CHAPTER 3

Bringing Up the Cisco IOS XR Software on a Multishelf System

This chapter describes how to bring up Cisco IOS XR software on a Cisco CRS Multishelf System for the first time. Layer 2 system switching is achieved using an integrated switch located on the 22-port shelf controller Gigabit Ethernet (22-port SCGE) card. The 22-port SCGE card is available as of Cisco IOS XR Software Release 3.4.1. The configuration and cabling of the Cisco CRS Multishelf System using the 22-port SCGE card is described in this chapter.

Contents

Prerequisites

The following sections describe the software and hardware requirements for bringing up a multishelf system running Cisco IOS XR Software Release 4.1.

Software Requirements

The multishelf system requires the following software:

- Compatible ROM Monitor firmware on all RPs.

Caution The ROM Monitor firmware on all RPs must be compatible with the Cisco IOS XR software release currently running on the router before a Cisco CRS system can be upgraded to Cisco IOS XR Software Release 4.1. For minimum ROM Monitor requirements, see *Software/Firmware Compatibility Matrix*.

If the router is brought up with an incompatible version of the ROM Monitor software, then the standby RP may fail to boot. If a boot block occurs in a multishelf system, contact your Cisco Systems support representative for assistance. See Obtaining Documentation and Submitting a Service Request, page xi.

Cisco CRS multishelf systems should be upgraded to ROMMON release 1.5.3 before being upgraded to Cisco IOS XR Release 4.1 to ensure that RPs are assigned the correct rack numbers during system boot.

- On a 22-port SCGE card-based system, the minimum ROMMON version required is 1.43.

For more information, see *Cisco IOS XR ROM Monitor Guide for the Cisco CRS Router* .

Hardware Requirements

Before you can bring up a multishelf system, the system components must be physically installed and tested. A variety of multishelf system configurations are supported, and they require the following components:

- One, two, three, or four 16-slot line card chassis (LCCs):
  - Each LCC must contain eight FC/M (S13) fabric cards.
  - There can be up to 64 modular services cards (MSCs) among all LCCs.
- Two 22-port shelf controller gigabit ethernet (SCGE) cards for each FCC

Caution One 22-port SCGE card works, but we strongly suggest using two cards for redundancy. If you operate the multishelf system with a single card and that card fails, the multishelf system has no control network connectivity and the router fails.

- Single-FCC systems require one FCC; two-FCC systems require two FCCs; and four-FCC systems require four FCCs. A minimum of eight S2 switch fabric cards are required for up to three LCCs; 24 S2 cards are required for 4 LCCs. In two- and four-FCC configurations, the S2 cards are distributed equally in the FCCs.

For instructions to install, cable, and verify a multishelf system, see the documents listed on the Cisco CRS documentation web page listed in the "Related Documents" section on page x.

Restrictions

The following restrictions apply to multishelf systems installed with Cisco IOS XR Software Release 4.1.

- The multishelf system supports:
  - Up to eight 16-slot LCCs.
  - One, two, or four FCCs.
  - Two 22-port shelf controller Gigabit Ethernet (SCGE) cards for each FCC, to form a Control Ethernet plane used for administrative management and for monitoring of the system.
- The 4-slot and 8-slot LCCs are not supported.
- Although Cisco IOS XR Software Release 4.1 supports the addition of a second line card chassis, the removal of a line card chassis is restricted. Consult your Cisco Technical Support representative for more information (see the "Obtaining Documentation and Submitting a Service Request" section on page xi).

Information About Bringing Up a Multishelf System

The following sections provide information that is good to know before you bring up a multishelf system:

Bringup Overview

The bringup procedure for a multishelf system starts after the hardware installation is complete. The bringup procedure tasks configure the system components to work together and verify the operation and configuration of system components. To bring up the multishelf system, complete the following procedures in the sequence shown:

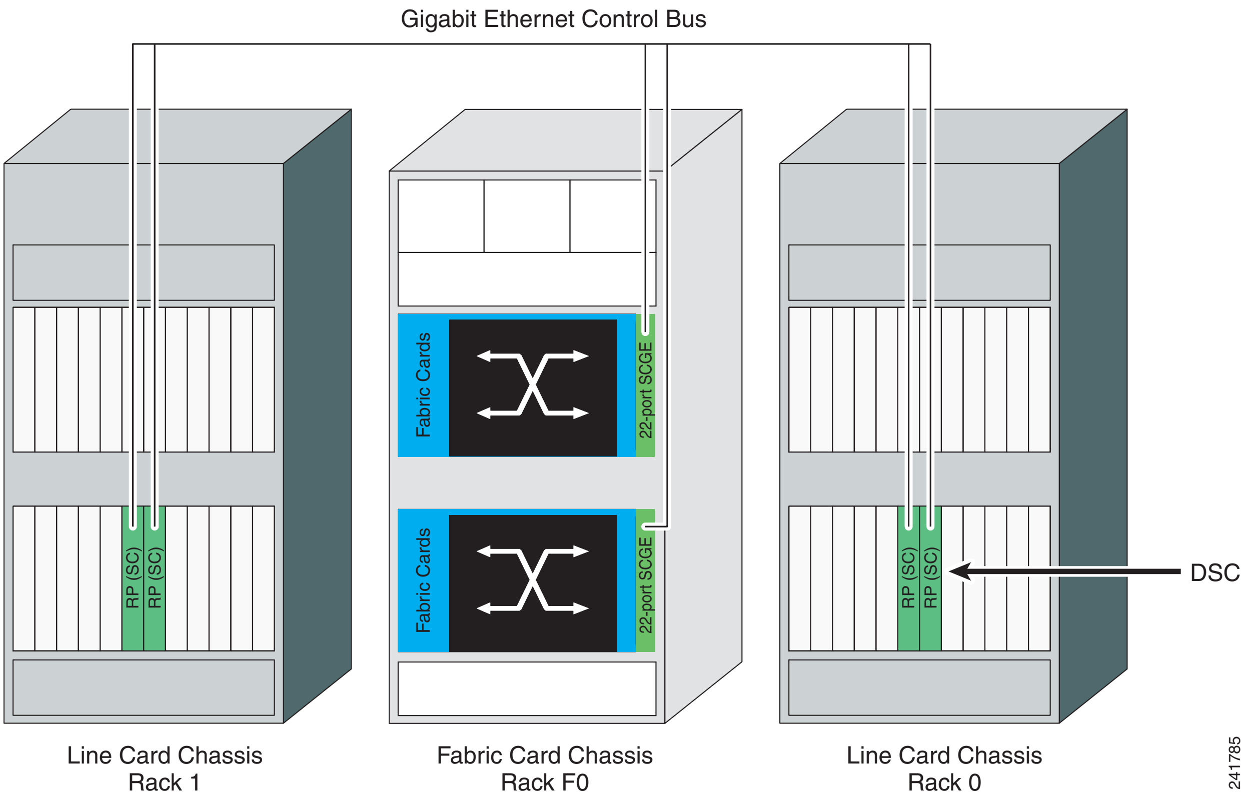
During the bringup procedure, you need the information presented in the following section.

Preparing a Rack Number Plan

In a multishelf system, each chassis must be assigned a unique rack number, as shown in Figure 3-1. This rack number is used to identify a chassis in the system, and maintain the software and configurations for the chassis.

Caution Failure to assign a unique rack number to each chassis in the system can result in serious system error and potential downtime. Unique rack numbers must be assigned and committed on Rack 0 before additional chassis are powered on and brought online.

Figure 3-1 DSC in a CRS-MC-FC24 Multishelf System



Note Chassis, shelf, and rack are used interchangeably. Each term refers to the physical tower that contains the installed cards, power, and cooling equipment. In general, *chassis* describes the system components. *Rack* is used in software to assign a rack number to each chassis.

A rack number plan lists each chassis in a system with the correct chassis serial ID and an assigned rack number. The serial ID is the chassis serial number, which can be accessed by the software and uniquely identifies the chassis. The rack number for an LCC is a number in the range of 0 to 255, which is easier to remember and read than serial numbers in display messages.

The rack number plan is used during the startup and configuration of Rack 0. The LCC that hosts the DSC must be configured as Rack 0. The non-DSC LCC must be configured to use a rack number in the range of 1 to 255. FCC rack numbers range from F0 to F3, as shown in Table 3-1, Table 3-2, and Table 3-3.

Table 3-1 shows a sample rack number plan for a single-FCC system.

Table 3-1 Sample Rack Number Plan for Single-FCC Multishelf System

Chassis	Serial ID	Rack Number
LCC containing the active DSC		0
Non-DSC LCC		1
LCC		2
LCC		3
Fabric chassis		F0

Table 3-2 shows a sample rack number plan for a two-FCC system.

Table 3-2 Sample Rack Number Plan for a Two-FCC Multishelf System

Chassis	Serial ID	Rack Number
LCC containing the active DSC		0
Non-DSC LCC		1
LCC		2
LCC		3
Fabric chassis 0		F0
Fabric chassis 1		F1

Table 3-3 shows a sample rack number plan for a four-FCC system.

Table 3-3 Sample Rack Number Plan for a Four-FCC Multishelf System

Chassis	Serial ID	Rack Number
LCC containing the active DSC		0
Non-DSC LCC		1
LCC		2
LCC		3
Fabric chassis 0		F0
Fabric chassis 1		F1
Fabric chassis 2		F2
Fabric chassis 3		F3

To complete the rack number plan, change the rack number for the non-DSC LCC if you want, and record the serial number for each chassis. The chassis serial number is attached to the back of the chassis, as shown in Figure 3-2 and Figure 3-3.

