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Interchassis Redundancy Using Virtual Chassis Feature Guide for MX Series Routers

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Junos® OS Interchassis Redundancy Using Virtual Chassis Feature Guide for MX Series Routers
14.1

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Table of Contents

About the Documentation xiii
Documentation and Release Notes xiii
Supported Platforms xiii
Using the Examples in This Manual xiii
Merging a Full Example xiv
Merging a Snippet xiv
Documentation Conventions xv
Documentation Feedback xvii
Requesting Technical Support xvii
Self-Help Online Tools and Resources xvii
Opening a Case with JTAC xviii

Chapter 1 **Understanding How Virtual Chassis Provides Interchassis Redundancy 19**

Interchassis Redundancy and Virtual Chassis Overview 19
Interchassis Redundancy Overview 19
Virtual Chassis Overview 20
Supported Platforms for MX Series Virtual Chassis 20
Benefits of Configuring a Virtual Chassis 20

Chapter 2 **Understanding How a Virtual Chassis Works 23**

Virtual Chassis Components Overview 23
Virtual Chassis Master Router 24
Virtual Chassis Backup Router 24
Virtual Chassis Line-card Router 25
Virtual Chassis Ports 25
Virtual Chassis Port Trunks 26
Slot Numbering in the Virtual Chassis 27
Virtual Chassis Control Protocol 27
Member IDs, Roles, and Serial Numbers 28
Global Roles and Local Roles in a Virtual Chassis 29
Role Name Format 29
Global Role and Local Role Descriptions 29
Mastership Election in a Virtual Chassis 31
Switchover Behavior in a Virtual Chassis 32
Virtual Chassis Role Transitions During a Global Switchover 33
Virtual Chassis Role Transitions During a Local Switchover 33
GRES Readiness in a Virtual Chassis Configuration 34
Split Detection Behavior in a Virtual Chassis 35
How Split Detection Works in a Virtual Chassis 35
Effect of Split Detection on Virtual Chassis Failure Scenarios 36

Virtual Chassis Heartbeat Connection Overview . . . 39
Benefits of Configuring a Virtual Chassis Heartbeat Connection . . . 39
Configuration Requirements for the Heartbeat Connection . . . 40
How the Heartbeat Connection Works . . . 42
Heartbeat Connection and Virtual Chassis Failure Conditions . . . 43
Heartbeat Connection Compared to Split Detection . . . 43
Command Forwarding in a Virtual Chassis . . . 45

Chapter 3 Configuring a Virtual Chassis . . . 55

Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis . . . 56
Preparing for a Virtual Chassis Configuration . . . 57
Installing Junos OS Licenses on Virtual Chassis Member Routers . . . 59
Creating and Applying Configuration Groups for a Virtual Chassis . . . 61
Configuring Preprovisioned Member Information for a Virtual Chassis . . . 63
Configuring Enhanced IP Network Services for a Virtual Chassis . . . 65
Enabling Graceful Routing Engine Switchover and Nonstop Active Routing for a Virtual Chassis . . . 66
Configuring Member IDs for a Virtual Chassis . . . 68
Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis . . . 69
Switching the Global Master and Backup Roles in a Virtual Chassis Configuration . . . 87
Deleting Member IDs in a Virtual Chassis Configuration . . . 89
Disabling Split Detection in a Virtual Chassis Configuration . . . 90
Example: Replacing a Routing Engine in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers . . . 91
Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers . . . 102
Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers . . . 103

Chapter 4 Configuring Virtual Chassis Ports to Interconnect Member Devices . . . 115

Guidelines for Configuring Virtual Chassis Ports . . . 116
Configuring Virtual Chassis Ports to Interconnect Member Routers or Switches . . . 118
Deleting Virtual Chassis Ports in a Virtual Chassis Configuration . . . 120

Chapter 5 Configuring Locality Bias to Conserve Bandwidth on Virtual Chassis Ports . . . 123

Locality Bias in a Virtual Chassis . . . 123
How Locality Bias Works . . . 123
Locality Bias Percentages . . . 124
Guidelines for Configuring Locality Bias in a Virtual Chassis . . . 125
Configuring Locality Bias for a Virtual Chassis . . . 125

Chapter 6 Configuring Class of Service for Virtual Chassis Ports . . . 127

Class of Service Overview for Virtual Chassis Ports . . . 127
Default CoS Configuration for Virtual Chassis Ports . . . 127
Supported Platforms and Maximums for CoS Configuration of Virtual Chassis Ports . . . 128

Default Classifiers for Virtual Chassis Ports . . . 129
Default Rewrite Rules for Virtual Chassis Ports . . . 129
Default Scheduler Map for Virtual Chassis Ports . . . 130
Customized CoS Configuration for Virtual Chassis Ports . . . 131
Output Traffic-Control Profiles . . . 131
Classifiers and Rewrite Rules . . . 131
Per-Priority Shaping . . . 131
Guidelines for Configuring Class of Service for Virtual Chassis Ports . . . 132
Example: Configuring Class of Service for Virtual Chassis Ports on MX Series 3D Universal Edge Routers . . . 132

Chapter 7 Configuring Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis . . . 139

Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis . . . 139
Link Redundancy in a Virtual Chassis . . . 139
Module Redundancy in a Virtual Chassis . . . 140
Chassis Redundancy in a Virtual Chassis . . . 140
Configuring Module Redundancy for a Virtual Chassis . . . 141
Configuring Chassis Redundancy for a Virtual Chassis . . . 142
Multichassis Link Aggregation in a Virtual Chassis . . . 143
Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis . . . 144
Targeted Distribution in a Virtual Chassis . . . 144
Benefits of Targeted Distribution . . . 144

Chapter 8 Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines . . . 145

Example: Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines . . . 145

Chapter 9 Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified In-Service Software Upgrade (ISSU) . . . 151

Unified ISSU in a Virtual Chassis . . . 151
Benefits of Performing a Unified ISSU in an Virtual Chassis . . . 151
Prerequisites for Performing a Unified ISSU in a Virtual Chassis . . . 152
How Unified ISSU Works in a Virtual Chassis . . . 152
Virtual Chassis Role Transitions After a Unified ISSU . . . 153
Preparing for a Unified ISSU in an MX Series Virtual Chassis . . . 154
Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified ISSU . . . 156

Chapter 10 Monitoring an MX Series Virtual Chassis . . . 159

Accessing the Virtual Chassis Through the Management Interface . . . 160
Verifying the Status of Virtual Chassis Member Routers or Switches . . . 161
Verifying the Operation of Virtual Chassis Ports . . . 161
Verifying Neighbor Reachability for Member Routers or Switches in a Virtual Chassis . . . 162
Verifying Neighbor Reachability for Hardware Devices in a Virtual Chassis . . . 162
Determining GRES Readiness in a Virtual Chassis Configuration . . . 163

Viewing Information in the Virtual Chassis Control Protocol Adjacency Database . . . 164
Viewing Information in the Virtual Chassis Control Protocol Link-State Database . . . 164
Viewing Information About Virtual Chassis Port Interfaces in the Virtual Chassis Control Protocol Database . . . 165
Viewing Virtual Chassis Control Protocol Routing Tables . . . 166
Viewing Virtual Chassis Control Protocol Statistics for Member Devices and Virtual Chassis Ports . . . 166
Verifying and Managing the Virtual Chassis Heartbeat Connection . . . 167
Inline Flow Monitoring for Virtual Chassis Overview . . . 167
Split Detection . . . 168
Syntax of the sampling-instance Statement . . . 168
FPC Slot Numbers for the Virtual Chassis . . . 168
Managing Files on Virtual Chassis Member Routers or Switches . . . 169
Virtual Chassis Slot Number Mapping for Use with SNMP . . . 170
Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet . . . 172
Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets . . . 183

Chapter 11 Tracing Virtual Chassis Operations for Troubleshooting Purposes . . . 199

Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers . . 200
Configuring the Name of the Virtual Chassis Trace Log File . . . 201
Configuring Characteristics of the Virtual Chassis Trace Log File . . . 201
Configuring Access to the Virtual Chassis Trace Log File . . . 202
Using Regular Expressions to Refine the Output of the Virtual Chassis Trace Log File . . . 203
Configuring the Virtual Chassis Operations to Trace . . . 204

Chapter 12 Configuration Statements . . . 207

aggregated-ether-options . . . 208
heartbeat-address (MX Series Virtual Chassis) . . . 209
heartbeat-timeout (MX Series Virtual Chassis) . . . 210
locality-bias (MX Series Virtual Chassis) . . . 211
logical-interface-chassis-redundancy (MX Series Virtual Chassis) . . . 211
logical-interface-fpc-redundancy (Aggregated Ethernet Subscriber Interfaces) . . . 212
member (MX Series Virtual Chassis) . . . 213
network-services . . . 214
no-split-detection (MX Series Virtual Chassis) . . . 215
preprovisioned (MX Series Virtual Chassis) . . . 216
role (MX Series Virtual Chassis) . . . 217
sampling-instance . . . 218
serial-number (MX Series Virtual Chassis) . . . 219
targeted-distribution (Static Interfaces over Aggregated Ethernet) . . . 220
traceoptions (MX Series Virtual Chassis) . . . 221
virtual-chassis (MX Series Virtual Chassis) . . . 223

Chapter 13 Operational Commands 225
clear virtual-chassis heartbeat (MX Series Virtual Chassis) 226
request system software in-service-upgrade (MX Series 3D Universal Edge Routers) 228
request virtual-chassis member-id delete (MX Series Virtual Chassis) 245
request virtual-chassis member-id set 246
request virtual-chassis routing-engine master switch 247
request virtual-chassis vc-port delete (MX Series Virtual Chassis) 249
request virtual-chassis vc-port set (MX Series Virtual Chassis) 251
show chassis network services 253
show services accounting status 255
show virtual-chassis active-topology (MX Series Virtual Chassis) 258
show virtual-chassis device-topology (MX Series Virtual Chassis) 260
show virtual-chassis heartbeat (MX Series Virtual Chassis) 263
show virtual-chassis protocol adjacency (MX Series Virtual Chassis) 266
show virtual-chassis protocol database (MX Series Virtual Chassis) 270
show virtual-chassis protocol interface (MX Series Virtual Chassis) 276
show virtual-chassis protocol route (MX Series Virtual Chassis) 279
show virtual-chassis protocol statistics (MX Series Virtual Chassis) 282
show virtual-chassis status (MX Series Virtual Chassis) 285
show virtual-chassis vc-port (MX Series Virtual Chassis) 287
Chapter 14 Index 291
Index 293

List of Figures

Chapter 2 **Understanding How a Virtual Chassis Works 23**

Figure 1: Sample Topology for MX Series Virtual Chassis 23

Chapter 3 **Configuring a Virtual Chassis 55**

Figure 2: Sample Topology for a Virtual Chassis with Two MX Series Routers 71
Figure 3: Sample Topology for a Virtual Chassis with Two MX Series Routers . . . 92
Figure 4: Sample Topology for a Virtual Chassis with Two MX Series Routers . . 104

Chapter 8 **Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines 145**

Figure 5: Sample Topology for a Virtual Chassis with Two MX Series Routers . . 146

List of Tables

About the Documentation xiii

Table 1: Notice Icons xv
Table 2: Text and Syntax Conventions xv

Chapter 2 Understanding How a Virtual Chassis Works 23

Table 3: Global Roles and Local Roles 30
Table 4: Virtual Chassis Role Transitions During Global Switchover 33
Table 5: Virtual Chassis Role Transitions During Local Switchover 34
Table 6: Effect of Split Detection on Common Virtual Chassis Failure Scenarios 36
Table 7: Comparison of Heartbeat Connection Configuration Tasks for Member Routers in Same Subnet and Member Routers in Different Subnets 42
Table 8: Effect of Heartbeat Connection on Common Virtual Chassis Failure Conditions 43
Table 9: Comparison of Heartbeat Connection and Split Detection for Virtual Chassis Failure Conditions 44
Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis 45

Chapter 3 Configuring a Virtual Chassis 55

Table 11: Components of the Sample MX Series Virtual Chassis 71
Table 12: Virtual Chassis Global Role Transitions Before and After Mastership Switchover 87
Table 13: Components of the Sample MX Series Virtual Chassis 93
Table 14: Virtual Chassis Role Transitions Before and After Local Routing Engine Switchover 101
Table 15: Components of the Sample MX Series Virtual Chassis 105

Chapter 6 Configuring Class of Service for Virtual Chassis Ports 127

Table 16: Sample CoS Scheduler Hierarchy for Virtual Chassis Ports 133

Chapter 8 Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines 145

Table 17: Components of the Sample MX Series Virtual Chassis 147

Chapter 9 Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified In-Service Software Upgrade (ISSU) 151

Table 18: Virtual Chassis Role Transitions After Unified ISSU 153

Chapter 10 Monitoring an MX Series Virtual Chassis 159

Table 19: jnxFruSlot Numbers and Corresponding Slot Numbers in an MX Series or EX9200 Virtual Chassis 170

Table 20: Components of the Sample MX Series Virtual Chassis with Member Routers in Same Subnet 174
Table 21: Heartbeat Cross-Connections for Member Routers in Different Subnets 185
Table 22: Components of the Sample MX Series Virtual Chassis with Member Routers in Different Subnets 186

Chapter 11 **Tracing Virtual Chassis Operations for Troubleshooting Purposes 199**

Table 23: Tracing Flags for Virtual Chassis 204

Chapter 13 **Operational Commands 225**

Table 24: clear virtual-chassis heartbeat Output Fields 226
Table 25: show chassis network services Output Fields 253
Table 26: show services accounting status Output Fields 255
Table 27: show virtual-chassis active-topology Output Fields 258
Table 28: show virtual-chassis device-topology Output Fields 260
Table 29: show virtual-chassis heartbeat Output Fields 263
Table 30: show virtual-chassis protocol adjacency Output Fields 266
Table 31: show virtual-chassis protocol database Output Fields 270
Table 32: show virtual-chassis protocol interface Output Fields 276
Table 33: show virtual-chassis protocol route Output Fields 279
Table 34: show virtual-chassis protocol statistics Output Fields 282
Table 35: show virtual-chassis status Output Fields 285
Table 36: show virtual-chassis vc-port Output Fields 287

About the Documentation

- Documentation and Release Notes on page xiii
- Supported Platforms on page xiii
- Using the Examples in This Manual on page xiii
- Documentation Conventions on page xv
- Documentation Feedback on page xvii
- Requesting Technical Support on page xvii

Documentation and Release Notes

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Supported Platforms

For the features described in this document, the following platforms are supported:

- MX Series

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   system {
     scripts {
       commit {
         file ex-script.xsl;
       }
     }
   }
   interfaces {
     fxp0 {
       disable;
       unit 0 {
         family inet {
           address 10.0.0.1/24;
         }
       }
     }
   }
   ```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

   ```
   [edit]
   user@host# load merge /var/tmp/ex-script.conf
   load complete
   ```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

   For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

   ```
   commit {
     file ex-script-snippet.xsl; }
   ```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see the *CLI User Guide*.

Documentation Conventions

Table 1 on page xv defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xv defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric** ***metric*****>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.

Table 2: Text and Syntax Conventions *(continued)*

Convention	Description	Examples
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page at the Juniper Networks Technical Documentation site at http://www.juniper.net/techpubs/index.html, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at https://www.juniper.net/cgi-bin/docbugreport/.
- E-mail—Send your comments to **techpubs-comments@juniper.net**. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: http://www.juniper.net/customers/support/
- Search for known bugs: http://www2.juniper.net/kb/
- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/

- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: http://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://tools.juniper.net/SerialNumberEntitlementSearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at http://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see http://www.juniper.net/support/requesting-support.html.

CHAPTER 1

Understanding How Virtual Chassis Provides Interchassis Redundancy

- Interchassis Redundancy and Virtual Chassis Overview on page 19

Interchassis Redundancy and Virtual Chassis Overview

As more high-priority voice and video traffic is carried on the network, interchassis redundancy has become a baseline requirement for providing stateful redundancy on broadband subscriber management equipment such as broadband services routers, broadband network gateways, and broadband remote access servers. To provide a stateful interchassis redundancy solution for MX Series 3D Universal Edge Routers, you can configure a Virtual Chassis.

This topic provides an overview of interchassis redundancy and the Virtual Chassis, and explains the benefits of configuring a Virtual Chassis on supported MX Series routers.

- Interchassis Redundancy Overview on page 19
- Virtual Chassis Overview on page 20
- Supported Platforms for MX Series Virtual Chassis on page 20
- Benefits of Configuring a Virtual Chassis on page 20

Interchassis Redundancy Overview

Traditionally, redundancy in broadband edge equipment has used an intrachassis approach, which focuses on providing redundancy within a single system. However, a single-system redundancy mechanism no longer provides the degree of high availability required by service providers who must carry mission-critical voice and video traffic on their network. Consequently, service providers are requiring interchassis redundancy solutions that can span multiple systems that are colocated or geographically dispersed.

Interchassis redundancy is a high availability feature that prevents network outages and protects routers against access link failures, uplink failures, and wholesale chassis failures without visibly disrupting the attached subscribers or increasing the network management burden for service providers. Network outages can cause service providers to lose revenues and require them to register formal reports with government agencies. A robust interchassis redundancy implementation enables service providers to fulfill strict

service-level agreements (SLAs) and avoid unplanned network outages to better meet the needs of their customers.

Virtual Chassis Overview

One approach to providing interchassis redundancy is the Virtual Chassis model. In general terms, a *Virtual Chassis* configuration enables a collection of member routers to function as a single virtual router, and extends the features available on a single router to the member routers in the Virtual Chassis. The interconnected member routers in a Virtual Chassis are managed as a single network element that appears to the network administrator as a single chassis with additional line card slots, and to the access network as a single system.

To provide a stateful interchassis redundancy solution for MX Series 3D Universal Edge Routers, you can configure a Virtual Chassis. An MX Series Virtual Chassis interconnects two MX Series routers into a logical system that you can manage as a single network element. The member routers in a Virtual Chassis are designated as the *Virtual Chassis master router* (also known as the *protocol master*) and the *Virtual Chassis backup router* (also known as the *protocol backup*). The member routers are interconnected by means of dedicated *Virtual Chassis ports* that you configure on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces.

An MX Series Virtual Chassis is managed by the *Virtual Chassis Control Protocol* (*VCCP*), which is a dedicated control protocol based on IS-IS. VCCP runs on the Virtual Chassis port interfaces and is responsible for building the Virtual Chassis topology, electing the Virtual Chassis master router, and establishing the interchassis routing table to route traffic within the Virtual Chassis.

Supported Platforms for MX Series Virtual Chassis

You can configure a Virtual Chassis on the following MX Series 3D Universal Edge Routers with MPC/MIC interfaces (for configuration of Virtual Chassis ports) and dual Routing Engines:

- MX240 3D Universal Edge Router
- MX480 3D Universal Edge Router
- MX960 3D Universal Edge Router

In addition, graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) must be enabled on both member routers in the Virtual Chassis.

Benefits of Configuring a Virtual Chassis

Configuring a Virtual Chassis for MX Series routers provides the following benefits:

- Simplifies network management of two routers that are either colocated or geographically dispersed across a Layer 2 point-to-point network.
- Provides resiliency against network outages and protects member routers against access link failures, uplink failures, and chassis failures without visibly disrupting attached subscribers or increasing the network management burden for service providers.

- Extends the high availability capabilities of applications such as graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) beyond a single MX Series router to both member routers in the Virtual Chassis.
- Enables service providers to fulfill strict service level agreements (SLAs) and avoid unplanned network outages to better meet their customers' needs.
- Provides the ability to scale bandwidth and service capacity as more high-priority voice and video traffic is carried on the network.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

CHAPTER 2

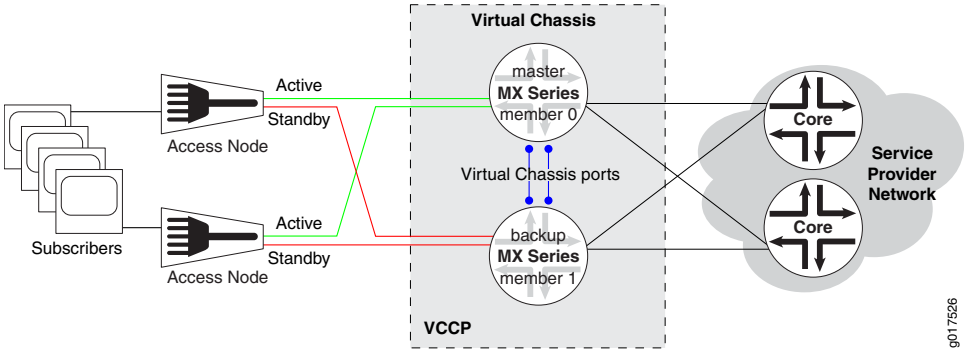
Understanding How a Virtual Chassis Works

- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Mastership Election in a Virtual Chassis on page 31
- Switchover Behavior in a Virtual Chassis on page 32
- Split Detection Behavior in a Virtual Chassis on page 35
- Virtual Chassis Heartbeat Connection Overview on page 39
- Command Forwarding in a Virtual Chassis on page 45

Virtual Chassis Components Overview

A Virtual Chassis configuration for MX Series 3D Universal Edge Routers interconnects two MX Series routers into a logical system that you can manage as a single network element. Figure 1 on page 23 illustrates a typical topology for a two-member MX Series Virtual Chassis.

Figure 1: Sample Topology for MX Series Virtual Chassis



This overview describes the basic hardware and software components of the Virtual Chassis configuration illustrated in Figure 1 on page 23, and covers the following topics:

- Virtual Chassis Master Router on page 24
- Virtual Chassis Backup Router on page 24

- Virtual Chassis Line-card Router on page 25
- Virtual Chassis Ports on page 25
- Virtual Chassis Port Trunks on page 26
- Slot Numbering in the Virtual Chassis on page 27
- Virtual Chassis Control Protocol on page 27
- Member IDs, Roles, and Serial Numbers on page 28

Virtual Chassis Master Router

One of the two member routers in the Virtual Chassis becomes the *master router*, also known as the *protocol master*. The Virtual Chassis master router maintains the global configuration and state information for both member routers, and runs the chassis management processes. The master Routing Engine that resides in the Virtual Chassis master router becomes the global master for the Virtual Chassis.

Specifically, the master Routing Engine that resides in the Virtual Chassis master router performs the following functions in a Virtual Chassis:

- Manages both the master and backup member routers
- Runs the chassis management processes and control protocols
- Receives and processes all incoming and exception path traffic destined for the Virtual Chassis
- Propagates the Virtual Chassis configuration (including member IDs, roles, and configuration group definitions and applications) to the members of the Virtual Chassis

The first member of the Virtual Chassis becomes the initial master router by default. After the Virtual Chassis is formed with both member routers, the Virtual Chassis Control Protocol (VCCP) software runs a mastership election algorithm to elect the master router for the Virtual Chassis configuration.

NOTE: **You cannot configure mastership election for an MX Series Virtual Chassis in the current release.**

Virtual Chassis Backup Router

The member router in the Virtual Chassis that is not designated as the master router becomes the *backup router*, also known as the *protocol backup*. The Virtual Chassis backup router takes over mastership of the Virtual Chassis if the master router is unavailable, and synchronizes routing and state information with the master router. The master Routing Engine that resides in the Virtual Chassis backup router becomes the global backup for the Virtual Chassis.

Specifically, the master Routing Engine that resides in the Virtual Chassis backup router performs the following functions in a Virtual Chassis:

- If the master router fails or is unavailable, takes over mastership of the Virtual Chassis in order to preserve routing information and maintain network connectivity without disruption
- Synchronizes routing and application state, including routing tables and subscriber state information, with the master Routing Engine that resides in the Virtual Chassis master router
- Relays chassis control information, such as line card presence and alarms, to the master router

Virtual Chassis Line-card Router

NOTE: **The line-card role is not supported in the preprovisioned configuration for a two-member MX Series Virtual Chassis. In this release, the line-card role applies only in the context of split detection behavior.**

A member router functioning in the **line-card** role runs only a minimal set of chassis management processes required to relay chassis control information, such as line card presence and alarms, to the Virtual Chassis master router.

You cannot explicitly configure a member router with the **line-card** role in the current release. However, if the backup router fails in a two-member Virtual Chassis configuration and split detection is enabled (the default behavior), the master router takes a **line-card** role, and line cards (FPCs) that do not host Virtual Chassis ports go offline. This state effectively isolates the master router and removes it from the Virtual Chassis until connectivity is restored. As a result, routing is halted and the Virtual Chassis configuration is disabled.

Virtual Chassis Ports

Virtual Chassis ports are special Ethernet interfaces that form a point-to-point connection between the member routers in a Virtual Chassis. When you create a Virtual Chassis, you must configure the Virtual Chassis ports on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces. After you configure a Virtual Chassis port, it is renamed **vcp-*slot/pic/port*** (for example, **vcp-2/2/0**), and the line card associated with that port comes online. For example, the sample Virtual Chassis topology shown in Figure 1 on page 23 has a total of four Virtual Chassis ports (represented by the blue dots), two on each of the two member routers.

After a Virtual Chassis port is configured, it is dedicated to the task of interconnecting member routers, and is no longer available for configuration as a standard network port. To restore this port to the global configuration and make it available to function as a standard network port, you must delete the Virtual Chassis port from the Virtual Chassis configuration.

NOTE: The Junos OS software enables you to preconfigure ports that are currently unavailable for use. Although a Virtual Chassis port is unavailable for use as a standard network port, you can configure this port as a standard network port even after you configure it as a Virtual Chassis port. However, the router does not apply the configuration until you delete the Virtual Chassis port from the Virtual Chassis configuration.

You can configure a Virtual Chassis port on either a 1-Gigabit Ethernet (**ge**) interface or a 10-Gigabit Ethernet (**xe**) interface. However, you cannot configure a combination of 1-Gigabit Ethernet Virtual Chassis ports and 10-Gigabit Ethernet Virtual Chassis ports in the same Virtual Chassis. We recommend that you configure Virtual Chassis ports only on 10-Gigabit Ethernet interfaces. In addition, to minimize network disruption in the event of a router or link failure, configure redundant Virtual Chassis ports that reside on different line cards in each member router.

Virtual Chassis port interfaces carry both VCCP packets and internal control and data traffic. Because the internal control traffic is neither encrypted nor authenticated, make sure the Virtual Chassis port interfaces are properly secured to prevent malicious third-party attacks on the data.

Virtual Chassis ports use a default class of service (CoS) configuration that applies equally to all Virtual Chassis port interfaces configured in a Virtual Chassis. Optionally, you can create a customized CoS traffic-control profile and apply it to all Virtual Chassis port interfaces. For example, you might want to create a nondefault traffic-control profile that allocates more than the default 5 percent of the Virtual Chassis port bandwidth to control traffic, or that assigns different priorities and excess rates to different forwarding classes.

Virtual Chassis Port Trunks

If two or more Virtual Chassis ports of the same type and speed are configured between the same two member routers in an MX Series Virtual Chassis, the Virtual Chassis Control Protocol (VCCP) bundles these Virtual Chassis port interfaces into a trunk, reduces the routing cost accordingly, and performs traffic load balancing across all of the Virtual Chassis port interfaces (also referred to as Virtual Chassis port links) in the trunk.

A Virtual Chassis port trunk must include only Virtual Chassis ports of the same type and speed. For example, a Virtual Chassis port trunk can include either all 10-Gigabit Ethernet (**xe** media type) Virtual Chassis ports or all 1-Gigabit Ethernet (**ge** media type) Virtual Chassis ports. An MX Series Virtual Chassis does *not* support a combination of 1-Gigabit Ethernet Virtual Chassis ports and 10-Gigabit Ethernet Virtual Chassis ports in the same Virtual Chassis port trunk.

The router uses the following formula to determine the cost metric of a Virtual Chassis port link in a Virtual Chassis port trunk:

Cost = (300 * 1,000,000,000) / *port-speed*

where *port-speed* is the aggegate speed, in bits per second, of the Virtual Chassis port.

For example, a 10-Gigabit Ethernet Virtual Chassis port link has a cost metric of 30 (300 * 1,000,000,000 / 10,000,000,000). A 1-Gigabit Ethernet Virtual Chassis port link has a cost metric of 300 (300 * 1,000,000,000 / 1,000,000,000). Virtual Chassis port links with a lower cost metric are preferred over those with a higher cost metric.

An MX Series Virtual Chassis supports up to 16 Virtual Chassis ports per trunk.

Slot Numbering in the Virtual Chassis

When the Virtual Chassis forms, the slots for line cards (FPCs) that do not host Virtual Chassis ports are renumbered to reflect the slot numbering and offsets used in the Virtual Chassis instead of the physical slot numbers where the line card is actually installed. In a two-member MX Series Virtual Chassis, member 0 in the Virtual Chassis uses FPC slot numbers 0 through 11 with no offset, and member 1 uses FPC slot numbers 12 through 23, with an offset of 12.

For example, a 10-Gigabit Ethernet interface that appears as **xe-14/2/2** (FPC slot 14, PIC slot 2, port 2) in the **show interfaces** command output is actually physical interface **xe-2/2/2** (FPC slot 2, PIC slot 2, port 2) on member 1 after deducting the FPC slot numbering offset of 12 for member 1.

The slot numbering for Virtual Chassis ports uses the physical slot number where the Virtual Chassis port is configured. For example, **vcp-3/2/0** is configured on physical FPC slot 3, PIC slot 2, port 0.

NOTE: For information about how the slot numbering in an MX Series Virtual Chassis affects the use of SNMP, see "Virtual Chassis Slot Number Mapping for Use with SNMP" on page 170.

Virtual Chassis Control Protocol

An MX Series Virtual Chassis is managed by the Virtual Chassis Control Protocol (VCCP), which is a dedicated control protocol based on IS-IS. VCCP runs on the Virtual Chassis port interfaces and performs the following functions in the Virtual Chassis:

- Discovers and builds the Virtual Chassis topology
- Runs the mastership election algorithm to determine the Virtual Chassis master router
- Establishes the interchassis routing table to route traffic within the Virtual Chassis

Like IS-IS, VCCP exchanges link-state PDUs for each member router to construct a shortest path first (SPF) topology and to determine each member router's role (master or backup) in the Virtual Chassis. Because VCCP supports only point-to-point connections, no more than two member routers can be connected on any given Virtual Chassis port interface.

Member IDs, Roles, and Serial Numbers

To configure an MX Series Virtual Chassis, you must create a preprovisioned configuration that provides the following required information for each member router:

- Member ID—A numeric value (**0** or **1**) that identifies the member router in a Virtual Chassis configuration.
- Role—The role to be performed by each member router in the Virtual Chassis. In a two-member MX Series Virtual Chassis, you must assign both member routers the **routing-engine** role, which enables either router to function as the master router or backup router of the Virtual Chassis.
- Serial number—The chassis serial number of each member router in the Virtual Chassis. To obtain the router's serial number, find the label affixed to the side of the MX Series chassis, or issue the **show chassis hardware** command on the router to display the serial number in the command output.

The preprovisioned configuration permanently associates the member ID and role with the member router's chassis serial number. When a new member router joins the Virtual Chassis, the VCCP software compares the router's serial number against the values specified in the preprovisioned configuration. If the serial number of a joining router does not match any of the configured serial numbers, the VCCP software prevents that router from becoming a member of the Virtual Chassis.

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Guidelines for Configuring Virtual Chassis Ports on page 116
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Split Detection Behavior in a Virtual Chassis on page 35
- Virtual Chassis Slot Number Mapping for Use with SNMP on page 170
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Global Roles and Local Roles in a Virtual Chassis

In a Virtual Chassis configuration for MX Series 3D Universal Edge Routers or EX9200 switches, each of the two member devices and each of the two Routing Engines in each member device has a distinct role. A *global role* defines the function of each member device in the Virtual Chassis, and applies globally across the entire Virtual Chassis. A *local role* defines the function of each Routing Engine in the member device, and applies locally only to that member device.

Global roles change when you switch the Virtual Chassis mastership, and both global roles and local roles change when you switch the Routing Engine mastership in one of the member devices. In addition, the **line-card** global role, though not supported in a preprovisioned configuration for a two-member MX Series or EX9200 Virtual Chassis, applies in the context of split detection behavior.

This topic describes the global roles and local roles in a MX Series or EX9200 Virtual Chassis so you can better understand how the Virtual Chassis behaves during a global mastership switch, a local Routing Engine switchover, or when split detection is enabled.

- Role Name Format on page 29
- Global Role and Local Role Descriptions on page 29

Role Name Format

The global and local role names in an MX Series or EX9200 Virtual Chassis use the following format:

VC-*GlobalRole*<*LocalRole*>

where:

- ***GlobalRole*** applies to the global function of the member device for the entire Virtual Chassis, and can be one of the following:
  - **M**—Virtual Chassis master device, also referred to as the protocol master.
  - **B**—Virtual Chassis backup device, also referred to as the protocol backup.
  - **L**—Virtual Chassis line-card device. The **line-card** role is not supported in the preprovisioned configuration for a two-member Virtual Chassis. The **line-card** role applies only in the context of split detection behavior.
- ***LocalRole*** (optional) applies to the function of the Routing Engine in the local member device, and can be one of the following:
  - **m**—Master Routing Engine
  - **s**—Standby Routing Engine

Global Role and Local Role Descriptions

Table 3 on page 30 describes the global roles and local roles in an MX Series or EX9200 Virtual Chassis.

Table 3: Global Roles and Local Roles

Virtual Chassis Role	Type of Role	Description
VC-M	Global	Master device for the Virtual Chassis
VC-B	Global	Backup device for the Virtual Chassis
VC-L	Global	Line-card device for the Virtual Chassis NOTE: The **line-card** role is not supported in the preprovisioned configuration for a two-member MX Series or EX9200 Virtual Chassis. The **line-card** role applies only in the context of split detection behavior.
VC-Mm	Local	Master Routing Engine in the Virtual Chassis master device
VC-Ms	Local	Standby Routing Engine in the Virtual Chassis master device
VC-Bm	Local	Master Routing Engine in the Virtual Chassis backup device
VC-Bs	Local	Standby Routing Engine in the Virtual Chassis backup device
VC-Lm	Local	Master Routing Engine in the Virtual Chassis line-card device NOTE: The **line-card** role is not supported in the preprovisioned configuration for a two-member MX Series or EX9200 Virtual Chassis. The **line-card** role applies only in the context of split detection behavior.
VC-Ls	Local	Standby Routing Engine in the Virtual Chassis line-card device NOTE: The **line-card** role is not supported in the preprovisioned configuration for a two-member MX Series or EX9200 Virtual Chassis. The **line-card** role applies only in the context of split detection behavior.

Related Documentation

- Virtual Chassis Components Overview on page 23
- *Understanding EX9200 Virtual Chassis*
- Mastership Election in a Virtual Chassis on page 31
- Switching the Global Master and Backup Roles in a Virtual Chassis Configuration on page 87
- Disabling Split Detection in a Virtual Chassis Configuration on page 90

Mastership Election in a Virtual Chassis

In a two-member MX Series or EX9200 Virtual Chassis, either member device can be elected as the master device (also known as the protocol master, or VC-M) of the Virtual Chassis. The first member device to join the Virtual Chassis becomes the initial master device by default. After the Virtual Chassis is formed with both member devices, the Virtual Chassis Control Protocol (VCCP) software runs a mastership election algorithm to elect the master device for the Virtual Chassis configuration.

If the master device in a Virtual Chassis fails, the backup device (also known as the protocol backup, or VC-B) takes over mastership of the Virtual Chassis. You can also switch the global roles of the master device and backup device in a Virtual Chassis by issuing the request virtual-chassis routing-engine master switch command.

NOTE: You cannot configure mastership election for an MX Series or EX9200 Virtual Chassis in the current release.

The VCCP software uses the following algorithm to elect the master device for an EX9200 or MX Series Virtual Chassis:

1. Choose the member device that has the highest value for the internal mastership election flag.

   The mastership election algorithm uses an internal flag that keeps track of the member state for the purpose of electing the Virtual Chassis master device. In most cases, VCCP elects the member device with the higher flag value over the member device with the lower flag value as the protocol master.

   To display the mastership election flag value, issue the show virtual-chassis protocol database **extensive** command. The flag value used for mastership election appears in the **TLVs** field of the command output, as shown in the following example:

   ```
   {master:member1-re0}

