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Virtual Chassis User Guide for Switches

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About This Guide

Use this guide to set up and configure an EX Series or QFX Series Virtual Chassis. A Virtual Chassis is composed of a supported combination of multiple switches that operate and are managed as a single switch or network entity. Refer also to the hardware documentation for the types of switches comprising the Virtual Chassis and for more details on how to physically interconnect them.

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CHAPTER

Virtual Chassis Overview

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Virtual Chassis Overview for Switches

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Many Juniper Networks EX Series and QFX Series switches support *Virtual Chassis*, a flexible and scalable technology with which you can connect individual switches together to form one unit, and configure and manage the unit as a single chassis. Virtual Chassis ports (VCPs) connect member switches together to form a Virtual Chassis, and are responsible for passing all data and control traffic between member switches.

Use the following links to find the right Virtual Chassis User Guide for different EX Series and QFX Series switches if this guide doesn't cover the switches you're interested in:

- For deployments with EX9200 switches, you should plan or move to MC-LAG or Junos Fusion Enterprise architectures rather than using a Virtual Chassis. We do not recommend using EX9200 switches in a Virtual Chassis. If needed to aid in migration away from EX9200 Virtual Chassis, see Virtual Chassis User Guide for EX9200 Switches.
- Virtual Chassis User Guide for Switches describes configuring and maintaining *all other* EX Series and QFX Series Virtual Chassis.

Benefits of Virtual Chassis on Switches

- Simplifies configuration and maintenance: Multiple devices can be managed as a single device with the same or similar capabilities as the standalone device.
- Increases fault tolerance and high availability (HA): A Virtual Chassis can remain active and network traffic can be redirected to other member switches when a single member switch fails.

- Flattens your network and reduces networking overhead by allowing network devices to synchronize to one resilient logical device rather than to multiple physical devices.
- Enables a simplified Layer 2 network topology that minimizes or eliminates the need for loop prevention protocols such as Spanning Tree Protocol (STP).
- Provides a flexible model for expanding your network: You can easily add Virtual Chassis member switches to increase the number of access ports on your network to support more servers, computers, phones, or other devices with minimal complications to the existing network topology and switch configuration.

Virtual Chassis Basics on Switches

Virtual Chassis is a feature on Juniper Networks routing or switching devices that provides network resiliency in the form of redundant Routing Engines and network expansion flexibility with minimal impact to a configuration.

Virtual Chassis technology on switches enables you to interconnect supported combinations of EX Series and QFX Series switches into one logical device that you can configure and manage as a single unit. Switches interconnected into a Virtual Chassis are called Virtual Chassis member switches, identified by a member ID within the Virtual Chassis.

Virtual Chassis member switches are interconnected and communicate with each other using Virtual Chassis ports (VCPs).

Connecting Member Switches with Virtual Chassis Ports

A switch is not recognized by the Virtual Chassis as a member switch until it is interconnected with the primary or interconnected with an existing member of the Virtual Chassis using VCPs. EX Series and QFX Series switches that can be in a Virtual Chassis might support one or more of the following VCP options:

- Network or uplink ports that support the option to be configured as VCPs. Most switches support this VCP option.
- Ports that are configured as VCPs in the default factory settings. These ports can also be converted into and used as network ports instead of as VCPs, and converted back into VCPs again if needed.
- Dedicated VCPs, which are ports that can only function as VCPs. Only a few switches have dedicated VCPs.

Available VCP options vary among the different switch models. See "Virtual Chassis Port Options" on page 46 for a summary of the ports that are supported as VCPs on different switches.

When a port is set as a VCP, it cannot be used for any other purpose. If you want to use the port for another purpose, you must delete the VCP setting using the `request virtual-chassis vc-port` command. You can run this command directly on the member whose uplink VCP setting you want to delete or through the primary member of the Virtual Chassis configuration.

CAUTION: Deleting a VCP in a Virtual Chassis configuration can cause the Virtual Chassis configuration to split. For more information, see "Understanding Split and Merge in a Virtual Chassis" on page 63.

If redundant VCP links of the same speed are connected between the same two member switches of a Virtual Chassis, the ports automatically form a VCP Link Aggregation Group (LAG) or bundle that distributes the inter-member VCP traffic load among them. See "Understanding Virtual Chassis Port Link Aggregation" on page 61 for details.

