed. If the port number is uninstalled, this space remains blank and indicates an unbound port number. For example, 56 is an unbound port number in Displays Port Address Information in a Brief Format, on page 42.

Displays Port Address Information in a Brief Format

```
switch# show ficon vsan 69 portaddress 50-55 brief
--------------------------------------------------------------------------------
Port    Port    Interface          Admin     Status           Oper    FCID
Address Number                     Blocked                    Mode
--------------------------------------------------------------------------------
0x32    0x32    fc2/3              off       up               F       0xc03200
0x33    0x33    fc2/4              off       up               F       0xc03300
0x34    0x34    fc2/5              off       up               F       0xc03400
0x35    0x35    fc2/6              off       up               F       0xc03500
0x36    0x36    fc2/7              off       up               F       0xc03600
0x37    0x37    fc2/8              off       up               F       0xc03700
```

Displays Port Address Counter Information, on page 42 displays the counters in FICON version format 1 (32-bit format)

Displays Port Address Counter Information

```
switch# show ficon vsan 69 portaddress 8 counters
Port Address 8(0x8) is up in vsan 20
    Port number is 8(0x8), Interface is fc1/8
    Version presented 1, Counter size 32b
    242811 frames input, 9912794 words
      484 class-2 frames, 242302 class-3 frames
      0 link control frames, 0 multicast frames
      0 disparity errors inside frames
      0 disparity errors outside frames
      0 frames too big, 0 frames too small
      0 crc errors, 0 eof errors
      0 invalid ordered sets
      0 frames discarded c3
```

```
  0 address id errors
116620 frames output, 10609188 words
  0 frame pacing time
  0 link failures
  0 loss of sync
  0 loss of signal
  0 primitive seq prot errors
  0 invalid transmission words
  1 lrr input, 0 ols input, 5 ols output
  0 error summary
```

Displaying the Configured FICON State

If FICON is enabled on a VSAN, you can display the port address information for that VSAN (see Displays the Specified Port Address When FICON Is Enabled, on page 43).

Displays the Specified Port Address When FICON Is Enabled

```
switch# show ficon vsan 69 portaddress 5
Port Address 5(0x5) is up in vsan 69
Port number is 5(0x5), Interface is fc1/6
 Port name is
 Admin port mode is auto
 Port mode is F, FCID is 0xc00500
 Peer is type 008561 model T01 manufactured by IBM
 Serial num is 00000007AFB8, FICON tag is 0x80A9
```

Displaying Buffer Information

In Displays the History Buffer for the Specified VSAN, on page 43, the Key Counter column displays the 32-bit value maintained by Cisco MDS switches. This value is incremented when any port changes state in that VSAN. The key counter (a 32-bit value) is incremented when a FICON-related configuration is changed. Host programs can increment this value at the start of the channel program and then perform operations on multiple ports. The director history buffer keeps a log of which port address configuration was changed for each key-counter value.

The director history buffer provides a mechanism to determine the change in the port state from the previous time when a value was contained in the key counter.

Displays the History Buffer for the Specified VSAN

```
switch# show ficon vsan 20 director-history
Director History Buffer for vsan 20
-------------------------------------------
Key Counter           Ports Address
                      Changed
-------------------------------------------
74556                 43
74557                 44
74558                 45
74559                 46
74560                 47
74561                 48
```

```
74562                49
74563                50
74564                51
74565                52
74566                53
74567                54
74568                55
74569                56
74570                57
74571                58
74572                59
74573                60
74574                61
74575                62
74576                63
74577                64
74578
74579
74580                1-3,5,10,12,14-16,34-40,43-45,47-54,56-57,59-64
74581                3,5
74582                64
74583
74584                1-3,10,12,14-16,34-40,43-45,47-54,56-57,59-64
74585                1
74586                2
74587                3
```

Viewing the History Buffer

In the directory history buffer, the Key Counter column displays the 32-bit value maintained by Cisco MDS switches. This value is incremented when any port changes state in that VSAN. The key counter (a 32-bit value) is incremented when a FICON-related configuration is changed. Host programs can increment this value at the start of the channel program and then perform operations on multiple ports. The director history buffer keeps a log of which port address configuration was changed for each key-counter value.

The director history buffer provides a mechanism to determine the change in the port state from the previous time when a value was contained in the key counter.

Displaying FICON Information in the Running Configuration

Displays the Running Configuration Information, on page 44 displays the FICON-related information in the running configuration.