Figure 3-2 Location of the Serial Number on a Fabric Card Chassis

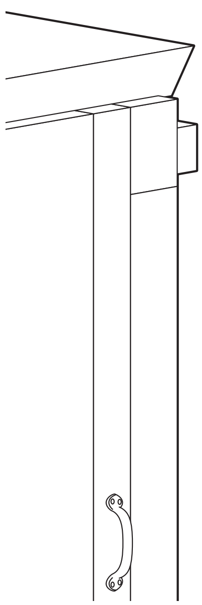
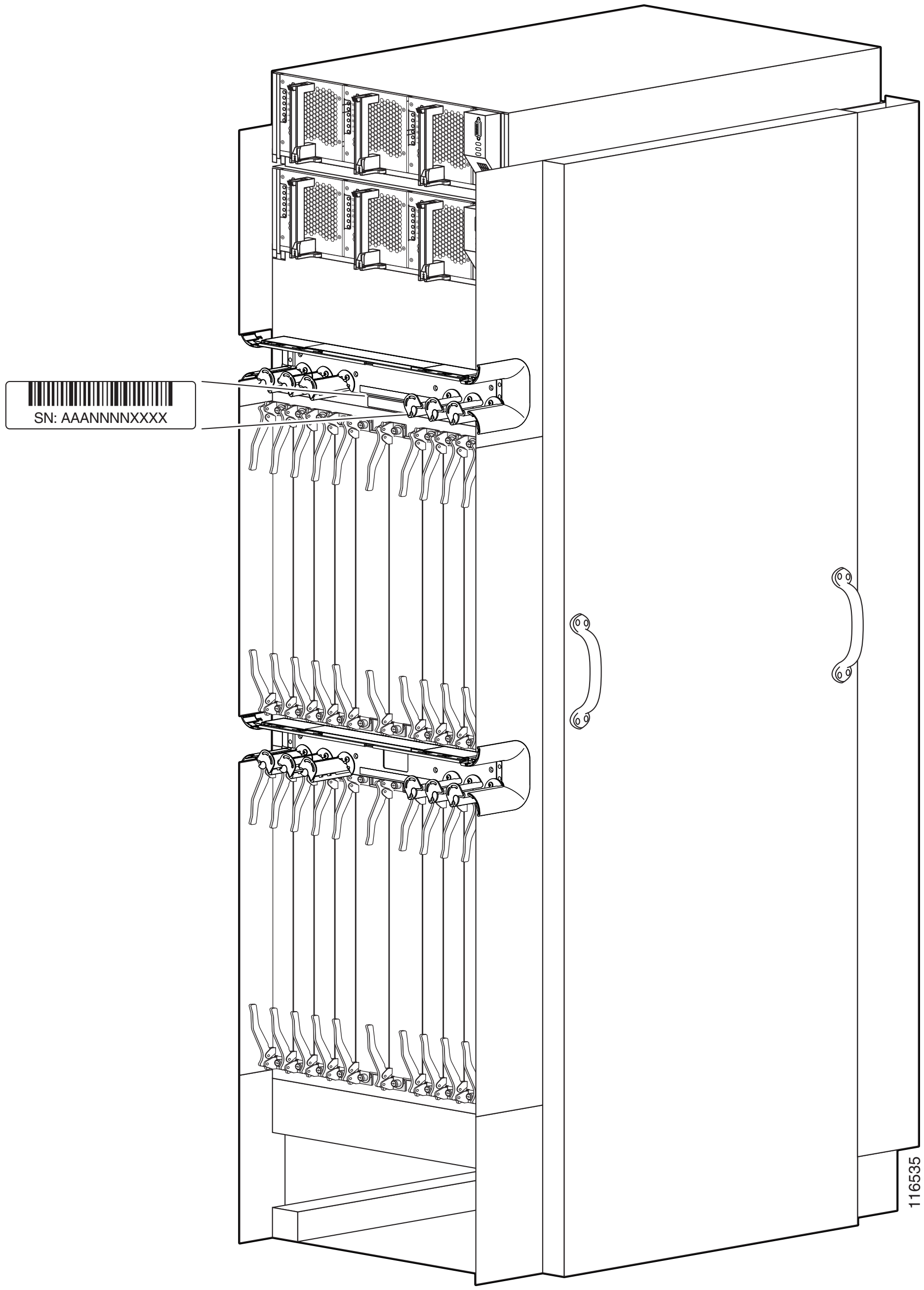


Figure 3-3 Location of the Serial Number on a Line Card Chassis



> **Caution** Always assign a rack number to each chassis in the system before the chassis is booted. If a chassis is not assigned a rack number, or if the rack number conflicts with an existing chassis, it may not be recognized by the system or cause other operational difficulties.

If you cannot locate or read the chassis serial number on a chassis, you can view the serial number stored in the software, as described in the following documents:

- To display the chassis serial numbers in administration EXEC mode, see *Cisco IOS XR System Management Configuration Guide for the Cisco CRS Router.*

- To display the configured chassis serial numbers in administration EXEC mode, see *Cisco IOS XR System Management Configuration Guide for the Cisco CRS Router.*
- To display the chassis serial numbers in ROM Monitor, see *Cisco IOS XR ROM Monitor Guide for the Cisco CRS Router.*

See the "Bringing Up and Configuring Rack 0" section on page 3-52 for complete instructions to bring up a new router and configure the rack numbers.

Cabling the Control Network Using 22-Port Shelf Controller Gigabit Ethernet Cards

This section describes how to connect cables between two 22-port SCGE cards and the other components of a multishelf system. These connections establish control network connectivity for the multishelf system.

Control Network Cabling

This section describes cabling assignments for various multishelf system configurations. The following subsections are included:

The multishelf system is connected with two paths: LCC0 and LCC1. These paths have Gigabit Ethernet (GE) connections (on the RP) that are connected to one or more GE connections (on the 22-port SCGE cards) in the FCCs. The important thing about the dual paths is that all chassis are interconnected through a path through the 22-port SCGE card network controller and through the fabric. The 22-port SCGE card provides the GE path, or Control Ethernet network, among all chassis. The second path runs through the fabric cards in all LCCs and FCCs, which are interconnected with optical array cables called *fabric cables*.

Caution One 22-port SCGE card works, but we strongly suggest using two cards for redundancy. If you operate the multishelf system with a single card and that card fails, the multishelf system has no control network connectivity and the router fails.

Note the following connection tips:

- Any GE ports can be used, in any sequence, but we suggest using ports in the sequence left to right as a convention to enable easier maintenance.
- SCGE0 is the 22-port SCGE card in the FCC upper card cage. SCGE1 is the 22-port SCGE card in the FCC lower card cage.

Caution Do not remove the plugs from the GE optical bores or the fiber-optic cable until you are ready to connect the cable. The plugs protect the bores and cable from contamination.

Prerequisites

- Before cabling the system, install each line card chassis (LCC) and fabric card chassis (FCC) in the planned location.

  For information on installing the LCCs and FCCs, see the following documents:
  - *Cisco CRS Carrier Routing System Fabric Card Chassis Installation Guide*
  - *Cisco CRS Carrier Routing System 16-Slot Line Card Chassis Installation Guide*
- All connections are made using single-mode LC to LC fiber cables. Determine the required amount of cabling based on the configuration in use:
  - Single-FCC system requires 9 cables—8 RP to SCGE cables and 1 mesh cable
  - Two-FCC system requires 14 cables—8 RP to SCGE cables and 6 mesh cables
  - Four-FCC system requires 36 cables—8 RP to SCGE cables and 28 mesh cables

Connections for a Single-FCC System

Figure 3-4 shows the cabling scheme for a single-FCC system. Table 3-4 lists the cabling connections that must be completed between the RPs and the 22-port SCGE cards, and Table 3-5 lists the mesh connection in a single-FCC system.

Figure 3-4 Connections Within a Single-FCC Multishelf System

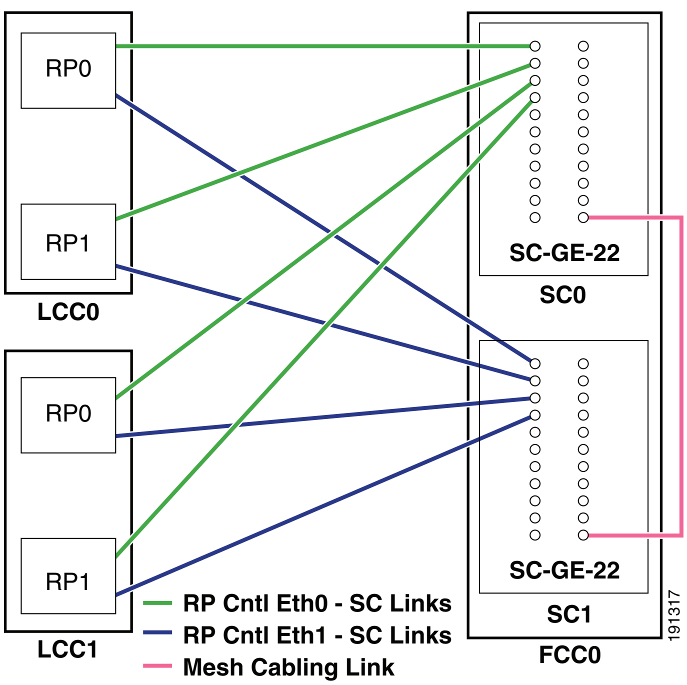


Table 3-4 RP to 22-Port SCGE Card Connections (Single-FCC System)

Chassis	RP Port	22-Port SCGE Card Number	22-Port SCGE Card Port Number
LCC0 (or lowest-number LCC)	RP0, Cntl Eth 0	SC0	GE0
	RP0, Cntl Eth 1	SC1	GE0
	RP1, Cntl Eth 0	SC0	GE1
	RP1, Cntl Eth 1	SC1	GE1
LCC1 (or highest-number LCC)	RP0, Cntl Eth 0	SC0	GE2
	RP0, Cntl Eth 1	SC1	GE2
	RP1, Cntl Eth 0	SC0	GE3
	RP1, Cntl Eth 1	SC1	GE3

Table 3-5 Mesh Connection (Single-FCC System)

Chassis	22-Port SCGE Card Number	22-Port SCGE Card Port Number
FCC0	SC0	GE21
	SC1	GE21

Connections for a Two-FCC System

Figure 3-5 shows the cabling scheme for a two-FCC system. Table 3-6 lists the cabling connections that must be completed between the RPs and the 22-port SCGE cards and Table 3-7 lists the mesh cabling connections in a two-FCC system.