Virtual Chassis Configuration

You configure and manage nearly all aspects of an EX Series or QFX Series Virtual Chassis through the primary switch of the Virtual Chassis. However, you can also configure Virtual Chassis parameters when a switch is a standalone switch not interconnected with other members yet, because any switch that supports being in a Virtual Chassis is by default a single-member Virtual Chassis with member ID 0. Upon connecting the switch with others in a Virtual Chassis, any Virtual Chassis configuration statements and uplink Virtual Chassis port (VCP) settings previously configured on the standalone switch remain part of its configuration.

You can set up an EX Series or QFX Series Virtual Chassis using a nonprovisioned or preprovisioned configuration. If you want to deterministically control the roles and member IDs assigned to the member switches when creating and managing a Virtual Chassis, use a preprovisioned configuration, which distinguishes member switches by associating their serial numbers with the member ID.

When adding new member switches to a preprovisioned Virtual Chassis, you might be able to simplify the procedure by using the autoprovisioning feature, which automatically converts the interconnecting links into VCPs when cabling the new switch into the Virtual Chassis under certain conditions and configuration settings. See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details.

Configuring Interfaces for a Virtual Chassis

The member ID of an EX Series or QFX Series Virtual Chassis member switch functions as an FPC slot number. When you are configuring interfaces for a Virtual Chassis configuration, you specify the appropriate member ID as the *slot* element of the interface name.

The default factory settings for a Virtual Chassis configuration include FPC 0 as a member of the default VLAN because FPC 0 is configured as part of the `ethernet-switching` family. To include the FPC in the default VLAN, add the `ethernet-switching` family to the configurations for those interfaces.

Mixed and Non-mixed EX Series and QFX Series Virtual Chassis

A Virtual Chassis might consist of all the same type of switches or different types of switches in supported combinations.

Some combinations of switches in a Virtual Chassis comprise a *mixed Virtual Chassis*, which contains member switches that have operational differences requiring the Virtual Chassis to be configured with a mixed mode setting that enables all of the member switches to inter-operate successfully.

Some combinations of different types or models of switches can inter-operate in a Virtual Chassis without requiring the Virtual Chassis to be configured in mixed mode, such as different switches that can run the same Junos OS software image.

See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on the different combinations of switches supported in a Virtual Chassis.

Virtual Chassis Member Switch Roles

Member switches in an EX Series or QFX Series Virtual Chassis operate in either a *primary* Routing Engine role, *backup* Routing Engine role, or *linecard* role. For some mixed Virtual Chassis, the member switches in the Routing Engine role are recommended (and in some cases required) to be particular types or models of switches. Any switch supported in a Virtual Chassis can operate in the linecard role.

A standalone switch that supports Virtual Chassis is by default a single-member Virtual Chassis that is assigned member ID `0` and operates in the primary Routing Engine role as the primary of itself. When connected and configured into a Virtual Chassis with other member switches, the switch will be assigned a unique member ID and might take on a different role.

A nonprovisioned Virtual Chassis uses a primary-role election algorithm to select the member switches that assume the primary and backup roles if an existing member switch in the Routing Engine role fails or when new member switches are added. In a preprovisioned Virtual Chassis, you assign the roles to each member switch when forming the Virtual Chassis and adding or replacing member switches.

See the following for details on EX Series and QFX Series Virtual Chassis member switch roles:

- "Understanding Virtual Chassis Components" on page 43
- "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56

Global Management of Member Switches in a Virtual Chassis

The interconnected member switches in a Virtual Chassis operate and can be configured as a single network entity.

The serial console port and dedicated out-of-band management port on individual switches have global virtual counterparts when the switches are interconnected in a Virtual Chassis configuration. You can connect to the primary switch by connecting a terminal directly to the console port of any member switch. A *virtual management Ethernet (VME)* interface allows you to remotely manage the Virtual Chassis configuration by connecting to the out-of-band management port of any member switch through a single IP address. You can perform remote configuration and administration of all member switches of the Virtual Chassis configuration using the Junos CLI through the VME interface. See "Understanding Global Management of a Virtual Chassis" on page 58 for details.

When setting up a Virtual Chassis on EX Series switches that support the EZSetup script, you can run EZSetup once to specify the identification parameters for the primary, and these parameters implicitly apply to all member switches of the Virtual Chassis.