Displays the Running Configuration Information

```
switch# show running-config
Building Configuration ...
in-order-guarantee
vsan database
  vsan 11 name "FICON11" loadbalancing src-dst-id
  vsan 75 name "FICON75" loadbalancing src-dst-id
fcdomain domain 11 static vsan 11
fcdomain domain 119 static vsan 75
fcdroplatency network 100 vsan 11
fcdroplatency network 500 vsan 75
feature fabric-binding
```

```
fabric-binding database vsan 11
  swwn 20:00:00:0d:ec:01:20:c0 domain 10
fabric-binding database vsan 75
  swwn 20:00:00:0d:ec:00:d6:40 domain 117
fabric-binding activate vsan 11
fabric-binding activate vsan 75
ficon vsan 75
interface port-channel 1
  ficon portnumber 0x80
  switchport mode E
snmp-server user mblair network-admin auth md5 0x688fa3a2e51ba5538211606e59ac292
7 priv 0x688fa3a2e51ba5538211606e59ac2927 localizedkey
snmp-server user wwilson network-admin auth md5 0x688fa3a2e51ba5538211606e59ac29
27 priv 0x688fa3a2e51ba5538211606e59ac2927 localizedkey
snmp-server host 171.71.187.101 traps version 2c public udp-port 1163
snmp-server host 172.18.2.247 traps version 2c public udp-port 2162
vsan database
  vsan 75 interface fc1/1
...
interface mgmt0
  ip address 172.18.47.39 255.255.255.128
  switchport speed 100
  switchport duplex full
no system health
ficon vsan 75
  file IPL
```

Displaying FICON Information in the Startup Configuration

Displays the Startup Configuration, on page 45 displays the FICON-related information in the startup configuration.

Displays the Startup Configuration

```
switch# show startup-config
...
ficon vsan 2
file IPL
```

Displays the Startup Configuration Status, on page 45 displays the switch response to an implicitly-issued copy running start command. In this case, only a binary configuration is saved until you explicitly issue the **copy running start** command again (seeTable 2: Saving the Active FICON and Switch Configuration , on page 24)

Displays the Startup Configuration Status

```
switch# show startup-config
No ASCII config available since configuration was last saved internally
on account of 'active=saved' mode.
Please perform an explicit 'copy running startup` to get ASCII configuration
```

Displaying FICON-Related Log Information

Displays Logging Levels for the FICON Feature, on page 46 and Displays FICON-Related Log File Contents, on page 46 display the logging information for FICON-related configurations.

Displays Logging Levels for the FICON Feature

```
switch# show logging level ficon
Facility        Default Severity        Current Session Severity
--------        ----------------        ------------------------
ficon                   2                       2
0(emergencies)          1(alerts)       2(critical)
3(errors)               4(warnings)     5(notifications)
6(information)          7(debugging)
```

Displays FICON-Related Log File Contents

```
switch# show logging logfile
...
2024 Jan 29 12:45:40.784113 Challenger-9710 %PORT-5-IF_UP: %$VSAN 69: 2024 Mon Jan 29
16:45:40.122353%$ Interface fc2/17 is up in mode F
2024 Jan 29 12:45:40.857400 Challenger-9710 %PORT-5-IF_UP: %$VSAN 69: 2024 Mon Jan 29
16:45:40.122371%$ Interface fc2/14 is up in mode F
2024 Jan 29 12:45:40.866201 Challenger-9710 %PORT-5-IF_UP: %$VSAN 69: 2024 Mon Jan 29
16:45:40.122373%$ Interface fc1/6 is up in mode F
2024 Jan 29 12:45:40.882935 Challenger-9710 %PORT-5-IF_UP: %$VSAN 69: 2024 Mon Jan 29
16:45:40.122378%$ Interface fc1/22 is up in mode F
2024 Jan 29 12:45:40.942220 Challenger-9710 %PORT-5-IF_UP: %$VSAN 69: 2024 Mon Jan 29
16:45:40.122392%$ Interface fc2/16 is up in mode F
2024 Jan 29 12:45:40.943643 Challenger-9710 %PORT-5-IF_UP: %$VSAN 69: 2024 Mon Jan 29
16:45:40.122392%$ Interface fc2/19 is up in mode F
```

Default Settings

Table 3: Default FICON Settings , on page 46 lists the default settings for FICON features.

Table 3: Default FICON Settings

Parameters	Default
FICON feature	Disabled.
Port numbers	Always the same as port addresses.
FC ID last byte value	0 (zero).
EBCDIC format option	US-Canada.
Switch offline state	Hosts are allowed to move the switch to an offline state.
Mainframe users	Allowed to configure FICON parameters on Cisco MDS switches.

Parameters	Default
Clock in each VSAN	Same as the switch hardware clock.
Host clock control	Allows host to set the clock on this switch.
SNMP users	Configure FICON parameters.