Figure 3-5 Connections Within a Two-FCC Multishelf System

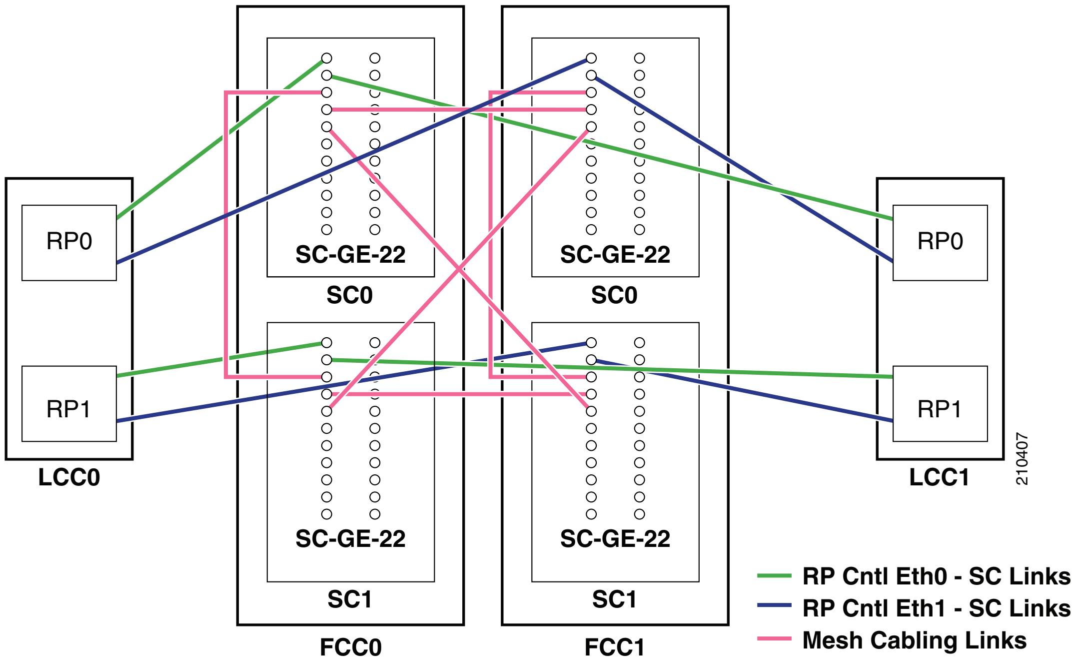


Table 3-6 RP to 22-Port SCGE Card Connections (Two-FCC System)

Chassis	RP Port	FCC	22-Port SCGE Card Number	22-Port SCGE Card Port Number
LCC0 (or lowest-number LCC)	RP0, Cntl Eth 0	FCC0	SC0	GE0
	RP0, Cntl Eth 1	FCC1	SC0	GE0
LCC0 (or lowest-number LCC)	RP1, Cntl Eth 0	FCC0	SC1	GE0
	RP1, Cntl Eth 1	FCC1	SC1	GE0
LCC1 (or highest-number LCC)	RP0, Cntl Eth 0	FCC0	SC0	GE1
	RP0, Cntl Eth 1	FCC1	SC0	GE1
LCC1 (or highest-number LCC)	RP1, Cntl Eth 0	FCC0	SC1	GE1
	RP1, Cntl Eth 1	FCC1	SC1	GE1

Table 3-7 Mesh Connections (Two-FCC System)

Originating Chassis	22-Port SCGE Card Number	22-Port SCGE Card Port Number	Destination Chassis	22-Port SCGE Card Number	22-Port SCGE Card Port Number
FCC0	SC0	GE2	FCC0	SC1	GE2
FCC1	SC0	GE2	FCC1	SC1	GE2
FCC0	SC0	GE3	FCC1	SC0	GE3
FCC0	SC1	GE3	FCC1	SC1	GE3
FCC0	SC0	GE4	FCC1	SC1	GE4
FCC0	SC1	GE4	FCC1	SC0	GE4

Connections for a Four-FCC System

Figure 3-6 shows the cabling scheme for a four-FCC system. Table 3-8 lists the cabling connections that must be completed between the RPs and the 22-port SCGE cards. Figure 3-7 shows the mesh cabling connections in a four-FCC system.

Figure 3-6 Connections Within a Four-FCC Multishelf System

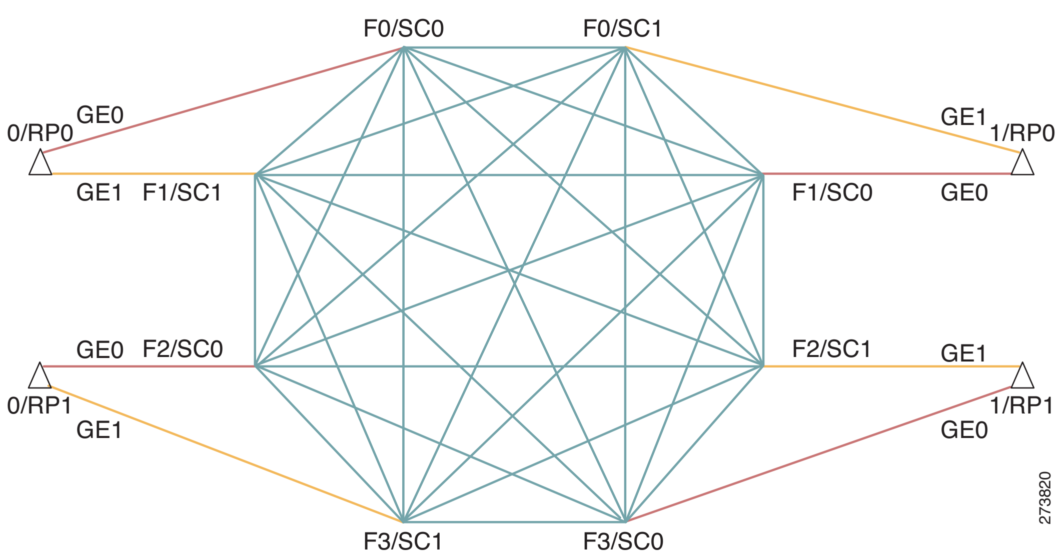


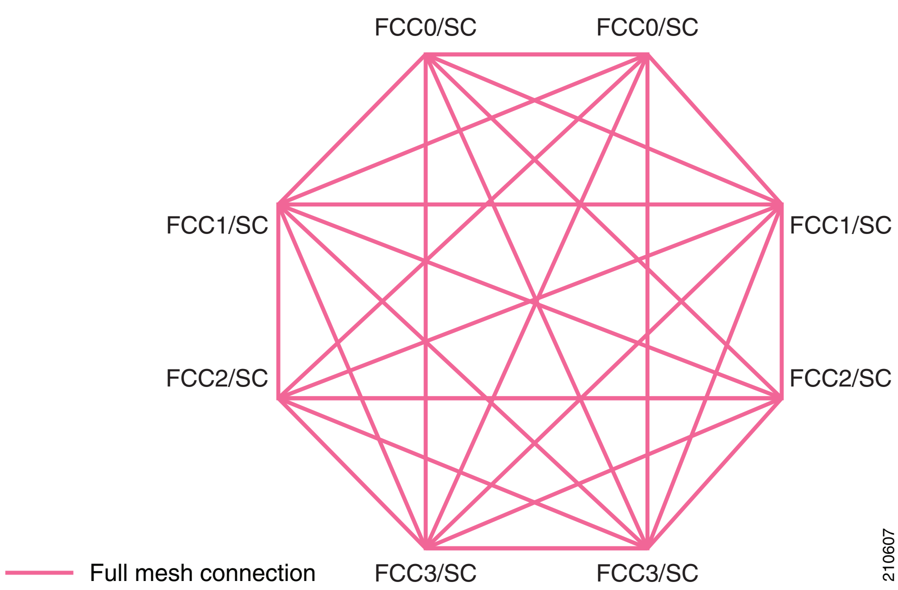
Table 3-8 RP to 22-Port SCGE Card Connections (Four-FCC System)

LCC	RP Port	FCC	22-Port SCGE Card Number	22-Port SCGE Card Port Number
LCC0 (or lowest-number LCC)	RP0, Cntl Eth 0	FCC0	SC0	GE0
	RP0, Cntl Eth 1	FCC1	SC1	GE0
	RP1, Cntl Eth 0	FCC2	SC0	GE0
	RP1, Cntl Eth 1	FCC3	SC1	GE0
LCC1 (or highest-number LCC)	RP0, Cntl Eth 0	FCC1	SC0	GE0
	RP0, Cntl Eth 1	FCC0	SC1	GE0
	RP1, Cntl Eth 0	FCC3	SC0	GE0
	RP1, Cntl Eth 1	FCC2	SC1	GE0

Mesh Cabling (Four-FCC System)

To complete the cabling of a four-FCC system, all the 22-port SCGE cards in the FCCs must be connected to each other in a full-mesh configuration. This provides a great amount of redundancy, so in the event that one of the nodes fails, network traffic is directed to any of the other nodes. Figure 3-7 shows a graphical view of the full-mesh configuration.

Figure 3-7 Mesh Cabling Diagram (Four-FCC System)



Configuring the Integrated Switches

Integrated switches are two Gigabit Ethernet switches placed on system controller cards in the fabric chassis. The system controller card is called a 22-port shelf controller Gigabit Ethernet (22-port SCGE) card, because it contains 22 ports on the front panel. Each 22-port SCGE card provides 22 Gigabit Ethernet (GE) links, which are used to interconnect control network connections of the different Cisco CRS chassis.

For information about the cabling schemes for a single-FCC multishelf system, two-FCC multishelf system, and four-FCC multishelf system, see *Cisco CRS Carrier Routing System Multishelf System Interconnection and Cabling Guide*.

This section includes the following topics:

- Prerequisites for Integrated Switches, page 3-44
- Before You Begin, page 3-44
- Information About the Integrated Switch Implementation, page 3-45
- Implementing the Integrated Switches on a Multishelf System, page 3-47

Prerequisites for Integrated Switches

Before configuring integrated switches, be sure that the following conditions are met:

- Software Requirements, page 3-44
- Hardware Requirements, page 3-44

Software Requirements

- Requires ROMMON 1.43 or higher on all RP and 22-port SCGE nodes. The 22-port SCGE card comes with ROMMON 1.43 or later version.

Note ROMMON 1.43 is the first ROMMON version to support 22-port SCGE cards.

- Requires Cisco IOS XR Software Release 3.4.1 or later release to support the 22-port SCGE cards.

Hardware Requirements

Route processors (RPs) must be revision 8 or higher. SMF cables are required and LX optics are recommended.