   user@host> show virtual-chassis protocol database member 0 extensive
    ...
     TLVs:
       Node Info: Member ID: 1, VC ID: 5a6a.e747.8511, Flags: 3, Priority: 129
          System ID: 001d.b510.0800, Device ID: 1
    ...
   ```

2. Choose the member device with the highest mastership priority value.

   The mastership priority value is assigned to the member device by the VCCP software, and is not configurable in the current release. The mastership priority value can be one of the following:

   - **129**—The **routing-engine** role is assigned to the member device.
   - **128**—No role is assigned to the member device.
   - **0**—The **line-card** role is assigned to the member device (not supported in the current release).

To display the mastership priority value for the member devices in the Virtual Chassis, issue the show virtual-chassis status command.

3. Choose the member device that is active in the Virtual Chassis.
4. Choose the member device that belongs to the Virtual Chassis with the largest number of members.

NOTE: This criterion is not used in the current release because all EX9200 and MX Series Virtual Chassis configurations have two member devices.

5. Choose the member device that is the accepted (elected) protocol master of the Virtual Chassis.
6. Choose the member device that is the current protocol master (VC-M) of the same Virtual Chassis.
7. Choose the member device that is the current protocol backup (VC-B) of the same Virtual Chassis.
8. Choose the member device that has been part of the Virtual Chassis configuration for the longest period of time.
9. Choose the member device that was the previous protocol master of the same Virtual Chassis.
10. Choose the member device with the lowest media access control (MAC) address.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Switching the Global Master and Backup Roles in a Virtual Chassis Configuration on page 87

Switchover Behavior in a Virtual Chassis

When an active or primary hardware or software component fails or is temporarily shut down, you can manually configure a *switchover* to a backup component that takes over the functions of the unavailable primary component. You can configure two types of switchovers in a Virtual Chassis configuration for MX Series 3D Universal Edge Routers or EX9200 Switches:

- Global switchover—Changes the mastership in an MX Series Virtual Chassis by switching the global roles of the master router or switch and backup router or switch in the Virtual Chassis configuration.
- Local switchover—Toggles the local mastership of the dual Routing Engines in a member router or switch of the Virtual Chassis.

During a switchover, the roles assigned to the member routers or switches and Routing Engines in a Virtual Chassis configuration change. This topic describes the role transitions

that occur so you can better understand how an MX Series Virtual Chassis behaves during a global or local switchover. The topic also describes how you can determine whether the member routers or switches are ready for a global graceful Routing Engine switchover (GRES) operation from a database synchronization perspective.

- Virtual Chassis Role Transitions During a Global Switchover on page 33
- Virtual Chassis Role Transitions During a Local Switchover on page 33
- GRES Readiness in a Virtual Chassis Configuration on page 34

Virtual Chassis Role Transitions During a Global Switchover

To change the mastership in an MX Series or Virtual Chassis and cause a global switchover, you issue the **request virtual-chassis routing-engine master switch** command from the master router or switch. After you issue this command, the current master router or switch in the Virtual Chassis (VC-M) becomes the backup router or switch(VC-B), and the current backup router or switch (VC-B) becomes the master router or switch (VC-M).

A global switchover in an MX Series or Virtual Chassis causes the role transitions listed in Table 4 on page 33.

Table 4: Virtual Chassis Role Transitions During Global Switchover

Virtual Chassis Role *Before* Global Switchover	Virtual Chassis Role *After* Global Switchover
Virtual Chassis master router or switch (VC-M)	Virtual Chassis backup router or switch (VC-B)
Virtual Chassis backup router or switch (VC-B)	Virtual Chassis master router or switch (VC-M)
Master Routing Engine in the Virtual Chassis master router or switch (VC-Mm)	Master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm)
Standby Routing Engine in the Virtual Chassis master router or switch (VC-Ms)	Standby Routing Engine in the Virtual Chassis backup router or switch (VC-Bs)
Master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm)	Master Routing Engine in the Virtual Chassis master router or switch (VC-Mm)
Standby Routing Engine in the Virtual Chassis backup router or switch (VC-Bs)	Standby Routing Engine in the Virtual Chassis master router or switch (VC-Ms)

The local roles (**master** and **standby**, or **m** and **s**) of the Routing Engines do not change after a global switchover. For example, as shown in Table 4 on page 33, the master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm) remains the master Routing Engine in the Virtual Chassis master router or switch (VC-Mm) after the global switchover.

Virtual Chassis Role Transitions During a Local Switchover

To ensure redundancy in a two-member Virtual Chassis configuration, each of the two member routers or switches must be configured with dual Routing Engines. To toggle local mastership between the master Routing Engine and the standby Routing Engine

in the member router or switch, you issue the **request chassis routing-engine master switch** command.

A local switchover in a Virtual Chassis causes the role transitions listed in Table 5 on page 34.

Table 5: Virtual Chassis Role Transitions During Local Switchover

Virtual Chassis Role *Before* Local Switchover	Virtual Chassis Role *After* Local Switchover
Master Routing Engine in the Virtual Chassis master router or switch (VC-Mm)	Standby Routing Engine in the Virtual Chassis backup router or switch (VC-Bs)
Standby Routing Engine in the Virtual Chassis master router or switch (VC-Ms)	Master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm)
Master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm)	Master Routing Engine in the Virtual Chassis master router or switch (VC-Mm)
Standby Routing Engine in the Virtual Chassis backup router or switch (VC-Bs)	Standby Routing Engine in the Virtual Chassis master router or switch (VC-Ms)

The local roles (**master** and **standby**, or **m** and **s**) of the Routing Engines in the Virtual Chassis master router or switch change after a local switchover, but the local roles of the Routing Engines in the Virtual Chassis backup router or switch do not change. For example, as shown in Table 5 on page 34, the master Routing Engine in the Virtual Chassis master router or switch (VC-Mm) becomes the standby Routing Engine in the Virtual Chassis backup router or switch (VC-Bs) after the local switchover. By contrast, the master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm) remains the master Routing Engine in the Virtual Chassis master router or switch (VC-Mm) after the local switchover.

GRES Readiness in a Virtual Chassis Configuration

Depending on the configuration, a variable amount of time is required before a router or switch is ready to perform a graceful Routing Engine switchover (GRES). Attempting a GRES operation before the router or switch is ready can cause system errors and unexpected behavior. To determine whether the member routers or switches in an MX Series or Virtual Chassis configuration are ready for a GRES operation from a database synchronization perspective, you can issue the **request virtual-chassis routing-engine master switch check** command from the Virtual Chassis master router or switch (VC-Mm) before you initiate the GRES operation.

The **request virtual-chassis routing-engine master switch check** command checks various system and database components on the member routers or switches to determine whether they are ready for GRES, but does not initiate the global GRES operation itself. The readiness check includes ensuring that a system timer, which expires after 300 seconds, has completed before the global GRES operation can begin.

Using the **request virtual-chassis routing-engine master switch check** command before you initiate the GRES operation ensures that the subscriber management and kernel

databases on both member routers or switches in an MX Series or Virtual Chassis are synchronized and ready for the GRES operation.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Mastership Election in a Virtual Chassis on page 31
- Switching the Global Master and Backup Roles in a Virtual Chassis Configuration on page 87
- Determining GRES Readiness in a Virtual Chassis Configuration on page 163
- *Understanding Graceful Routing Engine Switchover*

Split Detection Behavior in a Virtual Chassis

If there is a disruption to a Virtual Chassis configuration for MX Series 3D Universal Edge Routers or EX9200 Switches due to the failure of a member router or switch or one or more Virtual Chassis port interfaces, the resulting connectivity loss can cause a split in the Virtual Chassis configuration. *Split detection* identifies the split and can minimize further network disruption.

This topic covers:

- How Split Detection Works in a Virtual Chassis on page 35
- Effect of Split Detection on Virtual Chassis Failure Scenarios on page 36

How Split Detection Works in a Virtual Chassis

Split detection is enabled by default in an EX9200 or MX Series Virtual Chassis. Optionally, you can disable split detection by including the **no-split-detection** statement at the **[edit virtual-chassis]** hierarchy level. Disabling split detection can be useful in certain Virtual Chassis configurations.

For example, if the backup router or switch fails in a two-member Virtual Chassis configuration and split detection is enabled (the default behavior), the master router or switch takes a **line-card** role, and the line cards (FPCs) that do not host Virtual Chassis ports go offline. This state effectively halts routing and disables the Virtual Chassis configuration. By contrast, if the backup router or switch fails in a two-member Virtual Chassis configuration and split detection is disabled, the master router or switch retains mastership and maintains all of the Virtual Chassis ports, effectively resulting in a single-member Virtual Chassis consisting of only the master router or switch.

BEST PRACTICE: We recommend that you disable split detection for a two-member Virtual Chassis configuration if you think the backup router or switch is more likely to fail than the Virtual Chassis port interfaces to the backup router or switch. Configuring redundant Virtual Chassis ports on different line cards in each member router or switch reduces the likelihood that all Virtual Chassis port interfaces to the backup router or switch can fail.

Effect of Split Detection on Virtual Chassis Failure Scenarios

The behavior of a Virtual Chassis during certain failure scenarios depends on whether split detection is enabled or disabled. Table 6 on page 36 describes the effect of the split detection setting on common failure scenarios in a two-member MX Series Virtual Chassis.

Table 6: Effect of Split Detection on Common Virtual Chassis Failure Scenarios

Type of Failure	Split Detection Setting	Results
Virtual Chassis port interfaces go down	Enabled	• VC-B takes VC-M role. • Previous VC-M takes **line-card** (VC-L) role. The **line-card** role isolates the router or switch and removes it from the Virtual Chassis until connectivity is restored. • Result is a single-member Virtual Chassis consisting of only a single VC-M. The VC-M continues to maintain subscriber state information and route traffic. When Virtual Chassis port interfaces are reconnected: • VC-M retains VC-M role. • VC-L takes VC-B role. • Subscribers are not affected.

Table 6: Effect of Split Detection on Common Virtual Chassis Failure Scenarios *(continued)*

Type of Failure	Split Detection Setting	Results
Virtual Chassis port interfaces go down	Disabled	When Virtual Chassis port interfaces are disconnected: • VC-M retains VC-M role, and VC-B also takes VC-M role. The result is a Virtual Chassis with two VC-M routers or switches, each of which maintains subscriber state information. • Initially, both VC-M routers or switches have a complete list of subscribers. Because the two routers or switches have the same configuration, the effect on subscribers, traffic patterns, behavior of external applications, and subscriber login and logout operations is unpredictable while the Virtual Chassis port interfaces are disconnected. When Virtual Chassis port interfaces are reconnected: • Original VC-M before the disconnection resumes VC-M role, and original VC-B before the disconnection resumes VC-B role. • Subscribers on the VC-M are preserved. • Subscribers on the VC-B are purged. • The subscribers preserved on the VC-M are unaffected, and all remaining subscribers are able to log back in to the router or switch.

Table 6: Effect of Split Detection on Common Virtual Chassis Failure Scenarios *(continued)*

Type of Failure	Split Detection Setting	Results
Virtual Chassis backup router or switch (VC-B) goes down	Enabled	• VC-M takes **line-card** (VC-L) role, which causes all line cards (FPCs) that do not host Virtual Chassis ports to go offline. • Previous VC-B is out of service. • The **line-card** role isolates the master router or switch and removes it from the Virtual Chassis until connectivity is restored. As a result, the Virtual Chassis is left without a master router or switch, which halts interchassis routing and effectively disables the Virtual Chassis configuration. When the failed router or switch is brought back into service: • The mastership election algorithm is run to determine whether the router or switch takes a VC-M or VC-B role. The Virtual Chassis then becomes operational. • All subscribers can log back in to the router or switch. • Previous subscriber state information is not preserved.
Virtual Chassis backup router or switch (VC-B) goes down	Disabled	• VC-M retains VC-M role and maintains all Virtual Chassis ports. • Previous VC-B is out of service. • Result is a single-member Virtual Chassis consisting of only a single VC-M. The VC-M continues to maintain subscriber state information and route traffic.
Virtual Chassis master router or switch (VC-M) goes down	Split detection setting has no effect on behavior	• VC-B takes over VC-M role regardless of whether split detection is enabled or disabled. • Previous VC-M is out of service. • Result is a single-member Virtual Chassis consisting of only a single VC-M. The new VC-M continues to maintain subscriber state information and route traffic. When the original VC-M is brought back into service, or when the original VC-M is replaced with a new router or switch: • Original VC-M or its replacement takes VC-B role. • Subscribers are not affected.

Table 6: Effect of Split Detection on Common Virtual Chassis Failure Scenarios *(continued)*

Type of Failure	Split Detection Setting	Results
Active access link between the VC-M and the access node, such as a digital subscriber line access multiplexer (DSLAM), goes down	Split detection setting has no effect on behavior	• Previous standby access link becomes the active access link between the VC-B and the access node. • Traffic is routed through the new active access link. • The VC-M continues to maintain subscriber state information and route traffic.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Mastership Election in a Virtual Chassis on page 31
- Switchover Behavior in a Virtual Chassis on page 32
- Disabling Split Detection in a Virtual Chassis Configuration on page 90

Virtual Chassis Heartbeat Connection Overview

To determine the health and availability of member routers in an MX Series Virtual Chassis, you can configure an IP-based, bidirectional packet connection between the master router and backup router in the Virtual Chassis. The member routers forming this heartbeat connection exchange *heartbeat packets* that provide critical information about the availability and health of each member router. During a disruption or split in the Virtual Chassis configuration, the heartbeat connection prevents the member routers from changing mastership roles unnecessarily. Without the heartbeat connection, a change in mastership roles in such a situation can produce undesirable results, such as having two Virtual Chassis master routers or no Virtual Chassis master router.

- Benefits of Configuring a Virtual Chassis Heartbeat Connection on page 39
- Configuration Requirements for the Heartbeat Connection on page 40
- How the Heartbeat Connection Works on page 42
- Heartbeat Connection and Virtual Chassis Failure Conditions on page 43
- Heartbeat Connection Compared to Split Detection on page 43

Benefits of Configuring a Virtual Chassis Heartbeat Connection

Configuring a Virtual Chassis heartbeat connection provides the following benefits for an MX Series Virtual Chassis:

- Improved resiliency during failure scenarios

  Configuring the heartbeat connection improves resiliency of the Virtual Chassis in the event of an adjacency disruption or split caused by a failure of the Virtual Chassis port

interfaces, or when one of the member routers goes out of service. If the heartbeat connection detects that the Virtual Chassis master router (VC-M) is still operating and able to respond during a split, the software maintains mastership on the existing VC-M, isolates the Virtual Chassis backup router (VC-B) until the Virtual Chassis recovers, and resumes the backup role on the VC-B when the Virtual Chassis forms again. As a result, the heartbeat connection prevents the member routers from unnecessarily changing mastership roles, which consumes system resources and causes unexpected and undesirable results.

When the VC-B is isolated during a disruption, the software immediately restarts all line cards and powers off all network ports until the disruption is resolved and the Virtual Chassis forms again. This behavior supports network applications with external equipment that requires a physical link-down condition to switch the traffic paths to other connections.

- Enhanced mastership election process

  The Virtual Chassis Control Protocol (VCCP) controls mastership election in a Virtual Chassis. When you configure the heartbeat connection in an MX Series Virtual Chassis, the VCCP software assesses the health information collected from the heartbeat connection to help determine which member router should become the global master (VC-M) in the event of an adjacency disruption or split. When the heartbeat connection detects that the peer member router is responsive, the VCCP software suppresses unnecessary changes in mastership roles.

  By contrast, when the heartbeat connection is *not* configured, the VCCP software does not have this additional health information when determining the appropriate mastership roles after a disruption or split.

- Ability to easily view and clear statistics related to the heartbeat connection

  Operational commands for the Virtual Chassis enable you to display the status of the heartbeat connection, review detailed statistics and latency measurements related to the heartbeat connection, and clear heartbeat-related statistics counters and timestamp fields for one or both member routers.

Configuration Requirements for the Heartbeat Connection

To establish a heartbeat connection for an MX Series Virtual Chassis, you must configure a secure and reliable route between the master router and backup router for the exchange of TCP/IP heartbeat packets. Specifically, you must ensure that the master Routing Engine in the Virtual Chassis backup router (VC-Bm) can make a TCP/IP connection to the **master-only** IP address of the master Routing Engine in the Virtual Chassis master router (VC-Mm).

The following additional requirements apply when you configure the heartbeat connection:

- Configure the heartbeat connection only between Virtual Chassis member routers eligible to become the Virtual Chassis master router, also known as the *protocol master* or *global master*.

  In a two-member MX Series Virtual Chassis configuration, you assign the **routing-engine** role to each router as part of the preprovisioned configuration. The **routing-engine** role enables the router to function either as the master router or backup router of the Virtual Chassis as needed. As a result, you can configure the heartbeat connection between both member routers in a two-member MX Series Virtual Chassis configuration.

- Use the router's Ethernet management interface (**fxp0**) as the heartbeat path.

  The management interface is generally available earlier than the line card interfaces, and is typically connected to a more secure network than the other interfaces.

- Configure a **master-only** IP address for the **fxp0** management interface to ensure consistent access to the VC-Mm, regardless of which Routing Engine is currently active.

  The **master-only** address is active only on the management interface for the VC-Mm. During a switchover, the **master-only** address moves to the new Routing Engine currently functioning as the VC-Mm.

- Ensure TCP connectivity between the VC-Mm and VC-Bm member routers

  The Virtual Chassis heartbeat connection opens a proprietary TCP port numbered 33087 on the VC-Mm to listen for heartbeat messages. If your network design includes firewalls or filters, make sure the network allows traffic between TCP port 33087 on the VC-Mm and the dynamically allocated TCP port on the VC-Bm.

- When using a heartbeat connection, do not configure the **no-split-detection** statement as part of the preprovisioned Virtual Chassis configuration.

  The **no-split-detection** statement suppresses any action when a split is detected in the Virtual Chassis. Using the **no-split-detection** statement is prohibited when you configure a heartbeat connection, and the software prevents you from configuring both the **no-split-detection** and **heartbeat-address** statements at the same time. If you attempt to do so, the software displays an error message and causes the commit operation to fail.

In a two-member MX Series Virtual Chassis, you can configure a heartbeat connection with both member routers in the same subnet, or with each member router in a different subnet. Table 7 on page 42 summarizes the important differences between the configuration procedures for member routers in the same subnet and member routers in different subnets.

Table 7: Comparison of Heartbeat Connection Configuration Tasks for Member Routers in Same Subnet and Member Routers in Different Subnets

Task	Heartbeat Connection for Member Routers in *Same Subnet*	Heartbeat Connection for Member Routers in *Different Subnets*
Configure the **master-only** IP address for **fxp0** management interface.	Configure the same **fxp0 master-only** IP address for all four member Routing Engines.	Configure two different **master-only** IP addresses for the **fxp0** management interface: one address for the subnet in which the Virtual Chassis master router resides, and one for the subnet in which the backup router resides.
Configure a network path for the heartbeat connection.	Provide a path for the member routers to reach each other by means of a TCP/IP connection. For example, in a Virtual Chassis with member routers in the same subnet, you can use the router's default gateway. Alternatively, you can create a global static route as described in "Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet" on page 172.	Provide a path for the member routers to reach each other by means of a TCP/IP connection. In a Virtual Chassis with member routers in different subnets, you must ensure that both member routers can reach each other's network. For example, you can create static routes to both subnets on each member Routing Engine, as described in "Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets" on page 183.
Configure the heartbeat address to establish the heartbeat connection.	Configure a single (global) **master-only** IP address for the **fxp0** management interface as the heartbeat address to establish the connection.	Configure a heartbeat address for each member Routing Engine to cross-connect to the **master-only** IP address for the corresponding Routing Engine in the other subnet. For example, assume that **member0-re0** and **member0-re1** reside in subnet 10.4.0.0, and **member1-re0** and **member1-re1** reside in subnet 10.5.0.0. In this configuration, you would set the heartbeat address for **member0-re0** to the **master-only** IP address for **member1-re0** to cross-connect **member0-re0** and **member1-re0**. You would cross-connect **member0-re1** and **member1-re1** in a similar manner.

How the Heartbeat Connection Works

When the Virtual Chassis is operating properly, the heartbeat connection periodically sends heartbeat packets over the TCP/IP path between the master Routing Engine in the Virtual Chassis master router and the master Routing Engine in the Virtual Chassis backup router.

When an adjacency disruption or split is detected in the Virtual Chassis, each member router sends a final heartbeat message to determine whether the other member is able to respond, and stops sending additional periodic messages until the Virtual Chassis forms again. The other member must respond to the heartbeat message within the default heartbeat timeout period (2 seconds), or within a configured heartbeat timeout period in the range 1 through 60 seconds. To determine the time period that elapses in your network between transmission of a heartbeat request message and receipt of a heartbeat response message, you can issue the **show virtual-chassis heartbeat detail**

command to view the number of seconds reported in the **Maximum latency** and **Minimum latency** fields.

BEST PRACTICE: If your network is congested or has a round-trip latency that exceeds 2 seconds, we recommend that you increase the value of the heartbeat timeout period to account for this delay during a Virtual Chassis adjacency disruption or split.

Heartbeat Connection and Virtual Chassis Failure Conditions

Configuring the heartbeat connection prevents unnecessary mastership role changes between the Virtual Chassis member routers when an adjacency disruption or split occurs. Table 8 on page 43 describes the effects on mastership for common failure conditions when you enable the heartbeat connection in a two-member MX Series Virtual Chassis.

Table 8: Effect of Heartbeat Connection on Common Virtual Chassis Failure Conditions

Failure Condition	Result on Virtual Chassis Master Router (VC-M)	Result on Virtual Chassis Backup Router (VC-B)
Virtual Chassis port interfaces go down.	Retains VC-M role.	If the VC-M is in service but the Virtual Chassis port interfaces are down, the VC-B goes offline after the heartbeat timeout period expires because the Routing Engine state is invalid.
VC-M chassis fails.	Goes out of service.	Becomes VC-M.
VC-B chassis fails.	Retains VC-M role.	Goes out of service.
Heartbeat connection fails.	Retains VC-M role.	Retains VC-B role.

In all cases except when the VC-M chassis fails, mastership of the Virtual Chassis is maintained on the existing VC-Mm if the heartbeat connection detects that the VC-M is still operating and able to respond during a split. Preventing an unnecessary role change minimizes the system load caused by a protocol mastership switch, and reduces the liklihood of unpredictable results.

Heartbeat Connection Compared to Split Detection

In certain Virtual Chassis failure conditions, the split detection setting (enabled by default, or explicitly disabled) can cause unpredictable and undesirable results such as a Virtual Chassis with two master routers, or a Virtual Chassis with no master router. Table 9 on page 44 compares the effects of split detection and the heartbeat connection for two common failure conditions: failure of the Virtual Chassis port interfaces and failure of the VC-B chassis.

Table 9: Comparison of Heartbeat Connection and Split Detection for Virtual Chassis Failure Conditions

Failure Condition	Results with Heartbeat Connection	Results with Split Detection
Virtual Chassis port interfaces go down.	• VC-M chassis retains VC-M role. • If the VC-M chassis is in service but the Virtual Chassis port interfaces are down, the VC-B chassis goes offline after the heartbeat timeout period expires because the Routing Engine state is invalid.	When split detection is disabled: • VC-M chassis retains VC-M role. • VC-B chassis also takes VC-M role. • Virtual Chassis has two master routers, each of which maintains subscriber state information. The effect on subscribers, traffic patterns, behavior of external applications, and subscriber login and logout operations is unpredictable while the Virtual Chassis port interfaces are disconnected.
VC-B chassis fails.	• VC-M chassis retains VC-M role. • VC-B chassis is out of service.	When split detection is enabled: • VC-M chassis takes line-card (VC-L) role, which isolates and removes it from the Virtual Chassis until connectivity is restored. • VC-B chassis is out of service. • Virtual Chassis does not have a master router. This state halts interchassis routing and effectively disables the Virtual Chassis configuration.

BEST PRACTICE: We recommend that you use the heartbeat connection instead of the split detection feature in an MX Series Virtual Chassis to avoid unnecessary mastership role changes during an adjacency disruption or split, and to provide additional member health information for the mastership election process.

Related Documentation

- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Split Detection Behavior in a Virtual Chassis on page 35
- *Configuring a Consistent Management IP Address*

Command Forwarding in a Virtual Chassis

You can run some CLI commands on all member routers, on the local member router, or on a specific member router in an MX Series Virtual Chassis configuration. This feature is referred to as *command forwarding*. With command forwarding, the router sends the command to the specified member router or routers, and displays the results as if the command were processed on the local router.

For example, to collect information about your system prior to contacting Juniper Networks Technical Assistance Center (JTAC), use the command **request support information all-members** to gather data for all the member routers. If you want to gather this data only for a particular member router, use the command **request support information member *member-id***.

Table 10 on page 45 describes the commands that you can run on all (both) member routers (with the **all-members** option), on the local member router (with the **local** option), or on a specific member router (with the **member *member-id*** option) in an MX Series Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis

Command	Purpose	all-members	local	member *member-id*
request chassis fpc	Control the operation of the Flexible PIC Concentrator (FPC).	Change FPC status of all members of the Virtual Chassis configuration.	(Default) Change FPC status of the local Virtual Chassis member.	Change FPC status of the specified member of the Virtual Chassis configuration.
request chassis fpm resync	Resynchronize the craft interface status.	Resynchronize the craft interface status on all members of the Virtual Chassis configuration.	(Default) Resynchronize the craft interface status on the local Virtual Chassis member.	Resynchronize the craft interface status on the specified member of the Virtual Chassis configuration.
request chassis routing-engine master	Control which Routing Engine is the master for a router with dual Routing Engines.	Control Routing Engine mastership on the Routing Engines in all member routers of the Virtual Chassis configuration.	(Default) Control Routing Engine mastership on the Routing Engines in the local Virtual Chassis configuration.	Control Routing Engine mastership on the Routing Engines of the specified member in the Virtual Chassis configuration.
request routing-engine login	Specify a **tty** connection for login for a router with two Routing Engines.	Log in to all members of the Virtual Chassis configuration.	(Default) Log in to the local Virtual Chassis member.	Log in to the specified member of the Virtual Chassis configuration.
request support information	Display information about the system.	(Default) Display system information for all members of the Virtual Chassis configuration.	Display system information for the local Virtual Chassis member.	Display system information for the specified member of the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
request system halt	Stop the router.	(Default) Halt all members of the Virtual Chassis configuration.	Halt the local Virtual Chassis member.	Halt the specified member of the Virtual Chassis configuration.
request system partition abort	Terminate a previously scheduled storage media partition operation.	(Default) Abort a previously scheduled storage media partition operation for all members of the Virtual Chassis configuration.	Abort a previously scheduled storage media partition operation for the local Virtual Chassis member.	Abort a previously scheduled storage media partition operation for the specified member of the Virtual Chassis member.
request system partition hard-disk	Set up the hard disk for partitioning.	(Default) Schedule a partition of the hard disk for all members of the Virtual Chassis configuration.	Schedule a partition of the hard disk for the local Virtual Chassis member.	Schedule a partition of the hard disk for the specified member of the Virtual Chassis configuration.
request system power-off	Power off the software.	(Default) Power off all members of the Virtual Chassis configuration.	Power off the local Virtual Chassis member.	Power off the specified member of the Virtual Chassis configuration.
request system reboot	Reboot the software.	(Default) Reboot the software on all members of the Virtual Chassis configuration.	Reboot the software on the local Virtual Chassis member.	Reboot the software on the specified member of the Virtual Chassis configuration.
request system snapshot	Back up the currently running and active file system partitions on the router to standby partitions that are not running.	(Default) Archive data and executable areas for all members of the Virtual Chassis configuration.	Archive data and executable areas for the local Virtual Chassis member.	Archive data and executable areas for the specified member of the Virtual Chassis configuration.
request system software add	Install a software package or bundle on the router.	(Default if no options specified) Install a software package on all members of the Virtual Chassis configuration.	—	Install a software package on the specified member of the Virtual Chassis configuration.
request system software rollback	Revert to the software that was loaded at the last successful **request system software add** command.	(Default) Attempt to roll back to the previous set of packages on all members of the Virtual Chassis configuration.	Attempt to roll back to the previous set of packages on the local Virtual Chassis member.	Attempt to roll back to the previous set of packages on the specified member of the Virtual Chassis configuration.
request system software validate	Validate candidate software against the current configuration of the router.	—	(Default if no options specified) Validate the software package on the local Virtual Chassis member.	Validate the software bundle or package on the specified member of the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
request system storage cleanup	Free storage space on the router or switch by rotating log files and proposing a list of files for deletion.	(Default) Delete files on all members of the Virtual Chassis configuration.	Delete files on the local Virtual Chassis member.	Delete files on the specified member of the Virtual Chassis configuration.
restart	Restart a Junos OS process.	Restart the software process for all members of the Virtual Chassis configuration.	(Default) Restart the software process for the local Virtual Chassis member.	Restart the software process for a specified member of the Virtual Chassis configuration.
show chassis alarms	Display information about the conditions that have been configured to trigger alarms.	(Default) Display information about alarm conditions for all the member routers of the Virtual Chassis configuration.	Display information about alarm conditions for the local Virtual Chassis member.	Display information about alarm conditions for the specified member of the Virtual Chassis configuration.
show chassis craft-interface	View messages currently displayed on the craft interface.	(Default) Display information currently on the craft interface for all members of the Virtual Chassis configuration.	Display information currently on the craft interface for the specified member of the Virtual Chassis configuration.	Display information currently on the craft interface for the specified member of the Virtual Chassis configuration.
show chassis environment	Display environmental information about the router or switch chassis, including the temperature and information about the fans, power supplies, and Routing Engine.	(Default) Display chassis environmental information for all the members of the Virtual Chassis configuration.	Display chassis environmental information for the local Virtual Chassis member.	Display chassis environmental information for the specified member of the Virtual Chassis configuration.
show chassis environment cb	Display environmental information about the Control Boards (CBs).	(Default) Display environmental information about the CBs on all the members of the Virtual Chassis configuration.	Display environmental information about the CBs on the local Virtual Chassis member.	Display environmental information about the CBs on the specified member of the Virtual Chassis configuration.
show chassis environment fpc	Display environmental information about Flexible PIC Concentrators (FPCs).	(Default) Display environmental information for the FPCs in all the members of the Virtual Chassis configuration.	Display environmental information for the FPCs in the local Virtual Chassis member.	Display environmental information for the FPCs in the specified member of the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
show chassis environment pem	Display Power Entry Module (PEM) environmental status information.	(Default) Display environmental information about the PEMs in all the member routers of the Virtual Chassis configuration.	Display environmental information about the PEMs in the local Virtual Chassis member.	Display environmental information about the PEMs in the specified member of the Virtual Chassis configuration.
show chassis environment routing-engine	Display Routing Engine environmental status information.	(Default) Display environmental information about the Routing Engines in all member routers in the Virtual Chassis configuration.	Display environmental information about the Routing Engines in the local Virtual Chassis member.	Display environmental information about the Routing Engines in the specified member of the Virtual Chassis configuration.
show chassis ethernet-switch	Display information about the ports on the Control Board (CB) Ethernet switch.	(Default) Display information about the ports on the CB Ethernet switch on all the members of the Virtual Chassis configuration.	Display information about the ports on the CB Ethernet switch on the local Virtual Chassis member.	Display information about the ports on the CB Ethernet switch on the specified member of the Virtual Chassis configuration.
show chassis fabric fpcs	Display the state of the electrical and optical switch fabric links between the Flexible PIC Concentrators (FPCs) and the Switch Interface Boards (SIBs).	(Default) Display the switching fabric link states for the FPCs in all members of the Virtual Chassis configuration.	Display the switching fabric link states for the FPCs in the local Virtual Chassis member.	Display the switching fabric link states for the FPCs in the specified member of the Virtual Chassis configuration.
show chassis fabric map	Display the switching fabric map state.	(Default) Display the switching fabric map state for all the members of the Virtual Chassis configuration.	Display the switching fabric map state for the local Virtual Chassis member.	Display the switching fabric map state for the specified member of the Virtual Chassis configuration.
show chassis fabric plane	Display the state of all fabric plane connections.	(Default) Display the state of all fabric plane connections on all members of the Virtual Chassis configuration.	Display the state of all fabric plane connections on the local Virtual Chassis member.	Display the state of all fabric plane connections on the specified member of the Virtual Chassis configuration.
show chassis fabric plane-location	Display the Control Board (CB) location of each plane on both the master and backup Routing Engine.	(Default) Display the CB location of each fabric plane on the Routing Engines in all member routers in the Virtual Chassis configuration.	Display the CB location of each fabric plane on the Routing Engines in the local Virtual Chassis member.	Display the CB location of each fabric plane on the Routing Engines in the specified member in the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
show chassis fan	Display information about the fan tray and fans.	(Default) Display information about the fan tray and fans for all members of the Virtual Chassis configuration.	Display information about the fan tray and fans for the local Virtual Chassis member.	Display information about the fan tray and fans for the specified member of the Virtual Chassis configuration.
show chassis firmware	Display the version levels of the firmware running on the System Control Board (SCB), Switching and Forwarding Module (SFM), System and Switch Board (SSB), Forwarding Engine Board (FEB), Flexible PIC Concentrators (FPCs), and Routing Engines.	(Default) Display the version levels of the firmware running for all members of the Virtual Chassis configuration.	Display the version levels of the firmware running for the local Virtual Chassis member.	Display the version levels of the firmware running for the specified member of the Virtual Chassis configuration.
show chassis fpc	Display status information about the installed Flexible PIC Concentrators (FPCs) and PICs.	(Default) Display status information for all FPCs on all members of the Virtual Chassis configuration.	Display status information for all FPCs on the local Virtual Chassis member.	Display status information for all FPCs on the specified member of the Virtual Chassis configuration.
show chassis hardware	Display a list of all Flexible PIC Concentrators (FPCs) and PICs installed in the router or switch chassis, including the hardware version level and serial number.	(Default) Display hardware-specific information for all the members of the Virtual Chassis configuration.	Display hardware-specific information for the local Virtual Chassis member.	Display hardware-specific information for the specified member of the Virtual Chassis configuration.
show chassis location	Display the physical location of the chassis.	(Default) Display the physical location of the chassis for all the member routers in the Virtual Chassis configuration.	Display the physical location of the chassis for the local Virtual Chassis member.	Display the physical location of the chassis for the specified member of the Virtual Chassis configuration.
show chassis mac-addresses	Display the media access control (MAC) addresses for the router, switch chassis, or switch.	(Default) Display the MAC addresses for all the member routers of the Virtual Chassis configuration.	Display the MAC addresses for the local Virtual Chassis member.	Display the MAC addresses for the specified member of the Virtual Chassis configuration.
show chassis pic	Display status information about the PIC installed in the specified Flexible PIC Concentrator (FPC) and PIC slot.	(Default) Display PIC information for all member routers in the Virtual Chassis configuration.	Display PIC information for the local Virtual Chassis member.	Display PIC information for the specified member of the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
show chassis power	Display power limits and usage information for the AC or DC power sources.	(Default) Display power usage information for all members of the Virtual Chassis configuration.	Display power usage information for the local Virtual Chassis member.	Display power usage information for the specified member of the Virtual Chassis configuration.
show chassis routing-engine	Display the status of the Routing Engine.	(Default) Display Routing Engine information for all members of the Virtual Chassis configuration.	Display Routing Engine information for the local Virtual Chassis member.	Display Routing Engine information for the specified member of the Virtual Chassis configuration.
show chassis temperature-thresholds	Display chassis temperature threshold settings, in degrees Celsius.	(Default) Display the chassis temperature threshold settings of all member routers in the Virtual Chassis configuration.	Display the chassis temperature threshold settings of the local Virtual Chassis member.	Display the chassis temperature threshold settings of the specified member of the Virtual Chassis configuration.
show pfe fpc	Display Packet Forwarding Engine statistics for the specified Flexible PIC Concentrator (FPC).	(Default) Display Packet Forwarding Engine statistics for the specified FPC in all members of the Virtual Chassis configuration.	Display Packet Forwarding Engine statistics for the specified FPC in the local Virtual Chassis member.	Display Packet Forwarding Engine statistics for the specified FPC in the specified member of the Virtual Chassis configuration.
show pfe terse	Display Packet Forwarding Engine status information.	(Default) Display Packet Forwarding Engine status information for all members in the Virtual Chassis configuration.	Display Packet Forwarding Engine status information for the local Virtual Chassis member.	Display Packet Forwarding Engine status information for the specified member of the Virtual Chassis configuration.
show system audit	Display the state and checksum values for file systems.	(Default) Display file system MD5 hash and permissions information on all members of the Virtual Chassis configuration.	Display file system MD5 hash and permissions information on the local Virtual Chassis member.	Display file system MD5 hash and permissions information on the specified member of the Virtual Chassis configuration.
show system boot-messages	Display initial messages generated by the system kernel upon startup.	(Default) Display boot time messages on all members of the Virtual Chassis configuration.	Display boot time messages on the local Virtual Chassis member.	Display boot time messages on the specified member of the Virtual Chassis configuration.
show system buffers	Display information about the buffer pool that the Routing Engine uses for local traffic.	(Default) Show buffer statistics for all members of the Virtual Chassis configuration.	Show buffer statistics for the local Virtual Chassis member.	Show buffer statistics for the specified member of the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
show system connections	Display information about the active IP sockets on the Routing Engine.	(Default) Display system connection activity for all members of the Virtual Chassis configuration.	Display system connection activity for the local Virtual Chassis member.	Display system connection activity for the specified member of the Virtual Chassis configuration.
show system directory-usage	Display directory usage information.	Display directory information for all members of the Virtual Chassis configuration.	(Default) Display directory information for the local Virtual Chassis member.	Display directory information for the specified member of the Virtual Chassis configuration.
show system processes	Display information about software processes that are running on the router and that have controlling terminals.	(Default) Display standard system process information for all members of the Virtual Chassis configuration.	Display standard system process information for the local Virtual Chassis member.	Display standard system process information for the specified member of the Virtual Chassis configuration.
show system queues	Display queue statistics.	(Default) Display system queue statistics for all members of the Virtual Chassis configuration.	Display system queue statistics for the local Virtual Chassis member.	Display system queue statistics for the specified member of the Virtual Chassis configuration.
show system reboot	Display pending system reboots or halts.	(Default) Display halt or reboot request information for all members of the Virtual Chassis configuration.	Display halt or reboot request information for the local Virtual Chassis member.	Display halt or reboot request information for the specified member of the Virtual Chassis configuration.
show system statistics	Display system-wide protocol-related statistics.	(Default) Display system statistics for a protocol for all members of the Virtual Chassis configuration.	Display system statistics for a protocol for the local Virtual Chassis member.	Display system statistics for a protocol for the specified member of the Virtual Chassis configuration.
show system storage	Display statistics about the amount of free disk space in the router's file systems.	(Default) Display system storage statistics for all members of the Virtual Chassis configuration.	Display system storage statistics for the local Virtual Chassis member.	Display system storage statistics for the specified member of the Virtual Chassis configuration.

Table 10: Commands Available for Command Forwarding in an MX Series Virtual Chassis *(continued)*

Command	Purpose	all-members	local	member *member-id*
show system switchover	Display whether graceful Routing Engine switchover is configured, the state of the kernel replication (ready or synchronizing), any replication errors, and whether the primary and standby Routing Engines are using compatible versions of the kernel database.	(Default) Display graceful Routing Engine switchover information for all Routing Engines on all members of the Virtual Chassis configuration.	Display graceful Routing Engines switchover information for all Routing Engines on the local Virtual Chassis member.	Display graceful Routing Engine switchover information for all Routing Engines on the specified member of the Virtual Chassis configuration.
show system uptime	Display the current time and information about how long the router or switch, router or switch software, and routing protocols have been running.	(Default) Show time since the system rebooted and processes started on all members of the Virtual Chassis configuration.	Show time since the system rebooted and processes started on the local Virtual Chassis member.	Show time since the system rebooted and processes started on the specified member of the Virtual Chassis configuration.
show system users	List information about the users who are currently logged in to the router.	(Default) Display users currently logged in to all members of the Virtual Chassis configuration.	Display users currently logged in to the local Virtual Chassis member.	Display users currently logged in to the specified member of the Virtual Chassis configuration.
show system virtual-memory	Display the usage of Junos OS kernel memory listed first by size of allocation and then by type of usage.	(Default) Display kernel dynamic memory usage information for all members of the Virtual Chassis configuration.	Display kernel dynamic memory usage information for the local Virtual Chassis member.	Display kernel dynamic memory usage information for the specified member of the Virtual Chassis configuration.
show version	Display the hostname and version information about the software running on the router.	(Default) Display standard information about the hostname and version of the software running on all members of the Virtual Chassis configuration.	Display standard information about the hostname and version of the software running on the local Virtual Chassis member.	Display standard information about the hostname and version of the software running on the specified member of the Virtual Chassis configuration.
show version invoke-on	Display the hostname and version information about the software running on a router with two Routing Engines.	(Default) Display the hostname and version information about the software running on all master and backup Routing Engines on all members of the Virtual Chassis configuration.	Display the hostname and version information about the software running on all master and backup Routing Engines on the local Virtual Chassis member.	Display the hostname and version information about the software running on all master and backup Routing Engines on the specified member of the Virtual Chassis configuration.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- CLI Explorer

CHAPTER 3

Configuring a Virtual Chassis

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Preparing for a Virtual Chassis Configuration on page 57
- Installing Junos OS Licenses on Virtual Chassis Member Routers on page 59
- Creating and Applying Configuration Groups for a Virtual Chassis on page 61
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Configuring Enhanced IP Network Services for a Virtual Chassis on page 65
- Enabling Graceful Routing Engine Switchover and Nonstop Active Routing for a Virtual Chassis on page 66
- Configuring Member IDs for a Virtual Chassis on page 68
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Switching the Global Master and Backup Roles in a Virtual Chassis Configuration on page 87
- Deleting Member IDs in a Virtual Chassis Configuration on page 89
- Disabling Split Detection in a Virtual Chassis Configuration on page 90
- Example: Replacing a Routing Engine in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 91
- Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 102
- Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 103

Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis

To provide a stateful interchassis redundancy solution for MX Series routers, you can configure a Virtual Chassis. A *Virtual Chassis* interconnects two MX Series routers into a logical system that you can manage as a single network element.

To configure a Virtual Chassis for MX Series routers:

1. Prepare your site for the Virtual Chassis configuration.

   See "Preparing for a Virtual Chassis Configuration" on page 57.

2. Install Junos OS licenses on the routers to be configured as members of the Virtual Chassis.

   See "Installing Junos OS Licenses on Virtual Chassis Member Routers" on page 59.

3. Define configuration groups for the Virtual Chassis.

   See "Creating and Applying Configuration Groups for a Virtual Chassis" on page 61.

4. Create the preprovisioned member configuration on the master router in the Virtual Chassis.

   See "Configuring Preprovisioned Member Information for a Virtual Chassis" on page 63.

5. Configure enhanced IP network services on both member routers.

   See "Configuring Enhanced IP Network Services for a Virtual Chassis" on page 65.

6. Enable graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) on both member routers.

   See "Enabling Graceful Routing Engine Switchover and Nonstop Active Routing for a Virtual Chassis" on page 66.

7. Set the preprovisioned member IDs and reboot the routers in Virtual Chassis mode.

   See "Configuring Member IDs for a Virtual Chassis" on page 68.

8. Create the Virtual Chassis ports to interconnect the member routers, and commit the Virtual Chassis configuration on the master router.

   See "Configuring Virtual Chassis Ports to Interconnect Member Routers or Switches" on page 118.

9. (Optional) Verify the configuration and operation of the Virtual Chassis.

   See the following topics:

   - Verifying the Status of Virtual Chassis Member Routers or Switches on page 161
   - Verifying the Operation of Virtual Chassis Ports on page 161
   - Verifying Neighbor Reachability for Member Routers or Switches in a Virtual Chassis on page 162
   - Verifying Neighbor Reachability for Hardware Devices in a Virtual Chassis on page 162

- Viewing Information in the Virtual Chassis Control Protocol Adjacency Database on page 164
- Viewing Information in the Virtual Chassis Control Protocol Link-State Database on page 164
- Viewing Information About Virtual Chassis Port Interfaces in the Virtual Chassis Control Protocol Database on page 165
- Viewing Virtual Chassis Control Protocol Routing Tables on page 166
- Viewing Virtual Chassis Control Protocol Statistics for Member Devices and Virtual Chassis Ports on page 166

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23
- Guidelines for Configuring Virtual Chassis Ports on page 116
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Preparing for a Virtual Chassis Configuration

Before you configure and use an MX Series Virtual Chassis, we recommend that you prepare the hardware and software in your network for the configuration.

To prepare for configuring an MX Series Virtual Chassis:

1. Make a list of the serial numbers of each router that you want to configure as part of the Virtual Chassis.

   The chassis serial number is located on a label affixed to the side of the of the MX Series chassis. Alternatively, you can obtain the chassis serial number by issuing the **show chassis hardware** command, which is especially useful if you are accessing the router from a remote location. For example:

   ```
   user@gladius> show chassis hardware
   Hardware inventory:
   Item             Version  Part number  Serial number     Description
   Chassis                                JN10C7135AFC      MX240
   .
   .
   .
   ```

2. Note the desired function of each router in the Virtual Chassis.

   In a two-router Virtual Chassis configuration, you must designate each router with the **routing-engine** role, which enables either router to function as the master or backup of the Virtual Chassis.

   - The *master router* maintains the global configuration and state information for all members of the Virtual Chassis, and runs the chassis management processes.
   - The *backup router* synchronizes with the master router and relays chassis control information (such as line-card presence and alarms) to the master router. If the

master router is unavailable, the backup router takes mastership of the Virtual Chassis to preserve routing information and maintain network connectivity without disruption.

3. Note the member ID (0 or 1) to be assigned to each router in the Virtual Chassis.
4. Ensure that both MX Series routers in the Virtual Chassis have dual Routing Engines installed, and that all four Routing Engines in the Virtual Chassis are the same model.

   For example, you cannot configure a Virtual Chassis if one member router has RE-S-2000 Routing Engines installed and the other member router has RE-S-1800 Routing Engines installed.
5. Ensure that the necessary Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces on which to configure the Virtual Chassis ports are installed and operational in each router to be configured as a member of the Virtual Chassis.

   NOTE: An MX Series Virtual Chassis does not support a combination of 1-Gigabit Ethernet (ge media type) Virtual Chassis ports and 10-Gigabit Ethernet (xe media type) Virtual Chassis ports within the same Virtual Chassis. You must configure either all 10-Gigabit Ethernet Virtual Chassis ports or all 1-Gigabit Ethernet Virtual Chassis ports in the same Virtual Chassis. We recommend that you configure Virtual Chassis ports on 10-Gigabit Ethernet interfaces. This restriction has no effect on access ports or uplink ports in an MX Series Virtual Chassis configuration.
6. If MX Series Enhanced Queuing IP Services DPCs (DPCE-R-Q model numbers) or MX Series Enhanced Queuing Ethernet Services DPCs (DPCE-X-Q model numbers) are installed in a router to be configured as a member of the Virtual Chassis, make sure these DPCs are offline before you configure the Virtual Chassis. Otherwise, the MX Series Virtual Chassis configuration will not function.

   NOTE: MX Series Enhanced Queuing IP Services DPCs (DPCE-R-Q model numbers) and MX Series Enhanced Queuing Ethernet Services DPCs (DPCE-X-Q model numbers) do not interoperate with features of the MX Series Virtual Chassis.
7. Determine the desired location of the dedicated Virtual Chassis ports on both member routers, and use the Virtual Chassis ports to physically interconnect the member routers in a point-to-point topology.
8. Ensure that both MX Series routers to be configured as a member of the Virtual Chassis are running the same Junos OS release, and have basic network connectivity.

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Guidelines for Configuring Virtual Chassis Ports on page 116

- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Installing Junos OS Licenses on Virtual Chassis Member Routers

To enable some Junos OS features or router scaling levels, you might have to purchase, install, and manage separate software license packs. The presence on the router of the appropriate software license keys (passwords) determines whether you can configure and use certain features or configure a feature to a predetermined scale.

Before you configure an MX Series Virtual Chassis, install the following Junos OS software licenses on each MX Series router to be configured as a member of the Virtual Chassis:

- MX Virtual Chassis Redundancy Feature Pack—You must purchase and install a unique MX Virtual Chassis Redundancy Feature Pack for each member router in the Virtual Chassis. If you issue the **request virtual-chassis member-id set**, **request virtual-chassis member-id delete**, **request virtual-chassis vc-port set**, or **request virtual-chassis vc-port delete** command to set or delete member IDs or Virtual Chassis ports without first installing an MX Virtual Chassis Redundancy Feature Pack on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.
- Junos OS feature licenses—Purchase and install the appropriate Junos OS feature licenses to enable use of a particular software feature or scaling level in your network. You must install the required feature licenses on each member router in the Virtual Chassis.

Before you begin:

- Prepare your site for the Virtual Chassis configuration.

  See "Preparing for a Virtual Chassis Configuration" on page 57.

- Familiarize yourself with the procedures for installing and managing Junos OS licenses.

  See *Installation and Upgrade Guide*.

To install Junos OS licenses on each member router in the Virtual Chassis:

1. Install the required licenses on the MX Series router to be designated as the protocol master for the Virtual Chassis.
   a. Install the MX Virtual Chassis Redundancy Feature Pack.
   b. Install the Junos OS feature licenses required for your software feature or scaling level.
2. Install the required licenses on the MX Series router to be designated as the protocol backup for the Virtual Chassis.
   a. Install the MX Virtual Chassis Redundancy Feature Pack.
   b. Install the Junos OS feature licenses required for your software feature or scaling level.

3. (Optional) Verify the license installation on each member router.

   For example:

```
user@host> show system license
License usage:
                                Licenses     Licenses    Licenses    Expiry
  Feature name                       used    installed      needed
  subscriber-accounting                 0            1           0    permanent
  subscriber-authentication             0            1           0    permanent
  subscriber-address-assignment         0            1           0    permanent
  subscriber-vlan                       0            1           0    permanent
  subscriber-ip                         0            1           0    permanent
  scale-subscriber                      0       256000           0    permanent
  scale-l2tp                            0         1000           0    permanent
  scale-mobile-ip                       0         1000           0    permanent
  virtual-chassis                       0            1           0    permanent
```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- *Software Features That Require Licenses on MX Series Routers Only*
- *Installation and Upgrade Guide*

Creating and Applying Configuration Groups for a Virtual Chassis

For a Virtual Chassis configuration consisting of two MX Series routers or two EX9200 switches, each of which supports dual Routing Engines, you must create and apply on the master device of the Virtual Chassis the following configuration groups, instead of using the standard **re0** and **re1** configuration groups:

- **member0-re0**
- **member0-re1**
- **member1-re0**
- **member1-re1**

NOTE: The **member*n*-re*n*** naming format for configuration groups is reserved for exclusive use by member routers or switches in EX9200 or MX Series Virtual Chassis configurations.

Using configuration group names of the form **member*n*-re*n*** in an existing non-Virtual Chassis configuration or configuration script could interfere with Virtual Chassis operation. This misconfiguration could cause the router or switch to assign no IP address or an incorrect IP address to the **fxp0** management Ethernet interface, and could result in a display of the **Amnesiac** prompt during login.

To create and apply configuration group information from the router or switch to be configured as the master of the Virtual Chassis:

1. In the console window on the master router or switch (**member 0** in this procedure), create and apply the **member0-re0** configuration group.

   ```
   [edit]
   user@host# copy groups re0 to member0-re0
   user@host# set apply-groups member0-re0
   ```

2. Delete the standard **re0** configuration group from the global configuration on **member 0**.

   ```
   [edit]
   user@host# delete apply-groups re0
   user@host# delete groups re0
   ```

3. Create and apply the **member0-re1** configuration group.

   ```
   [edit]
   user@host# copy groups re1 to member0-re1
   user@host# set apply-groups member0-re1
   ```

4. Delete the standard **re1** configuration group from the global configuration on **member 0**.

   ```
   [edit]
   user@gladius# delete apply-groups re1
   ```

```
user@gladius# delete groups re1
```

5. Create and apply the **member1-re0** configuration information.

```
[edit]
user@host# set groups member1-re0 system host-name host-name
user@host# set groups member1-re0 system backup-router address
user@host# set groups member1-re0 system backup-router destination
  destination-address
user@host# set groups member1-re0 system backup-router destination
  destination-address
...
user@gladius# set groups member1-re0 interfaces fxp0 unit unit-number family inet
  address address
user@gladius# set apply-groups member1-re0
```

The commands in Steps 5 and 6 set the IP address for the **fxp0** management interface and add an IP route for it in the event that routing becomes inactive.

6. Create and apply the **member1-re1** configuration information.

```
[edit]
user@gladius# set groups member1-re1 system host-name host-name
user@gladius# set groups member1-re1 system backup-router address
user@gladius# set groups member1-re1 system backup-router destination
  destination-address
user@gladius# set groups member1-re1 system backup-router destination
  destination-address
...
user@gladius# set groups member1-re1 interfaces fxp0 unit unit-number family inet
  address address
user@gladius# set apply-groups member1-re1
```

7. Commit the configuration.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis.

For an EX9200 or MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for a Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- For more information about creating and managing configuration groups, see the *Junos OS CLI User Guide*

Configuring Preprovisioned Member Information for a Virtual Chassis

To configure a Virtual Chassis for MX Series routers, you must create a preprovisioned configuration on the master router by including the **virtual-chassis** stanza at the **[edit virtual-chassis]** hierarchy level. The preprovisioned configuration specifies the chassis serial number, member ID, and role for both member routers in the Virtual Chassis.

When a new member router joins the Virtual Chassis, the software compares its serial number against the values specified in the preprovisioned configuration. If the serial number of a joining router does not match any of the configured serial numbers, the software prevents that router from becoming a member of the Virtual Chassis.

To configure the preprovisioned member information for an MX Series Virtual Chassis:

1. Specify that you want to create a preprovisioned Virtual Chassis configuration.

   ```
   [edit virtual-chassis]
   user@host# set preprovisioned
   ```

2. Configure the member ID (**0** or **1**), role (**routing-engine**), and chassis serial number for each member router in the Virtual Chassis.

   ```
   [edit virtual-chassis]
   user@host# set member member-number role routing-engine serial-number
     serial-number
   user@host# set member member-number role routing-engine serial-number
     serial-number
   ```

   NOTE: In a two-member MX Series Virtual Chassis configuration, you must assign the routing-engine role to each router. The routing-engine role enables the router to function either as the master router or backup router of the Virtual Chassis.

3. Disable detection of a split in the Virtual Chassis configuration. (By default, split detection in an MX Series Virtual Chassis is enabled.)

   ```
   [edit virtual-chassis]
   user@host# set no-split-detection
   ```

   BEST PRACTICE: We recommend that you disable split detection for a two-member MX Series Virtual Chassis configuration if you think the backup router is more likely to fail than the Virtual Chassis port links to the backup router. Configuring redundant Virtual Chassis ports on different line cards in each member router reduces the likelihood that all Virtual Chassis port links to the backup router will fail.

4. (Optional) Enable locality bias in the Virtual Chassis configuration.

   ```
   [edit virtual-chassis]
   user@host# set locality-bias
   ```

BEST PRACTICE: Locality bias can cause traffic loss and oversubscription on egress interfaces if you configure it in a network that is not designed to handle locality biasing. Make sure you understand the utilization requirements, such as total and available bandwidth, for the local links in your network before changing the locality bias configuration.

5. (Optional) Enable tracing of Virtual Chassis operations.

   For example:

   ```
   [edit virtual-chassis]
   user@gladius# set traceoptions file filename
   user@gladius# set traceoptions file size maximum-file-size
   user@gladius# set traceoptions flag flag
   ```

6. Commit the configuration.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for an MX Series Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

The following example shows an MX Series Virtual Chassis preprovisioned configuration for two member routers.

```
[edit virtual-chassis]
user@gladius# show
preprovisioned;
no-split-detection;
locality-bias;
traceoptions {
    file vccp size 10m;
    flag all;
}
member 0 {
    role routing-engine;
    serial-number JN115FDADAFB;
}
member 1 {
    role routing-engine;
    serial-number JN10C78D1AFC;
}
```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56

- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Configuring Enhanced IP Network Services for a Virtual Chassis

For an existing MX Series Virtual Chassis to function properly, you must configure enhanced IP network services on all member routers in the Virtual Chassis from the Virtual Chassis master router.

Enhanced IP network services defines how the chassis recognizes and uses certain modules. When you set each member router's network services to **enhanced-ip**, only MPC/MIC modules and MS-DPC modules are powered on in the chassis. Non-service DPCs do not work with enhanced IP network services.

This procedure describes how to configure enhanced IP network services for an existing MX Series Virtual Chassis. For information about configuring enhanced IP network services when you first set up the Virtual Chassis, see *Configuring Enhanced IP Network Services* in "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for an MX Series Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

To configure enhanced IP network services for an existing Virtual Chassis:

1. Log in to the console for the master Routing Engine in the Virtual Chassis master router (member0-re0 in this procedure).
2. Access the chassis hierarchy.

   ```
   {master:member0-re0}[edit]
   user@hostA# edit chassis
   ```

3. Configure enhanced IP network services on member 0.

   ```
   {master:member0-re0}[edit chassis]
   user@hostA# set network-services enhanced-ip
   ```

4. Commit the configuration.
5. When prompted to do so, reboot all Routing Engines in the Virtual Chassis.

   ```
   {master:member0-re0}
   user@hostA> request system reboot
   ```

The **request system reboot** command reboots both Routing Engines in each member router forming the Virtual Chassis.

6. (Optional) Verify that enhanced IP network services has been properly configured for the Virtual Chassis.

   a. Verify that enhanced IP network services is configured on the master Routing Engine in the Virtual Chassis master router (member0-re0).

      ```
      {master:member0-re0}
      user@hostA> show chassis network services

      Network Services Mode: Enhanced-IP
      ```

   b. Verify that enhanced IP network services is configured on the master Routing Engine in the Virtual Chassis backup router (member1-re0).

      ```
      {backup:member1-re0}
      user@hostB> show chassis network services

      Network Services Mode: Enhanced-IP
      ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Enabling Graceful Routing Engine Switchover and Nonstop Active Routing for a Virtual Chassis

Before you configure member IDs and Virtual Chassis ports, you must enable graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) on both member routers in the Virtual Chassis.

To enable graceful Routing Engine switchover and nonstop active routing:

1. Enable graceful Routing Engine switchover and nonstop active routing on member 0 (**gladius**):

   a. Log in to the console on member 0.

   b. Enable graceful switchover.

      ```
      [edit chassis redundancy]
      user@gladius# set graceful-switchover
      ```

   c. Enable nonstop active routing.

      ```
      [edit routing-options]
      user@gladius# set nonstop-routing
      ```

   d. Configure the **commit** command to automatically result in a **commit synchronize** action between the dual Routing Engines in member 0.

      ```
      [edit system]
      ```

```
user@gladius# set commit synchronize
```

e. Commit the configuration.

2. Enable graceful Routing Engine switchover and nonstop active routing on member 1 (**trefoil**):

   a. Log in to the console on member 1.

   b. Enable graceful switchover.

   ```
   [edit chassis redundancy]
   user@trefoil# set graceful-switchover
   ```

   c. Enable nonstop active routing.

   ```
   [edit routing-options]
   user@trefoil# set nonstop-routing
   ```

   d. Configure the **commit** command to automatically result in a **commit synchronize** action between the dual Routing Engines in member 1.

   ```
   [edit system]
   user@trefoil# set commit synchronize
   ```

   e. Commit the configuration.

NOTE: When you configure nonstop active routing, you must include the **commit synchronize** statement at the **[edit system]** hierarchy level. Otherwise, the commit operation fails.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you use the **commit synchronize** statement. Including the **commit synchronize** statement for an MX Series Virtual Chassis configuration has the same effect as including the **commit synchronize force** statement.

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- *Configuring Graceful Routing Engine Switchover*
- *Configuring Nonstop Active Routing*

Configuring Member IDs for a Virtual Chassis

After you commit the preprovisioned configuration on the master router, you must assign the preprovisioned member IDs to both MX Series routers in the Virtual Chassis by using the **request virtual-chassis member-id set** command. Assigning the member ID causes the router to reboot in preparation for forming the Virtual Chassis.

NOTE: If you issue the **request virtual-chassis member-id set** command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

To configure the member ID and reboot each MX Series router in Virtual Chassis mode:

1. Set the member ID on the router configured as **member 0**.

   user@hostA> request virtual-chassis member-id set **member 0**

   ```
   This command will enable virtual-chassis mode and reboot the system.

    Continue? [yes,no] yes
   ```

   After the reboot, all MPCs remain powered off until the Virtual Chassis port connection is configured.

2. Set the member ID on the router configured as **member 1**.

   user@hostB> request virtual-chassis member-id set **member 1**

   ```
   This command will enable virtual-chassis mode and reboot the system.

    Continue? [yes,no] yes
   ```

   After the reboot, all MPCs remain powered off until the Virtual Chassis port connection is configured.

3. (Optional) Verify the member ID configuration for **member 0**.

   For example:

   ```
   {master:member0-re0}

   user@hostA> show virtual-chassis status
   Preprovisioned Virtual Chassis
   Virtual Chassis ID: 4f2b.1aa0.de08
                                                Mastership           Neighbor
   List
   Member ID       Status   Serial No    Model    priority    Role      ID
   Interface

   0 (FPC   0- 11) Prsnt    JN10C7135AFC mx240          129  Master*
   ```

4. (Optional) Verify the member ID configuration for **member 1**.

   For example:

   ```
   Amnesiac (ttyd0)
   ```

```
login: user
Password:
...

{master:member1-re0}

user> show virtual-chassis status
Virtual Chassis ID: ef98.2c6c.f7f7
                                                Mastership           Neighbor
List
Member ID       Status   Serial No    Model    priority    Role      ID
Interface

1 (FPC  12- 23) Prsnt    JN115D117AFB mx480          128  Master*
```

NOTE: At this point in the configuration procedure, all line cards are offline, and the routers are each designated with the Master role because they are not yet interconnected as a fully formed Virtual Chassis. In addition, member 1 remains in Amnesiac state (has no defined configuration) until the Virtual Chassis forms and the configuration is committed.

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis

To provide interchassis redundancy for MX Series 3D Universal Edge Routers, you can configure a Virtual Chassis. A *Virtual Chassis* configuration interconnects two MX Series routers into a logical system that you can manage as a single network element. The member routers in a Virtual Chassis are interconnected by means of Virtual Chassis ports that you configure on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces (network ports) on each MX Series router.

This example describes how to set up and configure a Virtual Chassis consisting of two MX Series routers:

- Requirements on page 69
- Overview and Topology on page 70
- Configuration on page 72
- Verification on page 83

Requirements

This example uses the following software and hardware components:

- Junos OS Release 11.2 and later releases

- One MX240 3D Universal Edge Router
- One MX480 3D Universal Edge Router

NOTE: This configuration example has been tested using the software release listed and is assumed to work on all later releases.

See Table 11 on page 71 for information about the hardware installed in each MX Series router.

BEST PRACTICE: We recommend that you use the **commit synchronize** command throughout this procedure to save any configuration changes to the Virtual Chassis.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for an MX Series Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

Overview and Topology

To configure the Virtual Chassis shown in this example, you must create a preprovisioned configuration at the **[edit virtual-chassis]** hierarchy level on the router to be designated as the master of the Virtual Chassis. The preprovisioned configuration includes the serial number, member ID, and role for each member router (also known as member chassis) in the Virtual Chassis. When a new member router joins the Virtual Chassis, the software compares its serial number against the values specified in the preprovisioned configuration. If the serial number of a joining router does not match any of the configured serial numbers, the software prevents that router from becoming a member of the Virtual Chassis.

After you commit the preprovisioned configuration on the master router, you must assign the preprovisioned member IDs by issuing the **request virtual-chassis member-id set** administrative command on each router, which causes the router to reboot. When the reboot is complete, you create one or more Virtual Chassis ports by issuing the **request virtual-chassis vc-port set** administrative command on each router. The Virtual Chassis forms when the line cards in both member routers are back online.

This example configures a Virtual Chassis that interconnects two MX Series routers, and uses the basic topology shown in Figure 2 on page 71. For redundancy, two Virtual Chassis ports are configured on each member router.

Figure 2: Sample Topology for a Virtual Chassis with Two MX Series Routers

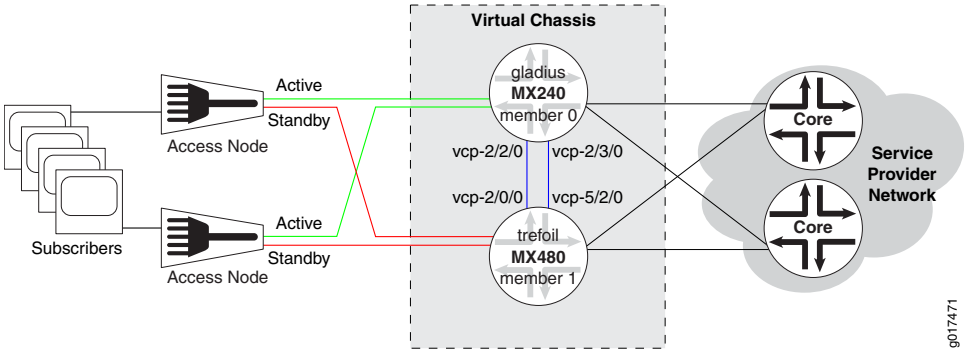


Table 11 on page 71 shows the hardware and software configuration settings for each MX Series router in the Virtual Chassis. You use some of these settings in the preprovisioned configuration and when you assign the member IDs and create the Virtual Chassis ports.

NOTE: MX Series Enhanced Queuing IP Services DPCs (DPCE-R-Q model numbers) and MX Series Enhanced Queuing Ethernet Services DPCs (DPCE-X-Q model numbers) do not interoperate with features of the MX Series Virtual Chassis. If any MX Series Enhanced Queuing DPCs are installed in a router to be configured as a member of a Virtual Chassis, you must ensure that these DPCs are offline before you configure the Virtual Chassis.

Table 11: Components of the Sample MX Series Virtual Chassis

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Network Port Slot Numbering
gladius	MX240 router with: • 60-Gigabit Ethernet Enhanced Queuing MPC • 20-port Gigabit Ethernet MIC with SFP • 4-port 10-Gigabit Ethernet MIC with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member0-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member0-re1**)	JN10C7135AFC	0	routing-engine (master)	vcp-2/2/0 vcp-2/3/0	FPC 0 – 11

Table 11: Components of the Sample MX Series Virtual Chassis *(continued)*

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Network Port Slot Numbering
trefoil	MX480 router with: • Two 30-Gigabit Ethernet Queuing MPCs • Two 20-port Gigabit Ethernet MICs with SFP • Two 2-port 10-Gigabit Ethernet MICs with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member1-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member1-re1**)	JN115D117AFB	1	routing-engine (backup)	vcp-2/0/0 vcp-5/2/0	FPC 12 – 23 (offset = 12)

Configuration

To configure a Virtual Chassis consisting of two MX Series routers, perform these tasks:

- Preparing for the Virtual Chassis Configuration on page 73
- Creating and Applying Configuration Groups for the Virtual Chassis on page 75
- Configuring Preprovisioned Member Information for the Virtual Chassis on page 76
- Configuring Enhanced IP Network Services on page 78
- Enabling Graceful Routing Engine Switchover and Nonstop Active Routing on page 79
- Configuring Member IDs and Rebooting the Routers to Enable Virtual Chassis Mode on page 80
- Configuring Virtual Chassis Ports to Interconnect Member Routers on page 82

Preparing for the Virtual Chassis Configuration

Step-by-Step Procedure

To prepare for configuring an MX Series Virtual Chassis:

1. Make a list of the serial numbers of both routers that you want to configure as part of the Virtual Chassis.

   The chassis serial number is located on a label affixed to the side of the of the MX Series chassis. Alternatively, you can obtain the chassis serial number by issuing the **show chassis hardware** command, which is especially useful if you are accessing the router from a remote location. For example:

   ```
   user@gladius> show chassis hardware
   Hardware inventory:
   Item             Version  Part number  Serial number     Description
   Chassis                                JN10C7135AFC      MX240
   .
   .
   .
   Fan Tray 0       REV 01   710-021113   JT0119            MX240 Fan Tray
   ```

2. Note the desired role (**routing-engine**) for each router in the Virtual Chassis.

   In a two-router Virtual Chassis configuration, you must designate each router with the **routing-engine** role, which enables either router to function as the master or backup of the Virtual Chassis.

   - The *master router* maintains the global configuration and state information for all members of the Virtual Chassis, and runs the chassis management processes.
   - The *backup router* synchronizes with the master router and relays chassis control information (such as line-card presence and alarms) to the master router. If the master router is unavailable, the backup router takes mastership of the Virtual Chassis to preserve routing information and maintain network connectivity without disruption.

3. Note the member ID (0 or 1) to be assigned to each router in the Virtual Chassis.

   In this example, the master router is assigned member ID 0, and the backup router is assigned member ID 1.

4. Ensure that both MX Series routers in the Virtual Chassis have dual Routing Engines installed, and that all four Routing Engines in the Virtual Chassis are the same model.

   For example, you cannot configure a Virtual Chassis if one member router has RE-S-2000 Routing Engines installed and the other member router has RE-S-1800 Routing Engines installed.

5. Ensure that the necessary Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces on which to configure the Virtual Chassis ports are installed and operational in each router to be configured as a member of the Virtual Chassis.

NOTE: An MX Series Virtual Chassis does not support a combination of 1-Gigabit Ethernet (ge media type) Virtual Chassis ports and 10-Gigabit Ethernet (xe media type) Virtual Chassis ports within the same Virtual Chassis. You must configure either all 10-Gigabit Ethernet Virtual Chassis ports or all 1-Gigabit Ethernet Virtual Chassis ports in the same Virtual Chassis. We recommend that you configure Virtual Chassis ports on 10-Gigabit Ethernet interfaces. This restriction has no effect on access ports or uplink ports in an MX Series Virtual Chassis configuration.

6. If MX Series Enhanced Queuing IP Services DPCs (DPCE-R-Q model numbers) or MX Series Enhanced Queuing Ethernet Services DPCs (DPCE-X-Q model numbers) are installed in a router to be configured as a member of the Virtual Chassis, make sure these DPCs are offline before you configure the Virtual Chassis. Otherwise, the MX Series Virtual Chassis configuration will not function.

NOTE: MX Series Enhanced Queuing IP Services DPCs (DPCE-R-Q model numbers) and MX Series Enhanced Queuing Ethernet Services DPCs (DPCE-X-Q model numbers) do not interoperate with features of the MX Series Virtual Chassis.

7. Determine the desired location of the dedicated Virtual Chassis ports on both member routers, and use the Virtual Chassis ports to physically interconnect the member routers in a point-to-point topology.
8. Ensure that both MX Series routers to be configured as members of the Virtual Chassis are running the same Junos OS release, and have basic network connectivity.
9. Install the MX Virtual Chassis Redundancy Feature Pack license on each router to be configured as part of the Virtual Chassis.
10. Install the necessary Junos OS feature licenses on each router to be configured as part of the Virtual Chassis.

Creating and Applying Configuration Groups for the Virtual Chassis

Step-by-Step Procedure

For a Virtual Chassis configuration consisting of two MX Series routers, each of which supports dual Routing Engines, you must create and apply the following configuration groups on the router to be designated as the master of the Virtual Chassis instead of using the standard re0 and re1 configuration groups:

- **member0-re0**
- **member0-re1**
- **member1-re0**
- **member1-re1**

NOTE: The **member*n*-re*n*** naming format for configuration groups is reserved for exclusive use by member routers in MX Series Virtual Chassis configurations.

To create and apply configuration group information for the Virtual Chassis:

1. Log in to the console on member 0 (**gladius**).
2. In the console window on member 0, create and apply the **member0-re0** configuration group.

   ```
   [edit]
   user@gladius# copy groups re0 to member0-re0
   user@gladius# set apply-groups member0-re0
   ```

3. Delete the standard **re0** configuration group from the global configuration on member 0.

   ```
   [edit]
   user@gladius# delete apply-groups re0
   user@gladius# delete groups re0
   ```

4. Create and apply the **member0-re1** configuration group on member 0.

   ```
   [edit]
   user@gladius# copy groups re1 to member0-re1
   user@gladius# set apply-groups member0-re1
   ```

5. Delete the standard **re1** configuration group from the global configuration on member 0.

   ```
   [edit]
   user@gladius# delete apply-groups re1
   user@gladius# delete groups re1
   ```

6. Create and apply the **member1-re0** configuration information on member 0.

   ```
   [edit]
   user@gladius# set groups member1-re0 system host-name trefoil
   user@gladius# set groups member1-re0 system backup-router 10.9.0.1
   ```

```
user@gladius# set groups member1-re0 system backup-router destination
  172.16.0.0/12
user@gladius# set groups member1-re0 system backup-router destination
  10.9.0.0/16
...
user@gladius# set groups member1-re0 interfaces fxp0 unit 0 family inet address
  10.9.3.97/21
user@gladius# set apply-groups member1-re0
```

The examples in Steps 5 and 6 set the IP address for the **fxp0** management interface and add an IP route for it in the event that routing becomes inactive.

7. Create and apply the **member1-re1** configuration information on member 0.

```
[edit]
user@gladius# set groups member1-re1 system host-name trefoil
user@gladius# set groups member1-re1 system backup-router 10.9.0.1
user@gladius# set groups member1-re1 system backup-router destination
  172.16.0.0/12
user@gladius# set groups member1-re1 system backup-router destination 10.9.0.0/16
...
user@gladius# set groups member1-re1 interfaces fxp0 unit 0 family inet address
  10.9.3.98/21
user@gladius# set apply-groups member1-re1
```

8. Commit the configuration on member 0.

Results Display the results of the configuration.

```
[edit]
user@gladius# show groups ?
  Possible completions:
   <[Enter]>          Execute this command
   <group_name>       Group name
   global             Group name
   member0-re0        Group name
   member0-re1        Group name
   member1-re0        Group name
   member1-re1        Group name
   |                  Pipe through a command

[edit]
user@gladius# show apply-groups
  apply-groups [ global member0-re0 member0-re1 member1-re0 member1-re1 ];
```

Configuring Preprovisioned Member Information for the Virtual Chassis

Step-by-Step Procedure To configure the preprovisioned member information on member 0 (**gladius**):

1. Log in to the console on member 0.
2. Specify that you want to create a preprovisioned Virtual Chassis configuration.

```
[edit virtual-chassis]
user@gladius# set preprovisioned
```

3. Configure the member ID (**0** or **1**), role (**routing-engine**), and chassis serial number for each member router in the Virtual Chassis.