Before You Begin

Before you begin to bring up the integrated switch control network, consider the following items:

- See Cabling the Control Network Using 22-Port Shelf Controller Gigabit Ethernet Cards, page 3-38 for information on cabling guidelines for the 22-port SCGE cards.
- For additional information regarding Cisco IOS commands and usage, see the “Cisco IOS Software Configuration” page at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/software/index.htm

Information About the Integrated Switch Implementation

To implement the integrated switch, you must understand the following concepts:

- Integrated Switch Overview, page 3-45
- Integrated Switch Functions, page 3-46
- Integrated Switch Control Network Topology, page 3-46
- LED Definitions for the Integrated Switch System, page 3-47

Integrated Switch Overview

Four switches are present on the 22-port SCGE card. Two switches provide connectivity to all cards inside the chassis. Two more Gigabit Ethernet (GE) switches on the board allow for all the external connections.

Table 3-9 lists the differences between intra-rack switch and inter-rack switch for the 22-port SCGE card.

Table 3-9 Differences Between Intra-Rack and Inter-Rack

Rack Type	Description
Intra-rack switch	Provides connectivity inside the rack through FE ports. These switches are similar to the switches found on the RP card. **Note** The GE1 link on intra-rack switches on the 22-port SCGE card is not connected.
Inter-rack switch	Provides connectivity between the racks.

Integrated Switch Functions

The 22-port SCGE performs the following functions:

- Arbitrates for shelf ownership (active mode or standby mode) with the other 22-port SCGE card that is installed on the rack.
- Provides 22 GE ports for external system management communication across racks.
- Performs the same type of control plane functions as the current SCGE for the multishelf system.
- Supports 22 GE ports and has the capability to support up to 72 line card chassis.
- Validates the link state before running the Spanning Tree Protocol (STP) that prevents a link from being unidirectional and causes a spanning tree loop.
- Checks the link for any unidirectional mode when a cable is plugged into the 22-port SCGE. If the 22-port SCGE software detects this condition, the port cannot be allowed to participate in the spanning tree algorithm.

In active mode, you can perform the following functions:

- Download the Ethernet MAC addresses from the backplane EPROM and assign them to all boards in the rack.
- Start up and monitor power supplies, rack fans, and thermal sensors within the fabric rack upon request from the system management network.
- Start up board power supplies and download software images to the fabric cards in the rack upon request from the system management network. Start and reset board processors.
- Send alarms, reset, and shut down portions of the rack hardware in case of abnormal or dangerous conditions in the rack.
- Keep a log of the 22-port SCGE cards and rack activity on nonvolatile memory. Take core dumps onto the hard disk.
- Initiate a self-reset and rearbitration for shelf ownership in case of a watchdog timeout.
- Control and monitor the fan speed.

In standby mode, you can perform the following functions:

- Test the FE links to all the rack hardware periodically.
- Keep the local state information synchronized to the rack master.
- Rearbitrate the shelf ownership if the primary router releases ownership.

Integrated Switch Control Network Topology

Once the 22-port SCGE cards are installed, the control network topology ceases to be a simple hub-and-spoke set of connections.

A control network topology provides the following functions:

- Each RP in a line card chassis is connected to two different 22-port SCGE cards in a fabric chassis.
- The 22-port SCGE cards are interconnected in a full mesh to provide an available control network with multiple redundant Ethernet connections.
- The 22-port SCGE cards appear to be a backbone in which different RPs are connected from the outside.
- Both the 22-port SCGE cards and RPs run the rapid spanning tree protocol (RSTP) to provide a loop-free topology.

LED Definitions for the Integrated Switch System

The 22-port SCGE displays the LEDs on the front panel foe every port. Table 3-10 lists the LEDs that are used to obtain information about the link.

Table 3-10 LEDs for the Integrated Switch

LED	Description
Green	Link Up
Blinking Green	Activity
Amber	Port error disabled Unidirectional Link Detection (UDLD)
Off	Link Down

Implementing the Integrated Switches on a Multishelf System

This section presents topics that explain how to implement the integrated switches:

Implementing the Integrated Switch Through ROMMON

When the 22-port SCGE comes out of reset, the ROM Monitor must initialize the switches so that no loops get formed and the processor can communicate with the rest of the system. The ROM Monitor configures the switches.

Table 3-11 lists the ROM Monitor switch configuration.

Table 3-11 ROM Monitor Switch Configuration

Type	Description
Switch connections	The BCM5618s create the intra-rack control network. The BCM5690s create the inter-rack control network. There are two BCM5690 switches that are connected through a 10 Gbps stacking link. Port 11 on BCM5690-sw1 is connected to BCM5618-sw0-GE, which is also referred to as BCM5618-GE0. This is the link that connects the intra-rack control network to the inter-rack control network. Port 0 on BCM5618-sw0 is connected to the control Ethernet port for the CPU.
Port configuration	Both BCM5690 switches are configured to forward traffic only to port 11 of BCM5690-sw1 (for example, the CPU bound port). Because forwarding is not enabled between any other ports on those switches, the switches can never participate in a loop. The BCM5618s are configured in a very similar manner by enabling forwarding to only port 0 (CPU port) of BCM5618-sw0 to or from any other port.

Implementing the Integrated Switch in Cisco IOS XR

When the RP and SCGE node boots to Cisco IOS XR software, Rapid Spanning Tree Protocol (RSTP) starts to run on that node. On the RP, the RSTP configures the state of the 2-GE and inter-RP (backplane) FE port. RSTP runs on all ports of inter-rack switches in addition to the intra-rack switch ports.

Assigning a Bridge Priority

The switches on the 22-port SCGE, which are connected to each other, form the core of the network. The RP connections form the edge (regardless of whether the 22-port SCGEs are connected in a full or partial mesh). In steady state, the integrated switch network has the root in the core. The root is one of the 22-port SCGEs.The following default priorities are achieved with the RSTP software:

- RP is set to 36864.
- 22-port SCGE is set to 32768.

Booting Up the Integrated Switch Network

For the 22-port SCGEs, the switching control fabric of the control Ethernet is brought up at the same time as the Cisco CRS system. Initially, the designated system controller (DSC) comes up first, followed by the FCCs and line card chassis (LCCs).

Reenabling the Ports

Perform this task to reenable the ports if the interfaces on the 22-port SCGE card are in the err-disable state due to a UDLD failure.

SUMMARY STEPS

1. **admin**
2. **clear controller switch errdisable** {**port** {**FE** | **GE**} {**0** | **1**}} {**location** *node-id*}}
3. **clear controller switch inter-rack** {**errdisable** {**ports** {*number* | **all**} | **statistics** {**all** | **ports** *number*}} {**location** *node-id*}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**admin** **Example:** `RP/0/RP0/CPU0:router# admin`	Places the router in administration EXEC mode.
Step 2	**clear controller switch errdisable** {**port** {**FE** | **GE**} {**0** | **1**}} {**location** *node-id*} **Example:** `RP/0/RP0/CPU0:router(admin)# clear controller switch errdisable port GE 1 location f0/sc0/cpu0`	Clears the err-disable state of the switch port for the RP ports. • Use the **FE** keyword to display the ports for Fast Ethernet (FE). • Use the **GE** keyword to display the ports for Gigabit Ethernet (GE).
Step 3	**clear controller switch inter-rack** {**errdisable** {**ports** {*number* | **all**} | **statistics** {**all** | **ports** *number*}} {**location** *node-id*} **Example:** `RP/0/RP0/CPU0:router(admin)# clear controller switch inter-rack statistics all location f0/sc0/cpu0`	Clears the err-disable state of the inter-rack switch ports on the 22-port SCGE.

Verifying the Connections of the Integrated Switch Control Network

This section presents how to verify the connections and operations of the integrated switch control network with 22-port SCGEs:

- Verifying the Control Ethernet Connection, page 3-49
- Verifying the Port Statistics, page 3-50
- Verifying Bidirectionality, page 3-51
- Verifying Unidirectional Link Detection (UDLD) Protocol Information, page 3-51
- Verifying Spanning Tree Protocol Information, page 3-51

Verifying the Control Ethernet Connection

To verify the control Ethernet connection on intra-rack switches, use the **show controllers switch** command with the **ports** and **location** keywords, as shown in the following example:

```
RP/0/RP0/CPU0:router(admin)# show controllers switch 0 ports location 0/rp0/Cpu0

Switch Instance 0:
FE Port  0 : Up, STP State : FORWARDING (Connects to - 0/RP0)
```

```
FE Port  1 : Up, STP State : FORWARDING (Connects to - 0/RP1)
FE Port  2 : Up, STP State : FORWARDING (Connects to - 0/SM0)
FE Port  3 : Up, STP State : FORWARDING (Connects to - 0/SM1)
FE Port  4 : Up, STP State : FORWARDING (Connects to - 0/SM2)
FE Port  5 : Up, STP State : FORWARDING (Connects to - 0/SM3)
FE Port  6 : Down                       (Connects to - )
FE Port  7 : Down                       (Connects to - )
FE Port  8 : Down                       (Connects to - 0/LC0)
FE Port  9 : Up, STP State : FORWARDING (Connects to - 0/LC1)
FE Port 10 : Down                       (Connects to - 0/LC2)
FE Port 11 : Down                       (Connects to - 0/LC3)
FE Port 12 : Up, STP State : FORWARDING (Connects to - 0/LC4)
FE Port 13 : Down                       (Connects to - 0/LC5)
FE Port 14 : Up, STP State : FORWARDING (Connects to - 0/LC6)
FE Port 15 : Down                       (Connects to - 0/LC7)
GE Port  0 : Down                       (Connects to - GE_0)
GE Port  1 : Down                       (Connects to - GE_1)
```

Verifying the Port Statistics

To verify the port statistics, use the **show controllers switch** command with the **statistics** and **location** keywords, as shown in the following example:

```
RP/0/RP0/CPU0:router(admin)# show controllers switch 0 statistics location 0/rp0/Cpu0

Switch Instance 0:
Port              Tx Frames             Tx Errors         Rx Frames    Rx Errors  Connects
------------------------------------------------------------------------------------------

0 :              58551626                    0             51173271         2       0/RP0
1 :              14529487                    0             11369535         8       0/RP1
2 :               9486386                     0             2822778         4       0/SM0
3 :               9486921                     0             2823279         4       0/SM1
4 :               9486996                     0             2823668         4       0/SM2
5 :               9486422                     0              2822799        4       0/SM3
6 :                      0                    0                    0        0
7 :                      0                    0                    0        0
8 :                      0                    0                    0        0       0/LC0
9 :              18044937                     0            11711858        4       0/LC1
10 :                      0                     0                    0        0       0/LC2
11 :                      0                     0                    0        0       0/LC3
12 :              13895759                     0             13753778        4       0/LC4
13 :                      0                     0                    0        0       0/LC5
14 :              19449052                     0             13103486        4       0/LC6
15 :                      0                     0                    0        0       0/LC7
24 :                      0                     0                    0        0        GE_0
25 :                      0                     0                    2        2        GE_1
```