```
[edit virtual-chassis]
user@gladius# set member 0 role routing-engine serial-number JN10C7135AFC
user@gladius# set member 1 role routing-engine serial-number JN115D117AFB
```

4. Disable detection of a split in the Virtual Chassis configuration. (By default, split detection in an MX Series Virtual Chassis is enabled.)

```
[edit virtual-chassis]
user@gladius# set no-split-detection
```

BEST PRACTICE: We recommend that you disable split detection for a two-member MX Series Virtual Chassis configuration if you think the backup router is more likely to fail than the Virtual Chassis port links to the backup router. Configuring redundant Virtual Chassis ports on different line cards in each member router reduces the likelihood that all Virtual Chassis port links to the backup router will fail.

5. (Optional) Enable tracing of Virtual Chassis operations.

```
[edit virtual-chassis]
user@gladius# set traceoptions file vccp
user@gladius# set traceoptions file size 100m
user@gladius# set traceoptions flag all
```

6. Commit the configuration.

Results Display the results of the configuration.

```
[edit virtual-chassis]
user@gladius# show
preprovisioned;
no-split-detection;
traceoptions {
    file vccp size 100m;
    flag all;
}
member 0 {
    role routing-engine;
    serial-number JN10C7135AFC;
}
member 1 {
    role routing-engine;
    serial-number JN115D117AFB;
}
```

Configuring Enhanced IP Network Services

Step-by-Step Procedure

For an MX Series Virtual Chassis to function properly, you must configure enhanced IP network services on both member routers (member 0 and member 1). Enhanced IP network services defines how the chassis recognizes and uses certain modules. When you set each member router's network services to **enhanced-ip**, only MPC/MIC modules and MS-DPC modules are powered on in the chassis. Non-service DPCs do not work with enhanced IP network services.

This procedure describes how to configure enhanced IP network services when you first set up the Virtual Chassis. For information about configuring enhanced IP network services for an existing MX Series Virtual Chassis, see "Configuring Enhanced IP Network Services for a Virtual Chassis" on page 65.

To configure enhanced IP network services for a Virtual Chassis:

1. Configure enhanced IP network services on member 0 (**gladius**).
   a. Log in to the console on member 0.
   b. Access the chassis hierarchy.

      ```
      [edit]
      user@gladius# edit chassis
      ```

   c. Configure enhanced IP network services for member 0.

      ```
      [edit chassis]
      user@gladius# set network-services enhanced-ip
      ```

   d. Commit the configuration on member 0.

NOTE: Immediately after you commit the configuration, the software prompts you to reboot the router. You can proceed without rebooting the router at this point because a reboot occurs when you configure the member IDs to enable Virtual Chassis mode, later in this procedure.

2. Configure enhanced IP network services on member 1 (**trefoil**).
   a. Log in to the console on member 1.
   b. Access the chassis hierarchy.

      ```
      [edit]
      user@trefoil# edit chassis
      ```

   c. Configure enhanced IP network services for member 1.

      ```
      [edit chassis]
      user@trefoil# set network-services enhanced-ip
      ```

   d. Commit the configuration on member 1.

NOTE: Immediately after you commit the configuration, the software prompts you to reboot the router. You can proceed without rebooting the router at this point because a reboot occurs when you configure the member IDs to enable Virtual Chassis mode, later in this procedure.

Enabling Graceful Routing Engine Switchover and Nonstop Active Routing

Step-by-Step Procedure

Before you configure member IDs and Virtual Chassis ports, you must enable graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) on both member routers in the Virtual Chassis.

To enable graceful Routing Engine switchover and nonstop active routing:

1. Enable graceful Routing Engine switchover and nonstop active routing on member 0 (**gladius**):

   a. Log in to the console on member 0.

   b. Enable graceful switchover.

      ```
      [edit chassis redundancy]
      user@gladius# set graceful-switchover
      ```

   c. Enable nonstop active routing.

      ```
      [edit routing-options]
      user@gladius# set nonstop-routing
      ```

   d. Configure the **commit** command to automatically result in a **commit synchronize** action between the dual Routing Engines in member 0.

      ```
      [edit system]
      user@gladius# set commit synchronize
      ```

   e. Commit the configuration.

2. Enable graceful Routing Engine switchover and nonstop active routing on member 1 (**trefoil**):

   a. Log in to the console on member 1.

   b. Enable graceful switchover.

      ```
      [edit chassis redundancy]
      user@trefoil# set graceful-switchover
      ```

   c. Enable nonstop active routing.

      ```
      [edit routing-options]
      user@trefoil# set nonstop-routing
      ```

   d. Configure the **commit** command to automatically result in a **commit synchronize** action between the dual Routing Engines in member 1.

      ```
      [edit system]
      ```

```
user@trefoil# set commit synchronize
```

e. Commit the configuration.

NOTE: When you configure nonstop active routing, you must include the **commit synchronize** statement at the **[edit system]** hierarchy level. Otherwise, the commit operation fails.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you use the **commit synchronize** statement. Including the **commit synchronize** statement for an MX Series Virtual Chassis configuration has the same effect as including the **commit synchronize force** statement.

Configuring Member IDs and Rebooting the Routers to Enable Virtual Chassis Mode

Step-by-Step Procedure

To configure (set) the preprovisioned member ID for each MX Series router in the Virtual Chassis, use the **request virtual-chassis member-id set** command. Assigning the member ID causes the router to reboot in preparation for forming the Virtual Chassis.

NOTE: If you issue the **request virtual-chassis member-id set** command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

To configure the member ID and reboot each router to enable Virtual Chassis mode:

1. Log in to the console on member 0 (**gladius**).
2. Set the member ID on member 0.

   ```
   user@gladius> request virtual-chassis member-id set member 0
   This command will enable virtual-chassis mode and reboot the system.
    Continue? [yes,no] yes
   ```

   Issuing the **request virtual-chassis member-id** command causes the router to reboot in preparation for membership in the Virtual Chassis.

   After the reboot, all MPCs remain powered off until the Virtual Chassis port connection is configured.
3. Log in to the console on member 1 (**trefoil**).
4. Set the member ID on member 1.

   ```
   user@trefoil> request virtual-chassis member-id set member 1
   This command will enable virtual-chassis mode and reboot the system.
   ```

```
Continue? [yes,no] yes
```

After the reboot, all MPCs remain powered off until the Virtual Chassis port connection is configured.

Results Display the results of the configuration on each router. At this point in the procedure, all line cards are offline, and the routers are each designated with the **Master** role because they are not yet interconnected as a fully formed Virtual Chassis. In addition, member 1 (**trefoil**) remains in Amnesiac state (has no defined configuration) until the Virtual Chassis forms and the configuration is committed.

For member 0 (**gladius**):

```
{master:member0-re0}

user@gladius> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: 4f2b.1aa0.de08
                                                Mastership           Neighbor List

Member ID       Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Prsnt    JN10C7135AFC mx240          129  Master*
```

For member 1 (**trefoil**):

```
Amnesiac (ttyd0)

login: user
Password:
...

{master:member1-re0}

user> show virtual-chassis status
Virtual Chassis ID: eabf.4e50.91e6
Virtual Chassis Mode: Disabled
                                                Mastership           Neighbor List

Member ID       Status   Serial No    Model    priority    Role      ID  Interface

1 (FPC  12- 23) Prsnt    JN115D117AFB mx480          128  Master*
```

Configuring Virtual Chassis Ports to Interconnect Member Routers

Step-by-Step Procedure

To interconnect the member routers in an MX Series Virtual Chassis, use the **request virtual-chassis vc-port set** command to configure (set) Virtual Chassis ports on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces.

NOTE: If you issue the request virtual-chassis vc-port set command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

To configure Virtual Chassis ports on MPC/MIC interfaces to connect the member routers in the Virtual Chassis:

1. Configure the Virtual Chassis ports on member 0 (**gladius**).
   a. Log in to the console on member 0.
   b. Configure the first Virtual Chassis port that connects to member 1 (**trefoil**).

      ```
      {master:member0-re0}

      user@gladius> request virtual-chassis vc-port set fpc-slot 2 pic-slot 2 port 0
      vc-port successfully set
      ```

      After the Virtual Chassis port is created, it is renamed **vcp-*slot/pic/port*** (for example, **vcp-2/2/0**), and the line card associated with that port comes online. The line cards in the other member router remain offline until the Virtual Chassis forms. Each Virtual Chassis port is dedicated to the task of interconnecting member routers in a Virtual Chassis, and is no longer available for configuration as a standard network port.

   c. When **vcp-2/2/0** is up, configure the second Virtual Chassis port that connects to member 1.

      ```
      {master:member0-re0}

      user@gladius> request virtual-chassis vc-port set fpc-slot 2 pic-slot 3 port 0
      vc-port successfully set
      ```

2. Configure the Virtual Chassis ports on member 1 (**trefoil**).
   a. Log in to the console on member 1.
   b. Configure the first Virtual Chassis port that connects to member 0 (**gladius**).

      ```
      {master:member1-re0}

      user@trefoil> request virtual-chassis vc-port set fpc-slot 2 pic-slot 0 port 0
      vc-port successfully set
      ```

   c. When **vcp-2/0/0** is up, configure the second Virtual Chassis port that connects to member 0.

      ```
      {master:member1-re0}

      user@trefoil> request virtual-chassis vc-port set fpc-slot 5 pic-slot 2 port 0
      ```

```
vc-port successfully set
```

When all of the line cards in all of the member routers are online, and the Virtual Chassis has formed, you can issue Virtual Chassis commands from the terminal window of the master router (**gladius**).

3. Verify that the Virtual Chassis is properly configured and operational.

```
{master:member0-re0}

user@gladius> show virtual-chassis status
{master:member0-re0}

user@gladius> show virtual-chassis vc-port all-members
```

See the Verification section for information about interpreting the output of these commands.

4. Commit the configuration on the master router.

The commit step is required to ensure that the configuration groups and Virtual Chassis configuration are propagated to both members of the Virtual Chassis.

Verification

To confirm that the Virtual Chassis configuration is working properly, perform these tasks:

- Verifying the Member IDs and Roles of the Virtual Chassis Members on page 83
- Verifying the Enhanced IP Network Services Configuration on page 84
- Verifying the Operation of the Virtual Chassis Ports on page 84
- Verifying Neighbor Reachability on page 85

Verifying the Member IDs and Roles of the Virtual Chassis Members

Purpose Verify that the member IDs and roles of the routers belonging to the Virtual Chassis are properly configured.

Action Display the status of the members of the Virtual Chassis configuration:

```
{master:member0-re0}

user@gladius> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: a5b6.be0c.9525
                                                    Mastership           Neighbor List
Member ID      Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Prsnt    JN10C7135AFC mx240          129  Master*    1  vcp-2/2/0
                                                                     1  vcp-2/3/0

1 (FPC  12- 23) Prsnt    JN115D117AFB mx480          129  Backup     0  vcp-2/0/0
                                                                     0  vcp-5/2/0
```

Meaning The value **Prsnt** in the **Status** column of the output confirms that the member routers specified in the preprovisioned configuration are currently connected to the Virtual Chassis. The display shows that member 0 (**gladius**) and member 1 (**trefoil**), which were both

configured with the **routing-engine** role, are functioning as the master router and backup router of the Virtual Chassis, respectively. The **Neighbor List** displays the interconnections between the member routers by means of the Virtual Chassis ports. For example, member 0 is connected to member 1 through **vcp-2/2/0** and **vcp-2/3/0**. The asterisk (*) following **Master** denotes the router on which the command was issued. The **Mastership priority** value is assigned by the software and is not configurable in the current release.

Verifying the Enhanced IP Network Services Configuration

Purpose Verify that enhanced IP network services has been properly configured for the Virtual Chassis.

Action Display the setting of the network services configuration for the master Routing Engine in the Virtual Chassis master router (member0-re0), and for the master Routing Engine in the Virtual Chassis backup router (member1-re0).

```
{master:member0-re0}

user@gladius> show chassis network services
Network Services Mode: Enhanced-IP


{backup:member1-re0}

user@trefoil> show chassis network services
Network Services Mode: Enhanced-IP
```

Meaning The output of the **show chassis network services** command confirms that enhanced IP network services is properly configured on both member routers in the Virtual Chassis.

Verifying the Operation of the Virtual Chassis Ports

Purpose Verify that the Virtual Chassis ports are properly configured and operational.

Action Display the status of the Virtual Chassis ports for both members of the Virtual Chassis.

```
{master:member0-re0}

user@gladius> show virtual-chassis vc-port all-members
member0:
--------------------------------------------------------------------------
Interface       Type              Trunk  Status       Speed        Neighbor
or                                 ID                (mbps)       ID  Interface
Slot/PIC/Port
2/2/0           Configured          3    Up           10000        1   vcp-2/0/0
2/3/0           Configured          3    Up           10000        1   vcp-5/2/0


member1:
--------------------------------------------------------------------------
Interface       Type              Trunk  Status       Speed        Neighbor
or                                 ID                (mbps)       ID  Interface
Slot/PIC/Port
2/0/0           Configured          3    Up           10000        0   vcp-2/2/0
5/2/0           Configured          3    Up           10000        0   vcp-2/3/0
```

Meaning The output confirms that the Virtual Chassis ports you configured are operational. For each member router, the **Interface or Slot/PIC/Port** column shows the location of the Virtual Chassis ports configured on that router. For example, the Virtual Chassis ports on **member0-re0** (**gladius**) are **vcp-2/2/0** and **vcp-2/3/0**. In the **Trunk ID** column, the value **3** indicates that a trunk has formed; if a trunk is not present, this field displays the value **-1** . In the **Status** column, the value **Up** confirms that the interfaces associated with the Virtual Chassis ports are operational. The **Speed** column displays the speed of the Virtual Chassis port interface. The **Neighbor ID/Interface** column displays the member IDs and Virtual Chassis port interfaces that connect to this router. For example, the connections to member 0 (**gladius**) are through **vcp-2/0/0** and **vcp-5/2/0** on member 1 (**trefoil**).

Verifying Neighbor Reachability

Purpose Verify that each member router in the Virtual Chassis can reach the neighbor routers to which it is connected.

Action Display the neighbor reachability information for both member routers in the Virtual Chassis.

```
{master:member0-re0}

user@gladius> show virtual-chassis active-topology all-members
member0:
--------------------------------------------------------------------------
  Destination ID        Next-hop

  1                    1(vcp-2/2/0.32768)


member1:
--------------------------------------------------------------------------
  Destination ID        Next-hop

  0                    0(vcp-2/0/0.32768)
```

Meaning The output confirms that each member router in the Virtual Chassis has a path to reach the neighbors to which it is connected. For each member router, the **Destination ID** specifies the member ID of the destination (neighbor) router. The **Next-hop** column displays the member ID and Virtual Chassis port interface of the next-hop to which packets for the destination ID are forwarded. For example, the next-hop from member 0 (**gladius**) to member 1 (**trefoil**) is through Virtual Chassis port interface **vcp-2/2/0.32768**.

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23
- Guidelines for Configuring Virtual Chassis Ports on page 116
- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56

Switching the Global Master and Backup Roles in a Virtual Chassis Configuration

You can change the mastership in an MX Series Virtual Chassis or EX9200 Virtual Chassis by switching the global roles of the master router or switch and backup router or switch in the Virtual Chassis configuration. When you change the mastership by issuing the **request virtual-chassis routing-engine master switch** administrative command, the current master router or switch in the Virtual Chassis (also known as the Virtual Chassis protocol master) becomes the backup router or switch, and the current backup router or switch (also known as the Virtual Chassis protocol backup) becomes the master router or switch.

Before you begin:

- Make sure the system configuration is synchronized between the master router or switch and the backup router or switch.

  If the configuration between the member devices is not synchronized when you issue the **request virtual-chassis routing-engine master switch** command, the device displays the following error message and rejects the command.

  ```
  Error: mastership switch request NOT honored, backup not ready
  ```

- Make sure the Virtual Chassis is not in a transition state (for example, the backup router or switch is in the process of disconnecting from the Virtual Chassis) when you issue the **request virtual-chassis routing-engine master switch** command.

  If you attempt to issue the **request virtual-chassis routing-engine master switch** command during a transition state, the device does not process the command.

To switch the global master and backup roles:

- Issue the **request virtual-chassis routing-engine master switch** command from the Virtual Chassis master router or switch:

  ```
  {master:member0-re0}

  user@host1> request virtual-chassis routing-engine master switch
  Do you want to continue ? [yes,no] (no) yes
  ```

  If you attempt to issue the **request virtual-chassis routing-engine master switch** command from the backup router or switch, the device displays the following error message and rejects the command.

  ```
  error: Virtual Chassis member is not the protocol master
  ```

  Issuing the **request virtual-chassis routing-engine master switch** command from the Virtual Chassis master router or switch causes the global role transitions listed in Table 12 on page 87.

Table 12: Virtual Chassis Global Role Transitions Before and After Mastership Switchover

Virtual Chassis Role Before Switching Mastership	Virtual Chassis Role After Switching Mastership
Master Routing Engine in Virtual Chassis master router or switch (VC-Mm)	Master Routing Engine in Virtual Chassis backup router or switch (VC-Bm)

Table 12: Virtual Chassis Global Role Transitions Before and After Mastership Switchover *(continued)*

Virtual Chassis Role Before Switching Mastership	Virtual Chassis Role After Switching Mastership
Standby Routing Engine in Virtual Chassis master router or switch (VC-Ms)	Standby Routing Engine in Virtual Chassis backup router or switch (VC-Bs)
Master Routing Engine in Virtual Chassis backup router or switch (VC-Bm)	Master Routing Engine in Virtual Chassis master router or switch (VC-Mm)
Standby Routing Engine in Virtual Chassis backup router or switch (VC-Bs)	Standby Routing Engine in Virtual Chassis master router or switch (VC-Ms)

The local roles (**master** and **standby**, or **m** and **s**) of the Routing Engines do not change after you issue the **request virtual-chassis routing-engine master switch** command. For example, as shown in Table 12 on page 87, the master Routing Engine in the Virtual Chassis master router or switch (VC-Mm) remains the master Routing Engine in the Virtual Chassis backup router or switch (VC-Bm) after the switchover.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Mastership Election in a Virtual Chassis on page 31
- Switchover Behavior in a Virtual Chassis on page 32
- *Configuring an EX9200 Virtual Chassis*

Deleting Member IDs in a Virtual Chassis Configuration

In most cases, you delete the member ID from a member router or switch as part of the procedure for deleting a Virtual Chassis configuration. When you delete the member ID by using the **request virtual-chassis member-id delete** command, the router or switch reboots and the software disables Virtual Chassis mode on that device. After the reboot, the router or switch is no longer part of the Virtual Chassis and functions as an independent device.

NOTE: If you issue the request virtual-chassis member-id delete command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

A software license is not needed to create an EX9200 Virtual Chassis.

To delete the Virtual Chassis member IDs from both member routers or switches and disable Virtual Chassis mode:

1. In the console window on the router or switch configured as **member 0**, delete member ID **0**.

```
{master:member0-re0}

user@host1> request virtual-chassis member-id delete
This command will disable virtual-chassis mode and reboot the system.
 Continue? [yes,no] (no) yes

Updating VC configuration and rebooting system, please wait...

{master:member0-re0}
user@host1>

*** FINAL System shutdown message from root@host1 ***
System going down IMMEDIATELY
```

2. In the console window on the router or switch configured as **member 1**, delete member ID **1**.

```
{master:member1-re0}

user@host2> request virtual-chassis member-id delete
This command will disable virtual-chassis mode and reboot the system.
 Continue? [yes,no] (no) yes

Updating VC configuration and rebooting system, please wait...

{master:member1-re0}
user@host2>

*** FINAL System shutdown message from root@host2 ***
System going down IMMEDIATELY
```

3. (Optional) Confirm that Virtual Chassis mode has been disabled on both member routers or switches.

For example:

```
user@host1> show virtual-chassis status
error: the virtual-chassis-control subsystem is not running
```

Related Documentation

- Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 102
- *Configuring an EX9200 Virtual Chassis*
- Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 103

Disabling Split Detection in a Virtual Chassis Configuration

If there is a disruption to a Virtual Chassis due to failure of a member device or one or more Virtual Chassis port links, the resulting connectivity loss can cause a split in the Virtual Chassis configuration. Split detection, which is enabled by default in an MX Series and EX9200 Virtual Chassis, identifies the split and minimizes further network disruption.

You can disable split detection by including the **no-split-detection** statement at the **[edit virtual-chassis]** hierarchy level. Disabling split detection can be useful in certain Virtual Chassis configurations.

For example, if the backup device fails in a two-member Virtual Chassis configuration and split detection is enabled (the default behavior), the master device takes a **line-card** role, and the line cards (FPCs) that do not host Virtual Chassis ports go offline. This state effectively isolates the master router or switch and removes it from the Virtual Chassis until connectivity is restored. As a result, routing or switching is halted and the Virtual Chassis configuration is disabled. By contrast, if the backup router or switch fails in a two-member Virtual Chassis configuration and split detection is disabled, the master router or switch retains mastership and maintains all of the Virtual Chassis ports, effectively resulting in a single-member Virtual Chassis consisting of only the master device.

BEST PRACTICE: We recommend that you disable split detection for a two-member Virtual Chassis configuration if you think the backup router or switch is more likely to fail than the Virtual Chassis port interfaces to the backup router or switch. Configuring redundant Virtual Chassis ports on different line cards in each member router or switch reduces the likelihood that all Virtual Chassis port interfaces to the backup router or switch can fail.

To disable split detection:

1. Specify that you want to disable the default detection of splits in the Virtual Chassis.

   ```
   [edit virtual-chassis]
   user@gladius# set no-split-detection
   ```

2. Commit the configuration.

Disabling split detection causes different results for different types of Virtual Chassis failures. For information, see "Split Detection Behavior in a Virtual Chassis" on page 35.

Related Documentation

- Split Detection Behavior in a Virtual Chassis on page 35
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Switchover Behavior in a Virtual Chassis on page 32
- Virtual Chassis Components Overview on page 23

Example: Replacing a Routing Engine in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers

If you remove a Routing Engine from a member router in an MX Series Virtual Chassis for upgrade or repair, you must replace it with a new Routing Engine in the empty Routing Engine slot, and install the same Junos OS release on the new Routing Engine that is running on the other Routing Engines in the Virtual Chassis. The Virtual Chassis remains operational during the replacement procedure.

All four Routing Engines (both Routing Engines in the master router and both Routing Engines in the backup router) in the Virtual Chassis must run the same Junos OS release.

BEST PRACTICE: **We recommend that you replace a Routing Engine in an MX Series Virtual Chassis configuration during a maintenance window to minimize the possibility of disruption to subscribers.**

This example describes how to replace a Routing Engine in an MX Series Virtual Chassis configuration consisting of two MX Series routers, each of which has dual Routing Engines installed:

- Requirements on page 91
- Overview and Topology on page 92
- Configuration on page 94
- Verification on page 98

Requirements

This example uses the following software and hardware and components:

- Junos OS Release 11.4 and later releases
- One MX240 3D Universal Edge Router with dual Routing Engines
- One MX480 3D Universal Edge Router with dual Routing Engines

NOTE: **This configuration example has been tested using the software release listed and is assumed to work on all later releases.**

See Table 13 on page 93 for information about the hardware installed in each MX Series router.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for an MX Series Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

Overview and Topology

To replace a Routing Engine in an MX Series Virtual Chassis configuration, you must:

1. Remove the Routing Engine that needs repair or upgrade.
2. Return the Routing Engine to Juniper Networks, Inc.
3. Install the new Routing Engine in the empty Routing Engine slot.
4. Modify the Routing Engine factory configuration to enable formation of the Virtual Chassis.
5. Install the same Junos OS release on the new Routing Engine that is running on the other Routing Engines in the Virtual Chassis.
6. Reboot the new Routing Engine to run the Junos OS software release.

Figure 3 on page 92 shows the topology of the MX Series Virtual Chassis configuration used in this example. This example replaces the backup RE-S-2000 Routing Engine in slot 1 of the Virtual Chassis backup router, which is an MX480 router named **trefoil** that is assigned member ID **1**. The backup Routing Engine in slot 1 of **trefoil** is represented in the example as **member1-re1**.

For redundancy, each of the two member routers is configured with two Virtual Chassis ports.

Figure 3: Sample Topology for a Virtual Chassis with Two MX Series Routers

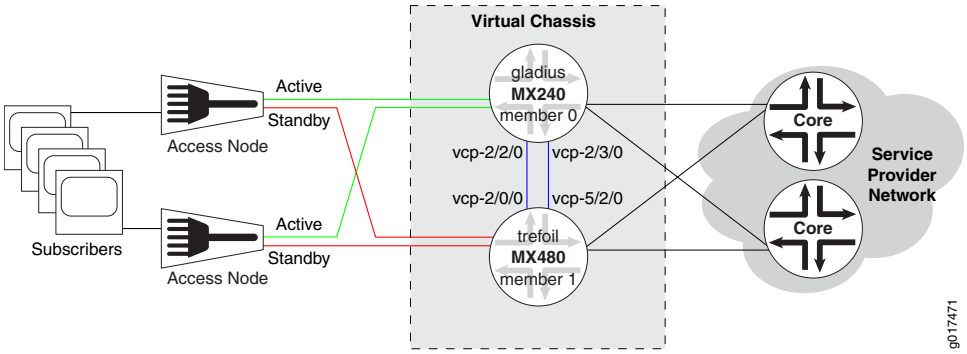


Table 13 on page 93 shows the hardware and software configuration settings for each MX Series router in the Virtual Chassis.

Table 13: Components of the Sample MX Series Virtual Chassis

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Network Port Slot Numbering
gladius	MX240 router with: • 60-Gigabit Ethernet Enhanced Queuing MPC • 20-port Gigabit Ethernet MIC with SFP • 4-port 10-Gigabit Ethernet MIC with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member0-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member0-re1**)	JN10C7135AFC	0	routing-engine (master)	vcp-2/2/0 vcp-2/3/0	FPC 0 – 11
trefoil	MX480 router with: • Two 30-Gigabit Ethernet Queuing MPCs • Two 20-port Gigabit Ethernet MICs with SFP • Two 2-port 10-Gigabit Ethernet MICs with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member1-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member1-re1**)	JN115D117AFB	1	routing-engine (backup)	vcp-2/0/0 vcp-5/2/0	FPC 12 – 23 (offset = 12)

Configuration

To replace a Routing Engine in a Virtual Chassis configuration consisting of two MX Series routers, each with dual Routing Engines, perform these tasks:

- Removing the Routing Engine on page 95
- Returning the Routing Engine to Juniper Networks, Inc. on page 95
- Installing the New Routing Engine on page 95
- Modifying the Routing Engine Factory Configuration on page 95
- Installing the Junos OS Release on the New Routing Engine on page 97

Removing the Routing Engine

Step-by-Step Procedure

To remove the Routing Engine that needs repair or upgrade:

- Remove the Routing Engine according to the procedure for your MX Series router.
  - For an MX240 router, see *Removing an MX240 Routing Engine* in the *MX240 3D Universal Edge Router Hardware Guide*.
  - For an MX480 router, see *Removing an MX480 Routing Engine* in the *MX480 3D Universal Edge Router Hardware Guide*.
  - For an MX960 router, see *Removing an MX960 Routing Engine* in the *MX960 3D Universal Edge Router Hardware Guide*.

Returning the Routing Engine to Juniper Networks, Inc.

Step-by-Step Procedure

To return the Routing Engine to Juniper Networks, Inc:

- Obtain a Return Materials Authorization (RMA) from the Juniper Networks Technical Assistance Center (JTAC) and return the Routing Engine to Juniper Networks, Inc.

  For instructions, see *Returning a Hardware Component to Juniper Networks, Inc.* in the *Hardware Guide* for your MX Series router.

Installing the New Routing Engine

Step-by-Step Procedure

To install the new Routing Engine in the Virtual Chassis member router:

- Install the Routing Engine in the empty Routing Engine slot of the member router according to the procedure for your MX Series router.
  - For an MX240 router, see *Installing an MX240 Routing Engine* in the *MX240 3D Universal Edge Router Hardware Guide*.
  - For an MX480 router, see *Installing an MX480 Routing Engine* in the *MX480 3D Universal Edge Router Hardware Guide*.
  - For an MX960 router, see *Installing an MX960 Routing Engine* in the *MX960 3D Universal Edge Router Hardware Guide*.

Modifying the Routing Engine Factory Configuration

Step-by-Step Procedure

A Routing Engine shipped from the factory is loaded with a default factory configuration that includes the following stanza at the [edit] hierarchy level:

```
[edit]
system {
  commit {
    factory-settings {
      reset-virtual-chassis-configuration;
    }
  }
}
```

When this configuration stanza is present, the Routing Engine can operate only in a standalone chassis and *not* in a Virtual Chassis member router. As a result, if you install this Routing Engine in the standby slot of a Virtual Chassis member router (**member1-re1** in this procedure), the Routing Engine does not automatically synchronize with the master Routing Engine and boot in Virtual Chassis mode.

To ensure that the standby factory Routing Engine successfully synchronizes with the master Routing Engine, you must remove the standalone chassis configuration stanza from the standby factory Routing Engine and verify that it reboots in Virtual Chassis mode before you install the Junos OS release.

To modify the Routing Engine factory configuration to ensure proper operation of the Virtual Chassis:

1. Log in to the console of the new Routing Engine as the user **root** with no password.
2. Configure a plain-text password for the **root** (superuser) login.

   ```
   {local:member1-re1}[edit system]
   root# set root-authentication plain-text-password
   New password: type password here
   Retype new password: retype password here
   ```

3. Delete the standalone chassis configuration.

   ```
   {local:member1-re1}[edit]
   root# delete system commit factory-settings reset-virtual-chassis-configuration
   ```

4. Commit the configuration.

   The new Routing Engine synchronizes the Virtual Chassis member ID with the master Routing Engine and boots in Virtual Chassis mode.

5. Verify that the new Routing Engine is in Virtual Chassis mode.

   During the boot process, the router displays the following output to indicate that it has synchronized the Virtual Chassis member ID (1) with the master Routing Engine and is in Virtual Chassis mode.

   ```
   ...
   virtual chassis member-id = 1
   virtual chassis mode      = 1
   ...
   ```

Installing the Junos OS Release on the New Routing Engine

Step-by-Step Procedure

You must install the same Junos OS release on the new Routing Engine that is running on the other Routing Engines in the MX Series Virtual Chassis. Installing the Junos OS software prepares the Routing Engine to run the new Junos OS release after a reboot. This action is also referred to as *arming* the Routing Engine.

To install the Junos OS release on the new Routing Engine (**member1-re1**) in the Virtual Chassis:

1. Use FTP or a Web browser to download the Junos OS software to the master Routing Engine on the Virtual Chassis master router (**member0-re0**).

   See *Downloading Software* in the *Installation and Upgrade Guide*.

   NOTE: **Make sure you download and install the same Junos OS release that is running on all Routing Engines in the Virtual Chassis.**

2. If you have not already done so, log in to the console of the new Routing Engine as the user **root** with no password.

3. If you have not already done so, configure a plain-text password for the **root** (superuser) login.

   ```
   {local:member1-re1}[edit system]
   root# set root-authentication plain-text-password
   New password: type password here
   Retype new password: retype password here
   ```

4. From the console, commit the configuration.

   ```
   {local:member1-re1}[edit]
   root# commit synchronize and-quit
   ...
   member1-re0:
   configuration check succeeds
   member0-re0:
   commit complete
   member1-re0:
   commit complete
   member1-re1:
   commit complete
   Exiting configuration mode
   ```

5. Use Telnet or SSH to log in to the member router containing the new Routing Engine (**trefoil**).

   ```
   {local:member1-re1}

   user@trefoil>
   ```

   Notice that the router name (**trefoil**) now appears in the command prompt.

6. Install the Junos OS release on the new Routing Engine (**member1-re1**) from the Virtual Chassis master router (**member0-re0**).

```
{master:member0-re0}
```

```
user@trefoil> request system software add member member-id re1 no-validate reboot
package-name force
```

For example:

```
{master:member0-re0}
```

```
user@trefoil> request system software add member 1 re1 no-validate reboot
/var/tmp/jinstall-11.4R1-8-domestic-signed.tgz force
Pushing bundle to re1...
```

This command reboots **member1-re1** after the software is added.

Results After the reboot, the new Routing Engine becomes part of the Virtual Chassis, updates its command prompt to display **member1-re1**, and copies the appropriate configuration from the Virtual Chassis.

Verification

To verify that the MX Series Virtual Chassis is operating properly with the new Routing Engine, perform these tasks:

- Verifying the Junos OS Installation on the New Routing Engine on page 98
- Verifying the Junos OS License Installation on the New Routing Engine on page 98
- Switching the Local Mastership in the Member Router to the New Routing Engine on page 99

Verifying the Junos OS Installation on the New Routing Engine

Purpose Verify that you have installed the correct Junos OS release on the new Routing Engine (**member1-re1**).

Action Display the hostname, model name, and version information of the Junos OS release running on the new Routing Engine.

```
{local:member1-re1}
```

```
user@trefoil> show version local
Hostname: trefoil
Model: mx480
. . .
JUNOS Base OS boot [11.4R1-8]
JUNOS Base OS Software Suite [11.4R1-8]
. . .
```

Meaning The relevant portion of the **show version local** command output confirms that Junos OS Release 11.4R1-8 was installed as intended.

Verifying the Junos OS License Installation on the New Routing Engine

Purpose Verify that the MX Virtual Chassis Redundancy Feature Pack and the required Junos OS feature licenses are properly installed on the member router containing the new Routing Engine.

For information about license installation, see:

- Installing Junos OS Licenses on Virtual Chassis Member Routers on page 59
- *Software Features That Require Licenses on MX Series Routers Only*

Action Display the Junos OS licenses installed on the new Routing Engine.

```
{local:member1-re1}

user@trefoil> show system license
License usage:
                                Licenses     Licenses    Licenses    Expiry
  Feature name                       used    installed      needed
  subscriber-accounting                 0            1           0    permanent
  subscriber-authentication             0            1           0    permanent
  subscriber-address-assignment         0            1           0    permanent
  subscriber-vlan                       0            1           0    permanent
  subscriber-ip                         0            1           0    permanent
  scale-subscriber                      0       256000           0    permanent
  scale-l2tp                            0         1000           0    permanent
  scale-mobile-ip                       0         1000           0    permanent
  virtual-chassis                       0            1           0    permanent
```

Meaning The **show system license** command output confirms that the MX Virtual Chassis Redundancy Feature Pack has been installed on this member router. In addition, the necessary Junos OS feature licenses have been installed to enable use of a particular software feature or scaling level.

Switching the Local Mastership in the Member Router to the New Routing Engine

Purpose Verify that the MX Series Virtual Chassis is operating properly with the new Routing Engine by confirming that the new Routing Engine can take over local mastership from the existing Routing Engine in the Virtual Chassis backup router, **trefoil** (member 1).

Action Switch the local mastership of the Routing Engines in **trefoil** from the Routing Engine in slot 0 (**member1-re0**) to the newly installed Routing Engine in slot 1 (**member1-re1**).

```
{backup:member1-re0}

user@trefoil> request chassis routing-engine master switch
```

Wait approximately 1 minute to display the status and roles of the member routers in the Virtual Chassis after the local switchover.

```
{backup:member1-re1}

user@trefoil> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: a5b6.be0c.9525
                                                Mastership           Neighbor List
Member ID       Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Prsnt    JN10C7135AFC mx240          129  Master     1  vcp-2/2/0
                                                                     1  vcp-2/3/0

1 (FPC  12- 23) Prsnt    JN115D117AFB mx480          129  Backup*    0  vcp-2/0/0
                                                                     0  vcp-5/2/0
```

Meaning Issuing the **request chassis routing-engine master switch** command to initiate the local switchover of the Routing Engines in the Virtual Chassis backup router (**trefoil**) affects only the roles of the Routing Engines in that member router (**member1-re0** and **member1-re1**), but does not change the global mastership of the Virtual Chassis. The output of the **show virtual-chassis status** command confirms that after the local switchover, member 0 (**gladius**) is still the Virtual Chassis master router, and member 1 (**trefoil**) is still the Virtual Chassis backup router.

Before the local switchover, **member1-re0** was the master Routing Engine in the Virtual Chassis backup router (VC-Bm), and **member1-re1** (the new Routing Engine) was the standby Routing Engine in the Virtual Chassis backup router (VC-Bs).

After the local switchover, **member1-re0** and **member1-re1** switch roles. The new Routing Engine, **member1-re1**, becomes the master Routing Engine in the Virtual Chassis backup router (VC-Bm), and **member1-re0** becomes the standby Routing Engine in the Virtual Chassis backup router (VC-Bs).

Table 14 on page 101 lists the role transitions that occur for each member router and Routing Engine before and after the local switchover of the Routing Engines in **trefoil**.

NOTE: The role transitions described in Table 14 on page 101 apply only when you initiate the local switchover from the Virtual Chassis backup router (VC-B). For information about the role transitions that occur when you initiate the local switchover from the Virtual Chassis master router (VC-M), see "Switchover Behavior in a Virtual Chassis" on page 32.

Table 14: Virtual Chassis Role Transitions Before and After Local Routing Engine Switchover

Virtual Chassis Component	Role *Before* Local Switchover	Role *After* Local Switchover
gladius (member 0)	Virtual Chassis master router (VC-M)	Virtual Chassis master router (VC-M)
trefoil (member 1)	Virtual Chassis backup router (VC-B)	Virtual Chassis backup router (VC-B)
member0-re0	Master Routing Engine in the Virtual Chassis master router (VC-Mm)	Master Routing Engine in the Virtual Chassis master router (VC-Mm)
member0-re1	Standby Routing Engine in the Virtual Chassis master router (VC-Ms)	Standby Routing Engine in the Virtual Chassis master router (VC-Ms)
member1-re0	Master Routing Engine in the Virtual Chassis backup router (VC-Bm)	Standby Routing Engine in the Virtual Chassis backup router (VC-Bs)
member1-re1 (new Routing Engine)	Standby Routing Engine in the Virtual Chassis backup router (VC-Bs)	Master Routing Engine in the Virtual Chassis backup router (VC-Bm)

BEST PRACTICE: After you switch the local mastership of the Routing Engines, full synchronization of the Routing Engines takes approximately 30 minutes to complete. To prevent possible loss of subscriber state information due to incomplete synchronization, we recommend that you wait at least 30 minutes before performing another local switchover, global switchover, or graceful Routing Engine switchover in an MX Series Virtual Chassis configuration.

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23
- Installing Junos OS Licenses on Virtual Chassis Member Routers on page 59
- Switchover Behavior in a Virtual Chassis on page 32
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- *Installation and Upgrade Guide*

Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers

You can delete an MX Series Virtual Chassis configuration at any time. You might want to do so if your network configuration changes, or if you want to replace one or both MX Series member routers with different MX Series routers.

To delete a Virtual Chassis configuration for MX Series routers:

1. Delete the Virtual Chassis ports from each member router.

   See "Deleting Virtual Chassis Ports in a Virtual Chassis Configuration" on page 120.

2. Delete the definitions and applications for the following configuration groups on each member router:

   - **member0-re0**
   - **member0-re1**
   - **member1-re0**
   - **member1-re1**

3. Delete the preprovisioned member information configured at the **[edit virtual-chassis]** hierarchy level on the master router.
4. Delete any interfaces that were configured on the member routers when the Virtual Chassis was created.
5. Delete the Virtual Chassis member IDs to reboot each router and disable Virtual Chassis mode.

   See "Deleting Member IDs in a Virtual Chassis Configuration" on page 89.

NOTE: You cannot override a Virtual Chassis configuration simply by using the **load override** command to load a different configuration on the router from an ASCII file or from terminal input, as you can with other configurations. The member ID and Virtual Chassis port definitions are not stored in the configuration file, and are still defined even after the new configuration file is loaded.

Related Documentation

- Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 103
- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23

Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers

You can delete an MX Series Virtual Chassis configuration at any time. You might want to do so if your network configuration changes, or if you want to replace one or both MX Series member routers in the Virtual Chassis with different MX Series routers. After you delete the Virtual Chassis configuration, the routers that were formerly members of the Virtual Chassis function as two independent routers.

This example describes how to delete a Virtual Chassis configuration consisting of two MX Series routers:

- Requirements on page 103
- Overview and Topology on page 103
- Configuration on page 105
- Verification on page 112

Requirements

This example uses the following software and hardware components:

- Junos OS Release 11.2 and later releases
- One MX240 3D Universal Edge Router with dual Routing Engines
- One MX480 3D Universal Edge Router with dual Routing Engines

NOTE: This configuration example has been tested using the software release listed and is assumed to work on all later releases.

See Table 15 on page 105 for information about the hardware installed in each MX Series router.

BEST PRACTICE: We recommend that you use the commit synchronize command to save any configuration changes to the Virtual Chassis.

For an MX Series Virtual Chassis, the force option is the default and only behavior when you issue the commit synchronize command. Issuing the commit synchronize command for an MX Series Virtual Chassis configuration has the same effect as issuing the commit synchronize force command.

Overview and Topology

To delete an MX Series Virtual Chassis configuration, you must:

1. Delete all Virtual Chassis ports.
2. Remove the definitions and applications of the Virtual Chassis configuration groups.

3. Delete the preprovisioned member information configured at the **[edit virtual-chassis]** hierarchy level.
4. Delete any configured interfaces.
5. Remove the member IDs of each member router.

After you issue the **request virtual-chassis member-id delete** command on each router to remove the member ID, the router reboots and the software disables Virtual Chassis mode on that router.

Because the entire Virtual Chassis configuration is propagated from the master router to the other member router when the Virtual Chassis forms, you must delete each component of the Virtual Chassis configuration from both member routers, even though the component was originally configured only on the master router. For example, even though the preprovisioned member information was configured at the **[edit virtual-chassis]** hierarchy level only on the master router, you must delete the **virtual-chassis** stanza from the other member router in the Virtual Chassis.

NOTE: You cannot override a Virtual Chassis configuration simply by using the **load override** command to load a different configuration on the router from an ASCII file or from terminal input, as you can with other configurations. The member ID and Virtual Chassis port definitions are not stored in the configuration file, and are still defined even after the new configuration file is loaded.

This example deletes the Virtual Chassis configuration that uses the basic topology shown in Figure 4 on page 104. For redundancy, each member router is configured with two Virtual Chassis ports, both of which must be removed as part of the deletion process.

Figure 4: Sample Topology for a Virtual Chassis with Two MX Series Routers

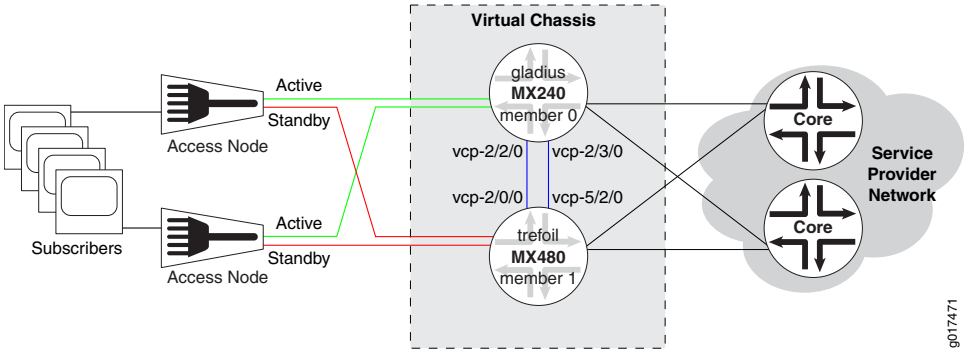


Table 15 on page 105 shows the hardware and software configuration settings for each MX Series router in the Virtual Chassis.

Table 15: Components of the Sample MX Series Virtual Chassis

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Network Port Slot Numbering
gladius	MX240 router with: • 60-Gigabit Ethernet Enhanced Queuing MPC • 20-port Gigabit Ethernet MIC with SFP • 4-port 10-Gigabit Ethernet MIC with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member0-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member0-re1**)	JN10C7135AFC	0	routing-engine (master)	vcp-2/2/0 vcp-2/3/0	FPC 0 – 11
trefoil	MX480 router with: • Two 30-Gigabit Ethernet Queuing MPCs • Two 20-port Gigabit Ethernet MICs with SFP • Two 2-port 10-Gigabit Ethernet MICs with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member1-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member1-re1**)	JN115D117AFB	1	routing-engine (backup)	vcp-2/0/0 vcp-5/2/0	FPC 12 – 23 (offset = 12)

Configuration

To delete a Virtual Chassis configuration consisting of two MX Series routers, perform these tasks:

- Deleting Virtual Chassis Ports on page 106
- Deleting Configuration Group Definitions and Applications on page 107
- Deleting Preprovisioned Member Information on page 109

- Deleting Configured Interfaces on page 109
- Deleting Member IDs to Disable Virtual Chassis Mode on page 110

Deleting Virtual Chassis Ports

Step-by-Step Procedure

To delete a Virtual Chassis port from a member router, you must use the **request virtual-chassis vc-port delete** command.

NOTE: If you issue the **request virtual-chassis vc-port delete** command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

To remove the Virtual Chassis ports from each member router:

1. In the console window on member 0 (**gladius**), remove both Virtual Chassis ports (**vcp-2/2/0** and **vcp-2/3/0**).

```
{master:member0-re0}

user@gladius> request virtual-chassis vc-port delete fpc-slot 2 pic-slot 2 port 0
vc-port successfully deleted

{master:member0-re0}

user@gladius> request virtual-chassis vc-port delete fpc-slot 2 pic-slot 3 port 0
vc-port successfully deleted
```

2. In the console window on member 1 (**trefoil**), remove both Virtual Chassis ports (**vcp-2/0/0** and **vcp-5/2/0**).

```
{backup:member1-re0}

user@trefoil> request virtual-chassis vc-port delete fpc-slot 2 pic-slot 0 port 0
vc-port successfully deleted

{backup:member1-re0}

user@trefoil> request virtual-chassis vc-port delete fpc-slot 5 pic-slot 2 port 0
vc-port successfully deleted
```

Results

Display the results of the Virtual Chassis port deletion on each router. Confirm that no Virtual Chassis ports are listed in the output of either the **show virtual-chassis status** command or the **show virtual-chassis vc-port** command.

```
{master:member0-re0}

user@gladius> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: 4d6f.54cd.d2c1

                                                Mastership            Neighbor List

Member ID       Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Prsnt    JN10C7135AFC mx240         129  Master*
```

```
1 (FPC  12- 23) NotPrsnt JN115D117AFB mx480


{master:member0-re0}
user@gladius> show virtual-chassis vc-port
member0:
--------------------------------------------------------------------------
```

TIP: Deleting and then re-creating a Virtual Chassis port in an MX Series Virtual Chassis configuration may cause the Virtual Chassis port to appear as **Absent** in the **Status** column of the **show virtual-chassis vc-port** command display. To resolve this issue, reboot the FPC that hosts the re-created Virtual Chassis port.

Deleting Configuration Group Definitions and Applications

Step-by-Step Procedure

As part of deleting a Virtual Chassis configuration for MX Series routers with dual Routing Engines, you must delete the definitions and applications for the following configuration groups on both member routers:

- **member0-re0**
- **member0-re1**
- **member1-re0**
- **member1-re1**

To retain the information in these configuration groups before you delete them, you must copy them to the standard **re0** and **re1** configuration groups on the router, as described in the following procedure. For example, copy configuration groups **member0-re0** and **member1-re0** to **re0**, and copy **member0-re1** and **member1-re1** to **re1**.

NOTE: The **member*n*-re*n*** naming format for configuration groups is reserved for exclusive use by member routers in MX Series Virtual Chassis configurations.

To delete the configuration group definitions and applications for an MX Series Virtual Chassis:

1. In the console window on member 0 (**gladius**), delete the Virtual Chassis configuration group definitions and applications.

   a. Copy the Virtual Chassis configuration groups to the standard configuration groups **re0** and **re1**.

      {master:member0-re0}[edit]

```
user@gladius# copy groups member0-re0 to re0
user@gladius# copy groups member0-re1 to re1
```

b. Apply the **re0** and **re1** configuration groups.

```
{master:member0-re0}[edit]
user@gladius# set apply-groups re0
user@gladius# set apply-groups re1
```

c. Delete the Virtual Chassis configuration group definitions.

```
{master:member0-re0}[edit]
user@gladius# delete groups member0-re0
user@gladius# delete groups member0-re1
user@gladius# delete groups member1-re0
user@gladius# delete groups member1-re1
```

d. Delete the Virtual Chassis configuration group applications.

```
{master:member0-re0}[edit]
user@gladius# delete apply-groups member0-re0
user@gladius# delete apply-groups member0-re1
user@gladius# delete apply-groups member1-re0
user@gladius# delete apply-groups member1-re1
```

2. In the console window on member 1 (**trefoil**), delete the Virtual Chassis configuration group definitions and applications.

a. Copy the Virtual Chassis configuration groups to the standard configuration groups **re0** and **re1**.

```
{backup:member1-re0}[edit]
user@trefoil# copy groups member1-re0 to re0
user@trefoil# copy groups member1-re1 to re1
```

b. Apply the **re0** and **re1** configuration groups.

```
{backup:member1-re0}[edit]
user@trefoil# set apply-groups re0
user@trefoil# set apply-groups re1
```

c. Delete the Virtual Chassis configuration group definitions.

```
{backup:member1-re0}[edit]
user@trefoil# delete groups member0-re0
user@trefoil# delete groups member0-re1
user@trefoil# delete groups member1-re0
user@trefoil# delete groups member1-re1
```

d. Delete the Virtual Chassis configuration group applications.

```
{backup:member1-re0}[edit]
user@trefoil# delete apply-groups member0-re0
user@trefoil# delete apply-groups member0-re1
user@trefoil# delete apply-groups member1-re0
user@trefoil# delete apply-groups member1-re1
```

Results Display the results of the configuration. Confirm that configuration groups **member0-re0**, **member 0-re1**, **member1-re0**, and **member1-re1** do not appear in the output of either the **show groups** command or the **show apply-groups** command.


```
[edit]
user@gladius# show groups ?
Possible completions:
  <[Enter]>            Execute this command
  <group_name>         Group name
  global               Group name
  re0                  Group name
  re1                  Group name
  |                    Pipe through a command

[edit]
user@gladius# show apply-groups
  ## Last changed: 2010-12-01 09:17:27 PST
  apply-groups [ global re0 re1 ];
```

Deleting Preprovisioned Member Information

Step-by-Step Procedure

You must delete the preprovisioned member information, which was configured at the **[edit virtual-chassis]** hierarchy level on the master router and then propagated to the backup router during the formation of the Virtual Chassis.

To delete the preprovisioned member information for the Virtual Chassis:

1. Delete the **virtual-chassis** configuration stanza on member 0 (**gladius**).

   ```
   {master:member0-re0}[edit]
   user@gladius# delete virtual-chassis
   ```

2. Delete the **virtual-chassis** configuration stanza on member 1 (**trefoil**).

   ```
   {backup:member1-re0}[edit]
   user@trefoil# delete virtual-chassis
   ```

Results

Display the results of the deletion. Confirm that the **virtual-chassis** stanza no longer exists on either member router. For example, on **gladius** (member 0):

```
{master:member0-re0}[edit]
user@gladius# show virtual-chassis
<no output>
```

Deleting Configured Interfaces

Step-by-Step Procedure

As part of deleting the Virtual Chassis, we recommend that you delete any interfaces that were configured when the Virtual Chassis was formed. This action ensures that nonexistent interfaces or interfaces belonging to the other member router do not remain on the router after Virtual Chassis mode is disabled.

To delete any interfaces that you configured when creating the Virtual Chassis:

1. In the console window on member 0 (**gladius**), delete any configured interfaces and commit the configuration.

   a. Delete the configured interfaces.

      ```
      {master:member0-re0}[edit]
      user@gladius# delete interfaces
      ```

b. Commit the configuration on member 0.

```
{master:member0-re0}[edit system]
user@gladius# commit synchronize
  member0-re0:
  configuration check succeeds
  member0-re1:
  commit complete
  member0-re0:
  commit complete
```

2. In the console window on member 1 (**trefoil**), delete any configured interfaces and commit the configuration.

   a. Delete the configured interfaces.

```
{backup:member1-re0}[edit]
user@trefoil# delete interfaces
```

   b. Commit the configuration on member 1.

```
{backup:member1-re0}[edit system]
user@trefoil# commit synchronize
  member1-re0:
  configuration check succeeds
  member1-re1:
  commit complete
  member1-re0:
  commit complete
```

Deleting Member IDs to Disable Virtual Chassis Mode

Step-by-Step Procedure

To delete a member ID from a Virtual Chassis member router, you must use the **request virtual-chassis member-id delete** command.

NOTE: If you issue the **request virtual-chassis member-id delete** command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

To delete the Virtual Chassis member IDs and disable Virtual Chassis mode:

1. In the console window on member 0 (**gladius**), delete the member ID and reboot the router.

   a. Exit configuration mode.

```
{master:member0-re0}[edit]
user@gladius# exit
Exiting configuration mode
```

   b. Delete member ID **0**.

```
{master:member0-re0}
```

```
user@gladius> request virtual-chassis member-id delete
This command will disable virtual-chassis mode and reboot the system.
 Continue? [yes,no] (no) yes

Updating VC configuration and rebooting system, please wait...

{master:member0-re0}
user@gladius>

*** FINAL System shutdown message from root@gladius ***

System going down IMMEDIATELY
```

2. In the console window on member 1 (**trefoil**), delete the member ID and reboot the router.

   a. Exit configuration mode.

   ```
   {master:member1-re0}[edit]
   user@trefoil# exit
   Exiting configuration mode
   ```

   b. Delete member ID **1**.

   ```
   {master:member1-re0}

   user@trefoil> request virtual-chassis member-id delete
   This command will disable virtual-chassis mode and reboot the system.
    Continue? [yes,no] (no) yes

   Updating VC configuration and rebooting system, please wait...

   {backup:member1-re0}
   user@trefoil>

   *** FINAL System shutdown message from root@trefoil ***

   System going down IMMEDIATELY
   ```

Results After you issue the **request virtual-chassis member-id delete** command to remove the member ID, the router reboots and the software disables Virtual Chassis mode on that router. The routers that were formerly members of the Virtual Chassis now function as two independent routers.

Display the results of the configuration to confirm that the Virtual Chassis configuration has been deleted on each router. For example, on **gladius** (formerly member 0):

```
user@gladius> show virtual-chassis status
error: the virtual-chassis-control subsystem is not running


user@gladius> show virtual-chassis vc-port
error: the virtual-chassis-control subsystem is not running
```

Verification

To confirm that the Virtual Chassis configuration has been properly deleted, perform these tasks:

- Verifying Deletion of the Virtual Chassis Ports on page 112
- Verifying Deletion of the Virtual Chassis Configuration Groups on page 112
- Verifying Deletion of the Virtual Chassis Member IDs on page 113

Verifying Deletion of the Virtual Chassis Ports

Purpose Verify that the Virtual Chassis ports on both member routers have been deleted from the configuration.

Action Display the status of the Virtual Chassis configuration and Virtual Chassis ports.