To verify the port statistics, use **show controllers switch inter-rack statistics** command with the **detail** and **location** keywords, as shown in the following example:

```
RP/0/RP0/CPU0:router(admin)# show controllers switch inter-rack statistics 0 detail
location f0/sc0/cpu0

GE_Port_0

 Rx fragment            :          0    Tx fragment            :          0
 Rx unicast             :    1642337    Tx unicast             :     379927
 Rx multicast           :      51619    Tx multicast           :     205950
 Rx broadcast           :      91436    Tx broadcast           :     150357
 Rx FCS error           :          0    Tx FCS error           :          0
 Rx Pause               :          0    Tx Pause               :          0
```

```
 Rx Undersize           :          0    Tx Oversize           :          0
 Rx FFP drop            :          0    Tx CFI drop           :          0
 Rx Control frame       :          0    Tx Cell error         :          0
                                        Tx Jabber             :          0
                                        Tx excessive collision:          0
                                        Tx tagged vlan        :          0
                                        Tx abort              :          0
```

Verifying Bidirectionality

To verify the bidirection for the integrated switch, you can use the Unidirectional Link Detection (UDLD) protocol to detect unidirectional links on Ethernet ports. UDLD is a Layer 2 protocol. UDLD is useful at linkup time. If the link is detected to be unidirectional, the port is shut down. In addition, UDLD detects unidirectional failures after a port has been up and bidirectional for a certain time. If a transceiver goes wrong, UDLD protects the control network from faulty transceivers that are plugged into the control network.

To provide the port information that is disabled (UDLD), use the **show controllers switch udld ports** command.

Verifying Unidirectional Link Detection (UDLD) Protocol Information

To verify Unidirectional Link Detection (UDLD) protocol information for inter-rack switches, use the **show controllers switch inter-rack udld location** command, as shown in the following example:

```
RP/0/RP0/CPU0:router(admin)# show controllers switch inter-rack udld all location
f0/sc0/cpu0

Interface Gig port# 13
---
…
Current bidirectional state: Bidirectional
Current operational state: Advertisement - Single neighbor detected
…
…
    Entry 1
    ---
    …
    Device name: 0_RP0_CPU0_Switch
    Port ID: GE_Port_0
    Neighbor echo 1 device: nodeF0_SC0_CPU0
    Neighbor echo 1 port: Gig port# 13
```

Verifying Spanning Tree Protocol Information

To verify Spanning Tree Protocol (STP) information for intra-rack switches, use the **show controllers switch stp location** command, as shown in the following example:

```
RP/0/RP0/CPU0:router(admin)# show controllers switch stp location f0/sc0/CPU0

##### MST   0 vlans mapped:   2-4094
Bridge        address 0800.453e.469a  priority      36864 (36864 sysid 0)
Root          address 5246.48f0.20ff  priority      32768 (32768 sysid 0)
              port       GE_Port_0    path cost            0
Regional Root address 5246.48f0.20ff  priority      32768 (32768 sysid 0)
                                      internal cost     20000 rem hops  3
Operational   hello time  1, forward delay  6, max age  8, txholdcount  6
```

```
Configured    hello time  1, forward delay  6, max age  8, max hops     4

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- ---------------------------

##### MST   1 vlans mapped:   1
Bridge        address 0800.453e.469a  priority      36865 (36864 sysid 1)
Root          address 5246.48f0.20ff  priority      32769 (32768 sysid 1)
              port       GE_Port_0    cost              20000 rem hops  3

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- ----------------------------
       FE_Port_1 Desg  FWD   200000 128.   2 P2p
       GE_Port_0 Root  FWD    20000 128.  49 P2p
```

To verify STP information for inter-rack switches, use the **show controllers switch inter-rack ports** command, as shown in the following example:

```
RP/0/RP0/CPU0:router(admin)# show controllers switch inter-rack stp location f0/sc0/cpu0

##### MST   0 vlans mapped:   2-4094
Bridge        address 5246.48f0.20ff  priority      32768 (32768 sysid 0)
Root          this switch for the CIST
Operational   hello time  1, forward delay  6, max age  8, txholdcount  6
Configured    hello time  1, forward delay  6, max age  8, max hops     4

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- ---------------------------

##### MST   1 vlans mapped:   1
Bridge        address 5246.48f0.20ff  priority      32769 (32768 sysid 1)
Root          this switch for MST1

Interface        Role Sts Cost      Prio.Nbr Type
---------------- ---- --- --------- -------- ---------------------------
           GE_13 Desg  FWD    20000 128.  14 P2p
           GE_14 Desg  FWD    20000 128.  15 P2p
           GE_15 Desg  FWD    20000 128.  16 P2p
           GE_17 Desg  FWD    20000 128.  18 P2p
           GE_22 Desg  FWD    20000 128.  23 P2p
```

Bringing Up and Configuring Rack 0

When the control network has been established by installing, cabling, and configuring the 22-port SCGE cards, bring up and configure Rack 0 in the multishelf system, as described in the following procedure:

SUMMARY STEPS

1. Power down all LCCs and FCCs.
2. Apply power to the LCC that contains the DSC.
3. Connect to the DSC console port and log in.
4. **admin**
5. **configure**
6. **dsc serial** *serial ID* **rack 0**
7. **dsc serial** *serial ID* **rack** *rackNumber*

8. **dsc serial** *serial ID* **rack F***n*
9. **commit**
10. **show running-config | include dsc**
11. **controllers fabric plane** *planeNumber*
    oim count 1
    oim instance 0 location F*rack***/***slot***/FM**
12. **commit**
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Power down all LCCs and FCCs.	Prepares the LCCs and FCCs for startup in the proper sequence. • Each LCC and FCC should be powered up in the order specified in this chapter.
Step 2	Apply power to the LCC that contains the DSC.	Boots the LCC containing the DSC. • Allow the rack to fully boot. • Verify that "IOS XR RUN" appears on the RP faceplates. • See the Cisco CRS documentation web page listed in the "Related Documents" section on page x for site planning information including DSC placement.
Step 3	Connect to the DSC console port and log in.	Establishes a CLI management session with the router. For more information, see the "Connecting to the Router Through the Console Port" section on page 1-13.
Step 4	**`admin`** **Example:** `RP/0/RP0/CPU0:router# admin`	Places the router in administration EXEC mode.
Step 5	**`configure`** **Example:** `RP/0/RP0/CPU0:router(admin)# configure`	Places the router in administration configuration mode.
Step 6	**`dsc serial`** *`serial ID`* **`rack 0`** **Example:** `RP/0/RP0/CPU0:router(admin-config)# dsc serial TBA00000001 rack 0`	Defines which LCC is Rack 0. • The LCC containing the DSC should be configured with the lowest rack number. • Replace *serial ID* with the serial number of the LCC you want to configure as Rack 0. • See the "Preparing a Rack Number Plan" section on page 3-33 for information on locating the serial number.

	Command or Action	Purpose
Step 7	**dsc serial** *serial ID* **rack** *rackNumber* **Example:** `RP/0/RP0/CPU0:router(admin-config)# dsc serial TBA00000002 rack 1`	Defines the rack number for the second LCC. • See the "Preparing a Rack Number Plan" section on page 3-33 for information on locating the serial numbers and selecting rack numbers. • Replace *serial ID* with the serial number of the second LCC. • Replace *rackNumber* with a number in the range of 1 to 255. • When each subsequent LCC comes on line, the DSC examines the chassis serial number and automatically assigns the correct rack number to that chassis.
Step 8	**dsc serial** *serial ID* **rack F***n* **Example:** `RP/0/RP0/CPU0:router(admin-config)# dsc serial TBA00000003 rack F0`	Defines the rack number for an FCC. • See the "Preparing a Rack Number Plan" section on page 3-33 for information on locating the serial numbers and selecting rack numbers. • Enter this command for every FCC in the multishelf system. • Replace *serial ID* with the serial number of the FCC. • Replace *n* with the FCC rack number. These numbers begin with F0 and increment to F1, F2, and F3. • When each subsequent rack comes on line, the DSC examines the chassis serial number and automatically assigns the correct rack number to that chassis.
Step 9	**commit** **Example:** `RP/0/RP0/CPU0:router(admin-config)# commit`	Commits the target configuration to the router running configuration.
Step 10	**show running-config | include dsc** **Example:** `RP/0/RP0/CPU0:router(admin-config)# show running-config | include dsc`	Displays the committed rack number configuration. Verify that the serial numbers entered for each chassis are correct.

	Command or Action	Purpose

Step 11	**controllers fabric plane** *planeNumber*
	oim count 1
	oim instance 0 location F*rack***/SM***slot***/FM**
	
	Example:
	`RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 0`
	`RP/0/RP0/CPU0:router(admin-config)# oim count 1`
	`RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM9/FM`
		Configures a plane to operate in an FCC slot.
		• Enter this command sequence for each of the eight fabric planes.
		• Replace *planeNumber* with the number of the plane (0 to 7) you want to configure.
		• Replace *rack* with the FCC rack number assigned to the FCC that hosts the plane.
		• Replace *slot* with the FCC slot number that supports the fabric plane you are configuring. Valid slot numbers are SM0 to SM23.
		• The plane numbers and slot numbers are determined by the hardware installation and cabling. The software configuration must match the hardware configuration. For more information, see *Cisco CRS Carrier Routing System Multishelf System Interconnection and Cabling Guide*.

Step 12	**commit** **Example:** `RP/0/RP0/CPU0:router(admin-config)# commit`	Commits the target configuration to the router running configuration.

Step 13	**end**
	
	Example:
	`RP/0/RP0/CPU0:router(admin-config)# end`
	`RP/0/RP0/CPU0:router(admin)#`
		Exits administration configuration mode and enters administration EXEC mode.