```
{master:member0-re0}

user@gladius> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: 4d6f.54cd.d2c1

                                                Mastership            Neighbor List

Member ID       Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Prsnt    JN10C7135AFC mx240         129  Master*

1 (FPC  12- 23) NotPrsnt JN115D117AFB mx480



{master:member0-re0}

user@gladius> show virtual-chassis vc-port
member0:
--------------------------------------------------------------------------
```

Meaning In the output of the **show virtual-chassis status** command, no Virtual Chassis ports (**vcp-*slot/pic/port***) are displayed in the Neighbor List. The asterisk (*) following **Master** denotes the router on which the **show virtual-chassis status** command command was issued.

In the output of the **show virtual-chassis vc-port** command, no Virtual Chassis ports are displayed on the router on which the command was issued.

Verifying Deletion of the Virtual Chassis Configuration Groups

Purpose Verify that the definitions and applications of the following Virtual Chassis configuration groups have been deleted from the global configuration:

- **member0-re0**
- **member0-re1**

- member1-re0
- member1-re1

Action Display the status of the Virtual Chassis configuration group definitions and applications.

```
[edit]
user@gladius# show groups ?
Possible completions:
  <[Enter]>            Execute this command
  <group_name>         Group name
  global               Group name
  re0                  Group name
  re1                  Group name
  |                    Pipe through a command

[edit]
user@gladius# show apply-groups
  apply-groups [ global re0 re1 ];
```

Meaning The output confirms that the Virtual Chassis configuration group definitions and applications have been deleted. In the output of both **show groups** and **show apply-groups**, only the standard configuration groups (**global**, **re0**, and **re1**) are listed. The Virtual Chassis configuration groups (**member0-re0**, **member 0-re1**, **member1-re0**, and **member1-re1**) do not appear.

Verifying Deletion of the Virtual Chassis Member IDs

Purpose Verify that the member IDs for the Virtual Chassis have been deleted, and that the Virtual Chassis is no longer configured on either MX Series router.

Action Display the results of the configuration on each router. For example, on **trefoil** (formerly member 1):

```
user@trefoil> show virtual-chassis status
error: the virtual-chassis-control subsystem is not running


user@trefoil> show virtual-chassis vc-port
error: the virtual-chassis-control subsystem is not running
```

Meaning When you attempt to issue either the **show virtual-chassis status** command or the **show virtual-chassis vc-port** command after the Virtual Chassis has been deleted, the router displays an error message indicating that the Virtual Chassis is no longer configured, and rejects the command.

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23
- Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 102

CHAPTER 4

Configuring Virtual Chassis Ports to Interconnect Member Devices

- Guidelines for Configuring Virtual Chassis Ports on page 116
- Configuring Virtual Chassis Ports to Interconnect Member Routers or Switches on page 118
- Deleting Virtual Chassis Ports in a Virtual Chassis Configuration on page 120

Guidelines for Configuring Virtual Chassis Ports

To interconnect the member routers in a Virtual Chassis for MX Series 3D Universal Edge Routers, you must configure Virtual Chassis ports on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces. After it is configured, a Virtual Chassis port is dedicated to the task of interconnecting member routers, and is no longer available for configuration as a standard network port.

NOTE: The Junos OS software enables you to preconfigure ports that are currently unavailable for use. Although a Virtual Chassis port is unavailable for use as a standard network port, you can configure this port as a standard network port even after you configure it as a Virtual Chassis port. However, the router does not apply the configuration until you delete the Virtual Chassis port from the Virtual Chassis configuration.

Consider the following guidelines when you configure Virtual Chassis ports in an MX Series Virtual Chassis:

- An MX Series Virtual Chassis supports up to 16 Virtual Chassis ports per trunk.

  If two or more Virtual Chassis ports of the same type and speed (that is, either all 10-Gigabit Ethernet Virtual Chassis ports or all 1-Gigabit Ethernet Virtual Chassis ports) are configured between the same two member routers in an MX Series Virtual Chassis, the Virtual Chassis Control Protocol (VCCP) bundles these Virtual Chassis port interfaces into a trunk, reduces the routing cost accordingly, and performs traffic load balancing across all of the Virtual Chassis port interfaces in the trunk.

- An MX Series Virtual Chassis does *not* support a combination of 1-Gigabit Ethernet (**ge** media type) Virtual Chassis ports and 10-Gigabit Ethernet (**xe** media type) Virtual Chassis ports within the same Virtual Chassis.

  You must configure either all 10-Gigabit Virtual Chassis ports or all 1-Gigabit Virtual Chassis ports in the same Virtual Chassis. We recommend that you configure Virtual Chassis ports on 10-Gigabit Ethernet (**xe**) interfaces.

  This restriction has no effect on access ports or uplink ports in an MX Series Virtual Chassis configuration.

- Configure redundant Virtual Chassis ports that reside on different line cards in each member router.

  For a two-member MX Series Virtual Chassis, we recommend that you configure a minimum of two 10-Gigabit Ethernet Virtual Chassis ports on different line cards in each member router, for a total minimum of four 10-Gigabit Ethernet Virtual Chassis ports in the Virtual Chassis. In addition, make sure the Virtual Chassis port bandwidth is equivalent to no less than 50 percent of the aggregate bandwidth required for user data traffic. The following examples illustrate these recommendations:

  - If the bandwidth in your network is equivalent to two 10-Gigabit Ethernet interfaces (20 Gbps) on the access-facing side of the Virtual Chassis and two 10-Gigabit

Ethernet interfaces (20 Gbps) on the core-facing side of the Virtual Chassis, we recommend that you configure two 10-Gigabit Ethernet Virtual Chassis ports, which is the recommended minimum in a Virtual Chassis for redundancy purposes.

- If the aggregate bandwidth in your network is equivalent to ten 10-Gigabit Ethernet interfaces (100 Gbps), we recommend that you configure a minimum of five 10-Gigabit Ethernet Virtual Chassis ports, which is 50 percent of the aggregate bandwidth.

- A user data packet traversing the Virtual Chassis port interfaces between member routers is discarded at the Virtual Chassis egress port if the MTU size of the packet exceeds 9150 bytes.

  The maximum MTU size of a Gigabit Ethernet interface or 10-Gigabit Ethernet interface on a single MX Series router is 9192 bytes. In an MX Series Virtual Chassis configuration, user data packets that traverse Gigabit Ethernet or 10-Gigabit Ethernet Virtual Chassis port interfaces have 42 extra bytes of Virtual Chassis-specific header data, which reduces their maximum MTU (payload) size to 9150 bytes. The user data packet is transmitted in its entirety across the Virtual Chassis port interface. However, because packet fragmentation and reassembly is not supported on Virtual Chassis port interfaces, user data packets that exceed 9150 bytes are discarded at the Virtual Chassis egress port.

Related Documentation

- Virtual Chassis Components Overview on page 23
- Configuring Virtual Chassis Ports to Interconnect Member Routers or Switches on page 118
- Class of Service Overview for Virtual Chassis Ports on page 127
- Guidelines for Configuring Class of Service for Virtual Chassis Ports on page 132
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Configuring Virtual Chassis Ports to Interconnect Member Routers or Switches

To interconnect the member routers in an MX Series Virtual Chassis, you must use the **request virtual-chassis vc-port set** command to configure network ports into Virtual Chassis ports on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces. To interconnect the member switches into an EX9200 Virtual Chassis, you must use the **request virtual-chassis vc-port set** command to configure network ports into Virtual Chassis ports on line card interfaces. After the **request virtual-chassis vc-port set** is configured on both ends of the link, a Virtual Chassis port that is dedicated to the task of interconnecting member devices is created and the link can no longer be used as a standard network port.

NOTE: If you issue the **request virtual-chassis vc-port set** command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers in an MX Series Virtual Chassis, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

A software license is not needed to create an EX9200 Virtual Chassis.

To configure Virtual Chassis ports:

1. Configure the Virtual Chassis ports on the router or switch configured as member 0.
   a. Configure the first Virtual Chassis port that connects to member 1.

      ```
      {local:member0-re0}
      ```

      ```
      user@hostA> request virtual-chassis vc-port set fpc-slot fpc-slot-number pic-slot pic-slot-number port port-number
      ```

      After the Virtual Chassis port is created, it is renamed **vcp-*slot/pic/port***, and the line card associated with that port comes online. The line cards in the other member devices remain offline until the Virtual Chassis forms.

      For example, the following command configures Virtual Chassis port **vcp-2/2/0** on member 0:

      ```
      {local:member0-re0}
      ```

      ```
      user@hostA> request virtual-chassis vc-port set fpc-slot 2 pic-slot 2 port 0
      vc-port successfully set
      ```

   b. When the first Virtual Chassis port is up on member 0, repeat Step 1a to configure the second Virtual Chassis port that connects to member 1.

      ```
      {local:member0-re0}
      ```

      ```
      user@hostA> request virtual-chassis vc-port set fpc-slot fpc-slot-number pic-slot pic-slot-number port port-number
      ```

2. Configure the Virtual Chassis ports on the device configured as member 1.
   a. Configure the first Virtual Chassis port that connects to member 0.

      ```
      {master:member1-re0}
      ```

```
user@hostB> request virtual-chassis vc-port set fpc-slot fpc-slot-number pic-slot
pic-slot-number port port-number
```

b. When the first Virtual Chassis port is up on member 1, repeat Step 2a to configure the second Virtual Chassis port that connects to member 0.

```
{master:member1-re0}

user@hostB> request virtual-chassis vc-port set fpc-slot fpc-slot-number pic-slot
pic-slot-number port port-number
```

When all of the line cards in all of the member routers or switches are online, and the Virtual Chassis has formed, you can issue Virtual Chassis commands from the terminal window of the master router or switch.

NOTE: When the Virtual Chassis forms, the FPC slots are renumbered to reflect the slot numbering and offsets used in the Virtual Chassis instead of the physical slot numbers where the FPC is actually installed. Member 0 in the Virtual Chassis uses FPC slot numbers 0 through 11 with no offset, and member 1 uses FPC slot numbers 12 through 23, with an offset of 12.

For example, a 10-Gigabit Ethernet interface that appears as xe-14/2/2 (FPC slot 14, PIC slot 2, port 2) in the show interfaces command output is actually interface xe-2/2/2 (FPC slot 2, PIC slot 2, port 2) on member 1 after deducting the FPC slot numbering offset of 12 for member 1.

3. (Optional) Verify the that the Virtual Chassis is properly configured and that the Virtual Chassis ports are operational.

```
{master:member0-re0}

user@hostA> show virtual-chassis status
{master:member0-re0}

user@hostA> show virtual-chassis vc-port all-members
```

4. Commit the configuration on the master router or switch.

The commit step is required to ensure that the configuration groups and Virtual Chassis configuration are propagated to both members of the Virtual Chassis.

BEST PRACTICE: We recommend that you use the commit synchronize command to save any configuration changes to the Virtual Chassis.

For an MX Series or Virtual Chassis, the force option is the default and only behavior when you issue the commit synchronize command. Issuing the commit synchronize command for an MX Series Virtual Chassis configuration has the same effect as issuing the commit synchronize force command.

Related Documentation

- Guidelines for Configuring Virtual Chassis Ports on page 116
- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56

- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Deleting Virtual Chassis Ports in a Virtual Chassis Configuration

You can delete a Virtual Chassis port (**vcp-*slot/pic/port***) as part of the procedure for deleting a Virtual Chassis configuration. You can also delete a Virtual Chassis port when you want to replace it with a Virtual Chassis port configured on a different FPC slot, PIC slot, or port number in the router or switch. After you delete a Virtual Chassis port by using the **request virtual-chassis vc-port delete** command, the port becomes available to the global configuration and can again function as a standard network port.

NOTE: If you issue the **request virtual-chassis vc-port delete** command without first installing an MX Virtual Chassis Redundancy Feature Pack license on both member routers, the software displays a warning message that you are operating without a valid Virtual Chassis software license.

A software license is not needed to create an EX9200 Virtual Chassis.

To remove the Virtual Chassis ports from both member devices in a Virtual Chassis:

1. In the console window on the router or switch configured as **member 0**, remove one or more Virtual Chassis ports.

   ```
   {master:member0-re0}
   ```

   ```
   user@host1> request virtual-chassis vc-port delete fpc-slot fpc-slot-number pic-slot pic-slot-number port port-number
   ```

   For example, the following command deletes **vcp-2/2/0** (the Virtual Chassis port on FPC slot 2, PIC slot 2, and port 0) from **member 0** in the Virtual Chassis.

   ```
   {master:member0-re0}
   ```

   ```
   user@host1> request virtual-chassis vc-port delete fpc-slot 2 pic-slot 2 port 0
   vc-port successfully deleted
   ```

2. In the console window on the router or switch configured as **member 1**, remove one or more Virtual Chassis ports.

   ```
   {master:member1-re0}
   ```

   ```
   user@host2> request virtual-chassis vc-port delete fpc-slot fpc-slot-number pic-slot pic-slot-number port port-number
   ```

3. (Optional) Confirm that the Virtual Chassis ports have been deleted from each of the two member routers or switches.

   When you delete a Virtual Chassis port, its name (**vcp-*slot/pic/port***) no longer appears in the output of the **show virtual-chassis vc-port** command. For example, the following output for the **show virtual-chassis vc-port** command on each member router or switch confirms that all Virtual Chassis ports have been deleted from both member devices.

   For member 0 (**host1**):

```
{master:member0-re0}

user@host1> show virtual-chassis vc-port all-members
member0:
--------------------------------------------------------------------------
```

For member 1 (**host2**):

```
{backup:member1-re0}

user@host2> show virtual-chassis vc-port all-members
member1:
--------------------------------------------------------------------------
```

TIP: Deleting and then re-creating a Virtual Chassis port configuration may cause the Virtual Chassis port to appear as **Absent** in the **Status** column of the **show virtual-chassis vc-port** command display. To resolve this issue, reboot the FPC that hosts the re-created Virtual Chassis port.

Related Documentation

- Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 102
- *Configuring an EX9200 Virtual Chassis*
- Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 103
- Guidelines for Configuring Virtual Chassis Ports on page 116

CHAPTER 5

Configuring Locality Bias to Conserve Bandwidth on Virtual Chassis Ports

- Locality Bias in a Virtual Chassis on page 123
- Guidelines for Configuring Locality Bias in a Virtual Chassis on page 125
- Configuring Locality Bias for a Virtual Chassis on page 125

Locality Bias in a Virtual Chassis

By default, member routers in an MX Series Virtual Chassis distribute egress traffic equally across all egress port links. If you want to conserve bandwidth across the internal Virtual Chassis ports, you can use *locality bias* to direct unicast transit traffic to egress links on the same (local) member router.

- How Locality Bias Works on page 123
- Locality Bias Percentages on page 124

How Locality Bias Works

Locality bias conserves Virtual Chassis port bandwidth in a two-member MX Series Virtual Chassis by directing unicast transit traffic for equal-cost multipath (ECMP) groups and aggregated Ethernet bundles to egress links in the same (local) member router, provided that the local member router has an equal or larger number of available egress links than the remote member router. Because locality bias directs all of the traffic towards the local member router, Virtual Chassis ports do not use bandwidth.

However, if the number of available remote member router egress links exceeds the number of available local member router egress links, the system reduces the amount of traffic in the local member router by using a ratio that is based on the number of remote versus local links. The amount of traffic that the system does not direct toward egress links on the local member router is then split evenly across the egress links in the remote member router.

If either the local member router or remote member router do not have available egress links, then the traffic forwarding state across the Virtual Chassis ports does not change.

Locality Bias Percentages

The router uses the following algorithms to determine the percentage of traffic that is directed toward the local member router egress links, where *L* is the number of egress links on the local member router and *R* is the number of egress links on the remote member router.

BEST PRACTICE: To avoid possible traffic loss and oversubscription on egress interfaces, make sure you understand the utilization requirements, such as total and available bandwidth, for the local links in your network before changing the locality bias configuration.

- If *L >= R*, then *Locality Bias Percentage* = 100 percent and the local member router receives all egress traffic.

  For example, if the local member router and remote member router each contain one egress link, then the locality bias is 100 percent. The router directs all unicast transit traffic that is destined for an ECMP group or aggregated Ethernet bundle to the local member router.

- If *L < R*, then *Locality Bias Percentage* = 200 * (L / (R + L))

  For example, if the local member router (*L*) contains one link and the remote member router (*R*) contains two links, the locality bias percentage calculation is

  200 * (1 / (2 + 1)) = 66

  This means that the system directs 66 percent of the unicast transit traffic destined for an ECMP group or aggregated Ethernet bundle toward the local member router. The system splits the remaining 34 percent of the unicast transit traffic equally between the remote member router egress links. Each of the two remote egress links in the example receives 17 percent of the traffic.

NOTE: The actual amount of traffic that the local member router receives can vary slightly from the percentages in the algorithm calculations.

- If *L = 0* or *R = 0*, then locality bias does not change the forwarding state.

For both the *L < R* and *L >= R* algorithms, locality bias percentages are recalculated on each line card whenever one of the aggregated Ethernet child links goes up or down, or whenever a link is added to or removed from an ECMP bundle.

NOTE: If an ECMP bundle has one or more child links that are aggregated Ethernet links, then those aggregated Ethernet child links are always considered remote unless *all* of the aggregated Ethernet child links are local.

Related Documentation

- Guidelines for Configuring Locality Bias in a Virtual Chassis on page 125
- Configuring Locality Bias for a Virtual Chassis on page 125

Guidelines for Configuring Locality Bias in a Virtual Chassis

Consider the following guidelines when you configure locality bias in an MX Series Virtual Chassis:

- Make sure you know the total and available amounts of bandwidth in your network. Enabling locality bias when local egress links do not have enough bandwidth to support additional traffic can result in immediate traffic loss. The system does not prevent configurations that result in oversubscription.
- Locality bias directs only user traffic toward the local member router. Locality bias does not affect load balancing of control traffic within the Virtual Chassis.
- You cannot configure adaptive aggregated Ethernet load balancing and locality bias together.
- You cannot configure weighted load balancing and locality bias together.

Related Documentation

- Locality Bias in a Virtual Chassis on page 123
- *Understanding Aggregated Ethernet Load Balancing*
- Configuring Locality Bias for a Virtual Chassis on page 125

Configuring Locality Bias for a Virtual Chassis

Configuring locality bias enables you to conserve Virtual Chassis port bandwidth, reduce infrastructure costs, and reduce network latency in a two-member MX Series Virtual Chassis. Locality bias works by directing unicast traffic for equal-cost multipath (ECMP) groups and aggregated Ethernet bundles to egress links in the same (local) member router in the Virtual Chassis rather than to egress links in the remote member router.

You can enable locality bias by including the **locality-bias** statement at the **[edit virtual-chassis]** hierarchy level.

BEST PRACTICE: **To avoid possible traffic loss and oversubscription on egress interfaces, make sure you understand the utilization requirements for the local links in your network before changing the locality bias configuration.**

To configure locality bias for an MX Series Virtual Chassis:

1. Specify that you want to enable locality bias in the Virtual Chassis.

   ```
   [edit virtual-chassis]
   user@host# set locality-bias
   ```

2. Commit the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Locality Bias in a Virtual Chassis on page 123
- Guidelines for Configuring Locality Bias in a Virtual Chassis on page 125

CHAPTER 6

Configuring Class of Service for Virtual Chassis Ports

- Class of Service Overview for Virtual Chassis Ports on page 127
- Guidelines for Configuring Class of Service for Virtual Chassis Ports on page 132
- Example: Configuring Class of Service for Virtual Chassis Ports on MX Series 3D Universal Edge Routers on page 132

Class of Service Overview for Virtual Chassis Ports

By default, all Virtual Chassis port interfaces in a Virtual Chassis for MX Series 3D Universal Edge Routers use a default class of service (CoS) configuration specifically tailored for Virtual Chassis ports. The default configuration, which applies to all Virtual Chassis ports in the Virtual Chassis, includes classifiers, forwarding classes, rewrite rules, and schedulers. In most cases, the default CoS configuration is adequate for your needs without requiring any additional CoS configuration.

In some cases, however, you might want to customize the traffic-control profile configuration on Virtual Chassis ports. To do so, you can configure an output traffic-control profile and apply it to all Virtual Chassis ports interfaces in the Virtual Chassis.

This topic provides an overview of the default CoS configuration for Virtual Chassis ports and helps you understand the components of the CoS configuration that you can customize.

- Default CoS Configuration for Virtual Chassis Ports on page 127
- Supported Platforms and Maximums for CoS Configuration of Virtual Chassis Ports on page 128
- Default Classifiers for Virtual Chassis Ports on page 129
- Default Rewrite Rules for Virtual Chassis Ports on page 129
- Default Scheduler Map for Virtual Chassis Ports on page 130
- Customized CoS Configuration for Virtual Chassis Ports on page 131

Default CoS Configuration for Virtual Chassis Ports

In an MX Series Virtual Chassis configuration, the Virtual Chassis ports behave like switch fabric ports to transport packets between the member routers in a Virtual Chassis. More

specifically, the Virtual Chassis ports carry internal control traffic within the Virtual Chassis and forward user traffic between line cards in the router.

Like traffic on standard network port interfaces, traffic on Virtual Chassis port interfaces is mapped to one of four forwarding classes, as follows:

- Internal Virtual Chassis Control Protocol (VCCP) traffic is mapped to the network control forwarding class with the code point (IEEE 802.1p bit) value set to '111'b. You cannot change this configuration.
- Control traffic is mapped to the network control forwarding class with the code point (IEEE 802.1p bit) value set to '110'b. You cannot change this configuration.
- User traffic is mapped to the best effort, expedited forwarding, and assured forwarding traffic classes.

The CoS configuration applies globally to all Virtual Chassis ports in the Virtual Chassis. You cannot configure CoS for an individual Virtual Chassis port (such as **vcp-2/2/0**). If you create a new Virtual Chassis port, the global CoS configuration is propagated to the newly created Virtual Chassis port when the member router on which the new Virtual Chassis port resides joins the Virtual Chassis. Alternatively, you can configure CoS for the Virtual Chassis ports by configuring CoS for a standard network port, and then converting the network port to a Virtual Chassis port by issuing the **request virtual-chassis vc-port set** command.

You can convert a standard network port (for example, **xe-2/2/1**) to a Virtual Chassis port by issuing the **request virtual-chassis vc-port set** command. If the standard network port was configured with different CoS settings than the CoS configuration in effect for all Virtual Chassis ports in the Virtual Chassis, the newly converted Virtual Chassis port (**vcp-2/2/1**) uses the CoS configuration defined for all Virtual Chassis port interfaces instead of the original CoS configuration associated with the network port.

The default CoS configuration for Virtual Chassis ports provides the following benefits to keep the Virtual Chassis operating properly:

- Gives preference to internal VCCP traffic that traverses the Virtual Chassis port interfaces
- Prioritizes control traffic over user traffic on the Virtual Chassis port interfaces
- Preserves the CoS properties of each packet as it travels between member routers in the Virtual Chassis

Supported Platforms and Maximums for CoS Configuration of Virtual Chassis Ports

You can configure Virtual Chassis ports only on Modular Port Concentrator/Modular Interface Card (MPC/MIC) interfaces in the following MX Series 3D Universal Edge Routers with dual Routing Engines:

- MX240 3D Universal Edge Router
- MX480 3D Universal Edge Router
- MX960 3D Universal Edge Router

MPC/MIC interfaces support the following maximums for forwarding classes and priority scheduling levels:

- Up to eight forwarding classes
- Up to five priority scheduling levels

Default Classifiers for Virtual Chassis Ports

Classification takes place when a packet enters a Virtual Chassis member router from a network port. For Virtual Chassis configurations that support more than two member routers, the packet is reclassified for CoS treatment according to the default IEEE 802.1p classifier rules that apply to the Virtual Chassis port as the packet travels through the intermediate member routers in the Virtual Chassis. When the packet enters the last member router in the Virtual Chassis, it is reclassified according to the original classifier rules that applied when the packet entered the Virtual Chassis from a network port.

NOTE: This reclassification behavior does not apply to an MX Series Virtual Chassis, which supports only two member routers in the current release.

Because there are no intermediate member routers between the two member routers in an MX Series Virtual Chassis, the packet is not reclassified according to the default classifier rules for the Virtual Chassis port. Instead, the original classifier rules that applied when the packet entered the Virtual Chassis on a network port are retained.

The default IEEE 802.1p classifier rules map the code point (or .1p bit) value to the forwarding class and loss priority. You can display the default IEEE 802.1p classifier rules by issuing the **show class-of-service classifier** command:

```
{master:member0-re0}

user@host> show class-of-service classifier type ieee-802.1
Classifier: ieee8021p-default, Code point type: ieee-802.1, Index: 11
  Code point         Forwarding class                  Loss priority
  000                best-effort                       low
  001                best-effort                       high
  010                expedited-forwarding              low
  011                expedited-forwarding              high
  100                assured-forwarding                low
  101                assured-forwarding                high
  110                network-control                   low
  111                network-control                   high
```

Default Rewrite Rules for Virtual Chassis Ports

When a packet enters the Virtual Chassis from a network port, normal CoS classification takes place. If the packet exits a member router through the Virtual Chassis port to the other member router, the CoS software encapsulates the packet with a virtual LAN (VLAN) tag that contains the code point information used for CoS treatment. The code point value is assigned according to the default IEEE 802.1p rewrite rules, which map the forwarding class and loss priority value to a code point value.

You can display the default IEEE 802.1p rewrite rules by issuing the **show class-of-service rewrite-rule** command:

```
{master:member0-re0}

user@host> show class-of-service rewrite-rule type ieee-802.1
Rewrite rule: ieee8021p-default, Code point type: ieee-802.1, Index: 34
  Forwarding class                  Loss priority       Code point
  best-effort                       low                 000
  best-effort                       high                001
  expedited-forwarding              low                 010
  expedited-forwarding              high                011
  assured-forwarding                low                 100
  assured-forwarding                high                101
  network-control                   low                 110
  network-control                   high                111
```

Default Scheduler Map for Virtual Chassis Ports

When you create a Virtual Chassis port, it automatically functions as a hierarchical scheduler. However, you cannot explicitly configure hierarchical scheduling on Virtual Chassis ports.

Virtual Chassis ports use the same default scheduler used by standard network ports. The network control and best effort forwarding classes are both assigned low priority, and only 5 percent of the bandwidth is allocated to control traffic.

You can display the scheduler parameters and the mapping of schedulers to forwarding classes by issuing the **show class-of-service scheduler-map** command. For brevity, the following example shows only the portions of the output relevant to the default best effort (**default-be**) and default network control (**default-nc**) schedulers.

```
{master:member0-re0}

user@host> show class-of-service scheduler-map
Scheduler map: <default>, Index: 2

  Scheduler: <default-be>, Forwarding class: best-effort, Index: 21
    Transmit rate: 95 percent, Rate Limit: none, Buffer size: 95 percent, Buffer
 Limit: none, Priority: low
    Excess Priority: low
    Drop profiles:
      Loss priority   Protocol    Index    Name
      Low             any             1    <default-drop-profile>
      Medium low      any             1    <default-drop-profile>
      Medium high     any             1    <default-drop-profile>
      High            any             1    <default-drop-profile>

  Scheduler: <default-nc>, Forwarding class: network-control, Index: 23
    Transmit rate: 5 percent, Rate Limit: none, Buffer size: 5 percent, Buffer
Limit: none, Priority: low
    Excess Priority: low
    Drop profiles:
      Loss priority   Protocol    Index    Name
      Low             any             1    <default-drop-profile>
      Medium low      any             1    <default-drop-profile>
      Medium high     any             1    <default-drop-profile>
      High            any             1    <default-drop-profile>
  ...
```

Customized CoS Configuration for Virtual Chassis Ports

Depending on your network topology, you might want to customize the CoS configuration for Virtual Chassis ports. For example, you might want to allocate more than the default 5 percent of the Virtual Chassis port bandwidth to control traffic. Or, you might want to assign different priorities and excess rates to different forwarding classes.

Output Traffic-Control Profiles

To create a customized (nondefault) CoS configuration and apply it to all Virtual Chassis ports, you can configure an output traffic-control profile, which defines a set of traffic scheduling resources and references a scheduler map. You then apply the profile to all Virtual Chassis port interfaces. To apply the output traffic-control profile globally to all Virtual Chassis port interfaces, you must use **vcp-*** as the interface name representing all Virtual Chassis port interfaces. You cannot configure CoS for an individual Virtual Chassis port (such as **vcp-1/1/0**).

For an example that shows how to configure an output traffic-control profile customized for Virtual Chassis ports, see "Example: Configuring Class of Service for Virtual Chassis Ports on MX Series 3D Universal Edge Routers" on page 132.

Classifiers and Rewrite Rules

Configuring nondefault IEEE 802.1p ingress classifiers and IEEE 802.1p egress rewrite rules *has no effect* in a two-member MX Series Virtual Chassis.

Because there are no intermediate routers between the two member routers in an MX Series Virtual Chassis, packets are not reclassified according to the default classifier rules for Virtual Chassis ports. Instead, the original classifier rules that applied when the packet entered the Virtual Chassis on a network port are retained, making configuration of nondefault ingress classifiers and nondefault egress rewrite rules unnecessary in the current release.

Per-Priority Shaping

MPC/MIC interfaces support per-priority shaping, which enables you to configure a separate traffic shaping rate for each of the five priority scheduling levels. However, configuring per-priority shaping for Virtual Chassis ports on MPC/MIC interfaces is unnecessary for the following reasons:

- The neighboring member router has exactly the same bandwidth.
- The same type of Virtual Chassis port is present at both ends of the connection.

Related Documentation

- Guidelines for Configuring Class of Service for Virtual Chassis Ports on page 132
- Example: Configuring Class of Service for Virtual Chassis Ports on MX Series 3D Universal Edge Routers on page 132
- *Junos OS Class of Service Library for Routing Devices*

Guidelines for Configuring Class of Service for Virtual Chassis Ports

Consider the following guidelines when you configure class of service (CoS) for Virtual Chassis ports in an MX Series Virtual Chassis:

- Virtual Chassis ports on MPC/MIC interfaces support a maximum of eight forwarding classes and five priority scheduling levels.
- The same CoS configuration applies globally to all Virtual Chassis ports in the Virtual Chassis. You cannot configure CoS for an individual Virtual Chassis port (such as **vcp-3/1/0**).
- The CoS configuration is propagated to a newly created Virtual Chassis port as soon as the member router on which the new Virtual Chassis port resides joins the Virtual Chassis.
- Although Virtual Chassis ports function as hierarchical schedulers, you cannot explicitly configure hierarchical scheduling on Virtual Chassis ports.
- If you configure a nondefault output traffic-control profile to customize the CoS configuration, you must apply the profile to all Virtual Chassis port interfaces at once by using **vcp-*** as the interface name.
- Configuring nondefault IEEE 802.1p ingress classifiers and IEEE 802.1p egress rewrite rules has no effect in a two-member MX Series Virtual Chassis because the forwarding class assigned to a packet is maintained across the Virtual Chassis until the packet reaches the egress network port.
- Configuring per-priority shaping for Virtual Chassis ports is unnecessary because the neighboring member router has exactly the same bandwidth, and the same type of Virtual Chassis port is present at both ends of the connection.

Related Documentation

- Class of Service Overview for Virtual Chassis Ports on page 127
- Example: Configuring Class of Service for Virtual Chassis Ports on MX Series 3D Universal Edge Routers on page 132
- *Junos OS Class of Service Library for Routing Devices*

Example: Configuring Class of Service for Virtual Chassis Ports on MX Series 3D Universal Edge Routers

This example illustrates a typical class of service (CoS) configuration that you might want to use for the Virtual Chassis ports in an MX Series Virtual Chassis.

- Requirements on page 132
- Overview on page 133
- Configuration on page 134

Requirements

Before you begin:

- Configure a Virtual Chassis consisting of two MX Series routers.

  See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69

Overview

By default, all Virtual Chassis ports in an MX Series Virtual Chassis use a default CoS configuration specifically tailored for Virtual Chassis ports. The default configuration, which applies to all Virtual Chassis ports in the Virtual Chassis, includes classifiers, forwarding classes, rewrite rules, and schedulers. This default CoS configuration prioritizes internal Virtual Chassis Control Protocol (VCCP) traffic that traverses the Virtual Chassis port interfaces, and prioritizes control traffic over user traffic on the Virtual Chassis ports. In most cases, the default CoS configuration is adequate for your needs without requiring any additional CoS configuration.

In some cases, however, you might want to customize the traffic-control profile configuration on Virtual Chassis ports. For example, you might want to assign different priorities and excess rates to different forwarding classes. To create a nondefault CoS configuration, you can create an output traffic-control profile that defines a set of traffic scheduling resources and references a scheduler map. You then apply the output traffic-control profile to all Virtual Chassis port interfaces at once by using **vcp-*** as the interface name representing all Virtual Chassis ports. You cannot configure CoS for Virtual Chassis ports on an individual basis.

Table 16 on page 133 shows the nondefault CoS scheduler hierarchy configured in this example for the Virtual Chassis ports.

Table 16: Sample CoS Scheduler Hierarchy for Virtual Chassis Ports

Traffic Type	Queue Number	Priority	Transmit Rate/ Excess Rate
Network control (VCCP traffic)	3	Medium	90%
Expedited forwarding (voice traffic)	2	High	10%
Assured forwarding (video traffic)	1	Excess Low	99%
Best effort (data traffic)	0	Excess Low	1%

In this example, you create a nondefault CoS configuration for Virtual Chassis ports by completing the following tasks on the Virtual Chassis master router:

- Associate forwarding classes with **queue 0** through **queue 3**, and configure a fabric priority value for each queue.
- Configure an output traffic control profile named **tcp-vcp-ifd** to define traffic scheduling parameters, and associate a scheduler map named **sm-vcp-ifd** with the traffic control profile.
- Apply the output traffic-control profile to the **vcp-*** interface, which represents all Virtual Chassis port interfaces in the Virtual Chassis.
- Associate the **sm-vcp-ifd** scheduler map with the forwarding classes and scheduler configuration.
- Configure the parameters for schedulers **s-medium-priority**, **s-high-priority**, **s-low-priority**, **s-high-weight**, and **s-low-weight**.

Configuration

CLI Quick Configuration

To quickly create a nondefault CoS configuration for Virtual Chassis ports, copy the following commands and paste them into the router terminal window:

```
[edit]
set class-of-service forwarding-classes queue 0 best-effort
set class-of-service forwarding-classes queue 0 priority low
set class-of-service forwarding-classes queue 1 assured-forwarding
set class-of-service forwarding-classes queue 1 priority low
set class-of-service forwarding-classes queue 2 expedited-forwarding
set class-of-service forwarding-classes queue 2 priority high
set class-of-service forwarding-classes queue 3 network-control
set class-of-service forwarding-classes queue 3 priority high
set class-of-service traffic-control-profiles tcp-vcp-ifd scheduler-map sm-vcp-ifd
set class-of-service interfaces vcp-* output-traffic-control-profile tcp-vcp-ifd
set class-of-service scheduler-maps sm-vcp-ifd forwarding-class network-control
  scheduler s-medium-priority
set class-of-service scheduler-maps sm-vcp-ifd forwarding-class expedited-forwarding
  scheduler s-high-priority
set class-of-service scheduler-maps sm-vcp-ifd forwarding-class assured-forwarding
  scheduler s-high-weight
set class-of-service scheduler-maps sm-vcp-ifd forwarding-class best-effort scheduler
  s-low-weight
set class-of-service schedulers s-medium-priority transmit-rate percent 10
set class-of-service schedulers s-medium-priority priority medium-high
set class-of-service schedulers s-medium-priority excess-priority high
set class-of-service schedulers s-high-priority transmit-rate percent 90
set class-of-service schedulers s-high-priority priority high
set class-of-service schedulers s-high-priority excess-priority high
set class-of-service schedulers s-low-priority priority low
set class-of-service schedulers s-high-weight excess-rate percent 99
set class-of-service schedulers s-low-weight excess-rate percent 1
```

Step-by-Step Procedure

To create a nondefault CoS configuration for Virtual Chassis ports in an MX Series Virtual Chassis:

1. Log in to the console on the master router of the Virtual Chassis.
2. Specify that you want to configure CoS forwarding classes.

   ```
   {master:member0-re0} [edit]
   user@host# edit class-of-service forwarding-classes
   ```

3. Associate a forwarding class with each queue name and number, and configure a fabric priority value for each queue.

   ```
   {master:member0-re0} [edit class-of-service forwarding-classes]
   user@host# set queue 0 best-effort priority low
   user@host# set queue 1 assured-forwarding priority low
   user@host# set queue 2 expedited-forwarding priority high
   user@host# set queue 3 network-control priority high
   ```

4. Return to the **[edit class-of-service]** hierarchy level to configure an output traffic-control profile.

   ```
   {master:member0-re0} [edit class-of-service forwarding-classes]
   user@host# up
   ```

5. Configure an output traffic-control profile and associate it with a scheduler map.

   ```
   {master:member0-re0} [edit class-of-service]
   user@host# set traffic-control-profiles tcp-vcp-ifd scheduler-map sm-vcp-ifd
   ```

6. Apply the output traffic-control profile to all Virtual Chassis port interfaces in the Virtual Chassis.

   ```
   {master:member0-re0} [edit class-of-service]
   user@host# set interfaces vcp-* output-traffic-control-profile tcp-vcp-ifd
   ```

7. Specify that you want to configure the scheduler map.

   ```
   {master:member0-re0} [edit class-of-service]
   user@host# edit scheduler-maps sm-vcp-ifd
   ```

8. Associate the scheduler map with the scheduler configuration and forwarding classes.

   ```
   {master:member0-re0} [edit class-of-service scheduler-maps sm-vcp-ifd]
   user@host# set forwarding-class network-control scheduler s-medium-priority
   user@host# set forwarding-class expedited-forwarding scheduler s-high-priority
   user@host# set forwarding-class assured-forwarding scheduler s-high-weight
   user@host# set forwarding-class best-effort scheduler s-low-weight
   ```

9. Return to the **[edit class-of-service]** hierarchy level to configure the schedulers.

   ```
   {master:member0-re0} [edit class-of-service scheduler-maps sm-vcp-ifd]
   user@host# up 2
   ```

10. Configure parameters for the schedulers.

    ```
    {master:member0-re0} [edit class-of-service]
    user@host# set schedulers s-medium-priority priority medium-high excess-priority
      high transmit-rate percent 10
    user@host# set schedulers s-high-priority priority high excess-priority high
      transmit-rate percent 90
    ```

```
user@host# set schedulers s-low-priority priority low
user@host# set schedulers s-high-weight excess-rate percent 99
user@host# set schedulers s-low-weight excess-rate percent 1
```

Results From the **[edit class-of-service]** hierarchy level in configuration mode, confirm the results of your configuration by issuing the **show** statement. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
{master:member0-re0} [edit class-of-service]
user@host# show
forwarding-classes {
   queue 0 best-effort priority low;
   queue 1 assured-forwarding priority low;
   queue 2 expedited-forwarding priority high;
   queue 3 network-control priority high;
}
traffic-control-profiles {
   tcp-vcp-ifd {
      scheduler-map sm-vcp-ifd;
   }
}
interfaces {
   vcp-* {
      output-traffic-control-profile tcp-vcp-ifd;
   }
}
scheduler-maps {
   sm-vcp-ifd {
      forwarding-class network-control scheduler s-medium-priority;
      forwarding-class expedited-forwarding scheduler s-high-priority;
      forwarding-class assured-forwarding scheduler s-high-weight;
      forwarding-class best-effort scheduler s-low-weight;
   }
}
schedulers {
   s-medium-priority {
      transmit-rate percent 10;
      priority medium-high;
      excess-priority high;
   }
   s-high-priority {
      transmit-rate percent 90;
      priority high;
      excess-priority high;
   }
   s-low-priority {
      priority low;
   }
   s-high-weight {
      excess-rate percent 99;
   }
   s-low-weight {
      excess-rate percent 1;
   }
```



```
}
```

If you are done configuring CoS on the master router, enter **commit** from configuration mode.

Related Documentation

- Class of Service Overview for Virtual Chassis Ports on page 127
- Guidelines for Configuring Class of Service for Virtual Chassis Ports on page 132
- *Junos OS Class of Service Library for Routing Devices*

CHAPTER 7

Configuring Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis

- Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis on page 139
- Configuring Module Redundancy for a Virtual Chassis on page 141
- Configuring Chassis Redundancy for a Virtual Chassis on page 142
- Multichassis Link Aggregation in a Virtual Chassis on page 143
- Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis on page 144

Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis

An MX Series Virtual Chassis configured with targeted traffic distribution for IP demux or VLAN demux subscribers on aggregated Ethernet interfaces supports three types of redundancy mechanisms: link redundancy, module redundancy, and chassis redundancy.

- Link Redundancy in a Virtual Chassis on page 139
- Module Redundancy in a Virtual Chassis on page 140
- Chassis Redundancy in a Virtual Chassis on page 140

Link Redundancy in a Virtual Chassis

By default, the router uses *link redundancy*, also known as *port redundancy*, as the default redundancy mechanism for targeted distribution on aggregated Ethernet interfaces. With link redundancy, the router assigns backup links for a subscriber based on the link with the fewest number of subscribers.

In an MX Series Virtual Chassis configured with link redundancy, the primary link and backup link can be assigned on the same Modular Port Concentrator/Modular Interface Card (MPC/MIC) module, on different MPC/MIC modules in the same member router, or on different MPC/MIC modules in different member routers. This feature provides redundancy if a link in the MX Series Virtual Chassis configuration fails.

Because link redundancy is the default redundancy mechanism, no special configuration is required on the Virtual Chassis master router to enable it.

Module Redundancy in a Virtual Chassis

You can configure *module redundancy*, also known as *Flexible PIC Concentrator (FPC) redundancy*, to provide redundancy if a module or a link fails. The router assigns backup links for the subscriber interface on a different MPC/MIC module from the primary link, based on the link with the fewest number of subscribers among the links on different modules.

In an MX Series Virtual Chassis configured with link redundancy, the router assigns the primary link and backup link to different MPC/MIC modules. For purposes of link selection, the router gives all MPC/MIC modules in the Virtual Chassis equal weight, and disregards the role (master or backup) of the member router in which the MPC/MIC module is installed. The router uses an algorithm to assign the primary and backup links, and is as likely to assign a primary link to an MPC/MIC module in the Virtual Chassis master router as it is to assign the primary link to an MPC/MIC module in the Virtual Chassis backup router.

Chassis Redundancy in a Virtual Chassis

Unlike link redundancy and module redundancy, which are supported on both standalone routers and Virtual Chassis member routers, chassis redundancy is available only for member routers in an MX Series Virtual Chassis configuration.

Chassis redundancy and module redundancy use the same algorithm for link assignment, with the exception that in a Virtual Chassis with chassis redundancy configured, the router assigns the backup link to an MPC/MIC module in a member router *other* than the router on which the primary link resides. For example, in a two-member MX Series Virtual Chassis, if the primary link for the aggregated Ethernet bundle is assigned to an MPC/MIC module in the Virtual Chassis master router, the router assigns the backup link to an MPC/MIC module in the Virtual Chassis backup router.

Chassis redundancy provides protection if the MPC/MIC module containing the primary link fails. In this event, the subscriber connections fail over to the backup link on the MPC/MIC module in the other member router.

BEST PRACTICE: **We recommend that you do not configure both module (FPC) redundancy and chassis redundancy for the same aggregated Ethernet interface in an MX Series Virtual Chassis. If you do, module redundancy takes precedence over chassis redundancy.**

Related Documentation

- Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis on page 144
- Configuring Module Redundancy for a Virtual Chassis on page 141
- Configuring Chassis Redundancy for a Virtual Chassis on page 142

Configuring Module Redundancy for a Virtual Chassis

By default, a router or switch uses link redundancy for aggregated Ethernet interfaces (bundles) configured with targeted traffic distribution. As an alternative to using link redundancy, you can configure module redundancy, also known as FPC redundancy, for a Virtual Chassis configured with targeted traffic distribution for IP demux or VLAN demux subscribers on aggregated Ethernet interfaces.

In a Virtual Chassis, module redundancy assigns the primary link and backup link to *different* MPC/MIC modules or line cards, regardless of the Virtual Chassis role (master or backup) of the member device in which the module is installed. Module redundancy provides redundancy protection if a module or a link in the Virtual Chassis fails.

Before you begin:

- Configure a Virtual Chassis consisting of two MX Series routers or two EX9200 switches.

  See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69

- Ensure that the aggregated Ethernet bundle is configured *without* link protection.

  See *Configuring Aggregated Ethernet Link Protection*

To configure module redundancy:

1. Log in to the console on the master device of the Virtual Chassis.
2. Specify that you want to configure the demux logical interface.

   ```
   {master:member0-re0} [edit]
   user@host# edit interfaces demux0 unit logical-unit-number
   ```

3. Enable targeted distribution for the interface.

   ```
   {master:member0-re0} [edit intefaces demux0 unit logical-unit-number]
   user@host# set targeted-distribution
   ```

4. Specify the aggregated Ethernet bundle for which you want to configure module redundancy.

   ```
   {master:member0-re0} [edit]
   user@host# edit interfaces aenumber aggregated-ether-options
   ```

5. Enable module (FPC) redundancy for the specified aggregated Ethernet bundle.

   ```
   {master:member0-re0} [edit interfaces aenumber aggregated-ether-options]
   user@host# set logical-interface-fpc-redundancy
   ```

BEST PRACTICE: We recommend that you do not configure both module (FPC) redundancy and chassis redundancy for the same aggregated Ethernet interface in the Virtual Chassis. If you do, module redundancy takes precedence over chassis redundancy.

Related Documentation

- Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis on page 144
- Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis on page 139
- Configuring Chassis Redundancy for a Virtual Chassis on page 142

Configuring Chassis Redundancy for a Virtual Chassis

By default, the router uses link redundancy for aggregated Ethernet interfaces (bundles) configured with targeted traffic distribution. As an alternative to using link redundancy, you can configure chassis redundancy for an MX Series Virtual Chassis configured with targeted traffic distribution for IP demux or VLAN demux subscribers on aggregated Ethernet interfaces.

In an MX Series Virtual Chassis, chassis redundancy assigns the backup link to an MPC/MIC module in a member router *other* than the member router on which the primary link resides. For example, in a two-member MX Series Virtual Chassis where the primary link for the aggregated Ethernet bundle is on an MPC/MIC module in the master router, chassis redundancy assigns the backup link for the bundle to an MPC/MIC module in the backup router. Chassis redundancy provides protection if the MPC/MIC module containing the primary link fails. In this event, the subscriber connections fail over to the backup link on the MPC/MIC module in the other member router.

Unlike link redundancy and module redundancy, each of which are supported for both standalone routers and Virtual Chassis member routers, chassis redundancy is available only for member routers in an MX Series Virtual Chassis.

Before you begin:

- Configure a Virtual Chassis consisting of two MX Series routers.

  See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69

- Ensure that the aggregated Ethernet bundle is configured *without* link protection.

  See *Configuring Aggregated Ethernet Link Protection*

To configure chassis redundancy for an MX Series Virtual Chassis:

1. Log in to the console on the master router of the Virtual Chassis.
2. Specify that you want to configure the demux logical interface.

   ```
   {master:member0-re0} [edit]
   user@host# edit interfaces demux0 unit logical-unit-number
   ```

3. Enable targeted distribution for the interface.

   ```
   {master:member0-re0} [edit intefaces demux0 unit logical-unit-number]
   user@host# set targeted-distribution
   ```

4. Specify the aggregated Ethernet bundle for which you want to configure chassis redundancy.

   ```
   {master:member0-re0} [edit]
   user@host# edit interfaces ae<number> aggregated-ether-options
   ```

5. Enable module (FPC) redundancy for the specified aggregated Ethernet bundle.

   ```
   {master:member0-re0} [edit interfaces ae<number> aggregated-ether-options]
   user@host# set logical-interface-chassis-redundancy
   ```

BEST PRACTICE: We recommend that you do not configure both module (FPC) redundancy and chassis redundancy for the same aggregated Ethernet interface in an MX Series Virtual Chassis. If you do, module redundancy takes precedence over chassis redundancy.

Related Documentation

- Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis on page 144
- Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis on page 139
- Configuring Module Redundancy for a Virtual Chassis on page 141

Multichassis Link Aggregation in a Virtual Chassis

You can configure multichassis link aggregation (MC-LAG) in an MX Series Virtual Chassis.

MC-LAG enables a device to form a logical link aggregation group interface with two or more other devices. The MC-LAG devices use the Inter-Chassis Communication Protocol (ICCP) to exchange control information between two MC-LAG network devices.

When you configure MC-LAG with an MX Series Virtual Chassis, the link aggregation group spans links to two Virtual Chassis configurations. Each Virtual Chassis consists of two MX Series member routers that form a logical system managed as a single network element. ICCP exchanges control information between the global master router (VC-M) of the first Virtual Chassis and the VC-M of the second Virtual Chassis.

To configure MC-LAG on member routers in a Virtual Chassis, use the same procedure that you would use to configure MC-LAG on a standalone MX Series router.

NOTE: Internet Group Management Protocol (IGMP) snooping is not supported on MC-LAG interfaces in an MX Series Virtual Chassis.

Related Documentation

- *Configuring Multichassis Link Aggregation*
- Global Roles and Local Roles in a Virtual Chassis on page 29

Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis

By default, member routers or switches in an EX9200 or MX Series Virtual Chassis use hash-based traffic distribution for subscriber interfaces in aggregated Ethernet bundles configured without link protection. The hash-based model distributes subscriber interface traffic over multiple links in the bundle, enabling you to load balance multiple traffic flows through the logical subscriber interface.

As an alternative to using hash-based distribution in an EX9200 or MX Series Virtual Chassis, you can configure targeted traffic distribution for IP demultiplexing (demux) or VLAN demux subscriber interfaces in an aggregated Ethernet bundle that is configured without link protection.

- Targeted Distribution in a Virtual Chassis on page 144
- Benefits of Targeted Distribution on page 144

Targeted Distribution in a Virtual Chassis

Targeted distribution enables you to configure the Virtual Chassis to send (target) all egress data traffic for a logical subscriber interface across a single member link in an *aggregated Ethernet bundle*, also referred to as an IEEE 802.3ad link aggregation group (LAG) bundle. You configure targeted distribution for a demux subscriber interface on the Virtual Chassis master router or switch.

With targeted distribution, the router or switch in a Virtual Chassis assigns the primary member link and backup member link for the aggregated Ethernet bundle across *all* Virtual Chassis port links that belong to the aggregated Ethernet bundle. To accomplish load balancing, the router or switch evenly distributes the demux subscriber interfaces over these member links.

Benefits of Targeted Distribution

Targeted distribution is especially useful in a Virtual Chassis configuration in which subscriber traffic enters through a Virtual Chassis port on one member router or switch and exits through a Virtual Chassis port on a different member router or switch. By combining Virtual Chassis ports from different member router or switches as member links of the aggregated Ethernet bundle, targeted distribution provides increased redundancy in the event of a chassis or link failure.

Related Documentation

- Redundancy Mechanisms on Aggregated Ethernet Interfaces in a Virtual Chassis on page 139
- Configuring Module Redundancy for a Virtual Chassis on page 141
- Configuring Chassis Redundancy for a Virtual Chassis on page 142

CHAPTER 8

Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines

- Example: Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines on page 145

Example: Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines

You can upgrade an MX Series Virtual Chassis configuration from Junos OS Release 11.2 to a later release by rebooting each of the Routing Engines. This upgrade procedure assumes that both member routers in the Virtual Chassis have dual Routing Engines installed.

NOTE: **Make sure all four Routing Engines in the Virtual Chassis (both Routing Engines in the master router and both Routing Engines in the backup router) are running the same Junos OS release.**

This example describes how to upgrade Junos OS in a Virtual Chassis consisting of two MX Series routers, each of which has dual Routing Engines:

- Requirements on page 145
- Overview and Topology on page 146
- Configuration on page 147

Requirements

This example uses the following software and hardware and components:

- Junos OS Release 11.2 and later releases
- One MX240 3D Universal Edge Router with dual Routing Engines
- One MX480 3D Universal Edge Router with dual Routing Engines

NOTE: This configuration example has been tested using the software release listed and is assumed to work on all later releases.

See Table 17 on page 147 for information about the hardware installed in each MX Series router.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis.

For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for an MX Series Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

Overview and Topology

To upgrade Junos OS in an MX Series Virtual Chassis configuration by rebooting the Routing Engines, you must:

1. Prepare for the upgrade.
2. Install the Junos OS software package on each of the four Routing Engines.
3. Reboot the Routing Engines to run the new Junos OS release.
4. Re-enable graceful Routing Engine switchover and nonstop active routing.

This example upgrades Junos OS in an MX Series Virtual Chassis configuration that uses the basic topology shown in Figure 5 on page 146. For redundancy, each member router is configured with two Virtual Chassis ports.

Figure 5: Sample Topology for a Virtual Chassis with Two MX Series Routers

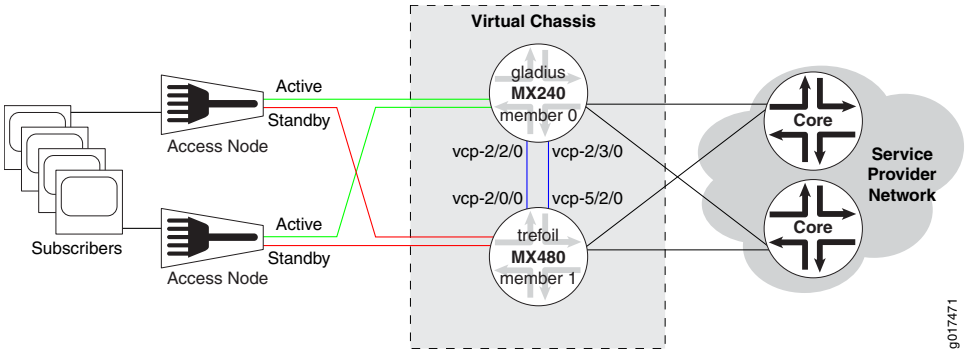


Table 17 on page 147 shows the hardware and software configuration settings for each MX Series router in the Virtual Chassis.

Table 17: Components of the Sample MX Series Virtual Chassis

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Network Port Slot Numbering
gladius	MX240 router with: • 60-Gigabit Ethernet Enhanced Queuing MPC • 20-port Gigabit Ethernet MIC with SFP • 4-port 10-Gigabit Ethernet MIC with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member0-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member0-re1**)	JN10C7135AFC	0	routing-engine (master)	vcp-2/2/0 vcp-2/3/0	FPC 0 – 11
trefoil	MX480 router with: • Two 30-Gigabit Ethernet Queuing MPCs • Two 20-port Gigabit Ethernet MICs with SFP • Two 2-port 10-Gigabit Ethernet MICs with XFP • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member1-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member1-re1**)	JN115D117AFB	1	routing-engine (backup)	vcp-2/0/0 vcp-5/2/0	FPC 12 – 23 (offset = 12)

Configuration

To upgrade Junos OS in a two-member MX Series Virtual Chassis by rebooting the Routing Engines, perform these tasks:

- Preparing for the Upgrade on page 148
- Installing the Junos OS Software Package on Each Routing Engine on page 148

- Rebooting the Routing Engines to Run the New Junos OS Release on page 149
- Re-enabling Graceful Routing Engine Switchover and Nonstop Active Routing on page 149

Preparing for the Upgrade

Step-by-Step Procedure

To prepare for the upgrade process:

1. Use FTP or a Web browser to download the Junos OS software package to the master Routing Engine on the Virtual Chassis master router (**member0-re0**).

   See *Downloading Software* in the *Installation and Upgrade Guide*.

2. Disable nonstop active routing on the master router.

   ```
   {master:member0-re0}[edit routing-options]
   user@gladius# delete nonstop-routing
   ```

3. Disable graceful Routing Engine switchover on the master router.

   ```
   {master:member0-re0}[edit chassis redundancy]
   user@gladius# delete graceful-switchover
   ```

4. Commit the configuration on the master router.

5. Exit CLI configuration mode.

   ```
   {master:member0-re0}[edit]
   user@gladius# exit
   ```

Installing the Junos OS Software Package on Each Routing Engine

Step-by-Step Procedure

Installing the Junos OS software package on each Routing Engine in an MX Series Virtual Chassis prepares the Routing Engines to run the new software release after a reboot. This action is also referred to as *arming* the Routing Engines.

To install the Junos OS software package on all four Routing Engines from the master router (**member0-re0**) in the Virtual Chassis:

1. Install the software package on **member0-re0**. This command also propagates the software package to **member1-re0**.

   ```
   {master:member0-re0}
   user@gladius> request system software add package-name
   ```

   For example:

   ```
   {master:member0-re0}
   user@gladius> request system software add jinstall-11.2R1-8-domestic-signed.tgz
   ```

2. Install the software package on **member0-re1**.

   ```
   {master:member0-re0}
   user@gladius> request system software add package-name re1
   ```

3. Install the software package on **member1-re1**.

   ```
   {master:member0-re0}
   user@gladius> request system software add package-name member 1 re1
   ```

Results Display the results of the installation. Verify that the correct software package has been installed on the local master Routing Engine in **member 0** (**member0-re0**) and on the local master Routing Engine in **member 1** (**member1-re0**).

```
{master:member0-re0}

user@gladius> show version
member0:
--------------------------------------
Hostname: gladius
Model: mx240
. . .
JUNOS Installation Software [11.2R1-8]


member1:
--------------------------------------
Hostname: trefoil
Model: mx480
. . .
JUNOS Installation Software [11.2R1-8]
```

Rebooting the Routing Engines to Run the New Junos OS Release

Step-by-Step Procedure To reboot each of the four Routing Engines in an MX Series Virtual Chassis from the Virtual Chassis master router (**member0-re0**):

1. Reboot **member1-re1**.

   ```
   {master:member0-re0}

   user@gladius> request system reboot member 1 other-routing-engine
   ```

2. Reboot **member0-re1**.

   ```
   {master:member0-re0}

   user@gladius> request system reboot other-routing-engine
   ```

3. Reboot both master Routing Engines (**member0-re0** and **member1-re0**).

   ```
   {master:member0-re0}

   user@gladius> request system reboot all-members
   ```

   This command reboots all line cards in **member 0** (**gladius**) and **member 1** (**trefoil**) to use the new Junos OS release. A traffic disruption occurs until all line cards are back online and the Virtual Chassis re-forms.

Re-enabling Graceful Routing Engine Switchover and Nonstop Active Routing

Step-by-Step Procedure After upgrading the Junos OS release, you need to re-enable graceful Routing Engine switchover and nonstop active routing for the Virtual Chassis.

To re-enable graceful Routing Engine switchover and nonstop active routing from the Virtual Chassis master router (**member0-re0**):

1. In the console window on **member 0** (**gladius**), enable graceful Routing Engine switchover on the master router.

   ```
   {master:member0-re0}[edit chassis redundancy]
   ```



```
user@gladius# set graceful-switchover
```

2. Re-enable nonstop active routing on the master router.

```
{master:member0-re0}[edit routing-options]
user@gladius# set nonstop-routing
```

3. Commit the configuration on the master router.

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23
- *Upgrading Junos OS in a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers by Rebooting the Routing Engines*

CHAPTER 9

Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified In-Service Software Upgrade (ISSU)

- Unified ISSU in a Virtual Chassis on page 151
- Preparing for a Unified ISSU in an MX Series Virtual Chassis on page 154
- Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified ISSU on page 156

Unified ISSU in a Virtual Chassis

You can perform a unified in-service software upgrade (unified ISSU) for an MX Series Virtual Chassis configuration. Unified ISSU enables you to upgrade the Junos OS system software on the Virtual Chassis member routers with minimal traffic disruption and no disruption on the control plane.

This topic assumes that you are familiar with the global roles and local roles in an MX Series Virtual Chassis. For information, see "Global Roles and Local Roles in a Virtual Chassis" on page 29.

- Benefits of Performing a Unified ISSU in an Virtual Chassis on page 151
- Prerequisites for Performing a Unified ISSU in a Virtual Chassis on page 152
- How Unified ISSU Works in a Virtual Chassis on page 152
- Virtual Chassis Role Transitions After a Unified ISSU on page 153

Benefits of Performing a Unified ISSU in an Virtual Chassis

Performing a unified ISSU in an MX Series Virtual Chassis provides the following benefits:

- Upgrades the Junos OS software package while maintaining subscriber sessions.
- Reduces risk associated with a software upgrade. After performing a unified ISSU, the resulting system is exactly the same as if you had upgraded it with a system reboot.
- Prevents software upgrades from negatively affecting the service provider's ability to fulfill strict service-level agreements (SLAs).
- Eliminates network downtime during software image upgrades.

- Enables faster implementation of new Junos OS features.
- Provides feature parity with unified ISSU support on standalone MX Series routers.

Prerequisites for Performing a Unified ISSU in a Virtual Chassis

Before you start a unified ISSU in a two-member MX Series Virtual Chassis, make sure you do all of the following:

- Ensure that all four Routing Engines in the Virtual Chassis (both Routing Engines in the master router and both Routing Engines in the backup router) are running the same Junos OS software release.
- Back up the existing router configuration so you can revert (roll back) to it if necessary.
- Verify that both graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) are enabled.

How Unified ISSU Works in a Virtual Chassis

To perform a unified ISSU in an MX Series Virtual Chassis, you issue the **request system software in-service-upgrade *package-name*** command from the console window for the master Routing Engine in the Virtual Chassis master router (VC-Mm). Issuing this command from the VC-Mm copies the software package to all other Routing Engines in the Virtual Chassis.

The **request system software in-service-upgrade *package-name*** command functions the same for upgrading member routers in a Virtual Chassis configuration as it does for upgrading a standalone MX Series router with dual Routing Engines, *with the following exceptions*:

- The **no-copy**, **no-old-master-upgrade**, and **unlink** options for the **request system software in-service-upgrade** command are not available for an MX Series Virtual Chassis.
- The **reboot** option for the **request system software in-service-upgrade** command is accepted but ignored for an MX Series Virtual Chassis. A unified ISSU always reboots all Routing Engines in the Virtual Chassis member routers.

At a high level, the software performs the following actions after you issue the **request system software in-service-upgrade *package-name*** command to upgrade to a new Junos OS software release in a two-member Virtual Chassis configuration:

1. Arms the new Junos OS software release on all Routing Engines in the Virtual Chassis.

   The Routing Engines are still running the old Junos OS software release.

2. Upgrades both standby (backup) Routing Engines (VC-Ms and VC-Bs) in the Virtual Chassis.

   The Virtual Chassis is still actively forwarding traffic.

3. Performs a local switchover of the Routing Engines in the Virtual Chassis backup router (VC-B).

The local switchover causes the VC-Bs upgraded in Step 2 to become the VC-Bm, and the VC-Bm that was still running the old Junos OS software to become the VC-Bs. The VC-Bm is now running the new Junos OS software release, and the VC-Bs is still running the old Junos OS software release. The Virtual Chassis is still actively forwarding traffic.

4. Upgrades the Packet Forwarding Engines to the new Junos OS software release.

   The Packet Forwarding Engines are now using the upgraded VC-Bm as the Virtual Chassis protocol master.

5. Performs a local switchover of the Routing Engines in the Virtual Chassis master router (VC-M).

   The local switchover of the VC-M also causes a global switchover in the Virtual Chassis, which causes the VC-M to become the VC-B. As a result, the VC-Mm becomes the VC-Bs, and the VC-Ms becomes the VC-Bm. The global switchover on the VC-B causes the VC-Bm to become the VC-Mm, and the VC-Bs to become the VC-Ms.

   The VC-Mm and VC-Bm are now running the new Junos OS software release. The VC-Ms (originally the VC-Bm) and VC-Bs (originally the VC-Mm) are still running the old Junos OS software release.

6. Upgrades the standby Routing Engines in the Virtual Chassis (VC-Ms and VC-Bs).

   The Virtual Chassis is now fully upgraded to the new Junos OS software release.

Virtual Chassis Role Transitions After a Unified ISSU

A unified ISSU in an MX Series Virtual Chassis upgrades all Routing Engines in the Virtual Chassis to the new Junos OS software release. In a two-member Virtual Chassis, this includes four Routing Engines: the master and standby (backup) Routing Engines in the Virtual Chassis master router, and the master and standby Routing Engines in the Virtual Chassis backup router. As a result, the member routers and their associated Routing Engines undergo both global and local role transitions after the unified ISSU completes.

A *global role transition* changes the mastership in the Virtual Chassis by switching the global roles of the Virtual Chassis master router (VC-M) and Virtual Chassis backup router (VC-B), and applies globally across the entire Virtual Chassis. A *local role transition* toggles the local mastership roles (**master** and **standby**, or **m** and **s**) of each of the two Routing Engines in a member router, and applies locally only to that member router.

A unified ISSU in an MX Series Virtual Chassis causes the global and local role transitions listed in Table 18 on page 153.

Table 18: Virtual Chassis Role Transitions After Unified ISSU

Virtual Chassis Role *Before* Unified ISSU	Virtual Chassis Role *After* Unified ISSU	Type of Role Change
Virtual Chassis master router (VC-M)	Virtual Chassis backup router (VC-B)	Global
Virtual Chassis backup router (VC-B)	Virtual Chassis master router (VC-M)	Global

Table 18: Virtual Chassis Role Transitions After Unified ISSU *(continued)*

Virtual Chassis Role *Before* Unified ISSU	Virtual Chassis Role *After* Unified ISSU	Type of Role Change
Master Routing Engine in the Virtual Chassis master router (VC-Mm)	Standby Routing Engine in the Virtual Chassis backup router (VC-Bs)	Local
Standby Routing Engine in the Virtual Chassis master router (VC-Ms)	Master Routing Engine in the Virtual Chassis backup router (VC-Bm)	Local
Master Routing Engine in the Virtual Chassis backup router (VC-Bm)	Standby Routing Engine in the Virtual Chassis master router (VC-Ms)	Local
Standby Routing Engine in the Virtual Chassis backup router (VC-Bs)	Master Routing Engine in the Virtual Chassis master router(VC-Mm)	Local

Related Documentation

- Preparing for a Unified ISSU in an MX Series Virtual Chassis on page 154
- Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified ISSU on page 156
- Global Roles and Local Roles in a Virtual Chassis on page 29
- *Unified ISSU System Requirements*

Preparing for a Unified ISSU in an MX Series Virtual Chassis

Before you begin a unified in-service software upgrade (unified ISSU) in an MX Series Virtual Chassis, we recommend that you perform the following tasks to help ensure the success of the upgrade.

To prepare for a unified ISSU in a two-member MX Series Virtual Chassis:

1. Back up the existing system software to each member router's hard disk so you can roll back to it if necessary.

   Isssue the **request system snapshot all-members** command to archive data and executable areas for all members of the Virtual Chassis configuration.

2. Make sure enhanced IP network services is configured.

   See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69.

3. Verify that both graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) are enabled.

   See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69.

4. Make sure the router is configured to delay for 180 seconds (3 minutes) before removing access routes and access-internal routes for DHCP and PPP subscriber management after a graceful Routing Engine switchover takes place.

See *Delaying Removal of Access Routes and Access-Internal Routes After Graceful Routing Engine Switchover*.

5. Ensure that the router is configured to use a *hold-time* value of 300 seconds when negotiating a BGP connection with the peer.

   See *BGP Messages Overview*.

6. (Aggregated Ethernet interfaces only) If you are using aggregated Ethernet interfaces, make sure each interface is configured to use a **slow** interval (every 30 seconds) for *periodic* transmission of Link Aggregation Control Protocol (LACP) packets.

   See *Configuring LACP for Aggregated Ethernet Interfaces*.

7. (IS-IS interfaces only) If you are using IS-IS interfaces configured with the **iso** protocol family, make sure the link-state PDU lifetime value (*lsp-lifetime*) is set to 65317 seconds.

   See *Example: Configuring the Transmission Frequency for Link-State PDUs on IS-IS Interfaces*.

BEST PRACTICE: To find additional information about unified ISSU, we recommend that you consult our Knowledge Base.

Related Documentation

- Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified ISSU on page 156
- Unified ISSU in a Virtual Chassis on page 151

Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified ISSU

You can upgrade the member routers in a two-member MX Series Virtual Chassis from Junos OS Release 14.1 to a later release on by performing a unified in-service software upgrade (unified ISSU). Unified ISSU enables you to upgrade to a new Junos OS software release with minimal traffic disruption and no loss of subscriber sessions.

The unified ISSU procedure upgrades and changes the roles of all Routing Engines in the Virtual Chassis to the new Junos OS software release. In a two-member Virtual Chassis, this includes four Routing Engines: the master and standby Routing Engines in the Virtual Chassis master router, and the master and standby Routing Engines in the Virtual Chassis backup router.

Before you begin a unified ISSU in a two-member MX Series Virtual Chassis, perform the following tasks:

- Prepare the member routers for the unified ISSU operation.

  See "Preparing for a Unified ISSU in an MX Series Virtual Chassis" on page 154.

To perform a unified ISSU in a two-member MX Series Virtual Chassis:

1. Use FTP or a Web browser to download the Junos OS software package from the Juniper Networks Support Web site.

   See *Downloading Software*.

2. Open four console windows to access the console ports on each of the four Routing Engines in the Virtual Chassis:

   - Master Routing Engine in the Virtual Chassis master router (VC-Mm)
   - Standby Routing Engine in the Virtual Chassis master router (VC-Ms)
   - Master Routing Engine in the Virtual Chassis backup router (VC-Bm)
   - Standby Routing Engine in the Virtual Chassis backup router (VC-Bs)

   Opening separate console windows enables you to monitor the progress of the unified ISSU on each of the Routing Engines.

3. (Optional but recommended) Confirm that the member routers are ready for the unified ISSU process.

   Issue the following commands in each console window:

   ```
   {master:member0-re0}

   user@host> show virtual-chassis vc-port | match "Configured"
   user@host> show system switchover local
   user@host> show system uptime local
   ```

   Issuing these commands provides the following information:

   - The **show virtual-chassis vc-port | match "Configured"** command output confirms that all Virtual Chassis port interfaces are properly configured and operational.

- The **show system switchover local** command output confirms that the configuration database and kernel database are ready for a unified ISSU.
- The **show system uptime local** command output displays the date and time when this Routing Engine was last booted, and how long it has been running. It typically takes from 5 minutes to 15 minutes since the last switchover or system reboot for the Routing Engine to be ready for a unified ISSU.

4. Verify that all four Routing Engines in the Virtual Chassis are running the same Junos OS software release.

   Issue the **show version invoke-on all-routing-engines** command with the **all-members** option to display the hostnames and version information about the software running on all Routing Engines in the Virtual Chassis.

   ```
   {master:member0-re0}

   user@host> show version all-members invoke-on all-routing-engines
   ```

5. Initiate the unified ISSU process.

   In the console window on the VC-Mm, issue the **request system software in-service-upgrade *package-name*** command.

   ```
   {master:member0-re0}

   user@host> request system software in-service-upgrade package-name
   ```

   NOTE: You do not need to specify the reboot option for the request system software in-service-upgrade command because a unified ISSU in an MX Series Virtual Chassis always reboots all Routing Engines in the member routers.

6. Check the console windows for each Routing Engine to monitor the unified ISSU progress and determine when the upgrade is complete.

   The unified ISSU can take between 30 minutes and 90 minutes to complete, depending on the size of your configuration. When the unified ISSU completes, the login prompt appears in the console windows.

For an example of the output for a unified ISSU operation in an MX Series Virtual Chassis, see **request system software in-service-upgrade**.

Related Documentation

- Preparing for a Unified ISSU in an MX Series Virtual Chassis on page 154
- Unified ISSU in a Virtual Chassis on page 151
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- *Performing a Unified ISSU*
- *Unified ISSU System Requirements*
- **request system software in-service-upgrade on page 228**

CHAPTER 10

Monitoring an MX Series Virtual Chassis

- Accessing the Virtual Chassis Through the Management Interface on page 160
- Verifying the Status of Virtual Chassis Member Routers or Switches on page 161
- Verifying the Operation of Virtual Chassis Ports on page 161
- Verifying Neighbor Reachability for Member Routers or Switches in a Virtual Chassis on page 162
- Verifying Neighbor Reachability for Hardware Devices in a Virtual Chassis on page 162
- Determining GRES Readiness in a Virtual Chassis Configuration on page 163
- Viewing Information in the Virtual Chassis Control Protocol Adjacency Database on page 164
- Viewing Information in the Virtual Chassis Control Protocol Link-State Database on page 164
- Viewing Information About Virtual Chassis Port Interfaces in the Virtual Chassis Control Protocol Database on page 165
- Viewing Virtual Chassis Control Protocol Routing Tables on page 166
- Viewing Virtual Chassis Control Protocol Statistics for Member Devices and Virtual Chassis Ports on page 166
- Verifying and Managing the Virtual Chassis Heartbeat Connection on page 167
- Inline Flow Monitoring for Virtual Chassis Overview on page 167
- Managing Files on Virtual Chassis Member Routers or Switches on page 169
- Virtual Chassis Slot Number Mapping for Use with SNMP on page 170
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

Accessing the Virtual Chassis Through the Management Interface

The management Ethernet interface (**fxp0**) on an MX Series router or EX9200 switch is an out-of-band management interface, also referred to as a management port, that enables you to use Telnet or SSH to access and manage the device remotely. You typically configure the management interface with an IP address and prefix length when you first install Junos OS.

You can configure a management Ethernet interface in one of two ways to access a Virtual Chassis:

- To access the Virtual Chassis as a whole, configure a consistent IP address for the management interface using the **master-only** option. You can use this management IP address to consistently access the master (primary) Routing Engine in the master router or switch (protocol master) for the Virtual Chassis.
- To access a specific Routing Engine in an individual member router or switch of the Virtual Chassis, configure an IP address for one of the following configuration groups:
  - **member0-re0**
  - **member0-re1**
  - **member1-re0**
  - **member1-re1**

BEST PRACTICE: For most management tasks, we recommend that you access the Virtual Chassis as a whole through a consistent management IP address. For troubleshooting purposes, however, accessing a specific Routing Engine in an individual member router or switch may be useful.

To access a Virtual Chassis through the management Ethernet interface, do one of the following:

- Configure a consistent management IP address that accesses the entire Virtual Chassis through the master Routing Engine in the Virtual Chassis master router or switch.

  ```
  {master:member0-re0}[edit]
  user@host# set interfaces fxp0 unit 0 family inet address ip-address/prefix-length
    master-only
  ```

  For example, to access the entire Virtual Chassis via management IP address **10.4.5.33/16**:

  ```
  {master:member0-re0}[edit]
  user@host# set interfaces fxp0 unit 0 family inet address 10.4.5.33/16 master-only
  ```

- Configure a management IP address that accesses a specified Routing Engine in an individual member router or switch in the Virtual Chassis.

  ```
  {master:member0-re0}[edit groups]
  ```

```
user@host# set membern-ren interfaces fxp0 unit 0 family inet address
  ip-address/prefix-length
```

For example, to access the Routing Engine installed in slot 1 of member router 1 (**member1-re1**) in the Virtual Chassis:

```
{master:member0-re0}[edit groups]
user@host# set member1-re1 interfaces fxp0 unit 0 family inet address 10.4.3.145/32
```

Related Documentation

- *Configuring a Consistent Management IP Address*

Verifying the Status of Virtual Chassis Member Routers or Switches

Purpose Verify that the member routers or switches in an MX Series or EX9200 Virtual Chassis are properly configured.

Action Display the status of the members of the Virtual Chassis configuration:

```
user@host> show virtual-chassis status
```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Verifying the Operation of Virtual Chassis Ports

Purpose Verify that the Virtual Chassis ports in an MX Series or EX9200 Virtual Chassis are properly configured and operational.

Action

- To display the status of the Virtual Chassis ports for both member routers or switches in the Virtual Chassis:

  ```
  user@host> show virtual-chassis vc-port all-members
  ```

- To display the status of the Virtual Chassis ports for a specified member router or switch in the Virtual Chassis:

  ```
  user@host> show virtual-chassis vc-port member member-id
  ```

- To display the status of the Virtual Chassis ports for the member router or switch on which you are issuing the command:

  ```
  user@host> show virtual-chassis vc-port local
  ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Verifying Neighbor Reachability for Member Routers or Switches in a Virtual Chassis

Purpose Verify that each member router or switch in an MX Series or EX9200 Virtual Chassis has a path to reach the neighbor devices to which it is connected.

Action

- To display neighbor reachability information for both member devices in the Virtual Chassis:

  ```
  user@host> show virtual-chassis active-topology all-members
  ```

- To display neighbor reachability information for a specified member device in the Virtual Chassis:

  ```
  user@host> show virtual-chassis active-topology member member-id
  ```

- To display neighbor reachability information for the member device on which you are issuing the command:

  ```
  user@host> show virtual-chassis active-topology local
  ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Verifying Neighbor Reachability for Hardware Devices in a Virtual Chassis

Purpose Verify that each hardware device in an MX Series Virtual Chassis or an EX9200 Virtual Chassis can reach the neighbor routers and devices to which it is connected. On the MX Series routing platform, there is only one active device for each member router.

Action

- To display neighbor reachability information for the devices in both member routers in the Virtual Chassis:

  ```
  user@host> show virtual-chassis device-topology all-members
  ```

- To display neighbor reachability information for the device in a specified member router in the Virtual Chassis:

  ```
  user@host> show virtual-chassis device-topology member member-id
  ```

- To display neighbor reachability information for the device in the member router on which you are issuing the command:

  ```
  user@host> show virtual-chassis device-topology local
  ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Determining GRES Readiness in a Virtual Chassis Configuration

Depending on the configuration, a variable amount of time is required before a router or switch is ready to perform a graceful Routing Engine switchover (GRES). Attempting a GRES operation before the device is ready can cause system errors and unexpected behavior.

To determine whether the member routers or switches in a Virtual Chassis configuration are ready for a GRES operation from a database synchronization perspective, you can issue the **request virtual-chassis routing-engine master switch check** command from the Virtual Chassis master router or switch (VC-Mm) before you initiate the GRES operation. Using the **request virtual-chassis routing-engine master switch check** command before you initiate the GRES operation ensures that the subscriber management and kernel databases on both member routers or switches are synchronized and ready for the GRES operation.

To determine whether the member routers or switches are ready for GRES from a database synchronization perspective:

1. Issue the **request virtual-chassis routing-engine master switch check** command from the Virtual Chassis master router or switch (VC-Mm).

   ```
   {master:member0-re0}

   user@host> request virtual-chassis routing-engine master switch check
   ```

   The **request virtual-chassis routing-engine master switch check** command checks various system and database components on the member routers or switches to determine whether they are ready for GRES, but does not initiate the global GRES operation itself. The readiness check includes ensuring that a system timer, which expires after 300 seconds, has completed before the global GRES operation can begin.

2. Review the results of the **request virtual-chassis routing-engine master switch check** command to determine whether the member routers or switches are ready for a GRES operation from a database synchronization perspective.

   - If the member routers or switches are ready for GRES, the **request virtual-chassis routing-engine master switch check** command returns the command prompt and displays no output.

     ```
     {master:member0-re0}

     user@host> request virtual-chassis routing-engine master switch check
     {master:member0-re0}
     ```

   - If the member routers or switches are not ready for GRES, the **request virtual-chassis routing-engine master switch check** command displays information about the readiness of the system. For example:

     ```
     {master:member0-re0}

     user@host> request virtual-chassis routing-engine master switch check
     error: chassisd Not ready for mastership switch, try after 217 secs.
     mastership switch request NOT honored, backup not ready
     ```

The specific command output differs depending on the GRES readiness state of the member routers or switches.

Related Documentation

- Switchover Behavior in a Virtual Chassis on page 32
- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- *Understanding Graceful Routing Engine Switchover*

Viewing Information in the Virtual Chassis Control Protocol Adjacency Database

Purpose View information about neighbors in the Virtual Chassis Control Protocol (VCCP) adjacency database for a Virtual Chassis configuration.

Action

- To display VCCP neighbor adjacency information for both member devices in the Virtual Chassis:

  ```
  user@host> show virtual-chassis protocol adjacency all-members
  ```

- To display VCCP neighbor adjacency information for a specified member device in the Virtual Chassis:

  ```
  user@host> show virtual-chassis protocol adjacency member member-id
  ```

- To display VCCP neighbor adjacency information for the device with a specified system ID:

  ```
  user@host> show virtual-chassis protocol adjacency system-id
  ```

- To display VCCP neighbor adjacency information for the device with a specified system ID on the specified member router or switch:

  ```
  user@host> show virtual-chassis protocol adjacency member member-id system-id
  ```

- To display VCCP neighbor adjacency information for the member device on which you are issuing the command:

  ```
  user@host> show virtual-chassis protocol adjacency local
  ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Viewing Information in the Virtual Chassis Control Protocol Link-State Database

Purpose View information about protocol data unit (PDU) packets in the Virtual Chassis Control Protocol (VCCP) link-state database for a Virtual Chassis configuration.

Action

- To display VCCP PDU information for both member routers or switches in the Virtual Chassis:

```
user@host> show virtual-chassis protocol database all-members
```

- To display VCCP PDU information for a specified member router or switch in the Virtual Chassis:

```
user@host> show virtual-chassis protocol database member member-id
```

- To display VCCP PDU information for the device with a specified system ID:

```
user@host> show virtual-chassis protocol database system-id
```

- To display VCCP PDU information for the device with a specified system ID on the specified member router or switch:

```
user@host> show virtual-chassis protocol database member member-id system-id
```

- To display VCCP PDU information for the member router or switch on which you are issuing the command:

```
user@host> show virtual-chassis protocol database local
```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Viewing Information About Virtual Chassis Port Interfaces in the Virtual Chassis Control Protocol Database

Purpose View information in the Virtual Chassis Control Protocol (VCCP) database about Virtual Chassis port interfaces in the Virtual Chassis.

Action

- To display VCCP information about Virtual Chassis port interfaces for both member routers or switches:

```
user@host> show virtual-chassis protocol interface all-members
```

- To display VCCP information about Virtual Chassis port interfaces for a specified member router or switch:

```
user@host> show virtual-chassis protocol interface member member-id
```

- To display VCCP information about a specified Virtual Chassis port interface:

```
user@host> show virtual-chassis protocol interface vcp-slot/pic/port.logical-unit-number
```

- To display VCCP information about Virtual Chassis port interfaces for the member router or switch on which you are issuing the command:

```
user@host> show virtual-chassis protocol interface local
```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Viewing Virtual Chassis Control Protocol Routing Tables

Purpose View Virtual Chassis Control Protocol (VCCP) unicast and multicast routing tables for an MX Series Virtual Chassis configuration.

Action

- To display the VCCP unicast and multicast routing tables for both member routers in the Virtual Chassis:

  ```
  user@host> show virtual-chassis protocol route all-members
  ```

- To display the VCCP unicast and multicast routing tables for a specified member router in the Virtual Chassis:

  ```
  user@host> show virtual-chassis protocol route member member-id
  ```

- To display the VCCP unicast and multicast routing tables to the destination with the specified system ID:

  ```
  user@host> show virtual-chassis protocol route destination-id
  ```

- To display the VCCP unicast and multicast routing tables to the destination with the specified system ID on the specified member router:

  ```
  user@host> show virtual-chassis protocol route member member-id destination-id
  ```

- To display the VCCP unicast and multicast routing tables for the member router on which you are issuing the command:

  ```
  user@host> show virtual-chassis protocol route local
  ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Viewing Virtual Chassis Control Protocol Statistics for Member Devices and Virtual Chassis Ports

Purpose View Virtual Chassis Control Protocol (VCCP) statistics for one or both member routers or switches, or for a specified Virtual Chassis port interface, in a Virtual Chassis configuration.

Action

- To display VCCP statistics for both member routers or switches in the Virtual Chassis:

  ```
  user@host> show virtual-chassis protocol statistics all-members
  ```

- To display VCCP statistics for a specified member router or switch in the Virtual Chassis:

  ```
  user@host> show virtual-chassis protocol statistics member member-id
  ```

- To display VCCP statistics for a specified Virtual Chassis port interface:

  ```
  user@host> show virtual-chassis protocol statistics vcp-slot/pic/port.logical-unit-number
  ```

- To display VCCP statistics for the member router or switch on which you are issuing the command:

  ```
  user@host> show virtual-chassis protocol statistics local
  ```

Related Documentation

- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Verifying and Managing the Virtual Chassis Heartbeat Connection

Purpose Verify the configuration and operation of a heartbeat connection for an MX Series Virtual Chassis.

Action

- To clear heartbeat connection statistics counters and timestamp fields for all (both) member routers, the specified member router, or the member router on which you are issuing the command:

```
user@host> clear virtual-chassis heartbeat <all-members>
user@host> clear virtual-chassis heartbeat member member-id
user@host> clear virtual-chassis heartbeat local
```

- To view the heartbeat connection state for all (both) member routers, the specified member router, or the member router on which you are issuing the command:

```
user@host> show virtual-chassis heartbeat <all-members>
user@host> show virtual-chassis heartbeat member member-id
user@host> show virtual-chassis heartbeat local
```

- To display and review the statistics collected by the heartbeat connection for all (both) member routers, the specified member router, or the member router on which you are issuing the command:

```
user@host> show virtual-chassis heartbeat detail <all-members>
user@host> show virtual-chassis heartbeat detail member member-id
user@host> show virtual-chassis heartbeat detail local
```

- To verify use (status) of the heartbeat connection when an adjacency disruption or split is detected in the Virtual Chassis:

```
user@host> show virtual-chassis status
```

Related Documentation

- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183
- Virtual Chassis Heartbeat Connection Overview on page 39

Inline Flow Monitoring for Virtual Chassis Overview

Inline flow monitoring enables you to monitor the flow of traffic by means of a router participating in a network.

Inline flow monitoring for an MX Series Virtual Chassis supports the following features:

- Active sampling and exporting of both IPv4 and IPv6 traffic flows. Active (inline) sampling occurs on an inline data path without the need for a services DPC.
- Sampling traffic flows in both the ingress and egress directions.
- Configuring flow collection on either IPv4 or IPv6 devices.
- Using the IPFIX flow collection template for traffic sampling. The IPFIX template supports both IPv4 and IPv6 export records.
- Sampling and exporting of VPLS flows
- Exporting of data in Version-IPFIX and Version 9 formats

Consider the following guidelines when you configure Virtual Chassis for inline flow monitoring.

- Split Detection on page 168
- Syntax of the sampling-instance Statement on page 168
- FPC Slot Numbers for the Virtual Chassis on page 168

Split Detection

In a two-member MX Series Virtual Chassis, you must disable split detection to configure and use inline flow monitoring. To do so, include the **no-split-detection** statement at the **[edit virtual-chassis]** hierarchy level when you set up the Virtual Chassis.

Syntax of the sampling-instance Statement

To associate a sampling instance with an FPC in the Virtual Chassis master router, use the **sampling-instance *instance-name*** statement at the **[edit chassis member *member-number* fpc slot *slot-number*]** hierarchy level, where ***member-number*** is 0 (zero) and *slot-number* is a number in the range 0 through 11. For example, the following statement associates a sampling instance named sample1 to the FPC in slot 1 of a Virtual Chassis master router:

```
[edit chassis member 0 fpc slot 1]
user@host# set sampling-instance sample1
```

To associate a sampling instance with an FPC in the Virtual Chassis backup router, use the **sampling-instance *instance-name*** statement at the **[edit chassis member *member-number* fpc slot *slot-number*]** hierarchy level, where ***member-number*** is 1 and *slot-number* is a number in the range 0 through 11. For example, the following statement associates a sampling instance named sample2 to the FPC in slot 2 of a Virtual Chassis backup router:

```
[edit chassis member 1 fpc slot 2]
user@host# set sampling-instance sample2
```

FPC Slot Numbers for the Virtual Chassis

When the Virtual Chassis forms, the FPC slots that do not host Virtual Chassis ports are renumbered to reflect the slot numbering and offsets used in the Virtual Chassis instead of the physical slot numbers where the line card is actually installed. In a two-member MX Series Virtual Chassis, the master router (member 0) uses FPC slot numbers 0 through

11 with no offset; the backup router (member 1) uses FPC slot numbers 12 through 23, with an offset of 12.

For example, a 10-Gigabit Ethernet interface that appears as xe-14/2/2 (FPC slot 14, PIC slot 2, port 2) in the **show services accounting status inline-jflow** command output or the **show interfaces** command output is actually physical xe-2/2/2 (FPC slot 2, PIC slot 2, port 2) on the Virtual Chassis backup router (member 1) after deducting the FPC slot numbering offset of 12 for member 1.

Related Documentation

- *Configuring Inline Sampling*
- *Sampling Instance Configuration*
- no-split-detection on page 215
- Disabling Split Detection in a Virtual Chassis Configuration on page 90
- Split Detection Behavior in a Virtual Chassis on page 35

Managing Files on Virtual Chassis Member Routers or Switches

In a Virtual Chassis configuration for MX Series 3D Universal Edge Routers or EX9200 switches, you can manage files on local and remote member routers or switches by including a member specification in the following **file** operational commands:

file archive	**file copy**
file checksum md5	**file delete**
file checksum sha1	**file list**
file checksum sha-256	**file rename**
file compare	**file show**

The member specification identifies the specific Virtual Chassis member router or switch and Routing Engine on which you want to manage files, and includes both of the following elements:

- The Virtual Chassis member ID (**0** or **1**)
- The Routing Engine slot number (**re0** or **re1**)

To manage files on a specific member router or switch and a specific Routing Engine:

- From operational mode, issue the **file** command and Virtual Chassis member specification:

  ```
  {master:member0-re0}
  user@host> file option member(0 | 1)-re(0 | 1):command-option
  ```

  For example, the following **file list** command uses the **member1-re0** specification to display a list of the files in the **/config** directory on the Routing Engine in slot 0 (**re0**) in

Virtual Chassis **member 1**. The router or switch forwards the command from **member 0**, where it is issued, to **member 1**, and displays the results as if the command were processed on the local device.

```
{master:member0-re0}

user@host> file list member1-re0:/config
member1-re0:
--------------------------------------------------------------------------

/config:
.snap/
juniper.conf.1.gz
juniper.conf.2.gz
juniper.conf.3.gz
juniper.conf.gz
juniper.conf.md5
license/
license.old/
usage.db
vchassis/
```

Related Documentation

- Interchassis Redundancy and Virtual Chassis Overview on page 19
- Virtual Chassis Components Overview on page 23
- *Format for Specifying Filenames and URLs in Junos OS CLI Commands*

Virtual Chassis Slot Number Mapping for Use with SNMP

Junos OS supports the use of SNMP to monitor the routers, switches, and other devices in your network. For example, the Juniper Networks jnxBoxAnatomy enterprise-specific Chassis MIB contains the jnxFruTable object, which shows the status of field-replaceable units (FRUs) in the chassis. Within the jnxFruTable object, the jnxFruSlot object displays the slot number where the FRU is installed.

If you are using the jnxFruSlot object in jnxFruTable to display the slot numbers of line cards installed in a member router of an MX Series Virtual Chassis or a member switch of an EX9200 Virtual Chassis, keep in mind that the offset used for slot numbering in the Virtual Chassis affects the value that appears for the jnxFruSlot object.

Table 19 on page 170 lists the jnxFruSlot number that appears in the jnxFruTable of the jnxBoxAnatomy MIB, and the corresponding line card physical slot number in each member router of a two-member EX9200 or MX Series Virtual Chassis. For example, a jnxFruSlot value of 15 corresponds to physical slot 3 in member 0 of the Virtual Chassis. A jnxFruSlot value of 30 corresponds to physical slot 6 in member 1 of the Virtual Chassis.

Table 19: jnxFruSlot Numbers and Corresponding Slot Numbers in an MX Series or EX9200 Virtual Chassis

jnxFruSlot Number	Line Card Slot Number	MX Series or EX9200 Virtual Chassis Member ID
Line Cards in MX Series Virtual Chassis Member ID 0 (offset = 12):		

Table 19: jnxFruSlot Numbers and Corresponding Slot Numbers in an MX Series or EX9200 Virtual Chassis *(continued)*

jnxFruSlot Number	Line Card Slot Number	MX Series or EX9200 Virtual Chassis Member ID
12	0	0
13	1	0
14	2	0
15	3	0
16	4	0
17	5	0
18	6	0
19	7	0
20	8	0
21	9	0
22	10	0
23	11	0
Line Cards in MX Series Virtual Chassis Member ID 1 (offset = 24)		
24	0	1
25	1	1
26	2	1
27	3	1
28	4	1
29	5	1
30	6	1
31	7	1
32	8	1
33	9	1

Table 19: jnxFruSlot Numbers and Corresponding Slot Numbers in an MX Series or EX9200 Virtual Chassis *(continued)*

jnxFruSlot Number	Line Card Slot Number	MX Series or EX9200 Virtual Chassis Member ID
34	10	1
35	11	1

Related Documentation

- Virtual Chassis Components Overview on page 23
- *SNMP MIBs and Traps Reference*

Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet

A *heartbeat connection* is an IP-based, bidirectional packet connection in an MX Series Virtual Chassis between the Virtual Chassis master and backup routers. The *heartbeat packets* exchanged over this connection provide critical information about the availability and health of each member router.

This example describes how to configure a heartbeat connection in an MX Series Virtual Chassis when both member routers reside in the same subnet. For information about configuring a heartbeat connection when the Virtual Chassis member routers reside in different subnets, see "Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets" on page 183.

- Requirements on page 172
- Overview on page 173
- Configuration on page 175
- Verification on page 180

Requirements

This example uses the following software and hardware components:

- Junos OS Release 14.1 and later releases
- Two MX240 3D Universal Edge Routers, each with dual Routing Engines

This configuration example has been tested using the software release listed and is assumed to work on all later releases.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis. For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit**

synchronize command for an MX Series Virtual Chassis configuration has the same effect as issuing the commit synchronize force command.

Before you configure a heartbeat connection for a Virtual Chassis:

- Configure a Virtual Chassis consisting of two MX Series routers.

  See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69

  As part of the preprovisioned Virtual Chassis configuration shown in the configuration example, you must create and apply the **member0-re0**, **member0-re1**, **member1-re0**, and **member1-re1** configuration groups for each member Routing Engine. Each configuration group includes a unique IP address for the management Ethernet interface (**fxp0**) on each Routing Engine.

  NOTE: When you create the preprovisioned Virtual Chassis configuration at the **[edit virtual-chassis]** hierarchy level, make sure you do *not* configure the **no-split-detection** statement to disable detection of a split in the Virtual Chassis. Using the **no-split-detection** statement is prohibited when you configure a Virtual Chassis heartbeat connection, and doing so causes the commit operation to fail.

- Ensure TCP connectivity between the master Routing Engine in the Virtual Chassis master router (VC-Mm) and the master Routing Engine in the Virtual Chassis backup router (VC-Bm).

  The Virtual Chassis heartbeat connection opens a proprietary TCP port numbered 33087 on the VC-Mm to listen for heartbeat messages. If your network design includes firewalls or filters, make sure the network allows traffic between TCP port 33087 on the VC-Mm and the dynamically allocated TCP port on the VC-Bm.

Overview

A *heartbeat connection* is an IP-based, bidirectional packet connection between the master router and backup router in an MX Series Virtual Chassis. The member routers forming the heartbeat connection exchange *heartbeat packets* that provide critical information about the availability and health of each member router. During a disruption or split in the Virtual Chassis configuration, the heartbeat connection prevents the member routers from changing mastership roles unnecessarily, which can cause undesirable results.

This example configures a heartbeat connection for an MX Series Virtual Chassis in which both MX240 member routers reside in the 10.4.0.0 subnet. Member router **caelum** is the global master router for the Virtual Chassis (VC-M), and member router **elnath** is the global backup router (VC-B). Both member routers have dual Routing Engines installed, and the heartbeat connection is configured between the master Routing Engine in **caelum**

(represented by VC-Mm or **member0-re0**) and the master Routing Engine in **elnath** (represented by VC-Bm or **member1-re0**).

Configuring a heartbeat connection for an MX Series Virtual Chassis when both member routers reside in the same subnet consists of the following tasks:

1. Configure the global **master-only** IP address for the **fxp0** management interface on the same subnet as the four Routing Engines in the Virtual Chassis.
2. Configure a network path for the heartbeat connection.

   This example uses a global static route to provide a path for member routers in the same subnet to reach each other via a TCP/IP connection.
3. Configure the global **master-only** IP address for the **fxp0** management interface as the heartbeat address to establish the Virtual Chassis heartbeat connection.
4. (Optional) Configure a nondefault value for the Virtual Chassis heartbeat timeout interval.

Topology

This example configures a heartbeat connection for an MX Series Virtual Chassis with both member routers in the same subnet. For redundancy, each member router is configured with two Virtual Chassis ports.

Table 20 on page 174 shows the hardware and software configuration settings for each MX Series router in the Virtual Chassis.

Table 20: Components of the Sample MX Series Virtual Chassis with Member Routers in Same Subnet

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Subnet
caelum	MX240 router with: • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member0-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member0-re1**)	JN11026AFAFC	0	routing-engine (master)	vcp-1/0/0 vcp-1/1/0	10.4.0.0/16

Table 20: Components of the Sample MX Series Virtual Chassis with Member Routers in Same Subnet *(continued)*

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Subnet
elnath	MX240 router with: • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member1-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member1-re1**)	JN112C2FCAFC	1	routing-engine (backup)	vcp-2/0/0 vcp-2/1/0	10.4.0.0/16

Configuration

To configure a heartbeat connection in an MX Series Virtual Chassis with both member routers in the same subnet, perform these tasks:

- Configuring a Consistent Management IP Address for Each Routing Engine on page 176
- Configuring a Static Route Between the Master and Backup Member Routers on page 178
- Configuring the Heartbeat Address and Heartbeat Timeout on page 179

CLI Quick Configuration

To quickly configure a heartbeat connection for a Virtual Chassis with both member routers in the same subnet, copy the following commands and paste them into the router terminal window:

```
[edit]
set groups member0-re0 interfaces fxp0 unit 0 family inet address 10.4.2.210/16
    master-only
set groups member0-re1 interfaces fxp0 unit 0 family inet address 10.4.2.210/16
    master-only
set groups member1-re0 interfaces fxp0 unit 0 family inet address 10.4.2.210/16
    master-only
set groups member1-re1 interfaces fxp0 unit 0 family inet address 10.4.2.210/16
    master-only
set groups global routing-options static route 10.4.0.0/16 next-hop 10.4.0.1
set groups global routing-options static route 10.4.0.0/16 retain
set groups global routing-options static route 10.4.0.0/16 no-readvertise
set virtual-chassis heartbeat-address 10.4.2.210
set virtual-chassis heartbeat-timeout 20
```

Configuring a Consistent Management IP Address for Each Routing Engine

Step-by-Step Procedure

In addition to configuring a unique IP address for the **fxp0** management interface on each Routing Engine when you first set up the Virtual Chassis, you must configure an additional management IP address, known as the **master-only** address, to ensure consistent access to the **fxp0** management interface on the master Routing Engine in the Virtual Chassis master router (VC-Mm, represented by **member0-re0** in this example). You then use the **master-only** address as the heartbeat address to establish the Virtual Chassis heartbeat connection.

Because the Virtual Chassis member routers in this example both reside in the same subnet (10.4.0.0), you can configure the same **master-only** address for each Routing Engine. The **master-only** address is active only on the management interface for the VC-Mm. During a switchover, the **master-only** address moves to the new Routing Engine currently functioning as the VC-Mm.

To configure the **master-only fxp0** IP address for each Routing Engine:

- From the console on member 0, configure the same IP address for the **fxp0** management interface on each Routing Engine.

```
{master:member0-re0}[edit]
user@caelum# set groups member0-re0 interfaces fxp0 unit 0 family inet address
  10.4.2.210/16 master-only
user@caelum# set groups member0-re1 interfaces fxp0 unit 0 family inet address
  10.4.2.210/16 master-only
user@caelum# set groups member1-re0 interfaces fxp0 unit 0 family inet address
  10.4.2.210/16 master-only
user@caelum# set groups member1-re1 interfaces fxp0 unit 0 family inet address
  10.4.2.210/16 master-only
```

Results

From the console on the Virtual Chassis master router, display the results of the configuration for each configuration group. For brevity, portions of the configuration unrelated to this procedure are replaced by an ellipsis (...).

For **member0-re0**:

```
{master:member0-re0}[edit]
user@caelum# show groups member0-re0
system {
   host-name caelum;
   backup-router 10.4.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
}
interfaces {
   fxp0 {
      unit 0 {
         family inet {
            address 10.4.2.100/16;
            address 10.4.2.210/16 {
               master-only;
            }
         }
      }
```

```
    }
  }
```

For **member0-re1**:

```
  {master:member0-re0}[edit]
  user@caelum# show groups member0-re1
  system {
    host-name caelum1;
    backup-router 10.4.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
  }
  interfaces {
    fxp0 {
      unit 0 {
        family inet {
          address 10.4.2.101/16;
          address 10.4.2.210/16 {
            master-only;
          }
        }
      }
    }
  }
```

For **member1-re0**:

```
  {master:member0-re0}[edit]
  user@caelum# show groups member1-re0
  system {
    host-name elnath;
    backup-router 10.4.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
  }
  interfaces {
    fxp0 {
      unit 0 {
        family inet {
          address 10.4.3.101/16;
          address 10.4.2.210/16 {
            master-only;
          }
        }
      }
    }
  }
```

For **member1-re1**:

```
  {master:member0-re0}[edit]
  user@caelum# show groups member1-re1
  system {
    host-name elnath1;
    backup-router 10.4.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
  }
  interfaces {
    fxp0 {
      unit 0 {
        family inet {
```

```
            address 10.4.3.102/16;
            address 10.4.2.210/16 {
              master-only;
            }
          }
        }
      }
    }
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring a Static Route Between the Master and Backup Member Routers

Step-by-Step Procedure

You must configure a secure and reliable path between the master router and backup router for the exchange of TCP/IP heartbeat packets. The heartbeat packets provide critical information about the availability and health of each member router.

The route you create for the heartbeat connection must be independent of the Virtual Chassis port links. Specifically, you must ensure that the master Routing Engine in the Virtual Chassis backup router (VC-Bm) can make a TCP/IP connection to the **master-only** IP address of the master Routing Engine in the Virtual Chassis master router (VC-Mm).

This examples creates a global static route between the member routers to configure the heartbeat path. However, you can choose the method that best meets your needs to configure the heartbeat path for member routers in the same subnet. For example, you might use the member router's default gateway for this purpose.

BEST PRACTICE: We recommend that you use the router management interface (fxp0) as the heartbeat path. The management interface is generally available earlier than the line card interfaces, and is typically connected to a more secure network than the other interfaces.

To create a static route between the master and backup member routers:

- From the console on member 0, configure a static route between the member routers in subnet 10.4.0.0.

```
{master:member0-re0}[edit]
user@caelum# set groups global routing-options static route 10.4.0.0/16 next-hop
  10.4.0.1
user@caelum# set groups global routing-options static route 10.4.0.0/16 retain
user@caelum# set groups global routing-options static route 10.4.0.0/16
  no-readvertise
```

Results

Display the results of the configuration. For brevity, portions of the configuration unrelated to this procedure are replaced by an ellipsis (...).

```
{master:member0-re0}[edit]
user@caelum# show groups global routing-options static
route 10.4.0.0/16 {
  next-hop 10.4.0.1;
```

```
    retain;
    no-readvertise;
}
...
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring the Heartbeat Address and Heartbeat Timeout

Step-by-Step Procedure

To establish the heartbeat connection in a two-member MX Series Virtual Chassis, you must configure the IP address for the connection between the master and backup member routers. To ensure consistent access to the master Routing Engine in the Virtual Chassis master router (VC-Mm) regardless of which Routing Engine is currently active, you set the heartbeat address to the previously configured global **master-only** IP address for the **fxp0** management interface.

Optionally, you can also configure a nondefault value for the heartbeat timeout interval. The heartbeat timeout is the maximum time within which a Virtual Chassis member router must respond to a heartbeat packet sent by the other member router. If you do not explicitly configure the heartbeat timeout interval, the default value (2 seconds) applies.

To configure the heartbeat address and heartbeat timeout:

1. From the console on member 0, specify that you want to edit the Virtual Chassis preprovisioned configuration.

   ```
   {master:member0-re0}[edit]
   user@caelum# edit virtual-chassis
   ```

2. Configure the common **master-only** IP address for the **fxp0** management interface as the heartbeat address.

   ```
   {master:member0-re0}[edit virtual-chassis]
   user@caelum# set heartbeat-address 10.4.2.210
   ```

3. (Optional) Configure a nondefault value for the heartbeat timeout interval.

   ```
   {master:member0-re0}[edit virtual-chassis]
   user@caelum# set heartbeat-timeout 20
   ```

Results

Display the results of the configuration.

```
{master:member0-re0}[edit]
user@caelum# show virtual-chassis
preprovisioned;
traceoptions {
    file VCCP size 100m;
    flag all;
}
heartbeat-address 10.4.2.210;
heartbeat-timeout 20;
member 0 {
    role routing-engine;
    serial-number JN11026AFAFC;
}
```

```
member 1 {
  role routing-engine;
  serial-number JN112C2FCAFC;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

To confirm that the Virtual Chassis heartbeat connection is working properly, perform these tasks:

- Verifying the Virtual Chassis Heartbeat Connection on page 180
- Verifying Use of the Heartbeat Connection During an Adjacency Split or Disruption on page 180
- Verifying Virtual Chassis Member Health from Heartbeat Statistics on page 181

Verifying the Virtual Chassis Heartbeat Connection

Purpose Verify that the heartbeat connection between the Virtual Chassis member routers is properly configured and operational.

Action Display the state of one or both member routers when a heartbeat connection is configured.

```
{master:member0-re0}

user@caelum> show virtual-chassis heartbeat
member0:
--------------------------------------------------------------------------
Local        Remote          State        Time
10.4.2.210   10.4.3.101      Alive        2014-02-18 11:18:14 PST

member1:
--------------------------------------------------------------------------
Local        Remote          State        Time
10.4.3.101   10.4.2.210      Alive        2014-02-18 11:18:15 PST
```

Meaning For each member router, the command output displays the IP addresses of the local and remote member routers that form the heartbeat connection. The value **Alive** in the **State** field confirms that the master Routing Engine in the specified member router is connected and has received a heartbeat response message. The **Time** field specifies the date and time of the last connection state change.

Verifying Use of the Heartbeat Connection During an Adjacency Split or Disruption

Purpose Verify use of the heartbeat connection when an adjacency disruption or split is detected in the Virtual Chassis.

Action Display the status of the member routers in the Virtual Chassis:

```
{master:member0-re0}

user@caelum> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: 4806.94d6.2362
                                                Mastership           Neighbor List
Member ID       Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Heartbt  JN11026AFAFC mx240          129  Master*    1  vcp-1/0/0
                                                                     1  vcp-1/1/0

1 (FPC  12- 23) Prsnt    JN112C2FCAFC mx240          129  Backup     0  vcp-2/0/0
                                                                     0  vcp-2/1/0
```

Meaning The **Status** field for member ID 0 displays **Heartbt**, which indicates that this member router has used the heartbeat packet connection to maintain mastership roles during an adjacency disruption or split in the Virtual Chassis configuration. The **Status** field for member ID 1 displays **Prsnt**, which indicates that this member router is connected to the Virtual Chassis.

If a router is not currently connected to the Virtual Chassis, the **Status** field displays **NotPrsnt**.

Verifying Virtual Chassis Member Health from Heartbeat Statistics

Purpose Use statistics collected by the heartbeat connection to verify the availability and health of each Virtual Chassis member router. You can also use the **show virtual-chassis heartbeat detail** command to determine the maximum latency and minimum latency in your network.

Action Display and review the statistics collected by the heartbeat connection.

```
{master:member0-re0}

user@caelum> show virtual-chassis heartbeat detail
member0:
--------------------------------------------------------------------------
Local           Remote          State        Time
10.4.2.210      10.4.3.101      Alive        2014-02-18 11:18:14 PST

Heartbeat statistics
  Heartbeats sent: 10079
  Heartbeats received: 10079
  Heartbeats lost/missed: 0
  Last time sent: 2014-02-18 20:03:10 PST (00:00:00 ago)
  Last time received: 2014-02-18 20:03:10 PST (00:00:00 ago)
  Maximum latency (secs): 0
  Minimum latency (secs): 0

member1:
--------------------------------------------------------------------------
Local           Remote          State        Time
10.4.3.101      10.4.2.210      Alive        2014-02-18 11:18:15 PST

Heartbeat statistics
  Heartbeats sent: 10083
  Heartbeats received: 10083
  Heartbeats lost/missed: 0
  Last time sent: 2014-02-18 20:03:09 PST (00:00:01 ago)
  Last time received: 2014-02-18 20:03:09 PST (00:00:01 ago)
  Maximum latency (secs): 0
  Minimum latency (secs): 0
```

Meaning In this example, the number of heartbeat request messages sent (**Heartbeats sent**) equals the number of heartbeat response messages received (**Heartbeats received**), with no heartbeat messages lost (**Heartbeats lost/missed**). This indicates that both member routers forming the heartbeat connection were available and operational. Any difference between **Heartbeats sent** and **Heartbeats received** appears in the **Heartbeats lost/missed** field.

The **Maximum latency** and **Minimum latency** fields measure the maximum and minimum number of seconds that elapse on the local router between trasnmission of a heartbeat request message and receipt of a heartbeat response message. In this example, the value **0** in the **Maximum latency** and **Minimum latency** fields indicates that there is no measurable network delay caused by this operation. You can use the **Maximum latency** value to determine whether you need to increase the **heartbeat-timeout** to a value higher than the default (2 seconds). If the maximum latency in your network is too high to accommodate a 2-second **heartbeat-timeout** value, increasing the **heartbeat-timeout** interval enables you to account for network delay when a Virtual Chassis adjacency disruption or split occurs.

Related Documentation

- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Virtual Chassis Heartbeat Connection Overview on page 39
- Global Roles and Local Roles in a Virtual Chassis on page 29
- *Configuring a Consistent Management IP Address*

Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets

A *heartbeat connection* is an IP-based, bidirectional packet connection in an MX Series Virtual Chassis between the Virtual Chassis master and backup routers. The *heartbeat packets* exchanged over this connection provide critical information about the availability and health of each member router.

This example describes how to configure a heartbeat connection in an MX Series Virtual Chassis when the member routers reside in different subnets. For information about configuring a heartbeat connection when the Virtual Chassis member routers reside in the same subnet, see "Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet" on page 172.

- Requirements on page 183
- Overview on page 184
- Configuration on page 186
- Verification on page 195

Requirements

This example uses the following software and hardware components:

- Junos OS Release 14.1 and later releases
- One MX240 3D Universal Edge Router
- One MX480 3D Universal Edge Router

This configuration example has been tested using the software release listed and is assumed to work on all later releases.

BEST PRACTICE: We recommend that you use the **commit synchronize** command to save any configuration changes to the Virtual Chassis. For an MX Series Virtual Chassis, the **force** option is the default and only behavior when you issue the **commit synchronize** command. Issuing the **commit synchronize** command for an MX Series Virtual Chassis configuration has the same effect as issuing the **commit synchronize force** command.