Examples

The following examples illustrate how to bring up and configure Rack 0:

- Configuring and Verifying the Rack Numbers in a Single-FCC Multishelf System: Example, page 3-55
- Mapping Each Fabric Plane in a Single-FCC Multishelf System: Example, page 3-56
- Mapping Each Fabric Plane in a Two-FCC Multishelf System: Example, page 3-56
- Mapping Each Fabric Plane in a Four-FCC Multishelf System: Example, page 3-57

Configuring and Verifying the Rack Numbers in a Single-FCC Multishelf System: Example

In the following example, rack numbers are assigned to each LCC and FCC in administration configuration mode:

```
RP/0/RP0/CPU0:router# admin
RP/0/RP0/CPU0:router(admin)# configure
RP/0/RP0/CPU0:router(admin-config)# dsc serial TBA00000001 rack 0
RP/0/RP0/CPU0:router(admin-config)# dsc serial TBA00000002 rack 1
RP/0/RP0/CPU0:router(admin-config)# dsc serial TBA00000003 rack F0
RP/0/RP0/CPU0:router(admin-config)# commit
RP/0/RP0/CPU0:router(admin-config)# show running-config | include dsc
```

```
Building configuration...
dsc serial TBA00000003 rack F0
dsc serial TBA00000001 rack 0
dsc serial TBA00000002 rack 1
RP/0/RP0/CPU0:router(admin-config)#
```

Mapping Each Fabric Plane in a Single-FCC Multishelf System: Example

In the following example, each fabric plane is assigned to an FCC slot in administration configuration mode:

```
RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 0
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM9/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 1
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM6/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 2
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM3/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 3
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM0/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 4
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM12/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 5
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM15/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 6
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM18/FM

RP/0/RP0/CPU0:router(admin-config)# controllers fabric plane 7
RP/0/RP0/CPU0:router(admin-config)# oim count 1
RP/0/RP0/CPU0:router(admin-config)# oim instance 0 location F0/SM21/FM

RP/0/RP0/CPU0:router(admin-config)# commit
RP/0/RP0/CPU0:router(admin-config)# end
RP/0/RP0/CPU0:router(admin)#
```

Mapping Each Fabric Plane in a Two-FCC Multishelf System: Example

The following display is an example of a configuration for a two-FCC multishelf system:

```
RP/0/RP0/CPU0:router(admin)# show running-config

Building configuration...
username admin
 secret 5 $1$iGx3$0BI/8hOKRUMqtfWC4IUn50
 group root-system
 group cisco-support
!
dsc serial TBA09250241 rack 1
dsc serial TBA09270100 rack F0
dsc serial TBA09300128 rack F1
controllers fabric plane 0
```

```
 oim count 1
 oim instance 0 location F0/SM0/FM
!
controllers fabric plane 1
 oim count 1
 oim instance 0 location F0/SM9/FM
!
controllers fabric plane 2
 oim count 1
 oim instance 0 location F0/SM12/FM
!
controllers fabric plane 3
 oim count 1
 oim instance 0 location F0/SM21/FM
!
controllers fabric plane 4
 oim count 1
 oim instance 0 location F1/SM0/FM
!
controllers fabric plane 5
 oim count 1
 oim instance 0 location F1/SM91/FM
!
controllers fabric plane 6
 oim count 1
 oim instance 0 location F1/SM12/FM
!
controllers fabric plane 7
 oim count 1
 oim instance 0 location F1/SM21/FM
!
end
```

Mapping Each Fabric Plane in a Four-FCC Multishelf System: Example

The following configuration display is an example of a configuration for a four-FCC multishelf system:

```
RP/0/RP0/CPU0:router(admin)# show running-config

Building configuration...
username admin
 secret 5 $1$iGx3$0BI/8hOKRUMqtfWC4IUn50
 group root-system
 group cisco-support
!
dsc serial TBA09250241 rack 1
dsc serial TBA09270100 rack F0
dsc serial TBA09300128 rack F1
dsc serial TBA09460027 rack F3
dsc serial TBA09460028 rack F2
controllers fabric plane 0
 oim count 1
 oim instance 0 location F0/SM0/FM
!
controllers fabric plane 1
 oim count 1
 oim instance 0 location F0/SM9/FM
!
controllers fabric plane 2
 oim count 1
 oim instance 0 location F1/SM0/FM
!
controllers fabric plane 3
```

```
 oim count 1
 oim instance 0 location F1/SM9/FM
!
controllers fabric plane 4
 oim count 1
 oim instance 0 location F2/SM0/FM
!
controllers fabric plane 5
 oim count 1
 oim instance 0 location F2/SM9/FM
!
controllers fabric plane 6
 oim count 1
 oim instance 0 location F3/SM0/FM
!
controllers fabric plane 7
 oim count 1
 oim instance 0 location F3/SM9/FM
!
end
```

Bringing Up and Verifying FCCs

When Rack 0 is up and configured to support the rack number and FCC fabric plane plans, it is time to bring up and configure the FCC in the multishelf system as described in the following procedure.

SUMMARY STEPS

1. Apply power to all FCCs.
2. **show controllers fabric rack all detail**
3. **show controllers fabric plane all detail**
4. **show controllers fabric connectivity all detail**
5. Verify that the links are not unidirectional

DETAILED STEPS

	Command or Action	Purpose
Step 1	Apply power to all FCCs.	Starts the FCCs. • Allow each FCC to fully boot. • Verify that "IOS XR RUN" appears on the SC faceplates. • Verify that the indicator LED on the OIM LED panel is green for each fabric cable connected to Rack 0. • Each FCC loads any required software and configurations from the DSC, including the rack number and appropriate Cisco IOS XR software packages. • Do not proceed until both SCGEs in each FCC display "IOS XR RUN." This message indicates that each SCGE has successfully loaded the Cisco IOS XR software.
Step 2	**show controllers fabric rack all detail** **Example:** `RP/0/RP0/CPU0:router(admin)# show controllers fabric rack all detail`	Displays the status of all racks in the system. • In a properly operating system, the rack status for all racks should be *Normal*, and the server status should be *Present*.
Step 3	**show controllers fabric plane all detail** **Example:** `RP/0/RP0/CPU0:router(admin)# show controllers fabric plane all detail`	Displays the status of all racks and additional information for racks in installation mode. • Wait for the status in the *Admin State* and *Oper State* columns to change to UP for all planes.
Step 4	**show controllers fabric connectivity all detail** **Example:** `RP/0/RP0/CPU0:router(admin)# show controllers fabric connectivity all detail`	Displays the LCC cards that can communicate with all eight fabric planes. • The expected output should contain a series of '1's for each of the fabric planes active in the system. If a fabric plane is administratively "shutdown" the output of the command above remains the same. If the fabric card is physically removed or powered down, the "1" changes to "."
Step 5	Verify that the links are not unidirectional.	Verifies that the links from the chassis are operating correctly. • If a unidirectional link is present, a loop may occur.

Examples

In the following examples, the fabric planes are examined in administration EXEC mode to ensure that they are ready to handle traffic.

- show controllers fabric rack all detail: Example, page 3-60
- show controllers fabric plane all detail: Example, page 3-60
- show controllers fabric connectivity all detail: Example, page 3-60

show controllers fabric rack all detail: Example

In the following example, the rack status is normal and the server status is present:

```
RP/0/RP0/CPU0:router(admin)# show controllers fabric rack all detail

Rack   Rack       Server
Num    Status     Status
----   ------     ------

 0       NORMAL    PRESENT
 1       NORMAL    PRESENT
 F0      NORMAL    PRESENT
RP/0/RP0/CPU0:router(admin)#
```

show controllers fabric plane all detail: Example

In the following example, all eight planes are displayed, and the administrative and operational state of each plane is up:

```
RP/0/RP0/CPU0:router(admin)# show controllers fabric plane all detail

Flags: P - plane admin down,       p - plane oper down
       C - card admin down,        c - card  oper down
       L - link port admin down,   l - linkport oper down
       A - asic admin down,        a - asic oper down
       B - bundle port admin Down, b - bundle port oper down
       I - bundle admin down,      i - bundle oper down
       N - node admin down,        n - node down
       o - other end of link down  d - data down
       f - failed component downstream
       m - plane multicast down,   s - link port permanently shutdown
       t - no barrier input

Plane  Admin   Oper       Down       Total     Down
Id     State   State      Flags      Bundles   Bundles
------------------------------------------------------
0      UP      UP                    9         3
1      UP      UP                    9         3
2      UP      UP                    9         3
3      UP      UP                    9         3
4      UP      UP                    9         3
5      UP      UP                    9         3
6      UP      UP                    9         3
7      UP      UP                    9         3
```

show controllers fabric connectivity all detail: Example

The expected output should contain a series of 1s for each of the fabric planes active in the system. If a fabric plane is administratively shut down, the output of the command remains the same. If the fabric card is physically removed or powered down, the 1 changes to a dot (.).

```
RP/0/RP0/CPU0:router(admin)# show controllers fabric connectivity all detail

  Flags: P - plane admin down,       p - plane oper down
         C - card admin down,        c - card  oper down
         L - link port admin down,   l - linkport oper down
         A - asic admin down,        a - asic oper down
         B - bundle port admin Down, b - bundle port oper down
         I - bundle admin down,      i - bundle oper down
         N - node admin down,        n - node down
         o - other end of link down  d - data down
```

```
         f - failed component downstream
         m - plane multicast down

 Card       In  Tx Planes  Rx Planes  Monitored        Total            Percent
 R/S/M      Use 01234567   01234567   For (s)          Uptime (s)       Uptime
-------------------------------------------------------------------------------
0/1/CPU0    1   11111111   11111111   1245608          1245608          100.0000
0/6/CPU0    1   11111111   11111111   1245608          1245608          100.0000
0/RP0/CPU0  1   11111111   11111111   1245608          1245608          100.0000
0/RP1/CPU0  1   11111111   11111111   1245608          1245608          100.0000
```

Bringing Up and Verifying the Non-DSC LCC

When all FCCs are up and properly supporting Rack 0, it is time to bring up and configure the next LCC in the multishelf system as described in the following procedure:

SUMMARY STEPS

1. Apply power to the second LCC.
2. **show controllers fabric rack all detail**
3. **show controllers fabric plane all detail**
4. **show controllers fabric connectivity all detail**
5. Verify that the links are not unidirectional.
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Apply power to the second LCC.	Starts up the LCC. • Allow the chassis to fully boot. • Verify that "IOS XR RUN" appears on the RP faceplates. • In each FCC, verify that the indicator LED on the OIM LED panel is green for each fabric cable connected to the non-DSC LCC. • The LCC loads any necessary software and configurations from the DSC, including the rack number and appropriate Cisco IOS XR software packages. • Do not proceed until both RPs in the LCC display "IOS XR RUN." This indicates that the RP has successfully loaded the Cisco IOS XR software.
Step 2	**show controllers fabric rack all detail** **Example:** `RP/0/RP0/CPU0:router(admin)# show controllers fabric rack all detail`	Displays the status of all racks in the system. • In a properly operating system, the rack status for all racks should be *Normal*, and the server status should be *Present*.
Step 3	**show controllers fabric plane all detail** **Example:** `RP/0/RP0/CPU0:router(admin)# show controllers fabric plane all detail`	Displays the status of all racks and additional information for racks in install mode. • Wait for the status in the *Admin State* and *Oper State* columns to change to UP for all planes.
Step 4	**show controllers fabric connectivity all detail** **Example:** `RP/0/RP0/CPU0:router(admin)# show controllers fabric connectivity all detail`	Displays the LCC cards that can communicate with all eight fabric planes. • The expected output should contain a series of '1's for each of the fabric planes active in the system. If a fabric plane is administratively "shutdown" the output of the command above remains the same. If the fabric card is physically removed or powered down, the "1" changes to "."
Step 5	Verify that the links are not unidirectional.	Verifies that the links from the chassis are operating correctly. • If a unidirectional link is present, a loop may occur.

Step 6	**exit**
	
	Example:
	`RP/0/RP0/CPU0:router(admin)# exit`
	`RP/0/RP0/CPU0:router#`
		Exits administration EXEC mode and returns to EXEC mode.

Verifying the Spanning Tree

When both LCCs and all FCCs are up and running, it is time to verify the spanning tree on the control network as described in the following procedure.

SUMMARY STEPS

1. **admin**
2. **show platform**
3. **show spantree mst 1 detail location** *rack*/*slot*/**cpu0**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**`admin`** **Example:** `RP/0/RP0/CPU0:router# admin`	Places the router in administration EXEC mode. • All commands listed in this procedure should be entered on the pre-existing single-chassis system.
Step 2	**`show platform`** **Example:** `RP/0/RP0/CPU0:router(admin)# show platform`	Displays the status of all hardware components. • The state for all modules should be **IOS XR RUN** or **OK**. • It can take a few minutes for all LCC modules to start up. **Note** To view the status of all cards and modules, the **show platform** command must be executed in administration EXEC mode.

Step 3	**`show spantree mst 1 detail location`** *`rack/slot/`***`cpu0`**
	
	Example:
	`RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 0/rp0/cpu0`
	`RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 0/rp1/cpu0`
	`RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 1/rp0/cpu0`
	`RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 1/rp1/cpu0`
	`RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location F0/SC0/cpu0`
	`RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location  F0/SC1/cpu0`
		Verifies the spanning tree.
		• Enter this command for each RP and SCGE card in the system.
		• The output for each RP and SCGE card should display the following:
		– In the Switched Interface column, one GE port should be in the forwarding (FWD) state.
		– Each RP and SCGE card should display the same designated root MAC address.
		• Verify that the designated root address matches the expected SCGE card. The root address should be the SCGE card with the lowest priority number (0).

Examples

The following examples illustrate how to verify the spanning tree:

- Verify That the FCCs and Non-DSC LCC Are Communicating with the DSC: Example, page 3-64
- Verify the Spanning Tree: Example, page 3-64

Verify That the FCCs and Non-DSC LCC Are Communicating with the DSC: Example

In the following EXEC mode example, all modules are displayed and the state for all modules is "IOS XR RUN."

```
RP/0/RP0/CPU0:router# admin
RP/0/RP0/CPU0:router(admin)# show platform

Node            Type            PLIM            State           Config State
-----------------------------------------------------------------------------
0/3/SP          MSC(SP)         N/A             IOS XR RUN      PWR,NSHUT,MON
0/3/CPU0        MSC             16OC48-POS/DPT  IOS XR RUN      PWR,NSHUT,MON
0/RP0/CPU0      RP(Active)      N/A             IOS XR RUN      PWR,NSHUT,MON
0/RP1/CPU0      RP(Standby)     N/A             IOS XR RUN      PWR,NSHUT,MON
0/FC0/SP        LCC-FAN-CT(SP)  N/A             IOS XR RUN      PWR,NSHUT,MON
0/FC1/SP        LCC-FAN-CT(SP)  N/A             IOS XR RUN      PWR,NSHUT,MON
0/AM0/SP        ALARM(SP)       N/A             IOS XR RUN      PWR,NSHUT,MON
0/AM1/SP        ALARM(SP)       N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM0/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM1/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM2/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM3/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM4/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM5/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM6/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
0/SM7/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/3/SP          MSC(SP)         N/A             IOS XR RUN      PWR,NSHUT,MON
1/3/CPU0        MSC             8-10GbE         IOS XR RUN      PWR,NSHUT,MON
1/RP0/CPU0      RP(Active)      N/A             IOS XR RUN      PWR,NSHUT,MON
1/FC0/SP        LCC-FAN-CT(SP)  N/A             IOS XR RUN      PWR,NSHUT,MON
1/FC1/SP        LCC-FAN-CT(SP)  N/A             IOS XR RUN      PWR,NSHUT,MON
1/AM0/SP        ALARM(SP)       N/A             IOS XR RUN      PWR,NSHUT,MON
1/AM1/SP        ALARM(SP)       N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM0/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM1/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM2/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM3/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM4/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM5/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM6/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
1/SM7/SP        FC/M(SP)        N/A             IOS XR RUN      PWR,NSHUT,MON
F0/SM0/SP       FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM3/SP       FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM6/SP       FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM9/SP       FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM12/SP      FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM15/SP      FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM18/SP      FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SM21/SP      FCC-SFC(SP)     FCC-FM-1S       IOS XR RUN      PWR,NSHUT,MON
F0/SC0/CPU0     FCC-SC(Active)  N/A             IOS XR RUN      PWR,NSHUT,MON
F0/SC1/CPU0     FCC-SC(Standby) N/A             PRESENT         PWR,NSHUT,MON
F0/AM1/SP       ALARM(SP)       N/A             IOS XR RUN      PWR,NSHUT,MON

RP/0/RP0/CPU0:router(admin)# end
```

Verify the Spanning Tree: Example

For each RP and SCGE card in the system, verify that:

- One GE port in the Switched Interface column is in the forwarding (FWD) state.
- Each RP and SCGE card displays the same designated root MAC address.

- The designated root address matches the expected SCGE card. The root address should be the switch with the lowest priority number (0).

The following EXEC commands display RP and SCGE card information that you can use to verify the spanning tree:

```
RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 0/rp0/cpu0

Instance                 1
Vlans mapped:            1

Designated Root          00-0e-39-fe-70-00
Designated Root Priority 1 (0 + 1)
Designated Root Port     GE_Port_0

Bridge ID MAC ADDR       00-05-9a-3e-89-4f
Bridge ID Priority       32769 (32768 + 1)
Bridge Max Age  8 sec    Hello Time  1 sec   Forward Delay  6 sec   Max Hops 4

Switched Interface   State Role   Cost     Prio Type
-------------------- ----- ---- --------- ---- --------------------------------
FE_Port_1              BLK altn    200000  128  P2P
GE_Port_0              FWD root     20000  128  P2P
GE_Port_1              BLK altn     20000  128  P2P

RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 0/rp1/cpu0

Instance                 1
Vlans mapped:            1

Designated Root          00-0e-39-fe-70-00
Designated Root Priority 1 (0 + 1)
Designated Root Port     GE_Port_0

Bridge ID MAC ADDR       00-05-9a-39-91-14
Bridge ID Priority       32769 (32768 + 1)
Bridge Max Age  8 sec    Hello Time  1 sec   Forward Delay  6 sec   Max Hops 4

Switched Interface   State Role   Cost     Prio Type
-------------------- ----- ---- --------- ---- --------------------------------
FE_Port_0              FWD desg    200000  128  P2P
GE_Port_0              FWD root     20000  128  P2P
GE_Port_1              BLK altn     20000  128  P2P

RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 1/rp0/cpu0

Instance                 1
Vlans mapped:            1

Designated Root          00-0e-39-fe-70-00
Designated Root Priority 1 (0 + 1)
Designated Root Port     GE_Port_0

Bridge ID MAC ADDR       00-05-9a-3e-89-2a
Bridge ID Priority       32769 (32768 + 1)
Bridge Max Age  8 sec    Hello Time  1 sec   Forward Delay  6 sec   Max Hops 4

Switched Interface   State Role   Cost     Prio Type
-------------------- ----- ---- --------- ---- --------------------------------
FE_Port_1              FWD desg    200000  128  P2P
GE_Port_0              FWD root     20000  128  P2P
GE_Port_1              BLK altn     20000  128  P2P
```

```
RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location 1/rp1/cpu0

Instance                 1
Vlans mapped:            1

Designated Root          00-0e-39-fe-70-00
Designated Root Priority 1 (0 + 1)
Designated Root Port     GE_Port_0

Bridge ID MAC ADDR       00-05-9a-3e-89-fe
Bridge ID Priority       32769 (32768 + 1)
Bridge Max Age  8 sec    Hello Time  1 sec   Forward Delay  6 sec   Max Hops 4

Switched Interface   State Role   Cost     Prio Type
-------------------- ----- ---- --------- ---- --------------------------------
FE_Port_0              BLK altn    200000  128  P2P
GE_Port_0              FWD root     20000  128  P2P
GE_Port_1              BLK altn     20000  128  P2P

RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location F0/SC0/cpu0

Instance                 1
Vlans mapped:            1

Designated Root          00-0e-39-fe-70-00
Designated Root Priority 1 (0 + 1)
Designated Root Port     GE_Port_1

Bridge ID MAC ADDR       00-05-9a-39-91-be
Bridge ID Priority       32769 (32768 + 1)
Bridge Max Age  8 sec    Hello Time  1 sec   Forward Delay  6 sec   Max Hops 4

Switched Interface   State Role   Cost     Prio Type
-------------------- ----- ---- --------- ---- --------------------------------
FE_Port_1              BLK altn    200000  128  P2P
GE_Port_0              BLK altn     20000  128  P2P
GE_Port_1              FWD root     20000  128  P2P

RP/0/RP0/CPU0:router(admin)# show spantree mst 1 detail location F0/SC1/cpu0

Instance                 1
Vlans mapped:            1

Designated Root          00-0e-39-fe-70-00
Designated Root Priority 1 (0 + 1)
Designated Root Port     GE_Port_1

Bridge ID MAC ADDR       00-05-9a-39-91-68
Bridge ID Priority       32769 (32768 + 1)
Bridge Max Age  8 sec    Hello Time  1 sec   Forward Delay  6 sec   Max Hops 4

Switched Interface   State Role   Cost     Prio Type
-------------------- ----- ---- --------- ---- --------------------------------
FE_Port_0              FWD desg    200000  128  P2P
GE_Port_0              BLK altn     20000  128  P2P
GE_Port_1              FWD root     20000  128  P2P
```

Verifying Fabric Cabling Connections

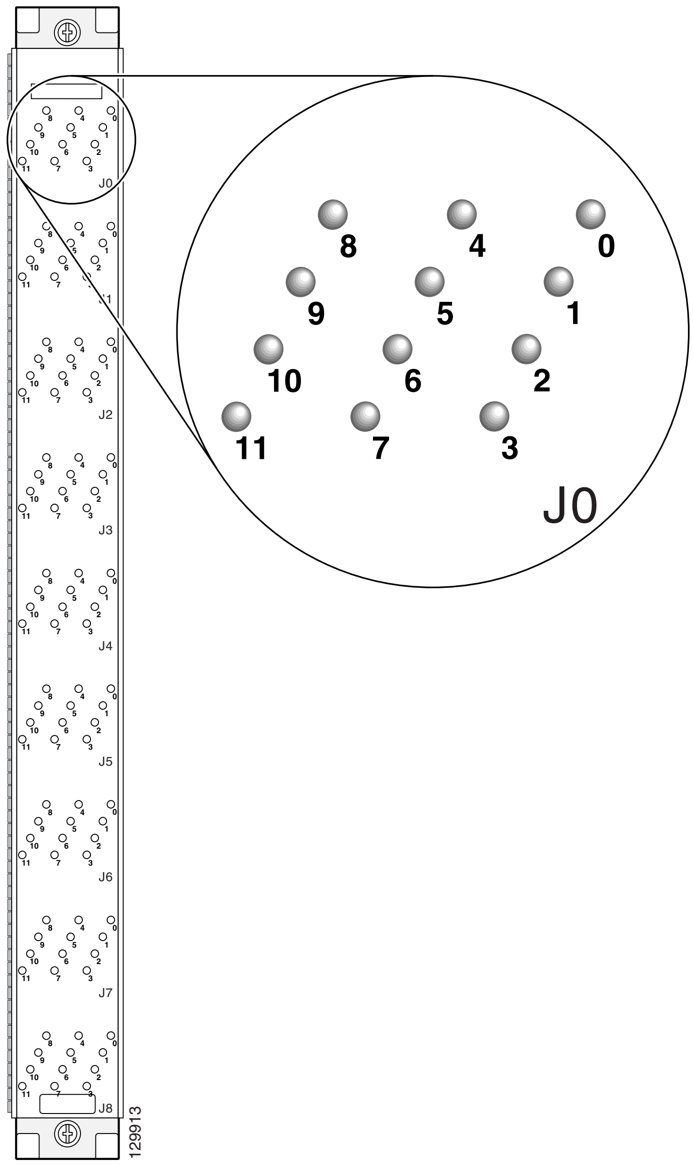
When the fabric cabling is complete and the power is on for all LCCs and FCCs, you can verify the fabric cabling connections, as described in this section.

Figure 3-8 shows the faceplate of the CRS-FCC- LED panel. The CRS-FCC-LED is also called an *optical interface module (OIM) LED panel*. This panel goes into slot LM0 or LM1 in a fabric card chassis.The OIM LED panel provides connectivity information on how the fabric chassis cards are functioning in the multishelf system. LEDs 0 through 11 correspond to OIM 0 through OIM 11 (FM 0 through FM 11 in software). Table 3-12 describes the possible states of the LEDs shown in Figure 3-8.

Table 3-12 LED Status Interpretation

LED State and Color	Meaning
Off	If the LED is off, it can mean: • The board to which the fabric cable is connected is powered off at one end or the other • The board is not present • The fabric cable is not connected at one end or the other
Green	The fabric cable is properly connected at both ends, and data transmission is okay.
Yellow	The fabric cable is properly connected at both ends, but there are some data errors.
Red	The fabric cable is not connected to the correct place (when more than one fabric cable is incorrect).
Blinking red	The fabric cable is not connected to the correct place (when the fabric cable is the only or “first” such fabric cable).
Blinking green	The blinking LED indicates the place where the first and only incorrect fabric cable should be connected (corresponds to the blinking red above).

Figure 3-8 Optical Interface Module LED Panel (Part CRS-FCC-LED)



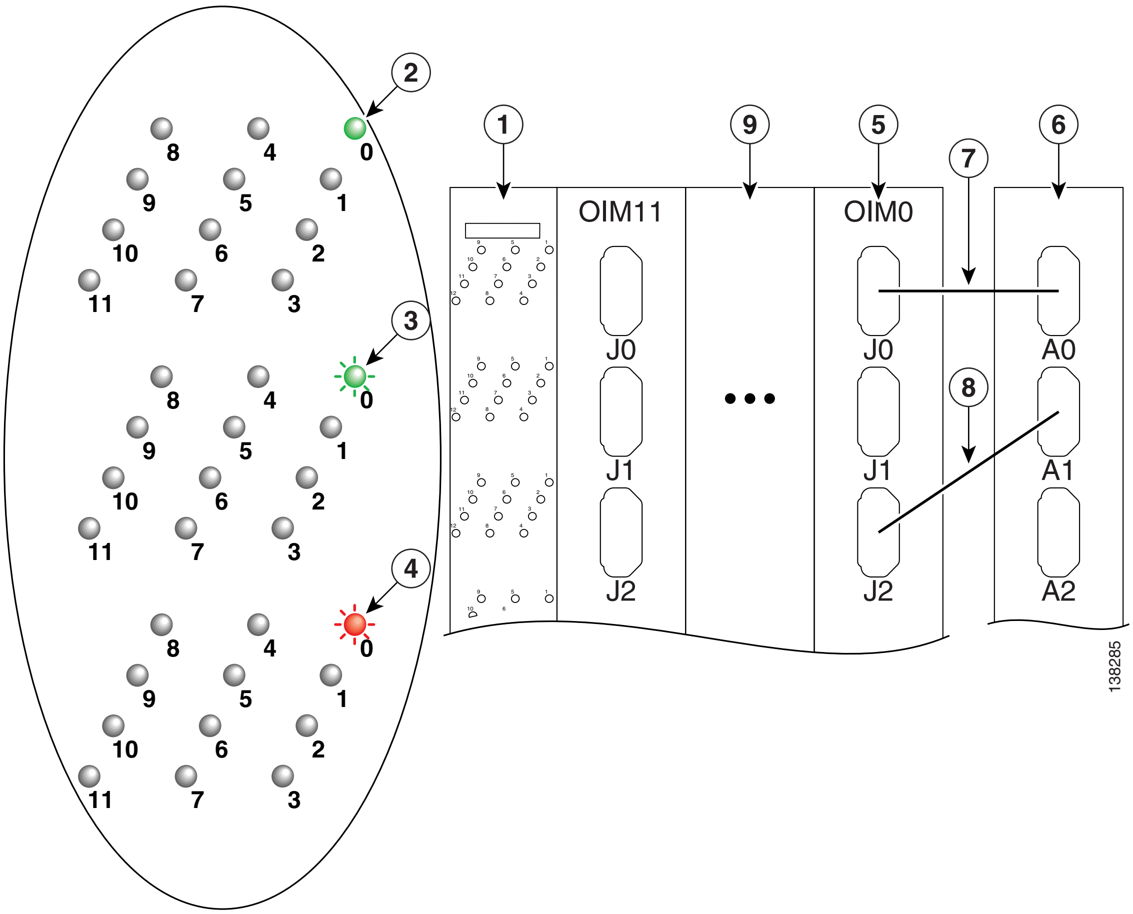
Because the OIM LED panel is present only in the fabric card chassis, the LEDs indicate the status of the bundles in the fabric card chassis only. Therefore, if a connection is wrong, the equipment assumes that the connection at the line card chassis is fixed, and the connection at the fabric card chassis is the one that needs to be relocated to the correct position as indicated by the LEDs.

Bundles are mapped to LEDs as follows:

The OIM LED panel has 9 rows of 12 LEDs— the 9 rows correspond to the 9 connectors for each slot, and 12 LEDs correspond to the 12 slots in the cage. Separate OIM LED panels provide status for the upper and lower card cages. The LED rows map to the connector number, and the LEDs in each LED row map to the slot number.

The following description explains the states of LEDs on the OIM LED panel. In Figure 3-9, fabric cables should connect an LCC S13 card to the FCC S2 card as follows: A0 to J0, A1 to J1, and A2 to J2. Instead, A1 is incorrectly connected to J2. This incorrect connection causes the LED corresponding to J2 to blink red, indicating that the cable connection is incorrect. The LED corresponding to J1 blinks green to show where the misplaced cable should be connected.

Figure 3-9 Illustration of How OIM LED Panel LEDs Map to Bundles and Slots (Single-Module Cabling)



1	OIM LED card
2	Solid green LED—Indicates that the fabric cable connected to the corresponding port (J0) is connected correctly.
3	Flashing green LED—Indicates that a single fabric cable is incorrectly connected and should be connected to the corresponding connector (J1).
4	Flashing red LED—Indicates that a single fabric cable is incorrectly connected to the corresponding connector (J2).
5	OIM card
6	S13 card—This card is installed in an LCC.
7	Correct fabric cable connection between FCC and LCC.
8	Incorrect fabric cable connection between FCC and LCC.
9	Fabric card chassis

Where to Go Next

For information on configuring basic router features, see Chapter 4, "Configuring General Router Features."