Before you configure a heartbeat connection for a Virtual Chassis:

- Configure a Virtual Chassis consisting of two MX Series routers.

  See "Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis" on page 69

  As part of the preprovisioned Virtual Chassis configuration shown in the configuration example, you must create and apply the **member0-re0**, **member0-re1**, **member1-re0**, and **member1-re1** configuration groups for each member Routing Engine. Each configuration group includes a unique IP address for the management Ethernet interface (**fxp0**) on each Routing Engine.

  NOTE: **When you create the preprovisioned Virtual Chassis configuration at the [edit virtual-chassis] hierarchy level, make sure you do *not* configure the no-split-detection statement to disable detection of a split in the Virtual Chassis. Using the no-split-detection statement is prohibited when you configure a Virtual Chassis heartbeat connection, and doing so causes the commit operation to fail.**

- Ensure TCP connectivity between the master Routing Engine in the Virtual Chassis master router (VC-Mm) and the master Routing Engine in the Virtual Chassis backup router (VC-Bm).

  The Virtual Chassis heartbeat connection opens a proprietary TCP port numbered 33087 on the VC-Mm to listen for heartbeat messages. If your network design includes firewalls or filters, make sure the network allows traffic between TCP port 33087 on the VC-Mm and the dynamically allocated TCP port on the VC-Bm.

Overview

A *heartbeat connection* is an IP-based, bidirectional packet connection between the master router and backup router in an MX Series Virtual Chassis. The member routers forming the heartbeat connection exchange *heartbeat packets* that provide critical information about the availability and health of each member router. During a disruption or split in the Virtual Chassis configuration, the heartbeat connection prevents the member routers from changing mastership roles unnecessarily, which can cause undesirable results.

This example configures a heartbeat connection for an MX Series Virtual Chassis in which the two member routers, each with dual Routing Engines installed, reside in different subnets. Member router **gladius** resides in subnet 10.4.0.0/16 and is the global master router for the Virtual Chassis (VC-M). Member router **trefoil** resides in subnet 10.5.0.0/16 and is the global backup router (VC-B) for the Virtual Chassis. The heartbeat connection is configured between the master Routing Engine in **gladius** (represented by VC-Mm or **member0-re0**) and the master Routing Engine in **trefoil** (represented by VC-Bm or **member1-re0**).

Configuring a heartbeat connection for an MX Series Virtual Chassis when the member routers reside in different subnets consists of the following tasks:

1. Configure two **master-only** IP addresses for the **fxp0** management interface: one for the member routers in subnet 10.4.0.0, and a diffferent address for the member routers in subnet 10.5.0.0.
2. Configure a network path for the heartbeat connection to ensure that both member routers can reach each other's networks.

   This example creates static routes to both subnet 10.4.0.0 and subnet 10.5.0.0 on each member router.
3. Configure the Virtual Chassis heartbeat address for each member Routing Engine to cross-connect to the **master-only** IP address for the corresponding member Routing Engine in the other subnet.
4. (Optional) Configure a nondefault value for the Virtual Chassis heartbeat timeout interval.

To establish the heartbeat connection in a two-member MX Series Virtual Chassis, you must configure the heartbeat address to establish the connection between the master and backup member routers. To ensure consistent access to the master Routing Engine in the Virtual Chassis master router (VC-Mm) regardless of which Routing Engine is currently active, you set the heartbeat address to the previously configured **master-only** IP address for the **fxp0** management interface.

Because the Virtual Chassis member routers in this example are in different subnets, you must configure a heartbeat address for each Routing Engine to enable a cross-connection to the **master-only** IP address for the corresponding Routing Engine in the other subnet, as shown in Table 21 on page 185:

Table 21: Heartbeat Cross-Connections for Member Routers in Different Subnets

Routing Engine	Subnet	Cross-connected Routing Engine	Heartbeat Address
member0-re0	10.4.0.0/16	**member1-re0**	10.5.2.210
member0-re1	10.4.0.0/16	**member1-re1**	10.5.2.210
member1-re0	10.5.0.0/16	**member0-re0**	10.4.2.210
member1-re1	10.5.0.0/16	**member0-re1**	10.4.2.210

Topology

This example configures a heartbeat connection for an MX Series Virtual Chassis with member routers residing in different subnets. For redundancy, each member router is configured with two Virtual Chassis ports.

Table 22 on page 186 shows the hardware and software configuration settings for each MX Series router in the Virtual Chassis.

Table 22: Components of the Sample MX Series Virtual Chassis with Member Routers in Different Subnets

Router Name	Hardware	Serial Number	Member ID	Role	Virtual Chassis Ports	Subnet
gladius	MX240 router with: • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member0-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member0-re1**)	JN10C7135AFC	0	routing-engine (master)	vcp-2/2/0 vcp-2/3/0	10.4.0.0/16
trefoil	MX480 router with: • Master RE-S-2000 Routing Engine in slot 0 (represented in example as **member1-re0**) • Backup RE-S-2000 Routing Engine in slot 1 (represented in example as **member1-re1**)	JN115D117AFB	1	routing-engine (backup)	vcp-2/0/0 vcp-5/2/0	10.5.0.0/16

Configuration

To configure a heartbeat connection in an MX Series Virtual Chassis with member routers in different subnets, perform these tasks:

- Configuring a Consistent Management IP Address for Each Routing Engine on page 187
- Configuring Static Routes for Both Subnets on Each Routing Engine on page 190
- Configuring the Heartbeat Address and Heartbeat Timeout on page 193

CLI Quick Configuration

To quickly configure a heartbeat connection for a Virtual Chassis with with member routers in different subnets, copy the following commands and paste them into the router terminal window:

```
[edit]
set groups member0-re0 interfaces fxp0 unit 0 family inet address 10.4.2.210/16
    master-only
set groups member0-re1 interfaces fxp0 unit 0 family inet address 10.4.2.210/16
    master-only
set groups member1-re0 interfaces fxp0 unit 0 family inet address 10.5.2.210/16
    master-only
set groups member1-re1 interfaces fxp0 unit 0 family inet address 10.5.2.210/16
    master-only
set groups member0-re0 routing-options static route 10.4.0.0/16 next-hop 10.4.0.1
set groups member0-re0 routing-options static route 10.4.0.0/16 retain
```

```
set groups member0-re0 routing-options static route 10.4.0.0/16 no-readvertise
set groups member0-re0 routing-options static route 10.5.0.0/16 next-hop 10.4.0.1
set groups member0-re0 routing-options static route 10.5.0.0/16 retain
set groups member0-re0 routing-options static route 10.5.0.0/16 no-readvertise
set groups member0-re1 routing-options static route 10.4.0.0/16 next-hop 10.4.0.1
set groups member0-re1 routing-options static route 10.4.0.0/16 retain
set groups member0-re1 routing-options static route 10.4.0.0/16 no-readvertise
set groups member0-re1 routing-options static route 10.5.0.0/16 next-hop 10.4.0.1
set groups member0-re1 routing-options static route 10.5.0.0/16 retain
set groups member0-re1 routing-options static route 10.5.0.0/16 no-readvertise
set groups member1-re0 routing-options static route 10.5.0.0/16 next-hop 10.5.0.1
set groups member1-re0 routing-options static route 10.5.0.0/16 retain
set groups member1-re0 routing-options static route 10.5.0.0/16 no-readvertise
set groups member1-re0 routing-options static route 10.4.0.0/16 next-hop 10.5.0.1
set groups member1-re0 routing-options static route 10.4.0.0/16 retain
set groups member1-re0 routing-options static route 10.4.0.0/16 no-readvertise
set groups member1-re1 routing-options static route 10.5.0.0/16 next-hop 10.5.0.1
set groups member1-re1 routing-options static route 10.5.0.0/16 retain
set groups member1-re1 routing-options static route 10.5.0.0/16 no-readvertise
set groups member1-re1 routing-options static route 10.4.0.0/16 next-hop 10.5.0.1
set groups member1-re1 routing-options static route 10.4.0.0/16 retain
set groups member1-re1 routing-options static route 10.4.0.0/16 no-readvertise
set groups member0-re0 virtual-chassis heartbeat-address 10.5.2.210
set groups member0-re1 virtual-chassis heartbeat-address 10.5.2.210
set groups member1-re0 virtual-chassis heartbeat-address 10.4.2.210
set groups member1-re1 virtual-chassis heartbeat-address 10.4.2.210
set virtual-chassis heartbeat-timeout 10
```

Configuring a Consistent Management IP Address for Each Routing Engine

Step-by-Step Procedure

In addition to configuring a unique IP address for the **fxp0** management interface on each Routing Engine when you first set up the Virtual Chassis, you must configure additional management IP addresses, known as the **master-only** address, to ensure consistent access to the **fxp0** management interface on the master Routing Engine in the Virtual Chassis master router (VC-Mm). The **master-only** address is active only on the management interface for the VC-Mm. During a switchover, the **master-only** address moves to the new Routing Engine currently functioning as the VC-Mm.

Because the Virtual Chassis master router and backup router in this example reside in different subnets, you must configure two different **master-only** IP addresses: one for the Routing Engines in subnet 10.4.0.0/16 (**member0-re0** and **member0-re1**), and one for the Routing Engines in subnet 10.5.0.0/16 (**member1-re0** and **member1-re1**). You then configure these **master-only** addresses as the subnet-specific heartbeat addresses to establish the heartbeat connection. For more information about the cross-connections in this example, see Table 21 on page 185.

To configure the master-only **fxp0** IP address for each Routing Engine:

1. From the console on member 0, configure the IP address for the **fxp0** management interface for the Routing Engines in subnet 10.4.0.0/16.

```
{master:member0-re0}[edit]
user@gladius# set groups member0-re0 interfaces fxp0 unit 0 family inet address
  10.4.2.210/16 master-only
```

```
user@gladius# set groups member0-re1 interfaces fxp0 unit 0 family inet address
  10.4.2.210/16 master-only
```

2. From the console on member 0, configure the IP address for the **fxp0** management interface for the Routing Engines in subnet 10.5.0.0/16.

```
{master:member0-re0}[edit]
user@gladius# set groups member1-re0 interfaces fxp0 unit 0 family inet address
  10.5.2.210/16 master-only
user@gladius# set groups member1-re1 interfaces fxp0 unit 0 family inet address
  10.5.2.210/16 master-only
```

Results From the console on the Virtual Chassis master router, display the results of the configuration. For brevity, portions of the configuration unrelated to this procedure are replaced by an ellipsis (...).

For **member0-re0**:

```
{master:member0-re0}[edit]
user@gladius# show groups member0-re0
system {
  host-name gladius;
  backup-router 10.4.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
}
interfaces {
  fxp0 {
    unit 0 {
      family inet {
        address 10.4.2.100/16;
        address 10.4.2.210/16 {
          master-only;
        }
      }
    }
  }
}
```

For **member0-re1**:

```
{master:member0-re0}[edit]
user@gladius# show groups member0-re1
system {
  host-name gladius1;
  backup-router 10.4.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
}
interfaces {
  fxp0 {
    unit 0 {
      family inet {
        address 10.4.2.101/16;
        address 10.4.2.210/16 {
          master-only;
        }
      }
    }
  }
```



```
}
```

For **member1-re0**:

```
{master:member0-re0}[edit]
user@gladius# show groups member1-re0
system {
    host-name trefoil;
    backup-router 10.5.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
}
interfaces {
    fxp0 {
        unit 0 {
            family inet {
                address 10.5.3.101/16;
                address 10.5.2.210/16 {
                    master-only;
                }
            }
        }
    }
}
```

For **member1-re1**:

```
{master:member0-re0}[edit]
user@gladius# show groups member1-re1
system {
    host-name trefoil1;
    backup-router 10.5.0.1 destination [ 172.16.0.0/12 ... 10.204.0.0/16 ];
}
interfaces {
    fxp0 {
        unit 0 {
            family inet {
                address 10.5.3.102/16;
                address 10.5.2.210/16 {
                    master-only;
                }
            }
        }
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring Static Routes for Both Subnets on Each Routing Engine

Step-by-Step Procedure

You must configure secure and reliable routes for subnets 10.4.0.0/16 and 10.5.0.0/16 on each Routing Engine for the exchange of TCP/IP heartbeat packets. The heartbeat packets provide critical information about the availability and health of each member router.

The routes you configure for the heartbeat connection must be independent of the Virtual Chassis port links. Specifically, you must ensure that the master Routing Engine in the Virtual Chassis backup router (VC-Bm) can make a TCP/IP connection to the **master-only** IP address of the master Routing Engine in the Virtual Chassis master router (VC-Mm).

This examples creates static routes to both subnets on each member Routing Engine to configure the heartbeat path. However, you can choose the method that best meets your needs to configure the heartbeat path for member routers in different subnets.

BEST PRACTICE: We recommend that you use the router management interface (**fxp0**) as the heartbeat path. The management interface is generally available earlier than the line card interfaces, and is typically connected to a more secure network than the other interfaces.

To create static routes for subnets 10.4.0.0/16 and 10.5.0.0/16 on each Routing Engine:

1. Log in to the console on member 0 (Virtual Chassis master router).
2. Configure the static routes for **member0-re0**.

```
{master:member0-re0}[edit]
user@gladius# set groups member0-re0 routing-options static route 10.4.0.0/16
  next-hop 10.4.0.1
user@gladius# set groups member0-re0 routing-options static route 10.4.0.0/16
  retain
user@gladius# set groups member0-re0 routing-options static route 10.4.0.0/16
  no-readvertise
user@gladius# set groups member0-re0 routing-options static route 10.5.0.0/16
  next-hop 10.4.0.1
user@gladius# set groups member0-re0 routing-options static route 10.5.0.0/16
  retain
user@gladius# set groups member0-re0 routing-options static route 10.5.0.0/16
  no-readvertise
```

3. Configure the static routes for **member0-re1**.

```
{master:member0-re0}[edit]
user@gladius# set groups member0-re1 routing-options static route 10.4.0.0/16
  next-hop 10.4.0.1
user@gladius# set groups member0-re1 routing-options static route 10.4.0.0/16
  retain
user@gladius# set groups member0-re1 routing-options static route 10.4.0.0/16
  no-readvertise
user@gladius# set groups member0-re1 routing-options static route 10.5.0.0/16
  next-hop 10.4.0.1
```

```
user@gladius# set groups member0-re1 routing-options static route 10.5.0.0/16
  retain
user@gladius# set groups member0-re1 routing-options static route 10.5.0.0/16
  no-readvertise
```

4. Configure the static routes for **member1-re0**.

```
{master:member0-re0}[edit]
user@gladius# set groups member1-re0 routing-options static route 10.5.0.0/16
  next-hop 10.5.0.1
user@gladius# set groups member1-re0 routing-options static route 10.5.0.0/16
  retain
user@gladius# set groups member1-re0 routing-options static route 10.5.0.0/16
  no-readvertise
user@gladius# set groups member1-re0 routing-options static route 10.4.0.0/16
  next-hop 10.5.0.1
user@gladius# set groups member1-re0 routing-options static route 10.4.0.0/16
  retain
user@gladius# set groups member1-re0 routing-options static route 10.4.0.0/16
  no-readvertise
```

5. Configure the static routes for **member1-re1**.

```
{master:member0-re0}[edit]
user@gladius# set groups member1-re1 routing-options static route 10.5.0.0/16
  next-hop 10.5.0.1
user@gladius# set groups member1-re1 routing-options static route 10.5.0.0/16
  retain
user@gladius# set groups member1-re1 routing-options static route 10.5.0.0/16
  no-readvertise
user@gladius# set groups member1-re1 routing-options static route 10.4.0.0/16
  next-hop 10.5.0.1
user@gladius# set groups member1-re1 routing-options static route 10.4.0.0/16
  retain
user@gladius# set groups member1-re1 routing-options static route 10.4.0.0/16
  no-readvertise
```

Results Display the results of the configuration. For brevity, portions of the configuration unrelated to this procedure are replaced by an ellipsis (...).

For **member0-re0**:

```
{master:member0-re0}[edit]
user@gladius# show groups member0-re0 routing-options static
route 10.4.0.0/16 {
    next-hop 10.4.0.1;
    retain;
    no-readvertise;
}
route 10.5.0.0/16 {
    next-hop 10.4.0.1;
    retain;
    no-readvertise;
}
...
```

For **member0-re1**:

```
{master:member0-re0}[edit]
user@gladius# show groups member0-re1 routing-options static
route 10.4.0.0/16 {
    next-hop 10.4.0.1;
    retain;
    no-readvertise;
}
route 10.5.0.0/16 {
    next-hop 10.4.0.1;
    retain;
    no-readvertise;
}
...
```

For **member1-re0**:

```
{master:member0-re0}[edit]
user@gladius# show groups member1-re0 routing-options static
route 10.5.0.0/16 {
    next-hop 10.5.0.1;
    retain;
    no-readvertise;
}
route 10.4.0.0/16 {
    next-hop 10.5.0.1;
    retain;
    no-readvertise;
}
...
```

For **member1-re1**:

```
{master:member0-re0}[edit]
user@gladius# show groups member1-re1 routing-options static
route 10.5.0.0/16 {
    next-hop 10.5.0.1;
    retain;
    no-readvertise;
}
route 10.4.0.0/16 {
    next-hop 10.5.0.1;
    retain;
    no-readvertise;
}
...
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring the Heartbeat Address and Heartbeat Timeout

Step-by-Step Procedure

To enable cross-connection between Virtual Chassis member routers in different subnets, you configure 10.5.2.210, which is the **master-only** IP address for the Routing Engines in subnet 10.5.0.0/16, as the heartbeat address for the Routing Engines in subnet 10.4.0.0/16 (**member0-re0** and **member0-re1**). Conversely, you configure 10.4.2.210, which is the **master-only** IP address for the Routing Engines in subnet 10.4.0.0/16, as the heartbeat address for the Routing Engines in subnet 10.5.0.0/16 (**member1-re0** and **member1-re1**). For more information about the cross-connections in this example, see Table 21 on page 185.

Optionally, you can also configure a nondefault value for the heartbeat timeout interval. The heartbeat timeout is the maximum time within which a Virtual Chassis member router must respond to a heartbeat packet sent by the other member router. If you do not explicitly configure the heartbeat timeout interval, the default value (2 seconds) applies.

To configure the heartbeat address and heartbeat timeout:

1. Log in to the console on member 0 (Virtual Chassis master router).
2. Configure the heartbeat address for each Routing Engine.

```
{master:member0-re0}[edit]
user@gladius# set groups member0-re0 virtual-chassis heartbeat-address 10.5.2.210
user@gladius# set groups member0-re1 virtual-chassis heartbeat-address 10.5.2.210
user@gladius# set groups member1-re0 virtual-chassis heartbeat-address 10.4.2.210
user@gladius# set groups member1-re1 virtual-chassis heartbeat-address 10.4.2.210
```

3. (Optional) Configure a nondefault value for the heartbeat timeout interval.

```
{master:member0-re0}[edit]
user@gladius# set virtual-chassis heartbeat-timeout 10
```

Results

Display the results of the configuration.

For **member0-re0**:

```
{master:member0-re0}[edit]
user@gladius# show groups member0-re0 virtual-chassis
preprovisioned;
traceoptions {
    file VCCP size 100m;
    flag all;
}
heartbeat-address 10.5.2.210;
heartbeat-timeout 10;
member 0 {
    role routing-engine;
    serial-number JN10C7135AFC;
}
member 1 {
    role routing-engine;
    serial-number JN115D117AFB;
}
```

For **member0-re1**:

```
{master:member0-re0}[edit]
user@gladius# show groups member0-re1 virtual-chassis
preprovisioned;
traceoptions {
    file VCCP size 100m;
    flag all;
}
heartbeat-address 10.5.2.210;
heartbeat-timeout 10;
member 0 {
    role routing-engine;
    serial-number JN10C7135AFC;
}
member 1 {
    role routing-engine;
    serial-number JN115D117AFB;
}
```

For **member1-re0**:

```
{master:member0-re0}[edit]
user@gladius# show groups member1-re0 virtual-chassis
preprovisioned;
traceoptions {
    file VCCP size 100m;
    flag all;
}
heartbeat-address 10.4.2.210;
heartbeat-timeout 10;
member 0 {
    role routing-engine;
    serial-number JN10C7135AFC;
}
member 1 {
    role routing-engine;
    serial-number JN115D117AFB;
}
```

For **member1-re1**:

```
{master:member0-re0}[edit]
user@gladius# show groups member1-re1 virtual-chassis
preprovisioned;
traceoptions {
    file VCCP size 100m;
    flag all;
}
heartbeat-address 10.4.2.210;
heartbeat-timeout 10;
member 0 {
    role routing-engine;
    serial-number JN10C7135AFC;
}
member 1 {
    role routing-engine;
```

```
    serial-number JN115D117AFB;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

To confirm that the Virtual Chassis heartbeat connection is working properly, perform these tasks:

- Verifying the Virtual Chassis Heartbeat Connection on page 195
- Verifying Use of the Heartbeat Connection During an Adjacency Split or Disruption on page 195
- Verifying Virtual Chassis Member Health from Heartbeat Statistics on page 196

Verifying the Virtual Chassis Heartbeat Connection

Purpose Verify that the heartbeat connection between the Virtual Chassis member routers is properly configured and operational.

Action Display the state of one or both member routers when a heartbeat connection is configured.

```
{master:member0-re0}

user@gladius> show virtual-chassis heartbeat
member0:
--------------------------------------------------------------------------
Local        Remote          State        Time
10.4.2.210   10.5.3.101      Alive        2014-03-18 10:18:14 PST

member1:
--------------------------------------------------------------------------
Local        Remote          State        Time
10.5.3.101   10.4.2.210      Alive        2014-03-18 10:18:15 PST
```

Meaning For each member router, the command output displays the IP addresses of the local and remote member routers that form the heartbeat connection. The value **Alive** in the **State** field confirms that the master Routing Engine in the specified member router is connected and has received a heartbeat response message. The **Time** field specifies the date and time of the last connection state change.

Verifying Use of the Heartbeat Connection During an Adjacency Split or Disruption

Purpose Verify use of the heartbeat connection when an adjacency disruption or split is detected in the Virtual Chassis.

Action Display the status of the member routers in the Virtual Chassis:

```
{master:member0-re0}

user@gladius> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: a5b6.be0c.9525
                                                Mastership           Neighbor List
Member ID       Status   Serial No    Model    priority    Role      ID  Interface

0 (FPC   0- 11) Heartbt  JN10C7135AFC mx240          129  Master*    1  vcp-2/2/0
                                                                     1  vcp-2/3/0

1 (FPC  12- 23) Prsnt    JN115D117AFB mx480          129  Backup     0  vcp-2/0/0
                                                                     0  vcp-5/2/0
```

Meaning The **Status** field for member ID 0 displays **Heartbt**, which indicates that this member router has used the heartbeat packet connection to maintain mastership roles during an adjacency disruption or split in the Virtual Chassis configuration. The **Status** field for member ID 1 displays **Prsnt**, which indicates that this member router is connected to the Virtual Chassis.

If a router is not currently connected to the Virtual Chassis, the **Status** field displays **NotPrsnt**.

Verifying Virtual Chassis Member Health from Heartbeat Statistics

Purpose Use statistics collected by the heartbeat connection to verify the availability and health of each Virtual Chassis member router. You can also use the **show virtual-chassis heartbeat detail** command to determine the maximum latency and minimum latency in your network.

Action Display and review the statistics collected by the heartbeat connection.

```
{master:member0-re0}

user@gladius> show virtual-chassis heartbeat detail
member0:
--------------------------------------------------------------------------
Local           Remote          State        Time
10.4.2.210      10.5.3.101      Alive        2014-03-18 10:18:14 PST

Heartbeat statistics
  Heartbeats sent: 10079
  Heartbeats received: 10079
  Heartbeats lost/missed: 0
  Last time sent: 2014-03-18 20:03:10 PST (00:00:00 ago)
  Last time received: 2014-03-18 20:03:10 PST (00:00:00 ago)
  Maximum latency (secs): 0
  Minimum latency (secs): 0

member1:
--------------------------------------------------------------------------
Local           Remote          State        Time
10.5.3.101      10.4.2.210      Alive        2014-03-18 10:18:15 PST

Heartbeat statistics
  Heartbeats sent: 10083
  Heartbeats received: 10083
  Heartbeats lost/missed: 0
  Last time sent: 2014-02-18 20:03:09 PST (00:00:01 ago)
  Last time received: 2014-02-18 20:03:09 PST (00:00:01 ago)
  Maximum latency (secs): 0
  Minimum latency (secs): 0
```

Meaning In this example, the number of heartbeat request messages sent (**Heartbeats sent**) equals the number of heartbeat response messages received (**Heartbeats received**), with no heartbeat messages lost (**Heartbeats lost/missed**). This indicates that both member routers forming the heartbeat connection are available and operational. Any difference between **Heartbeats sent** and **Heartbeats received** appears in the **Heartbeats lost/missed** field.

The **Maximum latency** and **Minimum latency** fields measure the maximum and minimum number of seconds that elapse on the local router between transmission of a heartbeat request message and receipt of a heartbeat response message. In this example, the value **0** in the **Maximum latency** and **Minimum latency** fields indicates that there is no measurable network delay caused by this operation. You can use the **Maximum latency** value to determine whether you need to increase the **heartbeat-timeout** to a value higher than the default (2 seconds). If the maximum latency in your network is too high to accommodate a 2-second **heartbeat-timeout** value, increasing the **heartbeat-timeout** interval enables you to account for network delay when a Virtual Chassis adjacency disruption or split occurs.

Related Documentation

- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172

- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Virtual Chassis Heartbeat Connection Overview on page 39
- Global Roles and Local Roles in a Virtual Chassis on page 29
- *Configuring a Consistent Management IP Address*

CHAPTER 11

Tracing Virtual Chassis Operations for Troubleshooting Purposes

- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Configuring the Name of the Virtual Chassis Trace Log File on page 201
- Configuring Characteristics of the Virtual Chassis Trace Log File on page 201
- Configuring Access to the Virtual Chassis Trace Log File on page 202
- Using Regular Expressions to Refine the Output of the Virtual Chassis Trace Log File on page 203
- Configuring the Virtual Chassis Operations to Trace on page 204

Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers

The Junos OS trace feature tracks Virtual Chassis operations and records events in a log file. The error descriptions captured in the log file provide detailed information to help you solve problems.

By default, tracing is disabled. When you enable the tracing operation on the router to be configured as the master (also referred to as the *protocol master*) of an MX Series Virtual Chassis, the default tracing behavior is as follows:

1. Important events are logged in a file with the name you specify in the **/var/log** directory. You cannot change the directory (**/var/log**) in which trace files are located.
2. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file*.0**, then ***trace-file*.1**, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

   You can optionally specify the maximum number of trace files to be from 2 through 1000. You can also configure the maximum file size to be from 10 KB through 1 gigabyte (GB). (For more information about how log files are created, see the *Junos OS System Log Messages Reference*.)

   By default, only the user who configures the tracing operation can access log files. You can optionally configure read-only access for all users.

To configure tracing of MX Series Virtual Chassis operations:

1. Configure a filename for the trace log.

   See "Configuring the Name of the Virtual Chassis Trace Log File" on page 201.
2. (Optional) Configure characteristics of the trace log file.

   See "Configuring Characteristics of the Virtual Chassis Trace Log File" on page 201.
3. (Optional) Configure user access to the trace log file.

   See "Configuring Access to the Virtual Chassis Trace Log File" on page 202.
4. (Optional) Refine the output of the trace log file.

   See "Using Regular Expressions to Refine the Output of the Virtual Chassis Trace Log File" on page 203.
5. Configure flags to specify the Virtual Chassis operations that you want to trace.

   See "Configuring the Virtual Chassis Operations to Trace" on page 204.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Configuring the Name of the Virtual Chassis Trace Log File

To trace operations for a Virtual Chassis, you must configure the name of the trace log file that the software saves in the **/var/log** directory.

To configure the filename for tracing Virtual Chassis operations:

- On the device to be designated as the master of the Virtual Chassis, specify the name of the trace log file.

  ```
  [edit virtual-chassis]
  user@host# set traceoptions file filename
  ```

Related Documentation

- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Configuring Characteristics of the Virtual Chassis Trace Log File

You can optionally configure the following characteristics of the trace log file for a Virtual Chassis:

- Maximum number of trace files—When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file*.0**, then ***trace-file*.1**, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten. You can optionally specify the maximum number of trace files to be from 2 through 1000. If you specify a maximum number of files with the **files** option, you must also specify a maximum file size with the **size** option.
- Maximum trace file size—You can configure the maximum trace file size to be from 10 KB through 1 gigabyte (GB) If you specify a maximum file size with the **size** option, you must also specify a maximum number of files with the **files** option.
- Timestamp—By default, timestamp information is placed at the beginning of each line of trace output. You can optionally prevent placement of a timestamp on any trace log file.
- Appending or replacing the trace file—By default, the router or switch appends new information to an existing trace file. You can optionally specify that the router or switch replace an exisiting trace file instead of appending information to it.

To configure the maximum number and maximum size of trace files:

- On the router or switch to be designated as the master of the Virtual Chassis, specify the maximum number and maximum size of the trace file.

  ```
  [edit virtual-chassis]
  user@host# set traceoptions file filename files number size maximum-file-size
  ```

For example, to set the maximum number of files to 20 and the maximum file size to 2 MB for a trace file named **vccp**:

```
[edit virtual-chassis]
user@host# set traceoptions file vccp files 20 size 2097152
```

When the **vccp** trace file for this example reaches 2 MB, **vccp** is renamed **vccp.0**, and a new file named **vccp** is created. When the new **vccp** file reaches 2 MB, **vccp.0** is renamed **vccp.1** and **vccp** is renamed **vccp.0**. This process repeats until there are 20 trace files. Then the oldest file (**vccp.19**) is overwritten by the newest file (**vccp.0**).

To prevent the router or switch from the placing a timestamp on the trace log file:

- On the router or switch to be designated as the master of the Virtual Chassis, specify that a timestamp not appear on the trace log file:

```
[edit virtual-chassis]
user@host# set traceoptions file filename no-stamp
```

To replace an exisiting trace file instead of appending information to it:

- On the router or switch to be designated as the master of the Virtual Chassis, specify that the router or switch replaces an existing trace file:

```
[edit virtual-chassis]
user@host# set traceoptions file filename replace
```

Related Documentation

- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Configuring Access to the Virtual Chassis Trace Log File

By default, only the user who configures the tracing operation can access the log files. You can enable all users to read the log file, and you can explicitly set the default behavior of the log file.

To configure access to the trace log file for all users:

- On the router or switch to be designated as the master of the Virtual Chassis, specify that all users can read the trace log file.

```
[edit virtual-chassis]
user@host# set traceoptions file filename world-readable
```

To explicitly set the default behavior to enable access to the trace log file only for the user who configured tracing:

- On the router or switch to be designated as the master of the Virtual Chassis, specify that only the user who configured tracing can read the trace log file.

```
[edit virtual-chassis]
```

```
user@host# set traceoptions file filename no-world-readable
```

Related Documentation

- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Using Regular Expressions to Refine the Output of the Virtual Chassis Trace Log File

By default, the trace operation output includes all lines relevant to the logged events. You can refine the output of the trace log file for a Virtual Chassis by including regular expressions to be matched.

To refine the output of the trace log file:

- On the router or switch to be designated as the master of the Virtual Chassis, configure a regular expression to be matched.

  ```
  [edit virtual-chassis]
  user@host# set traceoptions file filename match regular-expression
  ```

Related Documentation

- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

Configuring the Virtual Chassis Operations to Trace

By default, the router or switch logs only important events. You can specify which operations to trace for a Virtual Chassis by including specific tracing flags when you configure tracing. Table 23 on page 204 describes the flags that you can include.

Table 23: Tracing Flags for Virtual Chassis

Flag	Description
all	Trace all operations.
auto-configuration	Trace Virtual Chassis ports that have been automatically configured.
csn	Trace Virtual Chassis complete sequence number (CSN) packets.
error	Trace Virtual Chassis errored packets.
graceful-restart	Trace Virtual Chassis graceful restart events.
hello	Trace Virtual Chassis hello packets.
krt	Trace Virtual Chassis kernel routing table (KRT) events.
lsp	Trace Virtual Chassis link-state packets.
lsp-generation	Trace Virtual Chassis link-state packet generation.
me	Trace Virtual Chassis mastership election (ME) events.
normal	Trace normal events.
packets	Trace Virtual Chassis packets.
parse	Trace reading of the configuration.
psn	Trace partial sequence number (PSN) packets.
route	Trace Virtual Chassis routing information.
spf	Trace Virtual Chassis shortest-path-first (SPF) events.
state	Trace Virtual Chassis state transitions.
task	Trace Virtual Chassis task operations.

To configure the flags for the Virtual Chassis operations to be logged:

1. Specify the tracing flag that represents the operation you want to trace.

   ```
   [edit virtual-chassis]
   user@host# set traceoptions flag flag
   ```

2. (Optional) Specify one or more of the following additional tracing options for the specified flag:

   - To generate detailed trace output, use the **detail** option.
   - To disable a particular flag, use the **disable** option.
   - To trace received packets, use the **receive** option.
   - To trace transmitted packets, use the **send** option.

   For example, to generate detailed trace output for Virtual Chassis mastership election events in received packets:

   ```
   [edit virtual-chassis]
   user@host# set traceoptions flag me detail receive
   ```

Related Documentation

- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

CHAPTER 12

Configuration Statements

- aggregated-ether-options on page 208
- heartbeat-address (MX Series Virtual Chassis) on page 209
- heartbeat-timeout (MX Series Virtual Chassis) on page 210
- locality-bias (MX Series Virtual Chassis) on page 211
- logical-interface-chassis-redundancy (MX Series Virtual Chassis) on page 211
- logical-interface-fpc-redundancy (Aggregated Ethernet Subscriber Interfaces) on page 212
- member (MX Series Virtual Chassis) on page 213
- network-services on page 214
- no-split-detection (MX Series Virtual Chassis) on page 215
- preprovisioned (MX Series Virtual Chassis) on page 216
- role (MX Series Virtual Chassis) on page 217
- sampling-instance on page 218
- serial-number (MX Series Virtual Chassis) on page 219
- targeted-distribution (Static Interfaces over Aggregated Ethernet) on page 220
- traceoptions (MX Series Virtual Chassis) on page 221
- virtual-chassis (MX Series Virtual Chassis) on page 223

aggregated-ether-options

Syntax

```
aggregated-ether-options {
  ethernet-switch-profile {
    ethernet-policer-profile {
      input-priority-map {
        ieee802.1p premium [ values ];
      }
      output-priority-map {
        classifier {
          premium {
            forwarding-class class-name {
              loss-priority (high | low);
            }
          }
        }
      }
      policer cos-policer-name {
        aggregate {
          bandwidth-limit bps;
          burst-size-limit bytes;
        }
        premium {
          bandwidth-limit bps;
          burst-size-limit bytes;
        }
      }
    }
    (mac-learn-enable | no-mac-learn-enable);
  }
  (flow-control | no-flow-control);
  lacp {
    (active | passive);
    link-protection {
      disable;
    (revertive | non-revertive);
    periodic interval;
    system-priority priority;
    system-id system-id;
  }
  link-protection;
  load-balance;
  link-speed speed;
  logical-interface-chassis-redundancy;
  logical-interface-fpc-redundancy;
  (loopback | no-loopback);
  minimum-links number;
  rebalance-periodic time hour:minute <interval hours>;
  source-address-filter {
    mac-address;
    (source-filtering | no-source-filtering);
  }
}
```

Hierarchy Level [edit interfaces ae*x*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure aggregated Ethernet-specific interface properties.

The statements are explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation
- *Ethernet Interfaces Overview*

heartbeat-address (MX Series Virtual Chassis)

Syntax heartbeat-address (*ip-address* | *ipv6-address*);

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 14.1.

Description Configure an IPv4 address or IPv6 address used to create an IP-based packet connection, known as a *heartbeat connection*, between the master router and backup router in an MX Series Virtual Chassis. To ensure consistent access to the master Routing Engine in the Virtual Chassis master router (VC-Mm) regardless of which Routing Engine is active, you must configure the address for the management Ethernet interface (**fxp0**) with the **master-only** statement at the **[edit groups]** hierarchy level.

NOTE: The **heartbeat-address** statement and the **no-split-detection** statement at the **[edit virtual-chassis]** hierarchy level are mutually exclusive. As a result, the software prevents you from configuring both **heartbeat-address** and **no-split-detection** at the same time. If you attempt to do so, the software displays an error message and causes the **commit** operation to fail.

Options ***ip-address***—IPv4 **master-only** address for the **fxp0** management interface.

ipv6-address—IPv6 **master-only** address for the **fxp0** management interface.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

heartbeat-timeout (MX Series Virtual Chassis)

Syntax heartbeat-timeout *seconds*;

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 14.1.

Description Configure the maximum time period within which a Virtual Chassis member router must respond to a heartbeat packet sent by the other member router. When an adjacency disruption or split is detected in the Virtual Chassis configuration, each member router sends a single heartbeat packet to the other member router to determine whether that router is still operating and able to respond. If the other member router responds to the heartbeat packet within the configured or default timeout period, the heartbeat connection helps prevent the member routers from changing mastership roles, which can cause undesirable results.

NOTE: Both member routers forming the heartbeat connection must be assigned the routing-engine role in the preprovisioned Virtual Chassis configuration. The routing-engine role makes the router eligible to function as either the master router or backup router of the Virtual Chassis.

Options *seconds*—Number of seconds within which a Virtual Chassis member router must respond to a heartbeat packet.

Range: 1 through 60 seconds

Default: 2 seconds

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

locality-bias (MX Series Virtual Chassis)

Syntax locality-bias;

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 14.1.

Description Configure unicast transit traffic for equal-cost multipath (ECMP) groups and aggregated Ethernet bundles to egress links in the same (local) member router in an MX Series Virtual Chassis rather than to egress links in the remote member router, provided that the local member router has an equal or larger number of available egress links than the remote member router.

Required Privilege Level system—To view this statement in the configuration.
system-control—To add this statement to the configuration.

Related Documentation

- Configuring Locality Bias for a Virtual Chassis on page 125
- Locality Bias in a Virtual Chassis on page 123
- Guidelines for Configuring Locality Bias in a Virtual Chassis on page 125

logical-interface-chassis-redundancy (MX Series Virtual Chassis)

Syntax logical-interface-chassis-redundancy;

Hierarchy Level [edit interfaces ae*number* aggregated-ether-options]

Release Information Statement introduced in Junos OS Release 13.2.

Description For member routers in an MX Series Virtual Chassis, provide chassis redundancy for IP demultiplexing (demux) and VLAN demux subscriber interfaces in aggregated Ethernet bundles configured with targeted distribution. With chassis redundancy, the router assigns the backup link in the aggregated Ethernet bundle to an MPC/MIC module in a member router *other* than the router on which the primary link resides.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Chassis Redundancy for a Virtual Chassis on page 142

logical-interface-fpc-redundancy (Aggregated Ethernet Subscriber Interfaces)

Syntax logical-interface-fpc-redundancy;

Hierarchy Level [edit interfaces ae*number* aggregated-ether-options]

Release Information Statement introduced in Junos OS Release 11.2.
Statement introduced in Junos OS Release 13.2R2 for EX Series switches.

Description Provide module redundancy for demux subscribers on aggregated Ethernet bundles configured with targeted distribution. Backup links for a subscriber are chosen on a different EQ DPC or MPC from the primary link, based on the link with the fewest number of subscribers among the links on different modules. If all links are on a single module when this is configured, backup links are not provisioned.

By default, link redundancy is provided for the aggregated Ethernet bundle.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Configuring Link and Module Redundancy for Demux Subscribers in an Aggregated Ethernet Interface*
- Configuring Module Redundancy for a Virtual Chassis on page 141

member (MX Series Virtual Chassis)

Syntax

```
member member-id {
  role (routing-engine | line-card);
  serial-number serial-number;
}
```

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 11.2.

Description Configure an MX Series router as a member of a Virtual Chassis configuration. You can configure a maximum of two member routers in an MX Series Virtual Chassis.

Options

member-id—Numeric value that identifies a member router in a Virtual Chassis configuration.

Values: 0 or 1

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

network-services

Syntax network-services (ethernet | enhanced-ethernet | ip | enhanced-ip | lan);

Hierarchy Level [edit chassis]

Release Information Statement introduced before Junos OS Release 8.5.
Options **enhanced-ethernet** and **enhanced-ip** introduced in Junos OS Release 11.4.

Description Set the router's network services to a specific mode of operation.

Options

ethernet—Set the router's network services to Ethernet and use standard, compiled firewall filter format.

enhanced-ethernet—Set the router's network services to enhanced Ethernet and use enhanced mode capabilities. Only MPCs and MS-DPCs are powered on in the chassis.

ip—Set the router's network services to Internet Protocol and use standard, compiled firewall filter format.

enhanced-ip—Set the router's network services to enhanced Internet Protocol and use enhanced mode capabilities. Only MPCs and MS-DPCs are powered on in the chassis. Non-service DPCs do not work with enhanced network services mode options.

lan—Set the router's network services to LAN and use standard, compiled firewall filter format. Reboot the system after setting the router's network services to LAN.

NOTE: **Only Multiservices DPCs (MS-DPCs) are powered on with the enhanced network services mode options. No other DPCs function with the enhanced network services mode options.**

NOTE: **Whenever tunnel interfaces -pe/-pd are created using the MS-DPC instead of the MPC, the interface will not be able to process register messages. The MS-MPC and the MS-DPC have different multicast architecture and they are incompatible if the chassis is configured to "enhanced-ip" mode.**

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Network Services Mode Overview*
- *Firewall Filters and Enhanced Network Services Mode Overview*
- *Configuring Junos OS to Run a Specific Network Services Mode in MX Series Routers*
- Configuring Enhanced IP Network Services for a Virtual Chassis on page 65

no-split-detection (MX Series Virtual Chassis)

Syntax no-split-detection;

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 11.2.

Description As part of the preprovisioned configuration for an MX Series Virtual Chassis, disable detection of a split in the Virtual Chassis configuration. By default, split detection in the Virtual Chassis is enabled. To maintain the Virtual Chassis configuration in the event of a failure of one of the two member routers, we recommend that you use the **no-split-detection** statement to disable split detection in Virtual Chassis configurations in which you think the backup router is more likely to fail than the link to the backup router.

BEST PRACTICE: We recommend that you use the **no-split-detection** statement to disable split detection for a two-member MX Series Virtual Chassis configuration if you think the backup router is more likely to fail than the Virtual Chassis port links to the backup router. Configuring redundant Virtual Chassis ports on different line cards in each member router reduces the likelihood that all Virtual Chassis port interfaces to the backup router can fail.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Disabling Split Detection in a Virtual Chassis Configuration on page 90
- Split Detection Behavior in a Virtual Chassis on page 35
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

preprovisioned (MX Series Virtual Chassis)

Syntax preprovisioned;

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 11.2.

Description Enable creation of a Virtual Chassis by means of a preprovisioned configuration.

To configure a Virtual Chassis consisting of MX Series routers, you must create a preprovisioned configuration on the master router in the Virtual Chassis by specifying the serial number, member ID, and role for each router (member chassis) in the Virtual Chassis. When a new member router joins the Virtual Chassis, its serial number is compared against the values specified in the preprovisioned configuration. If the serial number of a joining router does not match any of the configured serial numbers, the software prevents that router from becoming a member of the Virtual Chassis.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

role (MX Series Virtual Chassis)

Syntax role (routing-engine | line-card);

Hierarchy Level [edit virtual-chassis member *member-id*]

Release Information Statement introduced in Junos OS Release 11.2.

Description As part of the preprovisioned configuration for an MX Series Virtual Chassis, assign the role to be performed by each member router in the Virtual Chassis. The preprovisioned configuration permanently associates the member ID and role with the member router's chassis serial number.

Options

routing-engine—Enable the member router to function as the master router or backup router of the Virtual Chassis configuration. The master router maintains the global configuration and state information for both members of the Virtual Chassis, and runs the chassis management processes. The backup router synchronizes with the master router and relays chassis control information, such as line-card presence and alarms, to the master router. If the master router is unavailable, the backup router takes mastership of the Virtual Chassis to preserve routing information and maintain network connectivity without disruption. You must assign the **routing-engine** role to both members of the Virtual Chassis. When the Virtual Chassis is formed, the software runs a mastership election algorithm to determine which of the two member routers functions as the master router and which functions as the backup router of the Virtual Chassis.

line-card—Explicitly configuring a member router with the **line-card** role is *not supported* in the current release. However, when split detection is enabled (the default behavior for a Virtual Chassis) and either the Virtual Chassis ports go down or the backup router fails, the master router takes a **line-card** role. The **line-card** role effectively removes the former master router from the Virtual Chassis configuration until connectivity is restored.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Virtual Chassis Components Overview on page 23
- Global Roles and Local Roles in a Virtual Chassis on page 29
- Split Detection Behavior in a Virtual Chassis on page 35

sampling-instance

Syntax sampling-instance *instance-name*;

Hierarchy Level [edit chassis fpc *slot-number*],
[edit chassis lcc *number* fpc *slot-number*] (Routing Matrix),
[edit chassis member *member-number* fpc slot *slot-number*]

Release Information Statement introduced in Junos OS Release 9.6.
Support at the **[edit chassis member *member-number* fpc slot *slot-number*]** hierarchy level introduced in Junos OS Release 14.1.

Description Associate a defined sampling instance with a specific FPC, MPC, or DPC for active sampling instances configured at the **[edit forwarding-options sampling]** hierarchy level.

For M120 routers with FEB, this statement must also be configured under **[edit chassis feb *slot-number*]**, in addition to the **[edit forwarding-options sampling]** hierarchy level.

In a two-member MX Series Virtual Chassis, the master router (member 0) uses FPC slot numbers 0 through 11 with no offset; the backup router (member 1) uses FPC slot numbers 12 through 23, with an offset of 12.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Associating Sampling Instances for Active Flow Monitoring with a Specific FPC, MPC, or DPC*
- Inline Flow Monitoring for Virtual Chassis Overview on page 167
- *Junos Services Interfaces Configuration Guide*

serial-number (MX Series Virtual Chassis)

Syntax serial-number *serial-number*;

Hierarchy Level [edit virtual-chassis member *member-id*]

Release Information Statement introduced in Junos OS Release 11.2.

Description As part of the preprovisioned configuration for an MX Series Virtual Chassis, specify the chassis serial number of each MX Series member router in the Virtual Chassis configuration. If you do not correctly specify a router's serial number in the preprovisioned configuration, the software does not recognize that router as a member of the Virtual Chassis.

Options ***serial-number***—Alphanumeric string that represents the chassis serial number of each member router in the Virtual Chassis configuration. The chassis serial number is located on a label affixed to the side of the MX Series chassis. You can also obtain the router's chassis serial number by issuing the **show chassis hardware** command.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

targeted-distribution (Static Interfaces over Aggregated Ethernet)

Syntax targeted-distribution;

Hierarchy Level [edit interfaces demux0 unit *logical-unit-number*],
[edit interfaces pp0 unit *logical-unit-number*]

Release Information Statement introduced in Junos OS Release 11.2.
Statement introduced in Junos OS Release 13.2R2 for EX Series switches.

Description Configure egress data for a logical interface to be sent across a single member link in an aggregated Ethernet bundle. A backup link is provisioned with CoS scheduling resources in the event that the primary assigned link goes down. The aggregated Ethernet interface must be configured without link protection.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *CoS for PPPoE Subscriber Interfaces Overview*
- *Configuring the Distribution Type for PPPoE Subscribers on Aggregated Ethernet Interfaces*
- *Verifying the Distribution of PPPoE Subscribers in an Aggregated Ethernet Interface*
- Targeted Traffic Distribution on Aggregated Ethernet Interfaces in a Virtual Chassis on page 144
- Configuring Module Redundancy for a Virtual Chassis on page 141
- Configuring Chassis Redundancy for a Virtual Chassis on page 142

traceoptions (MX Series Virtual Chassis)

Syntax

```
traceoptions {
  file filename <files number> <match regular-expression> <no-stamp> <replace> <size
    maximum-file-size> <world-readable | no-world-readable>;
  flag flag <detail> <disable> <receive> <send>;
}
```

Hierarchy Level [edit virtual-chassis]

Release Information Statement introduced in Junos OS Release 11.2.

Description Define tracing operations for the MX Series Virtual Chassis configuration.

Default Tracing operations are disabled.

Options

detail—(Optional) Generate detailed trace information for a flag.

disable—(Optional) Disable a flag.

file *filename*—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory **/var/log**.

files *number*—(Optional) Maximum number of trace files. When a trace file named **trace-file** reaches its maximum size, it is renamed **trace-file.0**, then **trace-file.1**, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten. If you specify a maximum number of files, you also must specify a maximum file size with the **size** option.

Range: 2 through 1000

Default: 3 files

flag *flag*—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements. You can include the following flags:

- **all**—All tracing operations.
- **auto-configuration**—Trace Virtual Chassis ports that have been automatically configured.
- **csn**—Trace Virtual Chassis complete sequence number (CSN) packets.
- **error**—Trace Virtual Chassis errored packets.
- **graceful-restart**—Trace Virtual Chassis graceful restart events.
- **hello**—Trace Virtual Chassis hello packets.
- **krt**—Trace Virtual Chassis kernel routing table (KRT) events.
- **lsp**—Trace Virtual Chassis link-state packets.
- **lsp-generation**—Trace Virtual Chassis link-state packet generation.
- **me**—Trace Virtual Chassis mastership election (ME) events.

- **normal**—Trace normal events.
- **packets**—Trace Virtual Chassis packets.
- **parse**—Trace reading of the configuration.
- **psn**—Trace partial sequence number (PSN) packets.
- **route**—Trace Virtual Chassis routing information.
- **spf**—Trace Virtual Chassis shortest-path-first (SPF) events.
- **state**—Trace Virtual Chassis state transitions.
- **task**—Trace Virtual Chassis task operations.

match ***regular-expression***—(Optional) Refine the output to include lines that contain the regular expression.

no-stamp—(Optional) Do not place a timestamp on any trace file.

no-world-readable—(Optional) Restrict file access to the user who created the file.

receive—(Optional) Trace received packets.

replace—(Optional) Replace a trace file instead of appending information to it.

send—(Optional) Trace transmitted packets.

size ***maximum-file-size***—(Optional) Maximum size of each trace file. By default, the number entered is treated as bytes. Alternatively, you can include a suffix to the number to indicate kilobytes (KB), megabytes (MB), or gigabytes (GB). If you specify a maximum file size, you also must specify a maximum number of trace files with the **files** option.

Syntax: ***size*****k** to specify KB, ***size*****m** to specify MB, or ***size*****g** to specify GB

Range: 10240 through 1073741824

world-readable—(Optional) Enable unrestricted file access.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Tracing Virtual Chassis Operations for MX Series 3D Universal Edge Routers on page 200
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

virtual-chassis (MX Series Virtual Chassis)

Syntax

```
virtual-chassis {
  heartbeat-address (ip-address | ipv6-address);
  heartbeat-timeout seconds;
  locality-bias;
  member member-id {
    role (routing-engine | line-card);
    serial-number serial-number;
  }
  no-split-detection;
  preprovisioned;
  traceoptions {
    file filename <files number> <match regular-expression> <no-stamp> <replace> <size
      maximum-file-size> <world-readable | no-world-readable>;
    flag flag <detail> <disable> <receive> <send>;
  }
}
```

Hierarchy Level [edit]

Release Information Statement introduced in Junos OS Release 11.2.

Description Create a Virtual Chassis configuration for MX Series routers.

The remaining statements are explained separately.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183
- Configuring Preprovisioned Member Information for a Virtual Chassis on page 63
- Configuring Locality Bias for a Virtual Chassis on page 125

CHAPTER 13

Operational Commands

- clear virtual-chassis heartbeat (MX Series Virtual Chassis)
- request system software in-service-upgrade (MX Series 3D Universal Edge Routers)
- request virtual-chassis member-id delete (MX Series Virtual Chassis)
- request virtual-chassis member-id set
- request virtual-chassis routing-engine master switch
- request virtual-chassis vc-port delete (MX Series Virtual Chassis)
- request virtual-chassis vc-port set (MX Series Virtual Chassis)
- show chassis network services
- show services accounting status
- show virtual-chassis active-topology (MX Series Virtual Chassis)
- show virtual-chassis device-topology (MX Series Virtual Chassis)
- show virtual-chassis heartbeat (MX Series Virtual Chassis)
- show virtual-chassis protocol adjacency (MX Series Virtual Chassis)
- show virtual-chassis protocol database (MX Series Virtual Chassis)
- show virtual-chassis protocol interface (MX Series Virtual Chassis)
- show virtual-chassis protocol route (MX Series Virtual Chassis)
- show virtual-chassis protocol statistics (MX Series Virtual Chassis)
- show virtual-chassis status (MX Series Virtual Chassis)
- show virtual-chassis vc-port (MX Series Virtual Chassis)

clear virtual-chassis heartbeat (MX Series Virtual Chassis)

Syntax clear virtual-chassis heartbeat
<(all-members | local | member *member-id*)>

Release Information Command introduced in Junos OS Release 14.1.

Description Clear statistics counter and timestamp fields associated with a heartbeat packet connection on both member routers in an MX Series Virtual Chassis. You can issue the **clear virtual-chassis heartbeat** command from the console of either member router in the Virtual Chassis.

NOTE: When you clear heartbeat statistics, the connection time is preserved to retain a record of previous heartbeat connectivity.

Options

none—Clear heartbeat statistics for both member routers in an MX Series Virtual Chassis.

all-members—(Optional) Clear heartbeat statistics for both member routers in an MX Series Virtual Chassis. This is the default behavior if no options are specified.

local—(Optional) Clear heartbeat statistics for the member router from which you are issuing the command.

member *member-id*—(Optional) Clear heartbeat statistics for the specified member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level clear

Related Documentation

- Verifying and Managing the Virtual Chassis Heartbeat Connection on page 167
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

List of Sample Output clear virtual-chassis heartbeat on page 227

Output Fields Table 24 on page 226 lists the output fields for the **clear virtual-chassis heartbeat** command. Output fields are listed in the approximate order in which they appear.

Table 24: clear virtual-chassis heartbeat Output Fields

Field Name	Field Description
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.

Table 24: clear virtual-chassis heartbeat Output Fields *(continued)*

Field Name	Field Description
heartbeat statistics cleared	Confirmation that heartbeat statistics are cleared on the specified member router.

Sample Output

clear virtual-chassis heartbeat

```
{master:member0-re0}

user@host> clear virtual-chassis heartbeat
member0:
--------------------------------------------------------------------------
heartbeat statistics cleared

member1:
--------------------------------------------------------------------------
heartbeat statistics cleared
```

request system software in-service-upgrade (MX Series 3D Universal Edge Routers)

Syntax request system software in-service-upgrade *package-name*
<no-copy>
<no-old-master-upgrade>
<reboot>
<unlink>

Release Information Command introduced in Junos OS Release 11.2.
Command introduced in Junos OS Release 14.1 for MX Series Virtual Chassis.

Description Perform a unified in-service software upgrade (unified ISSU). Unified ISSU enables you to upgrade from one Junos OS release to another with no disruption on the control plane and with minimal disruption of traffic. Unified ISSU is supported only by dual Routing Engine platforms. In addition, graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) must be enabled.

Options *package-name*—Location from which the software package or bundle is to be installed. For example:

- **/var/tmp/*package-name***— For a software package or bundle that is being installed from a local directory on the router.
- ***protocol*://*hostname*/*pathname*/*package-name***—For a software package or bundle that is to be downloaded and installed from a remote location. Replace ***protocol*** with one of the following:
  - **ftp**—File Transfer Protocol
  - **http**—Hypertext Transfer Protocol
  - **scp**—Secure copy (available only for Canada and U.S. version)

no-copy—(Optional) When the **no-copy** option is included, copies of package files are not saved on the Packet Forwarding Engine.

The **no-copy** option is not available for an MX Series Virtual Chassis.

no-old-master-upgrade—(Optional) When the **no-old-master-upgrade** option is included, after the backup Routing Engine is rebooted with the new software package and a switchover occurs to make it the new master Routing Engine, the former master (new backup) Routing Engine is not upgraded to the new software. In this case, you must manually upgrade the former master (new backup) Routing Engine. If you do not include the **no-old-master-upgrade** option, the system automatically upgrades the former master Routing Engine.

The **no-old-master-upgrade** option is not available for an MX Series Virtual Chassis.

reboot—(Optional) When the **reboot** option is included, the former master (new backup) Routing Engine is automatically rebooted after being upgraded to the new software. When the **reboot** option is not included, you must manually reboot the former master (new backup) Routing Engine using the **request system reboot** command.

The **reboot** option is accepted but ignored for an MX Series Virtual Chassis. A unified ISSU in an MX Series Virtual Chassis always reboots all Routing Engines in the member routers.

unlink—(Optional) When the **unlink** option is included, the package is removed from **/var/home** whether the installation is successful or unsuccessful.

The **unlink** option is not available for an MX Series Virtual Chassis.

Additional Information

The following conditions apply to unified ISSUs:

- Unified ISSUs are supported on MX Series 3D Universal Edge Routers.
- Unsupported PICs are restarted during a unified ISSU. For information about supported PICs, see the *Junos OS High Availability Library for Routing Devices*.
- Unsupported protocols will experience packet loss during a unified ISSU. For information about supported protocols, see the *Junos OS High Availability Library for Routing Devices*.
- During a unified ISSU, you cannot bring any PICs online or offline.

For more information, see the *Junos OS High Availability Library for Routing Devices*.

Required Privilege Level

view

Related Documentation

- *request system software abort*
- *show chassis in-service-upgrade*
- Upgrading Junos OS in an MX Series Virtual Chassis by Performing a Unified ISSU on page 156

List of Sample Output

request system software in-service-upgrade reboot on page 229
request system software in-service-upgrade (MX Series Virtual Chassis) on page 240

Output Fields

When you enter this command, you are provided feedback about the status of your request.

Sample Output

request system software in-service-upgrade reboot

```
{master}

user@host> request system software in-service-upgrade
/var/tmp/jinstall-11.2B2.1-domestic-signed.tgz reboot
Chassis ISSU Check Done
ISSU: Validating Image
Checking compatibility with configuration
Initializing...
Using jbase-11.2B1.5
Verified manifest signed by PackageProduction_11_2_0
Verified jbase-11.2B1.5 signed by PackageProduction_11_2_0
Using /var/tmp/jinstall-11.2B2.1-domestic-signed.tgz
Verified jinstall-11.2B2.1-domestic.tgz signed by PackageProduction_11_2_0
Using jinstall-11.2B2.1-domestic.tgz
```

```
Using jbundle-11.2B2.1-domestic.tgz
Checking jbundle requirements on /
Using jbase-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jbase-11.2B2.1 signed by PackageProduction_11_2_0
Using /var/validate/chroot/tmp/jbundle/jboot-11.2B2.1.tgz
Using jcrypto-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jcrypto-11.2B2.1 signed by PackageProduction_11_2_0
Using jdocs-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jdocs-11.2B2.1 signed by PackageProduction_11_2_0
Using jkernel-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jkernel-11.2B2.1 signed by PackageProduction_11_2_0
Using jpfe-11.2B2.1.tgz
Using jroute-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jroute-11.2B2.1 signed by PackageProduction_11_2_0
Using jruntime-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jruntime-11.2B2.1 signed by PackageProduction_11_2_0
Using jservices-11.2B2.1.tgz
Auto-deleting old jservices-voice ...
Removing /opt/sdk/service-packages/jservices-voice ...
Removing jservices-voice-bsg-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-voice ...
Verified jservices-voice-bsg-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /var/sw/pkg ...
Creating /opt/sdk/service-packages/jservices-voice ...
Storing jservices-voice-bsg-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-voice/jservices-voice-bsg ->
/var/sw/pkg/jservices-voice-bsg-11.2B2.1.tgz...
Auto-deleting old jservices-bgf ...
Removing /opt/sdk/service-packages/jservices-bgf ...
Removing jservices-bgf-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-bgf ...
Verified jservices-bgf-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-bgf ...
Storing jservices-bgf-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-bgf/jservices-bgf-pic ->
/var/sw/pkg/jservices-bgf-pic-11.2B2.1.tgz...
Auto-deleting old jservices-aacl ...
Removing /opt/sdk/service-packages/jservices-aacl ...
Removing jservices-aacl-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-aacl ...
Verified jservices-aacl-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-aacl ...
Storing jservices-aacl-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-aacl/jservices-aacl-pic ->
/var/sw/pkg/jservices-aacl-pic-11.2B2.1.tgz...
Auto-deleting old jservices-llpdf ...
Removing /opt/sdk/service-packages/jservices-llpdf ...
Removing jservices-llpdf-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-llpdf ...
Verified jservices-llpdf-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-llpdf ...
```



```
Storing jservices-llpdf-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-llpdf/jservices-llpdf-pic ->
/var/sw/pkg/jservices-llpdf-pic-11.2B2.1.tgz...
Auto-deleting old jservices-ptsp ...
Removing /opt/sdk/service-packages/jservices-ptsp ...
Removing jservices-ptsp-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-ptsp ...
Verified jservices-ptsp-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-ptsp ...
Storing jservices-ptsp-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-ptsp/jservices-ptsp-pic ->
/var/sw/pkg/jservices-ptsp-pic-11.2B2.1.tgz...
Auto-deleting old jservices-sfw ...
Removing /opt/sdk/service-packages/jservices-sfw ...
Removing jservices-sfw-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-sfw ...
Verified jservices-sfw-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-sfw ...
Storing jservices-sfw-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-sfw/jservices-sfw-pic ->
/var/sw/pkg/jservices-sfw-pic-11.2B2.1.tgz...
Auto-deleting old jservices-nat ...
Removing /opt/sdk/service-packages/jservices-nat ...
Removing jservices-nat-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-nat ...
Verified jservices-nat-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-nat ...
Storing jservices-nat-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-nat/jservices-nat-pic ->
/var/sw/pkg/jservices-nat-pic-11.2B2.1.tgz...
Auto-deleting old jservices-alg ...
Removing /opt/sdk/service-packages/jservices-alg ...
Removing jservices-alg-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-alg ...
Verified jservices-alg-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-alg ...
Storing jservices-alg-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-alg/jservices-alg-pic ->
/var/sw/pkg/jservices-alg-pic-11.2B2.1.tgz...
Auto-deleting old jservices-cpcd ...
Removing /opt/sdk/service-packages/jservices-cpcd ...
Removing jservices-cpcd-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-cpcd ...
Verified jservices-cpcd-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-cpcd ...
Storing jservices-cpcd-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-cpcd/jservices-cpcd-pic ->
/var/sw/pkg/jservices-cpcd-pic-11.2B2.1.tgz...
Auto-deleting old jservices-rpm ...
Removing /opt/sdk/service-packages/jservices-rpm ...
Removing jservices-rpm-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-rpm ...
Verified jservices-rpm-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-rpm ...
Storing jservices-rpm-pic-11.2B2.1.tgz in /var/sw/pkg ...
```

```
Link: /opt/sdk/service-packages/jservices-rpm/jservices-rpm-pic ->
/var/sw/pkg/jservices-rpm-pic-11.2B2.1.tgz...
Auto-deleting old jservices-hcm ...
Removing /opt/sdk/service-packages/jservices-hcm ...
Removing jservices-hcm-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-hcm ...
Verified jservices-hcm-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-hcm ...
Storing jservices-hcm-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-hcm/jservices-hcm-pic ->
/var/sw/pkg/jservices-hcm-pic-11.2B2.1.tgz...
Auto-deleting old jservices-appid ...
Removing /opt/sdk/service-packages/jservices-appid ...
Removing jservices-appid-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-appid ...
Verified jservices-appid-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-appid ...
Storing jservices-appid-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-appid/jservices-appid-pic ->
/var/sw/pkg/jservices-appid-pic-11.2B2.1.tgz...
Auto-deleting old jservices-idp ...
Removing /opt/sdk/service-packages/jservices-idp ...
Removing jservices-idp-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-idp ...
Verified jservices-idp-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-idp ...
Storing jservices-idp-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-idp/jservices-idp-pic ->
/var/sw/pkg/jservices-idp-pic-11.2B2.1.tgz...
Using jservices-crypto-11.2B2.1.tgz
Auto-deleting old jservices-crypto-base ...
Removing /opt/sdk/service-packages/jservices-crypto-base ...
Removing jservices-crypto-base-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-crypto-base ...
Verified jservices-crypto-base-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-crypto-base ...
Storing jservices-crypto-base-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-crypto-base/jservices-crypto-base-pic
-> /var/sw/pkg/jservices-crypto-base-pic-11.2B2.1.tgz...
Auto-deleting old jservices-ssl ...
Removing /opt/sdk/service-packages/jservices-ssl ...
Removing jservices-ssl-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-ssl ...
Verified jservices-ssl-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-ssl ...
Storing jservices-ssl-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-ssl/jservices-ssl-pic ->
/var/sw/pkg/jservices-ssl-pic-11.2B2.1.tgz...
Hardware Database regeneration succeeded
Validating against /config/juniper.conf.gz
mgd: commit complete
Validation succeeded
ISSU: Preparing Backup RE
Pushing bundle to re1
NOTICE: Validating configuration against jinstall-11.2B2.1-domestic-signed.tgz.
NOTICE: Use the 'no-validate' option to skip this if desired.
```



```
Checking compatibility with configuration
Initializing...
Using jbase-11.2B1.5
Verified manifest signed by PackageProduction_11_2_0
Verified jbase-11.2B1.5 signed by PackageProduction_11_2_0
Using /var/tmp/jinstall-11.2B2.1-domestic-signed.tgz
Verified jinstall-11.2B2.1-domestic.tgz signed by PackageProduction_11_2_0
Using jinstall-11.2B2.1-domestic.tgz
Using jbundle-11.2B2.1-domestic.tgz
Checking jbundle requirements on /
Using jbase-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jbase-11.2B2.1 signed by PackageProduction_11_2_0
Using /var/validate/chroot/tmp/jbundle/jboot-11.2B2.1.tgz
Using jcrypto-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jcrypto-11.2B2.1 signed by PackageProduction_11_2_0
Using jdocs-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jdocs-11.2B2.1 signed by PackageProduction_11_2_0
Using jkernel-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jkernel-11.2B2.1 signed by PackageProduction_11_2_0
Using jpfe-11.2B2.1.tgz
Using jroute-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jroute-11.2B2.1 signed by PackageProduction_11_2_0
Using jruntime-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jruntime-11.2B2.1 signed by PackageProduction_11_2_0
Using jservices-11.2B2.1.tgz
Auto-deleting old jservices-voice ...
Removing /opt/sdk/service-packages/jservices-voice ...
Removing jservices-voice-bsg-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-voice ...
Verified jservices-voice-bsg-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /var/sw/pkg ...
Creating /opt/sdk/service-packages/jservices-voice ...
Storing jservices-voice-bsg-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-voice/jservices-voice-bsg ->
/var/sw/pkg/jservices-voice-bsg-11.2B2.1.tgz...
Auto-deleting old jservices-bgf ...
Removing /opt/sdk/service-packages/jservices-bgf ...
Removing jservices-bgf-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-bgf ...
Verified jservices-bgf-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-bgf ...
Storing jservices-bgf-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-bgf/jservices-bgf-pic ->
/var/sw/pkg/jservices-bgf-pic-11.2B2.1.tgz...
Auto-deleting old jservices-aacl ...
Removing /opt/sdk/service-packages/jservices-aacl ...
Removing jservices-aacl-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-aacl ...
Verified jservices-aacl-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-aacl ...
Storing jservices-aacl-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-aacl/jservices-aacl-pic ->
```

```
/var/sw/pkg/jservices-aacl-pic-11.2B2.1.tgz...
Auto-deleting old jservices-llpdf ...
Removing /opt/sdk/service-packages/jservices-llpdf ...
Removing jservices-llpdf-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-llpdf ...
Verified jservices-llpdf-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-llpdf ...
Storing jservices-llpdf-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-llpdf/jservices-llpdf-pic ->
/var/sw/pkg/jservices-llpdf-pic-11.2B2.1.tgz...
Auto-deleting old jservices-ptsp ...
Removing /opt/sdk/service-packages/jservices-ptsp ...
Removing jservices-ptsp-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-ptsp ...
Verified jservices-ptsp-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-ptsp ...
Storing jservices-ptsp-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-ptsp/jservices-ptsp-pic ->
/var/sw/pkg/jservices-ptsp-pic-11.2B2.1.tgz...
Auto-deleting old jservices-sfw ...
Removing /opt/sdk/service-packages/jservices-sfw ...
Removing jservices-sfw-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-sfw ...
Verified jservices-sfw-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-sfw ...
Storing jservices-sfw-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-sfw/jservices-sfw-pic ->
/var/sw/pkg/jservices-sfw-pic-11.2B2.1.tgz...
Auto-deleting old jservices-nat ...
Removing /opt/sdk/service-packages/jservices-nat ...
Removing jservices-nat-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-nat ...
Verified jservices-nat-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-nat ...
Storing jservices-nat-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-nat/jservices-nat-pic ->
/var/sw/pkg/jservices-nat-pic-11.2B2.1.tgz...
Auto-deleting old jservices-alg ...
Removing /opt/sdk/service-packages/jservices-alg ...
Removing jservices-alg-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-alg ...
Verified jservices-alg-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-alg ...
Storing jservices-alg-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-alg/jservices-alg-pic ->
/var/sw/pkg/jservices-alg-pic-11.2B2.1.tgz...
Auto-deleting old jservices-cpcd ...
Removing /opt/sdk/service-packages/jservices-cpcd ...
Removing jservices-cpcd-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-cpcd ...
Verified jservices-cpcd-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-cpcd ...
Storing jservices-cpcd-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-cpcd/jservices-cpcd-pic ->
/var/sw/pkg/jservices-cpcd-pic-11.2B2.1.tgz...
```



```
Auto-deleting old jservices-rpm ...
Removing /opt/sdk/service-packages/jservices-rpm ...
Removing jservices-rpm-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-rpm ...
Verified jservices-rpm-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-rpm ...
Storing jservices-rpm-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-rpm/jservices-rpm-pic ->
/var/sw/pkg/jservices-rpm-pic-11.2B2.1.tgz...
Auto-deleting old jservices-hcm ...
Removing /opt/sdk/service-packages/jservices-hcm ...
Removing jservices-hcm-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-hcm ...
Verified jservices-hcm-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-hcm ...
Storing jservices-hcm-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-hcm/jservices-hcm-pic ->
/var/sw/pkg/jservices-hcm-pic-11.2B2.1.tgz...
Auto-deleting old jservices-appid ...
Removing /opt/sdk/service-packages/jservices-appid ...
Removing jservices-appid-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-appid ...
Verified jservices-appid-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-appid ...
Storing jservices-appid-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-appid/jservices-appid-pic ->
/var/sw/pkg/jservices-appid-pic-11.2B2.1.tgz...
Auto-deleting old jservices-idp ...
Removing /opt/sdk/service-packages/jservices-idp ...
Removing jservices-idp-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-idp ...
Verified jservices-idp-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-idp ...
Storing jservices-idp-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-idp/jservices-idp-pic ->
/var/sw/pkg/jservices-idp-pic-11.2B2.1.tgz...
Using jservices-crypto-11.2B2.1.tgz
Auto-deleting old jservices-crypto-base ...
Removing /opt/sdk/service-packages/jservices-crypto-base ...
Removing jservices-crypto-base-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-crypto-base ...
Verified jservices-crypto-base-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-crypto-base ...
Storing jservices-crypto-base-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-crypto-base/jservices-crypto-base-pic
-> /var/sw/pkg/jservices-crypto-base-pic-11.2B2.1.tgz...
Auto-deleting old jservices-ssl ...
Removing /opt/sdk/service-packages/jservices-ssl ...
Removing jservices-ssl-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-ssl ...
Verified jservices-ssl-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-ssl ...
Storing jservices-ssl-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-ssl/jservices-ssl-pic ->
/var/sw/pkg/jservices-ssl-pic-11.2B2.1.tgz...
```

```
Hardware Database regeneration succeeded
Validating against /config/juniper.conf.gz
mgd: commit complete
Validation succeeded
Installing package '/var/tmp/jinstall-11.2B2.1-domestic-signed.tgz' ...
Verified jinstall-11.2B2.1-domestic.tgz signed by PackageProduction_11_2_0
Adding jinstall...
Verified manifest signed by PackageProduction_11_2_0

WARNING:     This package will load JUNOS 11.2B2.1 software.
WARNING:     It will save JUNOS configuration files, and SSH keys
WARNING:     (if configured), but erase all other files and information
WARNING:     stored on this machine.  It will attempt to preserve dumps
WARNING:     and log files, but this can not be guaranteed.  This is the
WARNING:     pre-installation stage and all the software is loaded when
WARNING:     you reboot the system.

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:     A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:     'request system reboot' command when software installation is
WARNING:     complete. To abort the installation, do not reboot your system,
WARNING:     instead use the 'request system software delete jinstall'
WARNING:     command as soon as this operation completes.

Saving package file in /var/sw/pkg/jinstall-11.2B2.1-domestic-signed.tgz ...
Saving state for rollback ...
Backup upgrade done
Rebooting Backup RE

Rebooting re1
ISSU: Backup RE Prepare Done
Waiting for Backup RE reboot
GRES operational
Initiating Chassis In-Service-Upgrade
Chassis ISSU Started
ISSU: Preparing Daemons
ISSU: Daemons Ready for ISSU
ISSU: Starting Upgrade for FRUs
ISSU: Preparing for Switchover
ISSU: Ready for Switchover
Checking In-Service-Upgrade status
  Item           Status                  Reason
  FPC 1          Online (ISSU)
  FPC 4          Online (ISSU)
  FPC 8          Online (ISSU)
  FPC 10         Online (ISSU)
Resolving mastership...
Complete. The other routing engine becomes the master.
ISSU: RE switchover Done
ISSU: Upgrading Old Master RE
NOTICE: Validating configuration against jinstall-11.2B2.1-domestic-signed.tgz.
NOTICE: Use the 'no-validate' option to skip this if desired.
Checking compatibility with configuration
Initializing...
Using jbase-11.2B1.5
Verified manifest signed by PackageProduction_11_2_0
Verified jbase-11.2B1.5 signed by PackageProduction_11_2_0
```

```
Using /var/tmp/jinstall-11.2B2.1-domestic-signed.tgz
Verified jinstall-11.2B2.1-domestic.tgz signed by PackageProduction_11_2_0
Using jinstall-11.2B2.1-domestic.tgz
Using jbundle-11.2B2.1-domestic.tgz
Checking jbundle requirements on /
Using jbase-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jbase-11.2B2.1 signed by PackageProduction_11_2_0
Using /var/validate/chroot/tmp/jbundle/jboot-11.2B2.1.tgz
Using jcrypto-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jcrypto-11.2B2.1 signed by PackageProduction_11_2_0
Using jdocs-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jdocs-11.2B2.1 signed by PackageProduction_11_2_0
Using jkernel-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jkernel-11.2B2.1 signed by PackageProduction_11_2_0
Using jpfe-11.2B2.1.tgz
Using jroute-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jroute-11.2B2.1 signed by PackageProduction_11_2_0
Using jruntime-11.2B2.1.tgz
Verified manifest signed by PackageProduction_11_2_0
Verified jruntime-11.2B2.1 signed by PackageProduction_11_2_0
Using jservices-11.2B2.1.tgz
Auto-deleting old jservices-voice ...
Removing /opt/sdk/service-packages/jservices-voice ...
Removing jservices-voice-bsg-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-voice ...
Verified jservices-voice-bsg-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /var/sw/pkg ...
Creating /opt/sdk/service-packages/jservices-voice ...
Storing jservices-voice-bsg-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-voice/jservices-voice-bsg ->
/var/sw/pkg/jservices-voice-bsg-11.2B2.1.tgz...
Auto-deleting old jservices-bgf ...
Removing /opt/sdk/service-packages/jservices-bgf ...
Removing jservices-bgf-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-bgf ...
Verified jservices-bgf-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-bgf ...
Storing jservices-bgf-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-bgf/jservices-bgf-pic ->
/var/sw/pkg/jservices-bgf-pic-11.2B2.1.tgz...
Auto-deleting old jservices-aacl ...
Removing /opt/sdk/service-packages/jservices-aacl ...
Removing jservices-aacl-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-aacl ...
Verified jservices-aacl-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-aacl ...
Storing jservices-aacl-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-aacl/jservices-aacl-pic ->
/var/sw/pkg/jservices-aacl-pic-11.2B2.1.tgz...
Auto-deleting old jservices-llpdf ...
Removing /opt/sdk/service-packages/jservices-llpdf ...
Removing jservices-llpdf-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
```

```
Installing new jservices-llpdf ...
Verified jservices-llpdf-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-llpdf ...
Storing jservices-llpdf-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-llpdf/jservices-llpdf-pic ->
/var/sw/pkg/jservices-llpdf-pic-11.2B2.1.tgz...
Auto-deleting old jservices-ptsp ...
Removing /opt/sdk/service-packages/jservices-ptsp ...
Removing jservices-ptsp-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-ptsp ...
Verified jservices-ptsp-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-ptsp ...
Storing jservices-ptsp-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-ptsp/jservices-ptsp-pic ->
/var/sw/pkg/jservices-ptsp-pic-11.2B2.1.tgz...
Auto-deleting old jservices-sfw ...
Removing /opt/sdk/service-packages/jservices-sfw ...
Removing jservices-sfw-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-sfw ...
Verified jservices-sfw-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-sfw ...
Storing jservices-sfw-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-sfw/jservices-sfw-pic ->
/var/sw/pkg/jservices-sfw-pic-11.2B2.1.tgz...
Auto-deleting old jservices-nat ...
Removing /opt/sdk/service-packages/jservices-nat ...
Removing jservices-nat-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-nat ...
Verified jservices-nat-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-nat ...
Storing jservices-nat-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-nat/jservices-nat-pic ->
/var/sw/pkg/jservices-nat-pic-11.2B2.1.tgz...
Auto-deleting old jservices-alg ...
Removing /opt/sdk/service-packages/jservices-alg ...
Removing jservices-alg-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-alg ...
Verified jservices-alg-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-alg ...
Storing jservices-alg-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-alg/jservices-alg-pic ->
/var/sw/pkg/jservices-alg-pic-11.2B2.1.tgz...
Auto-deleting old jservices-cpcd ...
Removing /opt/sdk/service-packages/jservices-cpcd ...
Removing jservices-cpcd-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-cpcd ...
Verified jservices-cpcd-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-cpcd ...
Storing jservices-cpcd-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-cpcd/jservices-cpcd-pic ->
/var/sw/pkg/jservices-cpcd-pic-11.2B2.1.tgz...
Auto-deleting old jservices-rpm ...
Removing /opt/sdk/service-packages/jservices-rpm ...
Removing jservices-rpm-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-rpm ...
```

```
Verified jservices-rpm-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-rpm ...
Storing jservices-rpm-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-rpm/jservices-rpm-pic ->
/var/sw/pkg/jservices-rpm-pic-11.2B2.1.tgz...
Auto-deleting old jservices-hcm ...
Removing /opt/sdk/service-packages/jservices-hcm ...
Removing jservices-hcm-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-hcm ...
Verified jservices-hcm-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-hcm ...
Storing jservices-hcm-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-hcm/jservices-hcm-pic ->
/var/sw/pkg/jservices-hcm-pic-11.2B2.1.tgz...
Auto-deleting old jservices-appid ...
Removing /opt/sdk/service-packages/jservices-appid ...
Removing jservices-appid-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-appid ...
Verified jservices-appid-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-appid ...
Storing jservices-appid-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-appid/jservices-appid-pic ->
/var/sw/pkg/jservices-appid-pic-11.2B2.1.tgz...
Auto-deleting old jservices-idp ...
Removing /opt/sdk/service-packages/jservices-idp ...
Removing jservices-idp-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-idp ...
Verified jservices-idp-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-idp ...
Storing jservices-idp-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-idp/jservices-idp-pic ->
/var/sw/pkg/jservices-idp-pic-11.2B2.1.tgz...
Using jservices-crypto-11.2B2.1.tgz
Auto-deleting old jservices-crypto-base ...
Removing /opt/sdk/service-packages/jservices-crypto-base ...
Removing jservices-crypto-base-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-crypto-base ...
Verified jservices-crypto-base-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-crypto-base ...
Storing jservices-crypto-base-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-crypto-base/jservices-crypto-base-pic
-> /var/sw/pkg/jservices-crypto-base-pic-11.2B2.1.tgz...
Auto-deleting old jservices-ssl ...
Removing /opt/sdk/service-packages/jservices-ssl ...
Removing jservices-ssl-pic-11.2B1.5.tgz from /var/sw/pkg ...
Notifying mspd ...
Installing new jservices-ssl ...
Verified jservices-ssl-pic-11.2B2.1.tgz signed by PackageProduction_11_2_0
Creating /opt/sdk/service-packages/jservices-ssl ...
Storing jservices-ssl-pic-11.2B2.1.tgz in /var/sw/pkg ...
Link: /opt/sdk/service-packages/jservices-ssl/jservices-ssl-pic ->
/var/sw/pkg/jservices-ssl-pic-11.2B2.1.tgz...
Hardware Database regeneration succeeded
Validating against /config/juniper.conf.gz
mgd: commit complete
Validation succeeded
Installing package '/var/tmp/jinstall-11.2B2.1-domestic-signed.tgz' ...
```

```
Verified jinstall-11.2B2.1-domestic.tgz signed by PackageProduction_11_2_0
Adding jinstall...
Verified manifest signed by PackageProduction_11_2_0

WARNING:     This package will load JUNOS 11.2B2.1 software.
WARNING:     It will save JUNOS configuration files, and SSH keys
WARNING:     (if configured), but erase all other files and information
WARNING:     stored on this machine.  It will attempt to preserve dumps
WARNING:     and log files, but this can not be guaranteed.  This is the
WARNING:     pre-installation stage and all the software is loaded when
WARNING:     you reboot the system.

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:     A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:     'request system reboot' command when software installation is
WARNING:     complete. To abort the installation, do not reboot your system,
WARNING:     instead use the 'request system software delete jinstall'
WARNING:     command as soon as this operation completes.

Saving package file in /var/sw/pkg/jinstall-11.2B2.1-domestic-signed.tgz ...
Saving state for rollback ...
ISSU: Old Master Upgrade Done
ISSU: IDLE
Shutdown NOW!
Reboot consistency check bypassed - jinstall 11.2B2.1 will complete installation
 upon reboot
[pid 66780]

*** FINAL System shutdown message from user@host> ***
System going down IMMEDIATELY
```

request system software in-service-upgrade (MX Series Virtual Chassis)

```
{master:member0-re0}

user@host> request system software in-service-upgrade
jinstall-14.1-20140114.2-domestic-signed.tgz
[Jan 30 10:45:32]:ISSU: IDLE

Beginning in-service-upgrade at Jan 30, 2014; 10:45:34
[Jan 30 10:45:34]:ISSU: Validating Image
Validating VC readiness...
Validating required configuration...
Validating release compatibility...
Validation successful
Initiating chassis in-service-upgrade
[Jan 30 10:46:56]:ISSU: Preparing LCC Backup REs
Copying new release to all RE's
Pushing bundle to member0-re0
Pushing bundle to member1-re0
Pushing bundle to member1-re1
[Jan 30 10:51:11]:ISSU: Preparing Backup RE
Arming new release on all RE's
member0-re0:
--------------------------------------------------------------------------
Installing package
'/var/tmp/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz' ...
Verified jinstall-14.1-20140114_ib_14_1_psd.1-domestic.tgz signed by
```

```
PackageDevelopmentEc_2014
Adding jinstall...

WARNING:     The software that is being installed has limited support.
WARNING:     Run 'file show /etc/notices/unsupported.txt' for details.

veriexec: accepting signer: PackageDevelopmentEc_2014
Verified manifest signed by PackageDevelopmentEc_2014

WARNING:     This package will load JUNOS 14.1-20140114_ib_14_1_psd.1 software.
WARNING:     It will save JUNOS configuration files, and SSH keys
WARNING:     (if configured), but erase all other files and information
WARNING:     stored on this machine.  It will attempt to preserve dumps
WARNING:     and log files, but this can not be guaranteed.  This is the
WARNING:     pre-installation stage and all the software is loaded when
WARNING:     you reboot the system.

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:     A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:     'request system reboot' command when software installation is
WARNING:     complete. To abort the installation, do not reboot your system,
WARNING:     instead use the 'request system software delete jinstall'
WARNING:     command as soon as this operation completes.

Saving package file in
/var/sw/pkg/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz ...
Saving state for rollback ...

member1-re0:
--------------------------------------------------------------------------
Installing package
'/var/tmp/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz' ...
Verified jinstall-14.1-20140114_ib_14_1_psd.1-domestic.tgz signed by
PackageDevelopmentEc_2014
Adding jinstall...

WARNING:     The software that is being installed has limited support.
WARNING:     Run 'file show /etc/notices/unsupported.txt' for details.

veriexec: accepting signer: PackageDevelopmentEc_2014
Verified manifest signed by PackageDevelopmentEc_2014

WARNING:     This package will load JUNOS 14.1-20140114_ib_14_1_psd.1 software.
WARNING:     It will save JUNOS configuration files, and SSH keys
WARNING:     (if configured), but erase all other files and information
WARNING:     stored on this machine.  It will attempt to preserve dumps
WARNING:     and log files, but this can not be guaranteed.  This is the
WARNING:     pre-installation stage and all the software is loaded when
WARNING:     you reboot the system.

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:     A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:     'request system reboot' command when software installation is
```

```
WARNING:     complete. To abort the installation, do not reboot your system,
WARNING:     instead use the 'request system software delete jinstall'
WARNING:     command as soon as this operation completes.

Saving package file in
/var/sw/pkg/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz ...
Saving state for rollback ...

member1-re1:
--------------------------------------------------------------------------
Installing package
'/var/tmp/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz' ...
Verified jinstall-14.1-20140114_ib_14_1_psd.1-domestic.tgz signed by
PackageDevelopmentEc_2014
Adding jinstall...

WARNING:     The software that is being installed has limited support.
WARNING:     Run 'file show /etc/notices/unsupported.txt' for details.

veriexec: accepting signer: PackageDevelopmentEc_2014
Verified manifest signed by PackageDevelopmentEc_2014

WARNING:     This package will load JUNOS 14.1-20140114_ib_14_1_psd.1 software.
WARNING:     It will save JUNOS configuration files, and SSH keys
WARNING:     (if configured), but erase all other files and information
WARNING:     stored on this machine.  It will attempt to preserve dumps
WARNING:     and log files, but this can not be guaranteed.  This is the
WARNING:     pre-installation stage and all the software is loaded when
WARNING:     you reboot the system.

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:     A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:     'request system reboot' command when software installation is
WARNING:     complete. To abort the installation, do not reboot your system,
WARNING:     instead use the 'request system software delete jinstall'
WARNING:     command as soon as this operation completes.

Saving package file in
/var/sw/pkg/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz ...
Saving state for rollback ...
Installing package
'/var/tmp/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz' ...
Verified jinstall-14.1-20140114_ib_14_1_psd.1-domestic.tgz signed by
PackageDevelopmentEc_2014
Adding jinstall...

WARNING:     The software that is being installed has limited support.
WARNING:     Run 'file show /etc/notices/unsupported.txt' for details.

veriexec: accepting signer: PackageDevelopmentEc_2014
Verified manifest signed by PackageDevelopmentEc_2014

WARNING:     This package will load JUNOS 14.1-20140114_ib_14_1_psd.1 software.
WARNING:     It will save JUNOS configuration files, and SSH keys
WARNING:     (if configured), but erase all other files and information
WARNING:     stored on this machine.  It will attempt to preserve dumps
WARNING:     and log files, but this can not be guaranteed.  This is the
```



```
WARNING:     pre-installation stage and all the software is loaded when
WARNING:     you reboot the system.

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:     A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:     'request system reboot' command when software installation is
WARNING:     complete. To abort the installation, do not reboot your system,
WARNING:     instead use the 'request system software delete jinstall'
WARNING:     command as soon as this operation completes.

Saving package file in
/var/sw/pkg/jinstall-14.1-20140114_ib_14_1_psd.1-domestic-signed.tgz ...
Saving state for rollback ...
[Jan 30 11:03:12]:ISSU: Backup RE Prepare Done
Rebooting standby RE's
Sending Reboot Command to member0-re0
Shutdown NOW!
Reboot consistency check bypassed - jinstall 14.1-20140114_ib_14_1_psd.1 will
complete installation upon reboot
[pid 2757]
Sending Reboot Command to member1-re1
Shutdown NOW!
Reboot consistency check bypassed - jinstall 14.1-20140114_ib_14_1_psd.1 will
complete installation upon reboot
[pid 2670]
Waiting for standby RE's to boot
[Jan 30 11:18:26]:ISSU: LCC Backup REs Prepare Done
Waiting for standby RE's to have the correct ISSU state
Waiting for protocol backup to be ready to switch mastership
Switching mastership on the protocol backup chassis to slot 1
Waiting for protocol backup chassis master switch to complete
Globally updating ISSU state
Waiting for protocol backup chassis to become GRES ready
[Jan 30 11:19:18]:ISSU: VC Protocol Backup has Switched
Passing ISSU control to chassisd
Chassis ISSU Started
[Jan 30 11:21:01]:ISSU: Preparing Daemons
[Jan 30 11:22:02]:ISSU: Daemons Ready for ISSU
[Jan 30 11:22:06]:ISSU: Starting Upgrade for FRUs
[Jan 30 11:25:42]:ISSU: Preparing for Switchover
[Jan 30 11:26:06]:ISSU: Ready for Switchover
[Jan 30 11:26:20]:ISSU: All VC Members Ready for Switchover
Waiting for master chassis to be switch ready
Switching mastership locally
Resolving mastership...
Complete. The other routing engine becomes the master.
Waiting for virtual chassis roles to switch
Globally updating ISSU state to IDLE
[Jan 30 11:26:33]:ISSU: IDLE
Rebooting protocol backup standby RE.
Sending Reboot Command to member1-re0

member1-re0:
--------------------------------------------------------------------------
Shutdown NOW!
Reboot consistency check bypassed - jinstall 14.1-20140114_ib_14_1_psd.1 will
complete installation upon reboot
```

```
[pid 10462]
Rebooting locally to complete the in service upgrade.
Shutdown NOW!
Reboot consistency check bypassed - jinstall 14.1-20140114_ib_14_1_psd.1 will
complete installation upon reboot
[pid 13458]

{local:member0-re1}
regress@soso1>
*** FINAL System shutdown message from regress@soso1 ***

System going down IMMEDIATELY


Connection closed by foreign host.
```

request virtual-chassis member-id delete (MX Series Virtual Chassis)

Syntax request virtual-chassis member-id delete

Release Information Command introduced in Junos OS Release 11.2.
Command introduced in Junos OS Release 13.2R2 for EX Series switches.

Description Remove (**delete**) the member ID from a router or switch that you want to remove from a Virtual Chassis configuration.

NOTE: Issuing the command to remove the member ID causes the device to reboot, and requires you to confirm that you want to proceed with this operation. If you do not confirm the operation, the software cancels the command.

Required Privilege Level system-control

Related Documentation

- Deleting Member IDs in a Virtual Chassis Configuration on page 89
- Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 103

List of Sample Output request virtual-chassis member-id delete on page 245

Sample Output

request virtual-chassis member-id delete

```
user@host> request virtual-chassis member-id delete
This command will disable virtual-chassis mode and reboot the system.

 Continue? [yes,no] (no)
```

request virtual-chassis member-id set

Syntax request virtual-chassis member-id set member *member-id*

Release Information Command introduced in Junos OS Release 11.2.
Command introduced in Junos OS Release 13.2R2 for EX Series switches.

Description Assign (**set**) a member ID to a router or switch that you want to add as a member of a Virtual Chassis configuration.

NOTE: Issuing the command to assign a member ID causes the device to reboot, and requires you to confirm that you want to proceed with this operation. If you do not confirm the operation, the software cancels the command. After the reboot all MPCs remain powered off until the Virtual Chassis port connection is configured.

Options member ***member-id***—Numeric value that identifies a member router or switch in a Virtual Chassis configuration. When you assign a member ID to a router or switch, assign the same member ID defined for this device in the preprovisioned configuration. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level system-control

Related Documentation

- Configuring Member IDs for a Virtual Chassis on page 68
- *Configuring an EX9200 Virtual Chassis*
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

List of Sample Output request virtual-chassis member-id set on page 246

Sample Output

request virtual-chassis member-id set

```
user@host> request virtual-chassis member-id set member 0
This command will enable virtual-chassis mode and reboot the system.

 Continue? [yes,no] (no)
```

request virtual-chassis routing-engine master switch

Syntax

request virtual-chassis routing-engine master switch
<check>

Release Information

Command introduced in Junos OS Release 11.2.
Option **check** introduced in Junos OS Release 12.2.
Command introduced in Junos OS Release 13.2R2 for EX Series switches.

Description

Change the mastership in an MX Series Virtual Chassis or EX9200 Virtual Chassis by switching the global roles of the master router or switch and backup router or switch in the Virtual Chassis configuration. The **request virtual-chassis routing-engine master switch** command must be issued from the master router or switch (VC-Mm).

The local roles (master and standby) of the Routing Engines in each member router or switch do not change after you issue the **request virtual-chassis routing-engine master switch** command.

NOTE: Before you issue the **request virtual-chassis routing-engine master switch** command from the master router or switch in the Virtual Chassis, make sure that the system configuration is synchronized between the master and backup router or switch. If the configuration is not synchronized, or if you attempt to issue the **request virtual-chassis routing-engine master switch** command from the backup router or switch instead of from the master router or switch, the device displays an error message and rejects the command.

If you issue the **request virtual-chassis routing-engine master switch** command when the Virtual Chassis is in a transition state (for example, the backup router or switch is disconnecting from the Virtual Chassis), the device does not process the command.

Options

check—(Optional) Perform a check from the master router or switch to determine whether the member routers or switches are ready for GRES from a database synchronization perspective, without initiating the GRES operation itself.

Required Privilege Level

system-control

Related Documentation

- Switching the Global Master and Backup Roles in a Virtual Chassis Configuration on page 87
- Determining GRES Readiness in a Virtual Chassis Configuration on page 163
- Mastership Election in a Virtual Chassis on page 31

List of Sample Output

request virtual-chassis routing-engine master switch (From Master Router) on page 248

request virtual-chassis routing-engine master switch (Error When Configuration Not Synchronized) on page 248
request virtual-chassis routing-engine master switch (Error When Run from Backup Router) on page 248
request virtual-chassis routing-engine master switch check (Ready for GRES) on page 248
request virtual-chassis routing-engine master switch check (Not Ready for GRES) on page 248

Sample Output

request virtual-chassis routing-engine master switch (From Master Router)

```
{master:member0-re0}

user@host> request virtual-chassis routing-engine master switch
Do you want to continue ? [yes,no] (no)
```

request virtual-chassis routing-engine master switch (Error When Configuration Not Synchronized)

```
{master:member0-re0}

user@host> request virtual-chassis routing-engine master switch
Error: mastership switch request NOT honored, backup not ready
```

request virtual-chassis routing-engine master switch (Error When Run from Backup Router)

```
{backup:member1-re0}

user@host1> request virtual-chassis routing-engine master switch
error: Virtual Chassis member is not the protocol master
```

request virtual-chassis routing-engine master switch check (Ready for GRES)

```
{master:member0-re0}

user@host> request virtual-chassis routing-engine master switch check
{master:member0-re0}
```

request virtual-chassis routing-engine master switch check (Not Ready for GRES)

```
{master:member0-re0}

user@host> request virtual-chassis routing-engine master switch check
error: chassisd Not ready for mastership switch, try after 217 secs.
mastership switch request NOT honored, backup not ready
```

request virtual-chassis vc-port delete (MX Series Virtual Chassis)

Syntax request virtual-chassis vc-port delete fpc-slot *fpc-slot-number* pic-slot *pic-slot-number* port *port-number*
<(local | member *member-id*)>

Release Information Command introduced in Junos OS Release 11.2.

Description Remove (**delete**) a Virtual Chassis port from a member router in an MX Series Virtual Chassis configuration. After a Virtual Chassis port is created, it is renamed **vcp-*slot/pic/port***, and is no longer available for configuration as a standard network port. After you remove a Virtual Chassis port, it becomes available to the global configuration and can again function as a standard network port.

NOTE: If the member ID has not been set on the router where you issue the **request virtual-chassis vc-port delete** command, the software prevents the removal of the Virtual Chassis port on the router. To set the member ID, use the request virtual-chassis member-id set command.

Options

fpc-slot *fpc-slot-number*—Number of the Flexible PIC Concentrator (FPC) slot on which the Virtual Chassis port resides. The slot number corresponds to the Modular Port Concentrator (MPC) slot number. Replace ***fpc-slot-number*** with a value appropriate for your router:

- MX960 router—0 through 11.
- MX480 router—0 through 5.
- MX240 router—0 through 2.

pic-slot *pic-slot-number*—Number of the PIC slot on which the Virtual Chassis port resides. Replace ***pic-slot-number*** with a value in the range 0 through 3.

port *port-number*—Number of the port on the PIC on which the Virtual Chassis port resides. Replace ***port-number*** with a value appropriate for your PIC.

local—(Optional) Delete the Virtual Chassis port on the member router on which you are issuing the command. This is the default behavior if you do not specify the **local** or **member** options.

member *member-id*—(Optional) Numeric value that identifies the remote Virtual Chassis member on which you want to delete the Virtual Chassis port. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level system-control

Related Documentation

- Deleting Virtual Chassis Ports in a Virtual Chassis Configuration on page 120
- Example: Deleting a Virtual Chassis Configuration for MX Series 3D Universal Edge Routers on page 103

List of Sample Output request virtual-chassis vc-port delete (Remove vcp-3/2/1) on page 250

Sample Output

request virtual-chassis vc-port delete (Remove vcp-3/2/1)

```
user@host> request virtual-chassis vc-port delete fpc-slot 3 pic-slot 2 port 1
vc-port successfully deleted
```

request virtual-chassis vc-port set (MX Series Virtual Chassis)

Syntax request virtual-chassis vc-port set fpc-slot *fpc-slot-number* pic-slot *pic-slot-number* port *port-number*
<(local | member *member-id*)>

Release Information Command introduced in Junos OS Release 11.2.

Description Create (**set**) a Virtual Chassis port on an MX Series router through which the router connects to other member routers in the Virtual Chassis. You can create Virtual Chassis ports only on Modular Port Concentrator/Modular Interface Card (MPC/MIC) network ports on MX Series routers.

After a Virtual Chassis port is created, it is renamed **vcp-*slot/pic/port***, and is no longer available for configuration as a standard network port. Virtual Chassis ports can be used only to interconnect the MX Series routers in the Virtual Chassis.

NOTE: If the member ID has not been set on the router where you issue the **request virtual-chassis vc-port set** command, the software prevents the creation of the Virtual Chassis port on the router. To set the member ID, use the request virtual-chassis member-id set command.

Options **fpc-slot *fpc-slot-number***—Number of the Flexible PIC Concentrator (FPC) slot on which the Virtual Chassis port resides. The slot number corresponds to the Modular Port Concentrator (MPC) slot number. Replace ***fpc-slot-number*** with a value appropriate for your router:

- MX960 router—0 through 11.
- MX480 router—0 through 5.
- MX240 router—0 through 2.

When you issue the **show interfaces** command on a member router in an MX Series Virtual Chassis, the FPC slot number displayed in the command output reflects the FPC slot numbering and offset used in the Virtual Chassis instead of the physical slot number where the FPC is actually installed. The router with member ID 0 in the Virtual Chassis uses FPC slot numbers 0 through 11 with no offset, and the router with member ID 1 uses FPC slot numbers 12 through 23, with an offset of 12. For example, a 10-Gigabit Ethernet interface that appears as **xe-14/2/2** (FPC slot 14, PIC slot 2, port 2) in the **show interfaces** command is actually interface **xe-2/2/2** (FPC slot 2, PIC slot 2, port 2) on member ID 1 after deducting the FPC slot numbering offset of 12 for member ID 1.

pic-slot *pic-slot-number*—Number of the PIC slot on which the Virtual Chassis port resides. Replace ***pic-slot-number*** with a value in the range 0 through 3.

port *port-number*—Number of the port on the PIC on which the Virtual Chassis port resides. Replace ***port-number*** with a value appropriate for your PIC.

local—(Optional) Set the Virtual Chassis port on the member router on which you are issuing the command. This is the default behavior if you do not specify the **local** or **member** options.

member *member-id*—(Optional) Numeric value that identifies the remote Virtual Chassis member on which you want to create the Virtual Chassis port. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level system-control

Related Documentation

- Configuring Virtual Chassis Ports to Interconnect Member Routers or Switches on page 118
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Guidelines for Configuring Virtual Chassis Ports on page 116

List of Sample Output

request virtual-chassis vc-port set (No Existing Network Port) on page 252
request virtual-chassis vc-port set (Existing Network Port Converted) on page 252
request virtual-chassis vc-port set (On Local Router) on page 252
request virtual-chassis vc-port set (On Remote Member Router 1) on page 252

Sample Output

request virtual-chassis vc-port set (No Existing Network Port)

```
user@host> request virtual-chassis vc-port set fpc-slot 1 pic-slot 1 port 0
vc-port successfully set
```

request virtual-chassis vc-port set (Existing Network Port Converted)

```
user@host> request virtual-chassis vc-port set fpc-slot 2 pic-slot 1 port 1
Port conversion initiated, use “show virtual chassis vc-port” to verify
```

request virtual-chassis vc-port set (On Local Router)

```
user@host> request virtual-chassis vc-port set fpc-slot 2 pic-slot 1 port 3 local
vc-port successfully set
```

request virtual-chassis vc-port set (On Remote Member Router 1)

```
user@host> request virtual-chassis vc-port set fpc-slot 5 pic-slot 3 port 10 member 1
vc-port successfully set
```


show chassis network services

Syntax show chassis network services

Release Information Command introduced in Junos OS Release 9.4.
Command introduced in Junos OS Release 12.3 for MX2010 3D Universal Edge Routers.
Command introduced in Junos OS Release 12.3 for MX2020 3D Universal Edge Routers.
Command introduced in Junos OS Release 13.2 for MX104 3D Universal Edge Routers.

Description Display the network services mode that the router is configured to run in—IP Network Services mode, Ethernet Network Services mode, Enhanced IP Network Services mode, or Enhanced Ethernet Network Services mode.

Options This command has no options.

Required Privilege Level view

List of Sample Output
show chassis network services on page 253
show chassis network services (MX104 Router) on page 253
show chassis network services (MX2010 Router) on page 253
show chassis network services (MX2020 Router) on page 254

Output Fields Table 25 on page 253 lists the output fields for the **show chassis network services** command. Output fields are listed in the approximate order in which they appear.

Table 25: show chassis network services Output Fields

Field Name	Field Description
Network Services Mode	Network services mode configured for the MX Series router: • **IP**—IP Network Services mode. • **Ethernet**—Ethernet Network Services mode. • **enhanced-ip**—Enhanced IP Network Services mode • **enhanced-ethernet**—Enhanced Ethernet Network Services mode

Sample Output

show chassis network services

```
user@host> show chassis network services
Network Services Mode: IP
```

show chassis network services (MX104 Router)

```
user@host> show chassis network services
Network Services Mode: IP
```

show chassis network services (MX2010 Router)

```
user@host> show chassis network services
Network Services Mode: Enhanced-IP
```

show chassis network services (MX2020 Router)

```
user@host> show chassis network services
Network Services Mode: Enhanced-IP
```

show services accounting status

Syntax show services accounting status
<inline-jflow fpc-slot *slot-number* | name (* | all | *service-name*)>

Release Information Command introduced before Junos OS Release 7.4.

Description Display available Physical Interface Cards (PICs) for accounting services.

Options **none**—Display available PICs for all accounting services.

inline-jflow fpc-slot *slot-number*—(Optional) Display inline flow accounting status for the specified FPC. For a two-member MX Series Virtual Chassis, the master router uses FPC slot numbers 0 through 11 with no offset; the backup router uses FPC slot numbers 12 through 23, with an offset of 12.

name (* | all | *service-name*)—(Optional) Display available PICs. Use a wildcard character, specify all services, or provide a specific services name.

Required Privilege Level view

Related Documentation
- *show services accounting flow*
- Inline Flow Monitoring for Virtual Chassis Overview on page 167

List of Sample Output
show services accounting status name (Monitoring PIC interface) on page 256
show services accounting status name (Service PIC interface) on page 256
show services accounting status inline-jflow fpc-slot slot-number (when both IPv4 and IPv6 are configured) on page 257
show services accounting status inline-jflow (MX80 Router when both IPv4 and IPv6 are configured) on page 257

Output Fields Table 26 on page 255 lists the output fields for the **show services accounting status** command. Output fields are listed in the approximate order in which they appear.

Table 26: show services accounting status Output Fields

Field	Field Description
Service Accounting interface	Name of the service accounting interface.
Service name	Name of a service that was configured at the [**edit-forwarding-options accounting**] hierarchy level. The default display,**(default sampling)**, indicates the service was configured at the [**edit-forwarding-options sampling-level**] hierarchy level.
FPC Slot	Slot number of the FPC for which the flow information is displayed.
Local interface index	Index counter of the local interface.

Table 26: show services accounting status Output Fields *(continued)*

Field	Field Description
Interface state	Accounting state of the passive monitoring interface. • **Accounting**—PIC is actively accounting. • **Disabled**—PIC has been disabled from the CLI. • **Not accounting**—PIC is up but not accounting. This can happen while the PIC is coming online, or when the PIC is up but has no logical unit configured under the physical interface. • Unknown
Group index	Integer that represents the monitoring group of which the PIC is a member. **Group index** is a mapping from the group name to an index. It is not related to the number of monitoring groups.
Export interval (in seconds)	Configured export interval for cflowd records, in seconds.
Export format	Configured export format.
Protocol	Protocol the PIC is configured to monitor.
Engine type	Configured engine type that is inserted in output cflowd packets.
Engine ID	Configured engine ID that is inserted in output cflowd packets.
Route Record Count	Number of routes recorded.
AS Record Count	Number of autonomous systems recorded.
Route Records Set	Status of route recording; whether routes are recorded or not.
Configuration Set	Status of monitoring configuration; whether monitoring configuration is set or not.

Sample Output

show services accounting status name (Monitoring PIC interface)

```
user@host> show services accounting status name count1
Service Accounting interface: mo-2/0/0, Local interface index: 468
Service name: count1
Interface state: Accounting
  Group index: 0
  Export interval (in seconds): 60, Export format: cflowd v8
  Protocol: IPv4, Engine type: 55, Engine ID: 5
```

Sample Output

show services accounting status name (Service PIC interface)

```
user@host> show services accounting status name
Service Accounting interface: sp-0/1/0
Interface state: Accounting
  Export format: 9, Route record count: 0
```

```
  IFL to SNMP index count: 7, AS count: 0
  Configuration set: Yes, Route record set: No, IFL SNMP map set: Yes

Service Accounting interface: sp-1/0/0
Interface state: Accounting
  Export format: 9, Route record count: 33
  IFL to SNMP index count: 7, AS count: 1
  Configuration set: Yes, Route record set: Yes, IFL SNMP map set: Yes
```

show services accounting status inline-jflow fpc-slot slot-number (when both IPv4 and IPv6 are configured)

```
user@host> show services accounting status inline-jflow fpc-slot 5
FPC Slot: 5
    IPV4 export format: Version-IPFIX, IPV6 export format: Version-IPFIX
    VPLS export format: Not set
    IPv4 Route Record Count: 5, IPv6 Route Record Count: 7
    Route Record Count: 12, AS Record Count: 1
    Route-Records Set: Yes, Config Set: Yes
```

show services accounting status inline-jflow (MX80 Router when both IPv4 and IPv6 are configured)

```
user@host> show services accounting status inline-jflow

Status information
    TFEB Slot: 0
    Export format: IP-FIX
    IPv4 Route Record Count: 6, IPv6 Route Record Count: 8
    Route Record Count: 14, AS Record Count: 1
    Route-Records Set: Yes, Config Set: Yes
```

show virtual-chassis active-topology (MX Series Virtual Chassis)

Syntax show virtual-chassis active-topology
<(all-members | local | member *member-id*)>

Release Information Command introduced in Junos OS Release 11.2.

Description Display information about neighbor reachability from each member router in an MX Series Virtual Chassis configuration. You can issue the **show virtual-chassis active-topology** command from the console of either member router in the Virtual Chassis.

Options

all-members—(Optional) Display neighbor reachability information for both member routers in a Virtual Chassis configuration. This is the default behavior if no options are specified.

local—(Optional) Display neighbor reachability information for the member router on which you are issuing the command.

member *member-id*—(Optional) Display neighbor reachability information for the specified Virtual Chassis member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level view

Related Documentation

- Verifying Neighbor Reachability for Member Routers or Switches in a Virtual Chassis on page 162

List of Sample Output

show virtual-chassis active-topology all-members on page 258
show virtual-chassis active-topology local on page 259
show virtual-chassis active-topology member 1 on page 259

Output Fields Table 27 on page 258 lists the output fields for the **show virtual-chassis active-topology** command. Output fields are listed in the approximate order in which they appear.

Table 27: show virtual-chassis active-topology Output Fields

Field Name	Field Description
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.
Destination ID	Member ID of the destination (neighbor) router.
Next-hop	Member ID and Virtual Chassis port interface (in the format **vcp-*slot/pic/port.logical-unit-number***) of the next-hop to which the router forwards packets for the destination ID.

Sample Output

show virtual-chassis active-topology all-members

```
{master:member0-re0}
```

```
user@host> show virtual-chassis active-topology all-members
member0:
--------------------------------------------------------------------------
  Destination ID        Next-hop

  1                    1(vcp-5/0/0.32768)

member1:
--------------------------------------------------------------------------
  Destination ID        Next-hop

  0                    0(vcp-1/3/0.32768)
```

show virtual-chassis active-topology local

```
{master:member0-re0}

user@host> show virtual-chassis active-topology local

  Destination ID        Next-hop

  1                    1(vcp-5/0/0.32768)
```

show virtual-chassis active-topology member 1

```
{master:member0-re0}

user@host> show virtual-chassis active-topology member 1
member1:
--------------------------------------------------------------------------
  Destination ID        Next-hop

  0                    0(vcp-1/3/0.32768)
```

show virtual-chassis device-topology (MX Series Virtual Chassis)

Syntax
show virtual-chassis device-topology
<(all-members | local | member *member-id*)>

Release Information
Command introduced in Junos OS Release 11.2.

Description
Display information about neighbor reachability for each hardware device in an MX Series Virtual Chassis configuration. On the MX Series router, there is only one active device for each member router. You can issue the **show virtual-chassis device-topology** command from the console of either member router in the Virtual Chassis.

Options
all-members—(Optional) Display neighbor reachability information for the device in both member routers in a Virtual Chassis configuration.

local—(Optional) Display neighbor reachability information for the device in the member router on which you are issuing the command. This is the default behavior if no options are specified.

member *member-id*—(Optional) Display neighbor reachability information for the device in the specified Virtual Chassis member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level
view

Related Documentation
- Verifying Neighbor Reachability for Hardware Devices in a Virtual Chassis on page 162

List of Sample Output
show virtual-chassis device-topology all-members on page 261
show virtual-chassis device-topology local on page 261
show virtual-chassis device-topology member 1 on page 261

Output Fields
Table 28 on page 260 lists the output fields for the **show virtual-chassis device-topology** command. Output fields are listed in the approximate order in which they appear.

Table 28: show virtual-chassis device-topology Output Fields

Field Name	Field Description
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.
Member	Identifier assigned to the member router in the preprovisioned Virtual Chassis configuration.
Device	Identifier assigned to the device in the member router. Because there is only one active device per member router in an MX Series Virtual Chassis configuration, the values in the Device and Member fields are identical.

Table 28: show virtual-chassis device-topology Output Fields *(continued)*

Field Name	Field Description
Status	Status of the device: • **Prsnt**—Device is currently connected to the Virtual Chassis. • **NotPrsnt**—Device is not currently connected to the Virtual Chassis.
System ID	Unique identifier derived from the device's media access control (MAC) address. The System ID is included in each Virtual Chassis Control Protocol (VCCP) packet to identify the packet owner to all members of the Virtual Chassis.
Neighbor List Member/Device/Interface	Member IDs, Device IDs, and Virtual Chassis port interfaces (in the format **vcp-*slot/pic/port***) to which this device is connected.

Sample Output

show virtual-chassis device-topology all-members

```
{master:member0-re0}

user@host> show virtual-chassis device-topology all-members
member0:
--------------------------------------------------------------------------
                                                Neighbor List
Member  Device  Status   System ID         Member  Device  Interface
   0       0    Prsnt    b0c6.9abf.6800       1       1    vcp-5/0/0
   1       1    Prsnt    001d.b510.0800       0       0    vcp-1/3/0

member1:
--------------------------------------------------------------------------
                                                Neighbor List
Member  Device  Status   System ID         Member  Device  Interface
   0       0    Prsnt    b0c6.9abf.6800       1       1    vcp-5/0/0
   1       1    Prsnt    001d.b510.0800       0       0    vcp-1/3/0
```

show virtual-chassis device-topology local

```
{master:member0-re0}

user@host> show virtual-chassis device-topology local

                                                Neighbor List
Member  Device  Status   System ID         Member  Device  Interface
   0       0    Prsnt    b0c6.9abf.6800       1       1    vcp-5/0/0
   1       1    Prsnt    001d.b510.0800       0       0    vcp-1/3/0
```

show virtual-chassis device-topology member 1

```
{master:member0-re0}

user@host> show virtual-chassis device-topology member 1
member1:
--------------------------------------------------------------------------
                                                Neighbor List
Member  Device  Status   System ID         Member  Device  Interface
   0       0    Prsnt    b0c6.9abf.6800       1       1    vcp-5/0/0
   1       1    Prsnt    001d.b510.0800       0       0    vcp-1/3/0
```


show virtual-chassis heartbeat (MX Series Virtual Chassis)

Syntax

show virtual-chassis heartbeat
<(brief | detail)>
<(all-members | local | member *member-id*)>

Release Information

Command introduced in Junos OS Release 14.1.

Description

Display the state of one or both member routers in an MX Series Virtual Chassis configuration when an IP-based heartbeat packet connection is configured. You can issue the **show virtual-chassis heartbeat** command from the console of either member router in the Virtual Chassis.

Options

none—Display the heartbeat state of both member routers in an MX Series Virtual Chassis.

brief | detail—(Optional) Display the specified level of output. Using the **brief** option is equivalent to issuing the command with no options (the default). The **detail** option provides more output than the **brief** option.

all-members—(Optional) Display the heartbeat state of both member routers in an MX Series Virtual Chassis. This is the default behavior if no options are specified.

local—(Optional) Display the heartbeat state of the member router from which you are issuing the command.

member *member-id*—(Optional) Display the heartbeat state of the specified member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level

view

Related Documentation

- Verifying and Managing the Virtual Chassis Heartbeat Connection on page 167
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

List of Sample Output

show virtual-chassis heartbeat on page 264
show virtual-chassis heartbeat detail on page 265

Output Fields

Table 29 on page 263 lists the output fields for the **show virtual-chassis heartbeat** command. Output fields are listed in the approximate order in which they appear.

Table 29: show virtual-chassis heartbeat Output Fields

Field Name	Field Description	Level of Output
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.	All levels
Local	IP address of the local member router that forms the heartbeat connection.	All levels

Table 29: show virtual-chassis heartbeat Output Fields *(continued)*

Field Name	Field Description	Level of Output
Remote	IP address of the remote member router that forms the heartbeat connection.	All levels
State	State of the heartbeat connection: • **Alive**—Master Routing Engine in the specified member router is connected and has received a heartbeat response message. • **Connected**—Master Routing Engine in the specified member router is connected and awaiting a heartbeat response message. • **Conn-Pending**—Master Routing Engine in the specified member router is connecting to the other member router. • **Idle**—Heartbeat connection is enabled but not yet connected. • **Inactive**—Heartbeat connection is not active. To activate the connection, you must configure the heartbeat address and, optionally, the heartbeat timeout value.	All levels
Time	Date and time, in the format ***yyyy-mm-dd hh:mm:ss***, of the last connection state change. If you have cleared or never collected timestamps, this field displays **Never** and the time interval displays **0** (zero).	All levels
Heartbeat Statistics	Detailed statistics for the heartbeat connection: • **Heartbeats sent**—Number of heartbeat request messages sent. • **Heartbeats received**—Number of heartbeat response messages received. • **Heartbeats lost/missed**—Calculated difference between **Heartbeats sent** value and **Heartbeats received** value. • **Last time sent**—Date and time, in the format ***yyyy-mm-dd hh:mm:ss***, and time since, in the format **(*hh:mm:ss* ago)**, the last heartbeat request message was sent. If you have cleared or never collected timestamps, this field displays **Never** and the time interval displays **0** (zero). • **Last time received**—Date and time, in the format ***yyyy-mm-dd hh:mm:ss***, and time since, in the format **(*hh:mm:ss* ago)**, the last heartbeat request response message was received. If you have cleared or never collected timestamps, this field displays **Never** and the time interval displays **0** (zero). • **Maximum latency**—Maximum number of seconds that elapse on the local member router between transmission of a heartbeat request message and receipt of a heartbeat response message. • **Minimum latency**—Minimum number of seconds that elapse on the local member router between transmission of a heartbeat request message and receipt of a heartbeat response message.	**detail**

Sample Output

show virtual-chassis heartbeat

```
{master:member0-re0}

user@host> show virtual-chassis heartbeat
member0:
--------------------------------------------------------------------------
Local        Remote          State       Time
10.4.2.210   10.4.2.100      Alive       2014-01-14 14:46:52 PDT
```

```
member1:
--------------------------------------------------------------------------
Local        Remote          State       Time
10.4.2.100   10.4.2.210      Alive       2014-01-14 14:46:53 PDT
```

show virtual-chassis heartbeat detail

```
{master:member0-re0}

user@host> show virtual-chassis heartbeat detail
member0:
--------------------------------------------------------------------------
Local        Remote          State       Time
10.4.2.210   10.4.2.100      Alive       2014-01-14 14:46:52 PDT

Heartbeat statistics
 Heartbeats sent: 8812
 Heartbeats received: 8806
 Heartbeats lost/missed: 6
 Last time sent: 2014-01-14 14:28:00 PST (00:00:01 ago)
 Last time received: 2014-01-14 14:28:00 PST (00:00:01 ago)
 Maximum latency (secs): 1
 Minimum latency (secs): 0

member1:
--------------------------------------------------------------------------
Local        Remote          State       Time
10.4.2.100   10.4.2.210      Alive       2014-01-14 14:46:53 PDT

Heartbeat statistics
 Heartbeats sent: 8812
 Heartbeats received: 8806
 Heartbeats lost/missed: 6
 Last time sent: 2014-01-14 14:28:00 PST (00:00:01 ago)
 Maximum latency (secs): 1
 Minimum latency (secs): 0
```

show virtual-chassis protocol adjacency (MX Series Virtual Chassis)

Syntax

show virtual-chassis protocol adjacency
<(brief | detail | extensive)>
<(all-members | local | member *member-id*)>
<*system-id*>

Release Information

Command introduced in Junos OS Release 11.2.

Description

Display the entries (neighbors) in the Virtual Chassis Control Protocol (VCCP) adjacency database for an MX Series Virtual Chassis configuration. You can issue the **show virtual-chassis protocol adjacency** command from the console of either member router in the Virtual Chassis.

Options

brief | detail | extensive—(Optional) Display the specified level of output. Using the **brief** option is equivalent to issuing the command with no options (the default). The **detail** option provides more output than the **brief** option. The **extensive** option provides complete output and is most useful for customer support personnel.

all-members—(Optional) Display the VCCP adjacency database for both member routers in a Virtual Chassis. This is the default behavior if no options are specified.

local—(Optional) Display the VCCP adjacency database for the member router on which you are issuing the command.

member *member-id*—(Optional) Display the VCCP adjacency database for the specified member router. Replace ***member-id*** with the value 0 or 1.

system-id—(Optional) Display the VCCP adjacency database for the device with the specified system ID.

Required Privilege Level

view

Related Documentation

- Viewing Information in the Virtual Chassis Control Protocol Adjacency Database on page 164

List of Sample Output

show virtual-chassis protocol adjacency all-members brief on page 268
show virtual-chassis protocol adjacency member 0 detail on page 269
show virtual-chassis protocol adjacency member 0 detail 001d.b510.0800 on page 269
show virtual-chassis protocol adjacency local extensive on page 269

Output Fields

Table 30 on page 266 lists the output fields for the **show virtual-chassis protocol adjacency** command. Output fields are listed in the approximate order in which they appear.

Table 30: show virtual-chassis protocol adjacency Output Fields

Field Name	Field Description	Level of Output
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.	All levels

Table 30: show virtual-chassis protocol adjacency Output Fields *(continued)*

Field Name	Field Description	Level of Output
Interface	Name of the Virtual Chassis port interface, in the format **vcp-*slot/pic/port.logical-unit-number***.	**brief**
System	System ID of the device associated with the Virtual Chassis port interface. The System ID is derived from the device's media access control (MAC) address.	**brief**
State	State of the adjacency: • **Up**—The adjacency is up. • **Down**—The adjacency is down.	All levels
Hold (secs)	Remaining hold time of the adjacency, in seconds.	**brief**
system-id	System ID of the device associated with the Virtual Chassis port interface. The System ID is derived from the device's media access control (MAC) address.	**detail**, **extensive**
interface-name	Name of the Virtual Chassis port interface, in the format **vcp-*slot/pic/port.logical-unit-number***.	**detail**, **extensive**
Expires in	Number of seconds until the adjacency expires.	**detail**, **extensive**
Priority	Priority to become the designated intermediate system.	**detail**, **extensive**
Up/Down transitions	Count of adjacency status changes from **Up** to **Down** or from **Down** to **Up**.	**detail**, **extensive**
Last transition	Time of the last **Up**/**Down** transition.	**detail**, **extensive**

Table 30: show virtual-chassis protocol adjacency Output Fields *(continued)*

Field Name	Field Description	Level of Output

Transition log	List of recent adjacency transitions, including:
	• **When**—Date and time at which a VCCP adjacency transition occurred.
	• **State**—Current state of the VCCP adjacency:
	  • **Up**—Adjacency is up and operational.
	  • **Down**—Adjacency is down and not available.
	  • **Rejected**—Adjacency has been rejected.
	• **Event**—Type of transition that occurred:
	  • **Seenself**—Possible routing loop has been detected.
	  • **Interface down**—Virtual Chassis port interface has gone down and is no longer available.
	  • **Error**—Adjacency error.
	• **Down reason**—Reason that a VCCP adjacency is down:
	  • **3-Way Handshake Failed**—Connection establishment failed.
	  • **Address Mismatch**—Address mismatch caused link failure.
	  • **Aged Out**—Link expired.
	  • **ISO Area Mismatch**—VCCP area mismatch caused link failure.
	  • **Bad Hello**—Unacceptable hello message caused link failure.
	  • **BFD Session Down**—Bidirectional failure detection caused link failure.
	  • **Interface Disabled**—Virtual Chassis port interface is disabled.
	  • **Interface Down**—Virtual Chassis port interface is unavailable.
	  • **Interface Level Disabled**—VCCP level is disabled.
	  • **Level Changed**—VCCP level has changed on the adjacency.
	  • **Level Mismatch**—Levels on adjacency are not compatible.
	  • **MPLS LSP Down**—Label-switched path (LSP) is unavailable.
	  • **MT Topology Changed**—VCCP topology has changed.
	  • **MT Topology Mismatch**—VCCP topology is mismatched.
	  • **Remote System ID Changed**—Adjacency peer system ID changed.
	  • **Protocol Shutdown**—VCCP is disabled.
	  • **CLI Command**—Adjacency brought down by user.
	  • **Unknown**—Unknown.
		extensive

Sample Output

show virtual-chassis protocol adjacency all-members brief

```
{master:member0-re0}

user@host> show virtual-chassis protocol adjacency all-members brief
member0:
--------------------------------------------------------------------------
Interface             System         State       Hold (secs)
vcp-5/0/0.32768       001d.b510.0800 Up                  57

member1:
--------------------------------------------------------------------------
```

```
Interface             System         State        Hold (secs)
vcp-1/3/0.32768       b0c6.9abf.6800 Up                  58
```

show virtual-chassis protocol adjacency member 0 detail

```
{master:member0-re0}

user@host> show virtual-chassis protocol adjacency member 0 detail
member0:
--------------------------------------------------------------------------

001d.b510.0800
  interface-name: vcp-5/0/0.32768, State: Up, Expires in 57 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 18:50:41 ago
```

show virtual-chassis protocol adjacency member 0 detail 001d.b510.0800

```
{master:member0-re0}

user@host> show virtual-chassis protocol adjacency member 0 detail 001d.b510.0800
member0:
--------------------------------------------------------------------------

001d.b510.0800
  interface-name: vcp-5/0/0.32768, State: Up, Expires in 58 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 18:52:08 ago
```

show virtual-chassis protocol adjacency local extensive

```
{master:member0-re0}

user@host> show virtual-chassis protocol adjacency local extensive


001d.b510.0800
  interface-name: vcp-5/0/0.32768, State: Up, Expires in 59 secs
  Priority: 0, Up/Down transitions: 1, Last transition: 18:52:40 ago
  Transition log:
  When                  State        Event           Down reason
  Mon Sep 20 17:26:44   Up           Seenself
```

show virtual-chassis protocol database (MX Series Virtual Chassis)

Syntax

show virtual-chassis protocol database
<(brief | detail | extensive)>
<(all-members | local | member *member-id*)>
<*system-id*>

Release Information

Command introduced in Junos OS Release 11.2.

Description

Display the entries in the Virtual Chassis Control Protocol (VCCP) link-state database for an MX Series Virtual Chassis configuration. The VCCP link-state database contains information about protocol data unit (PDU) packets. You can issue the **show virtual-chassis protocol database** command from the console of either member router in the Virtual Chassis.

Options

brief | detail | extensive—(Optional) Display the specified level of output. Using the **brief** option is equivalent to issuing the command with no options (the default). The **detail** option provides more output than the **brief** option. The **extensive** option provides complete output and is most useful for customer support personnel.

all-members—(Optional) Display the VCCP link-state database for both member routers in a Virtual Chassis. This is the default behavior if no options are specified.

local—(Optional) Display the VCCP link-state database for the member router on which you are issuing the command.

member *member-id*—(Optional) Display the VCCP link-state database for the specified member router. Replace ***member-id*** with the value 0 or 1.

system-id—(Optional) Display the VCCP link-state database for the neighbor with the specified system ID.

Required Privilege Level

view

Related Documentation

- Viewing Information in the Virtual Chassis Control Protocol Link-State Database on page 164

List of Sample Output

show virtual-chassis protocol database all-members brief on page 272
show virtual-chassis protocol database member 0 detail on page 273
show virtual-chassis protocol database member 0 b0c6.9abf.6800 detail on page 273
show virtual-chassis protocol database member 0 extensive on page 273

Output Fields

Table 31 on page 270 lists the output fields for the **show virtual-chassis protocol database** command. Output fields are listed in the approximate order in which they appear.

Table 31: show virtual-chassis protocol database Output Fields

Field Name	Field Description	Level of Output
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.	All levels

Table 31: show virtual-chassis protocol database Output Fields *(continued)*

Field Name	Field Description	Level of Output
LSP ID	Link-state PDU (LSP) identifier.	All levels
Sequence	Sequence number of the link-state PDU.	All levels
Checksum	Checksum value of the link-state PDU.	All levels
Lifetime	Remaining lifetime of the link-state PDU, in seconds.	All levels
***number* LSPs**	Total number of link-state PDUs in the specified link-state database.	none, **brief**
Neighbor, Neighbor Info	Media access control (MAC) address of the neighbor on the advertising system.	**detail**, **extensive**
Interface	Name of the Virtual Chassis port interface, in the format **vcp-*slot/pic/port.logical-unit-number***.	**detail**, **extensive**
Metric	Metric value of the prefix or neighbor.	**detail**, **extensive**
Header	Link-state PDU (LSP) packet header: • **LSP ID**—LSP identifier in the header. • **Length**—Header length, in bytes. • **Allocated length**—Length available for the header, in bytes. • **Remaining lifetime**—Remaining lifetime of the link-state PDU, in seconds. • **Interface**—The interface from which the LSP is received. • **Estimated free bytes**—Estimated number of available bytes in the LSP. • **Actual free bytes**—Actual number of available bytes in the LSP. • **Aging timer expires in**—Remaining lifetime of the LSP, in seconds.	**extensive**
Packet	Link-state PDU (LSP) packet: • **LSP ID**—Identifier for the link-state packet. • **Length**—Packet length, in bytes. • **Lifetime**—Remaining lifetime, in seconds. • **Checksum**—Checksum of the link-state PDU. • **Sequence**—Sequence number of the link-state PDU. This number increments whenever the link-state PDU is updated. • **Fixed length**—Set length for the packet, in bytes. • **Version**—Protocol version. • **Sysid length**—Length of the system ID, in bytes. The value 0 represents 6 bytes. • **Packet type**—Protocol data unit (PDU) type of the LSP. • **SW version**—Junos OS Release number.	**extensive**

Table 31: show virtual-chassis protocol database Output Fields *(continued)*

Field Name	Field Description	Level of Output
TLVs	Link-state PDU (LSP) type, length, and value (TLV): • **Member ID**—Identifier configured for the Virtual Chassis member router. • **VC ID**—Identifier assigned to the Virtual Chassis member router. • **Flags**—Internal flags that keep track of the member state for the purpose of mastership election in the Virtual Chassis. • **Priority**—Priority value associated with the role assigned to a member router in the preprovisioned Virtual Chassis configuration. For example, the priority value for the **routing-engine** role is 129. The priority value is used for mastership election in the Virtual Chassis. • **System ID**—System ID of the device associated with the Virtual Chassis port interface. The System ID is derived from the device's media access control (MAC) address. • **Device ID**—Identifier for the device; usually the same as the Member ID. • **Neighbor Info**—System ID, Virtual Chassis port interface, and metric value for VCCP neighbor. • **Topology Info**—System ID of the VCCP neighbor. • **IRI Addr Info**—Internal routing interface (IRI) IP address, which is reserved for internal communication. • **Master Info**—System ID of the master router in the Virtual Chassis. • **Backup Info**—System ID of the backup router in the Virtual Chassis. • **Stable State Info**—Internal state information used for mastership election in the Virtual Chassis. • **Member Info**—System ID, Member ID, and role of each member router in the Virtual Chassis. • **Provision Info**—Member ID and chassis serial number specified for each member router in the preprovisioned configuration for an MX Series Virtual Chassis. • **Unknown TLV**—Type and length of TLVs with unsupported content received on this device.	**extensive**
***number* queued**	Number of link-state PDUs queued on the specified Virtual Chassis port interface.	**extensive**

Sample Output

show virtual-chassis protocol database all-members brief

```
{master:member1-re0}

user@host> show virtual-chassis protocol database all-members brief
member0:
--------------------------------------------------------------------------
LSP ID                      Sequence Checksum Lifetime
001d.b510.0800.00-00           0x9eb   0xb8f1      115
b0c6.9abf.6800.00-00           0x9ee   0x8f35      116
  2 LSPs

member1:
--------------------------------------------------------------------------
LSP ID                      Sequence Checksum Lifetime
001d.b510.0800.00-00           0x9eb   0xb8f1      117
```

```
b0c6.9abf.6800.00-00           0x9ee    0x8f35      114
  2 LSPs
```

show virtual-chassis protocol database member 0 detail

```
{master:member1-re0}

user@host> show virtual-chassis protocol database member 0 detail
member0:
--------------------------------------------------------------------------

001d.b510.0800.00-00 Sequence: 0x9f5, Checksum: 0x5b2b, Lifetime: 116 secs
   Neighbor: b0c6.9abf.6800.00  Interface: vcp-1/3/0.32768 Metric:      15

b0c6.9abf.6800.00-00 Sequence: 0x9f8, Checksum: 0x326e, Lifetime: 117 secs
   Neighbor: 001d.b510.0800.00  Interface: vcp-5/0/0.32768 Metric:      15
```

show virtual-chassis protocol database member 0 b0c6.9abf.6800 detail

```
{master:member1-re0}

user@host> show virtual-chassis protocol database member 0 b0c6.9abf.6800 detail
member0:
--------------------------------------------------------------------------

b0c6.9abf.6800.00-00 Sequence: 0xa06, Checksum: 0x925b, Lifetime: 117 secs
   Neighbor: 001d.b510.0800.00  Interface: vcp-5/0/0.32768 Metric:      15
```

show virtual-chassis protocol database member 0 extensive

```
{master:member1-re0}

user@host> show virtual-chassis protocol database member 0 extensive
member0:
--------------------------------------------------------------------------

001d.b510.0800.00-00 Sequence: 0xa09, Checksum: 0xa696, Lifetime: 116 secs
   Neighbor: b0c6.9abf.6800.00  Interface: vcp-1/3/0.32768 Metric:      15

  Header: LSP ID: 001d.b510.0800.00-00, Length: 804 bytes
    Allocated length: 804 bytes,
    Remaining lifetime: 116 secs, Interface: 64
    Estimated free bytes: 0, Actual free bytes: 0
    Aging timer expires in: 116 secs

  Packet: LSP ID: 001d.b510.0800.00-00, Length: 804 bytes, Lifetime : 118 secs
    Checksum: 0xa696, Sequence: 0xa09,
    Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 18, SW version: 11.1

  TLVs:
    Node Info: Member ID: 1, VC ID: 5a6a.e747.8511, Flags: 3, Priority: 129
       System ID: 001d.b510.0800, Device ID: 1
    Unknown TLV, Type: 0, Length: 0
    ...
    Unknown TLV, Type: 0, Length: 0
    Unknown TLV, Type: 1, Length: 1
    Neighbor Info: b0c6.9abf.6800.00, Interface: vcp-1/3/0.32768, Metric: 15
    Topology Info: System ID: 001d.b510.0800,
    Topology Info: System ID: b0c6.9abf.6800,
    IRI Addr Info: IP Address: 128.0.0.1,
    IRI Addr Info: IP Address: 128.0.0.4,
    IRI Addr Info: IP Address: 128.0.0.5,
```

```
    IRI Addr Info: IP Address: 128.0.0.6,
    IRI Addr Info: IP Address: 128.0.0.17,
    Master Info: System ID: 001d.b510.0800
    Backup Info: System ID: b0c6.9abf.6800
    Stable State Info: Master ID: 001d.b510.0800, Backup ID: b0c6.9abf.6800
    Member Info: System ID: b0c6.9abf.6800, Member ID: 0 Member role: Backup
       System ID: b0c6.9abf.6800, Device ID: 0
    Member Info: System ID: 001d.b510.0800, Member ID: 1 Member role: Master
       System ID: 001d.b510.0800, Device ID: 1
    Provision Info: Member ID: 1 Serial Number: JN10C78D1AFC,
    Provision Info: Member ID: 0 Serial Number: JN115FDADAFB,
    Unknown TLV, Type: 24, Length: 1
    Unknown TLV, Type: 28, Length: 56

  1 queued :
  Send PSN on vcp-5/0/0.32768 for 00:00:01

b0c6.9abf.6800.00-00 Sequence: 0xa0d, Checksum: 0x82d2, Lifetime: 118 secs
   Neighbor: 001d.b510.0800.00  Interface: vcp-5/0/0.32768 Metric:      15

  Header: LSP ID: b0c6.9abf.6800.00-00, Length: 808 bytes
    Allocated length: 1400 bytes,
    Remaining lifetime: 118 secs, Interface: 0
    Estimated free bytes: 546, Actual free bytes: 592
    Aging timer expires in: 118 secs

  Packet: LSP ID: b0c6.9abf.6800.00-00, Length: 808 bytes, Lifetime : 118 secs
    Checksum: 0x82d2, Sequence: 0xa0d,
    Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
    Packet type: 18, SW version: 11.1

  TLVs:
    Node Info: Member ID: 0, VC ID: 5a6a.e747.8511, Flags: 5, Priority: 129
       System ID: b0c6.9abf.6800, Device ID: 0
    Unknown TLV, Type: 0, Length: 0
    ...
    Unknown TLV, Type: 0, Length: 0
    Unknown TLV, Type: 1, Length: 1
    Neighbor Info: 001d.b510.0800.00, Interface: vcp-5/0/0.32768, Metric: 15
    Topology Info: System ID: 001d.b510.0800,
    Topology Info: System ID: b0c6.9abf.6800,
    IRI Addr Info: IP Address: 128.0.0.1,
    IRI Addr Info: IP Address: 128.0.0.4,
    IRI Addr Info: IP Address: 128.0.0.5,
    IRI Addr Info: IP Address: 128.0.0.6,
    IRI Addr Info: IP Address: 128.0.0.17,
    IRI Addr Info: IP Address: 128.0.0.21,
    Master Info: System ID: 001d.b510.0800
    Backup Info: System ID: b0c6.9abf.6800
    Stable State Info: Master ID: 001d.b510.0800, Backup ID: b0c6.9abf.6800
    Member Info: System ID: b0c6.9abf.6800, Member ID: 0 Member role: Backup
       System ID: b0c6.9abf.6800, Device ID: 0
    Member Info: System ID: 001d.b510.0800, Member ID: 1 Member role: Master
       System ID: 001d.b510.0800, Device ID: 1
    Provision Info: Member ID: 1 Serial Number: JN10C78D1AFC,
    Provision Info: Member ID: 0 Serial Number: JN115FDADAFB,
    Unknown TLV, Type: 24, Length: 1
    Unknown TLV, Type: 28, Length: 56

  1 queued :
  Retransmit on vcp-5/0/0.32768 for 00:00:01
```

show virtual-chassis protocol interface (MX Series Virtual Chassis)

Syntax

show virtual-chassis protocol interface
<(brief | detail)>
<*interface-name*>
<(all-members | local | member *member-id*)>

Release Information

Command introduced in Junos OS Release 11.2.

Description

Display Virtual Chassis Control Protocol (VCCP) information about Virtual Chassis port interfaces in an MX Series Virtual Chassis. You can issue the **show virtual-chassis protocol interface** command from the console of either member router in the Virtual Chassis.

Options

brief | detail—(Optional) Display the specified level of output. Using the **brief** option is equivalent to issuing the command with no options (the default). The **detail** option provides more output than the **brief** option.

all-members—(Optional) Display VCCP information about Virtual Chassis port interfaces for both member routers in a Virtual Chassis. This is the default behavior if no options are specified.

interface-name—(Optional) Display VCCP information about Virtual Chassis port interfaces for the specified Virtual Chassis port, in the format **vcp-*slot/pic/port.logical-unit-number***.

local—(Optional) Display VCCP information about Virtual Chassis port interfaces for the member router on which you are issuing the command.

member *member-id*—(Optional) Display VCCP information about Virtual Chassis port interfaces for the specified member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level

view

Related Documentation

- Viewing Information About Virtual Chassis Port Interfaces in the Virtual Chassis Control Protocol Database on page 165

List of Sample Output

show virtual-chassis protocol interface brief all-members on page 277
show virtual-chassis protocol interface detail all-members on page 278
show virtual-chassis protocol interface detail local on page 278

Output Fields

Table 32 on page 276 lists the output fields for the **show virtual-chassis protocol interface** command. Output fields are listed in the approximate order in which they appear.

Table 32: show virtual-chassis protocol interface Output Fields

Field Name	Field Description	Level of Output
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.	All levels

Table 32: show virtual-chassis protocol interface Output Fields *(continued)*

Field Name	Field Description	Level of Output
Interface	Name of the Virtual Chassis port interface, in the format **vcp-*slot/pic/port.logical-unit-number***.	**brief**
State	State of the Virtual Chassis port interface: • **Up**—The interface is up. • **Down**—The interface is down.	**brief**
Metric	Metric value for this Virtual Chassis port interface.	All levels
vcp-*slot/pic/port.logical-unit-number*	Name of the Virtual Chassis port interface.	**detail**
Index	Interface index number assigned by the Junos OS software.	**detail**
State	Internal implementation information.	**detail**
LSP interval	Interval, in milliseconds, between link-state protocol data units (PDUs) sent from the interface.	**detail**
***type* Hello padding**	Type of hello padding: • **Adaptive**—On point-to-point connections, the hello packets are padded from the initial detection of a new neighbor until the neighbor verifies the adjacency as Up in the adjacency state type, length, and value (TLV). If the neighbor does not support the adjacency state TLV, then padding continues. On LAN connections, padding starts from the initial detection of a new neighbor until there is at least one active adjacency on the interface. • **Loose**—(Default) The hello packet is padded from the initial detection of a new neighbor until the adjacency transitions to the Up state. • **Strict**—Padding is performed on all interface types and for all adjacency states, and is continuous.	**detail**
Adjacencies	Number of adjacencies established on this Virtual Chassis port interface.	**detail**
Hello(s)	Hello interval for the Virtual Chassis port interface.	**detail**
Hold(s)	Hold time for the Virtual Chassis port interface.	**detail**

Sample Output

show virtual-chassis protocol interface brief all-members

```
{master:member1-re0}

user@host> show virtual-chassis protocol interface brief all-members
member0:
--------------------------------------------------------------------------------
IS-IS interface database:
Interface             State        Metric
```

```
vcp-5/0/0.32768       Up             15

member1:
--------------------------------------------------------------------------
IS-IS interface database:
Interface             State         Metric
vcp-1/3/0.32768       Up             15
```

show virtual-chassis protocol interface detail all-members

```
{master:member1-re0}

user@host> show virtual-chassis protocol interface detail all-members
member0:
--------------------------------------------------------------------------

IS-IS interface database:
vcp-5/0/0.32768
  Index: 64, State: 0x46
  LSP interval: 100 ms, Loose Hello padding
  Adjacencies Metric Hello (s) Hold (s)n           1     15         3     60

member1:
--------------------------------------------------------------------------

IS-IS interface database:
vcp-1/3/0.32768
  Index: 64, State: 0x86
  LSP interval: 100 ms, Loose Hello padding
  Adjacencies Metric Hello (s) Hold (s)n           1     15         3     60
```

show virtual-chassis protocol interface detail local

```
{master:member1-re0}

user@host> show virtual-chassis protocol interface detail local


IS-IS interface database:
vcp-1/3/0.32768
  Index: 64, State: 0x46
  LSP interval: 100 ms, Loose Hello padding
  Adjacencies Metric Hello (s) Hold (s)n           1     15         3     60
```

show virtual-chassis protocol route (MX Series Virtual Chassis)

Syntax show virtual-chassis protocol route
<*destination-id*>
<(all-members | local | member *member-id*)>

Release Information Command introduced in Junos OS Release 11.2.

Description Display the Virtual Chassis Control Protocol (VCCP) unicast and multicast routing tables for an MX Series Virtual Chassis. You can issue the **show virtual-chassis protocol route** command from the console of either member router in the Virtual Chassis.

Options

all-members—(Optional) Display the VCCP unicast and multicast routing tables for both member routers in a Virtual Chassis configuration. This is the default behavior if no options are specified.

destination-id—(Optional) Display the VCCP unicast and multicast routing tables to the destination with the specified system ID.

local—(Optional) Display the VCCP unicast and multicast routing tables for the member router on which you are issuing the command.

member *member-id*—(Optional) Display the VCCP unicast and multicast routing tables for the specified member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level view

Related Documentation

- Viewing Virtual Chassis Control Protocol Routing Tables on page 166

List of Sample Output

show virtual-chassis protocol route all-members on page 280
show virtual-chassis protocol route member 0 001d.b510.0800 (For Specific Member ID and Destination ID) on page 281

Output Fields Table 33 on page 279 lists the output fields for the **show virtual-chassis protocol route** command. Output fields are listed in the approximate order in which they appear.

Table 33: show virtual-chassis protocol route Output Fields

Field Name	Field Description
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.
Dev	System ID of the device (member router) that stores the VCCP routing tables. The System ID is derived from the router's media access control (MAC) address.
ucast routing table	VCCP unicast routing table.
mcast routing table	VCCP multicast routing table.

Table 33: show virtual-chassis protocol route Output Fields *(continued)*

Field Name	Field Description
Current version	Version of the shortest-path-first (SPF) algorithm that generated the VCCP unicast or multicast routing table.
System ID	System ID of the device, derived from the device's MAC address.
Version	Version of the SPF algorithm that generated this route in the VCCP unicast or multicast routing table.
Metric	Metric value required to reach this device.
Interface	Name of the Virtual Chassis port interface (in the format **vcp-*slot/pic/port.logical-unit-number***) that interconnects the devices.
Via	MAC address of the next-hop device, if applicable.

Sample Output

show virtual-chassis protocol route all-members

```
{master:member1-re0}

user@host> show virtual-chassis protocol route all-members
member0:
--------------------------------------------------------------------------

Dev b0c6.9abf.6800 ucast routing table             Current version: 17
----------------
System ID          Version   Metric Interface     Via
001d.b510.0800          17       15 vcp-5/0/0.32768 001d.b510.0800
b0c6.9abf.6800          17        0

Dev b0c6.9abf.6800 mcast routing table             Current version: 17
----------------
System ID          Version   Metric Interface     Via
001d.b510.0800          17
b0c6.9abf.6800          17          vcp-5/0/0.32768

member1:
--------------------------------------------------------------------------

Dev 001d.b510.0800 ucast routing table             Current version: 17
----------------
System ID          Version   Metric Interface     Via
001d.b510.0800          17        0
b0c6.9abf.6800          17       15 vcp-1/3/0.32768 b0c6.9abf.6800

Dev 001d.b510.0800 mcast routing table             Current version: 17
----------------
System ID          Version   Metric Interface     Via
001d.b510.0800          17          vcp-1/3/0.32768
b0c6.9abf.6800          17
```

show virtual-chassis protocol route member 0 001d.b510.0800 (For Specific Member ID and Destination ID)

```
{master:member1-re0}

user@host> show virtual-chassis protocol route member 0 001d.b510.0800
member0:
--------------------------------------------------------------------------

Dev b0c6.9abf.6800 ucast routing table             Current version: 17
----------------
System ID          Version   Metric Interface     Via
001d.b510.0800          17       15 vcp-5/0/0.32768 001d.b510.0800
b0c6.9abf.6800          17        0

Dev b0c6.9abf.6800 mcast routing table             Current version: 17
----------------
System ID          Version   Metric Interface     Via
001d.b510.0800          17
b0c6.9abf.6800          17          vcp-5/0/0.32768
```

show virtual-chassis protocol statistics (MX Series Virtual Chassis)

Syntax show virtual-chassis protocol statistics
<*interface-name*>
<(all-members | local | member *member-id*)>

Release Information Command introduced in Junos OS Release 11.2.

Description Display Virtual Chassis Control Protocol (VCCP) statistics for one or both member routers, or for a specified Virtual Chassis port interface, in an MX Series Virtual Chassis. You can issue the **show virtual-chassis protocol statistics** command from the console of either member router in the Virtual Chassis.

Options

all-members—(Optional) Display VCCP statistics for both member routers in a Virtual Chassis configuration. This is the default behavior if no options are specified.

interface-name—(Optional) Display VCCP statistics for the specified Virtual Chassis port interface, in the format **vcp-*slot/pic/port.logical-unit-number***.

local—(Optional) Display VCCP statistics for the member router on which you are issuing the command.

member *member-id*—(Optional) Display VCCP statistics for the specified member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level view

Related Documentation

- Viewing Virtual Chassis Control Protocol Statistics for Member Devices and Virtual Chassis Ports on page 166

List of Sample Output

show virtual-chassis protocol statistics all-members on page 283
show virtual-chassis protocol statistics vcp-1/3/0.32768 member 1 (For Specific Virtual Chassis Port Interface and Member ID) on page 284

Output Fields Table 34 on page 282 lists the output fields for the **show virtual-chassis protocol statistics** command. Output fields are listed in the approximate order in which they appear.

Table 34: show virtual-chassis protocol statistics Output Fields

Field Name	Field Description
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.
PDU type	Type of protocol data unit (PDU).
Received	Number of PDUs received since VCCP started or since the statistics were set to zero.
Processed	Number of PDUs received minus the number of PDUs dropped.
Drops	Number of PDUs dropped.

Table 34: show virtual-chassis protocol statistics Output Fields *(continued)*

Field Name	Field Description
Sent	Number of PDUs transmitted since VCCP started or since the statistics were set to zero.
Rexmit	Number of PDUs retransmitted since VCCP started or since the statistics were set to zero.
Total packets received	Total number of PDUs received since VCCP started or since the statistics were set to zero.
Sent	Total number of PDUs transmitted since VCCP started or since the statistics were set to zero.
LSP queue length	Number of link-state PDUs waiting in the queue to be processed.
Drops	Number of link-state PDUs dropped.
SPF runs	Number of shortest-path-first (SPF) calculations performed.
Fragments rebuilt	Number of link-state PDU fragments computed by the local system.
LSP regenerations	Number of regenerated link-state PDUs. A link-state PDU is regenerated when the PDU nears the end of its lifetime and has not changed.
Purges initiated	Number of purges initiated by the software. A purge is initiated when the software determines that it must remove a link-state PDU from the network.

Sample Output

show virtual-chassis protocol statistics all-members

```
{master:member1-re0}

user@host> show virtual-chassis protocol statistics all-members
member0:
--------------------------------------------------------------------------

IS-IS statistics for b0c6.9abf.6800:
PDU type       Received    Processed        Drops         Sent       Rexmit
LSP                2937         2937            0         2934            0
HELLO              2913         2913            0         2922            0
CSNP                  1            1            0            1            0
PSNP               2916         2916            0         2925            0
Unknown               0            0            0            0            0
Totals             8767         8767            0         8782            0

Total packets received: 8767 Sent: 8782

LSP queue length: 0 Drops: 0
SPF runs: 17
Fragments rebuilt: 2955
LSP regenerations: 14
Purges initiated: 0

member1:
```

```
------------------------------------------------------------------------------

IS-IS statistics for 001d.b510.0800:
PDU type       Received    Processed        Drops         Sent       Rexmit
LSP                2934         2934            0         2937            0
HELLO              2922         2922            0         2914            0
CSNP                  1            1            0            1            0
PSNP               2925         2925            0         2916            0
Unknown               0            0            0            0            0
Totals             8782         8782            0         8768            0

Total packets received: 8782 Sent: 8768

LSP queue length: 0 Drops: 0
SPF runs: 17
Fragments rebuilt: 2953
LSP regenerations: 11
Purges initiated: 0
```

show virtual-chassis protocol statistics vcp-1/3/0.32768 member 1 (For Specific Virtual Chassis Port Interface and Member ID)

```
{master:member1-re0}

user@host> show virtual-chassis protocol statistics vcp-1/3/0.32768 member 1
member1:
------------------------------------------------------------------------------
vcp-1/3/0.32768

IS-IS statistics for 001d.b510.0800:
PDU type       Received    Processed        Drops         Sent       Rexmit
LSP                3013         3013            0         3016            0
HELLO              3001         3001            0         2993            0
CSNP                  1            1            0            1            0
PSNP               3003         3003            0         2994            0
Unknown               0            0            0            0            0
Totals             9018         9018            0         9004            0

Total packets received: 9018 Sent: 9004
```

show virtual-chassis status (MX Series Virtual Chassis)

Syntax show virtual-chassis status

Release Information Command introduced in Junos OS Release 11.2.

Description Display information about the status of both member routers in an MX Series Virtual Chassis configuration. You can issue the **show virtual-chassis status** command from the console of either member router in the Virtual Chassis.

Required Privilege Level view

Related Documentation

- Verifying the Status of Virtual Chassis Member Routers or Switches on page 161
- Verifying and Managing the Virtual Chassis Heartbeat Connection on page 167
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in the Same Subnet on page 172
- Example: Determining Member Health Using an MX Series Virtual Chassis Heartbeat Connection with Member Routers in Different Subnets on page 183

List of Sample Output show virtual-chassis status on page 286

Output Fields Table 35 on page 285 lists the output fields for the **show virtual-chassis status** command. Output fields are listed in the approximate order in which they appear.

Table 35: show virtual-chassis status Output Fields

Field Name	Field Description
Virtual Chassis ID	Assigned ID that applies to the entire Virtual Chassis configuration.
Member ID	Member ID assigned in the preprovisioned Virtual Chassis configuration, and the Flexible PIC Concentrator (FPC) slot range, including offset, for each member router in the Virtual Chassis.
Status	State of the member router: • **Prsnt**—Router is currently connected to the Virtual Chassis. • **NotPrsnt**—Router is not currently connected to the Virtual Chassis. • **Heartbt**—Router has used heartbeat packet connection to maintain mastership roles during an adjacency disruption or split in the Virtual Chassis configuration.
Serial No	Serial number of the member router.
Model	Model number of the member router.

Table 35: show virtual-chassis status Output Fields *(continued)*

Field Name	Field Description
Mastership priority	Metric used by the Virtual Chassis software for the mastership election algorithm. This value is assigned by the software and is not configurable in the current release.
Role	Role of the member router in the Virtual Chassis: **Master** or **Backup**. The asterisk (*) following the Role denotes the router on which the **show virtual-chassis status** command was issued.
Neighbor List ID Interface	Member IDs and Virtual Chassis port interfaces (in the format **vcp-*slot/pic/port***) to which this member router is connected.

Sample Output

show virtual-chassis status

```
{master:member1-re0}

user@host> show virtual-chassis status
Preprovisioned Virtual Chassis
Virtual Chassis ID: 5a6a.e747.8511
                                                 Mastership          Neighbor List
Member ID       Status   Serial No    Model    priority    Role      ID  Interface
0 (FPC   0- 11) Prsnt    JN115FDADAFB mx480          129  Backup     1  vcp-5/0/0
1 (FPC  12- 23) Prsnt    JN10C78D1AFC mx240          129  Master*    0  vcp-1/3/0
```

show virtual-chassis vc-port (MX Series Virtual Chassis)

Syntax
show virtual-chassis vc-port
<(all-members | local | member *member-id*)>

Release Information
Command introduced in Junos OS Release 11.2.

Description
Display the operational status of the Virtual Chassis ports for both member routers or for a specified member router in an MX Series Virtual Chassis configuration. You can issue the **show virtual-chassis vc-port** command from the console of either member router in the Virtual Chassis.

Options
all-members—(Optional) Display the operational status of the Virtual Chassis ports for both member routers in a Virtual Chassis configuration.

local—(Optional) Display the operational status of the Virtual Chassis ports on the member router on which you are issuing the command. This is the default behavior if no options are specified.

member *member-id*—(Optional) Display the operational status of the Virtual Chassis ports on the specified member router. Replace ***member-id*** with the value 0 or 1.

Required Privilege Level
view

Related Documentation
- Verifying the Operation of Virtual Chassis Ports on page 161
- Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 56
- Example: Configuring Interchassis Redundancy for MX Series 3D Universal Edge Routers Using a Virtual Chassis on page 69

List of Sample Output
show virtual-chassis vc-port all-members on page 288
show virtual-chassis vc-port local on page 288
show virtual-chassis vc-port member 0 on page 288
show virtual-chassis vc-port (Packet Forwarding Engine is not Ready) on page 289

Output Fields
Table 36 on page 287 lists the output fields for the **show virtual-chassis vc-port** command. Output fields are listed in the approximate order in which they appear.

Table 36: show virtual-chassis vc-port Output Fields

Field Name	Field Description
member*n*	Member ID of the Virtual Chassis member router for which output is displayed.
Interface or Slot/PIC/Port	Location, in the format ***slot/pic/port***, of the Virtual Chassis ports configured on the member router.
Type	Type of Virtual Chassis port. **Configured** indicates that the Virtual Chassis port is properly configured.

Table 36: show virtual-chassis vc-port Output Fields *(continued)*

Field Name	Field Description
Trunk ID	Trunk ID value assigned to a link aggregation group (LAG) formed by the Virtual Chassis. A positive number indicates that a trunk exists. The value **-1** indicates that a trunk is not present.
Status	State of the Virtual Chassis port interface: • **Up**—The port interface is up. • **Up (Resync-not-set)**—The port interface is up but the packet forwarding engine is not ready for forwarding. • **Down**—The port interface is down. • **Absent**—The port interface is absent.
Speed (mbps)	Speed, in megabits per second, of the Virtual Chassis port interface.
Neighbor ID Interface	Member IDs and Virtual Chassis port interfaces (in **vcp-*slot/pic/port*** format) that are connected to this member router.

Sample Output

show virtual-chassis vc-port all-members

```
{master:member1-re0}

user@host> show virtual-chassis vc-port all-members
member0:
--------------------------------------------------------------------------
Interface       Type              Trunk  Status       Speed        Neighbor
or                                 ID                (mbps)       ID  Interface
Slot/PIC/Port
5/0/0           Configured         -1    Up           10000        1   vcp-1/3/0


member1:
--------------------------------------------------------------------------
Interface       Type              Trunk  Status       Speed        Neighbor
or                                 ID                (mbps)       ID  Interface
Slot/PIC/Port
1/3/0           Configured         -1    Up           10000        0   vcp-5/0/0
```

show virtual-chassis vc-port local

```
{master:member1-re0}

user@host> show virtual-chassis vc-port local

Interface       Type              Trunk  Status       Speed        Neighbor
or                                 ID                (mbps)       ID  Interface
Slot/PIC/Port
1/3/0           Configured         -1    Up           10000        0   vcp-5/0/0
```

show virtual-chassis vc-port member 0

```
{master:member1-re0}

user@host> show virtual-chassis vc-port member 0
```

```
member0:
--------------------------------------------------------------------------
Interface       Type              Trunk  Status       Speed        Neighbor
or                                 ID                (mbps)       ID  Interface
Slot/PIC/Port
5/0/0           Configured         -1    Up           10000        1   vcp-1/3/0
```

show virtual-chassis vc-port (Packet Forwarding Engine is not Ready)

```
{master:member1-re0}

user@host> show virtual-chassis vc-port
member1:
--------------------------------------------------------------------------
Interface      Type       Trunk  Status             Speed     Neighbor
or                        ID                        (mbps)    ID  Interface
Slot/PIC/Port
3/0/2          Configured  -1     Up              10000      1   vcp-1/1/4
3/0/3          Configured  -1     Up (Resync-not-set)   10000     1   vcp-1/1/0
```


CHAPTER 14

Index

- Index on page 293

Index

Symbols

#, comments in configuration statements....xvi
( ), in syntax descriptions....xvi
< >, in syntax descriptions....xvi
[ ], in configuration statements....xvi
{ }, in configuration statements....xvi
| (pipe), in syntax descriptions....xvi

A

active flow monitoring
    available PICs, displaying....255
aggregated Ethernet
    targeted distribution of subscribers....212, 220
aggregated-ether-options statement....208

B

braces, in configuration statements....xvi
brackets
    angle, in syntax descriptions....xvi
    square, in configuration statements....xvi

C

chassis
    network services, displaying....253
clear virtual-chassis heartbeat command....226
command forwarding, MX Series Virtual Chassis....45
comments, in configuration statements....xvi
configuration examples, Virtual Chassis
    configuring....69
    CoS on Virtual Chassis ports....132
    deleting....103
    heartbeat connection with member routers in different subnets....183
    heartbeat connection with member routers in same subnet....172
    replacing a Routing Engine....91
    upgrading....145
configuration groups for MX Series Virtual Chassis....61
configuration guidelines, Virtual Chassis
    CoS on Virtual Chassis ports....132
    Virtual Chassis ports....116
conventions
    text and syntax....xv
curly braces, in configuration statements....xvi
customer support....xvii
    contacting JTAC....xvii

D

documentation
    comments on....xvii

E

enhanced IP network services
    MX Series Virtual Chassis....65
examples, configuration *See* configuration examples

F

flow monitoring
    active
        PICs, displaying available....255
font conventions....xv

G

graceful Routing Engine switchover
    MX Series Virtual Chassis....32, 66, 163

H

heartbeat connection, Virtual Chassis
    configuring for different subnets....183
    configuring for same subnet....172
    overview....39
    verifying....167
heartbeat-address statement
    Virtual Chassis....209
heartbeat-timeout statement
    Virtual Chassis....210

J

Junos OS
    unified ISSU for MX Series 3D Universal Edge Routers....228

L

license requirements for MX Series Virtual Chassis....59
locality bias, Virtual Chassis....125

locality-bias statement
Virtual Chassis....123, 211
logical-interface-chassis-redundancy statement....211
logical-interface-fpc-redundancy statement
aggregated Ethernet....212

M

manuals
comments on....xvii
mastership election, Virtual Chassis....31
member statement....213
multichassis link aggregation, Virtual Chassis....143
MX Series Virtual Chassis commands
clear virtual-chassis heartbeat....226
show virtual-chassis heartbeat....263
show virtual-chassis protocol adjacency....266

N

network services, enhanced IP
MX Series Virtual Chassis....65
network-services statement....214
no-split-detection statement....215
nonstop active routing
MX Series Virtual Chassis....66

P

parentheses, in syntax descriptions....xvi
PICs
active flow monitoring
available PICs, displaying....255
preprovisioned statement....216

R

redundancy mechanisms
chassis....211
redundancy mechanisms for Virtual Chassis
about....139
chassis....140, 142
link....139
module....140, 141, 212
request system software in-service-upgrade command
for MX Series 3D Universal Edge Routers....228
request virtual-chassis member-id delete command....245
request virtual-chassis member-id set command....246
request virtual-chassis routing-engine master switch command....247
request virtual-chassis vc-port delete command....249
request virtual-chassis vc-port set command....251
role statement....217
roles, Virtual Chassis....29, 87

S

sampling-instance statement....218
serial-number statement....219
show chassis network services command....253
show services accounting status command....255
show virtual-chassis active-topology command....258
show virtual-chassis device-topology command....260
show virtual-chassis heartbeat command....263
show virtual-chassis protocol adjacency command....266
show virtual-chassis protocol database command....270
show virtual-chassis protocol interface command....276
show virtual-chassis protocol route command....279
show virtual-chassis protocol statistics command....282
show virtual-chassis status command....285
show virtual-chassis vc-port command....287
SNMP
using with Virtual Chassis....170
split detection, Virtual Chassis....35, 90
support, technical *See* technical support
switchover behavior, Virtual Chassis....32, 151
syntax conventions....xv

T

targeted traffic distribution
Virtual Chassis....144, 220
targeted-distribution statement
aggregated Ethernet....220
technical support
contacting JTAC....xvii
traceoptions statement
Virtual Chassis....221
tracing Virtual Chassis operations....200
traffic distribution mechanisms for Virtual Chassis
targeted distribution....144, 220

U

Unified in-service software upgrade *See* Unified ISSU for MX Series 3D Universal Edge Routers
unified ISSU
    for Virtual Chassis....154, 156
Unified ISSU for MX Series 3D Universal Edge Routers....228

V

Virtual Chassis
    backup router....24
    benefits....20
    chassis redundancy....140, 142
    command forwarding....45
    components....23
    configuration
        overview....28
    configuration
        examples....69, 91, 103, 132, 145, 172, 183
    configuring....56
    CoS on Virtual Chassis ports....127, 132
    creating configuration groups....61
    deleting....102
    deleting Virtual Chassis ports....120
    disabling split detection....90
    enhanced IP network services, configuring....65
    flags, trace log....204
    graceful Routing Engine switchover....163
    graceful Routing Engine switchover
        readiness....32, 151
    graceful Routing Engine switchover,
        enabling....66
    heartbeat connection
        configuration examples....172, 183
        configuring for different subnets....183
        configuring for same subnet....172
        overview....39
        verifying....167
    license requirements....59
    line-card router....25
    link redundancy....139
    locality bias....125
    management interface, accessing....160
    managing files on member routers....169
    master router....24
    mastership election....31
    member IDs, configuring....68
    member IDs, deleting....89
    member routers and roles....23, 29
    module redundancy....140, 141, 212
    multichassis link aggregation....143
    network services, enhanced IP....65
    nonstop active routing, enabling....66
    overview....19
    performing unified ISSU....156
    preparing for the configuration....57
    preparring for unified ISSU....154
    preprovisioned member information....63
    redundancy
        chassis....140, 142
        link....139
        module....140, 141, 212
    redundancy mechanisms....139
    replacing a Routing Engine....91
    roles, global and local....29
    roles, switching master and backup....87
    slot numbering....27, 170
    SNMP, using with....170
    split detection....35, 90
    supported platforms....20
    switchover behavior....32
    targeted traffic distribution....144, 220
    tracing operations of....200
    unified ISSU....151
    verifying heartbeat connection....167
    verifying neighbor reachability....162
    verifying status and operation....161
    viewing database information....164, 165
    viewing routing tables....166
    viewing statistics information....166
    Virtual Chassis Control Protocol....27
    Virtual Chassis port trunks....26
    Virtual Chassis ports....25, 116, 118, 120
Virtual Chassis commands
    request virtual-chassis member-id
        delete....245
    request virtual-chassis member-id set....246
    request virtual-chassis routing-engine master
        switch....247
    request virtual-chassis vc-port delete....249
    request virtual-chassis vc-port set....251
    show virtual-chassis active-topology....258
    show virtual-chassis device-topology....260
    show virtual-chassis protocol database....270
    show virtual-chassis protocol interface....276
    show virtual-chassis protocol route....279
    show virtual-chassis protocol statistics....282

show virtual-chassis status....285
show virtual-chassis vc-port....287
Virtual Chassis ports
configuration guidelines....116
configuring....118
CoS configuration example....132
CoS configuration guidelines....132
CoS overview....127
deleting....120
forming trunks....26
overview....25
slot numbering....27
Virtual Chassis statements
heartbeat-address....209
heartbeat-timeout....210
locality-bias....123, 211
logical-interface-chassis-redundancy....211
member....213
network-services....214
no-split-detection....215
preprovisioned....216
role....217
serial-number....219
traceoptions....221
virtual-chassis....223
virtual-chassis statement....223