On switches that support the J-Web user interface, you can view the Virtual Chassis as a single device in J-Web and apply various device management functions to all member switches of the Virtual Chassis.

High Availability Using Redundancy

Interconnecting EX Series or QFX Series switches into a Virtual Chassis increases your network's high availability. A Virtual Chassis is more fault tolerant than a standalone switch because it can remain active, forward traffic and provide sub-second convergence in the case of a device or link failure.

Standalone switches that support only a single Routing Engine can operate with a primary and a backup Routing Engine when configured into a Virtual Chassis, and therefore support some high availability features that would otherwise not be available on the switch, such as Graceful Routing Engine Switchover (GRES) for hitless failover.

You can also increase fault tolerance within a Virtual Chassis by configuring other supported high availability features. For example, configuring Link Aggregation Group (LAG) bundles that include member links on different switches in the same Virtual Chassis enables traffic traversing the LAG to be redirected from a Virtual Chassis member switch that fails to links on another active Virtual Chassis member switch.

Adaptability as an Access Switch or Distribution Switch

A Virtual Chassis configuration supports a variety of user environments because it can be composed of different types of switches. You can select different switch models to support various functions. For example, you might set up one Virtual Chassis access switch configuration composed of full Power over Ethernet (PoE) models to support users sitting in cubicles equipped with PCs and Voice over IP (VoIP) phones. You could set up another Virtual Chassis configuration with partial PoE models to support the

company's internal servers, and another to support the company's external servers. You can alternatively use a Virtual Chassis in a topology as a distribution switch.

Virtual Chassis Provisioning From the Factory-Default State Using the Phone-Home Client

Phone-home provisioning on a Virtual Chassis is a form of zero-touch provisioning (ZTP). With phone-home provisioning, when a device in the factory-default state boots up, a phone-home client (PHC) process automatically starts running on the device. The PHC gets bootstrapping information over the network from a central network management data source called the phone-home server (PHS), and installs the intended software image and configuration on the device without requiring any user interaction at the remote site.

The PHC also supports phone-home provisioning on some EX Series Virtual Chassis. Check Feature Explorer and search for **phone-home** to see the Virtual Chassis platforms that support phone-home provisioning. Phone-home provisioning on a Virtual Chassis is an extension of standalone device phone-home support.

See Provision a Virtual Chassis Using the Phone-Home Client for details about how the PHC works to provision a Virtual Chassis.

The PHS is usually part of a network management system (NMS) that supports phone-home provisioning. The network administrator enters the information that defines how the devices or Virtual Chassis at remote sites should be set up. An organization might have more than one PHS for redundancy.

Requirements for Phone-Home Provisioning to Work for a Virtual Chassis

The PHC only supports Virtual Chassis that meet the following conditions:

- The Virtual Chassis member devices have dedicated or default-configured VCPs.

  "Virtual Chassis Port Options" on page 46 explains the different VCP types and what's supported on different platforms.

- The Virtual Chassis members are all the same type of device.

  In other words, it isn't a mixed-mode Virtual Chassis. See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32.

- All member devices have the factory-default configuration.

  The PHC process only runs when a device or Virtual Chassis is in the factory-default state.

- The Virtual Chassis member are interconnected in a ring topology using only dedicated or default-configured VCPs.

  How To Enable Phone-Home Provisioning on a Virtual Chassis shows a sample EX4300 Virtual Chassis that is wired this way.

- At least one Virtual Chassis member has an active connection to the network and can access an available PHS that supports provisioning a Virtual Chassis.

  The connection to the PHS can be through the Virtual Chassis VME interface or any network-facing port on any Virtual Chassis member. See "Understanding Global Management of a Virtual Chassis" on page 58 for more about how the VME interface works.

RELATED DOCUMENTATION

Understanding EX Series Virtual Chassis

IN THIS SECTION

This topic introduces EX Series Virtual Chassis. An EX Series Virtual Chassis is a supported combination of interconnected EX2200, EX2300, EX3300, EX3400, EX4000, EX4100, EX4100-F, EX4100-H, EX4200, EX4400, EX4400-24X, EX4300, EX4400, EX4600 or switches operating as one logical device and managed as a single chassis. Switches in a Virtual Chassis are called *member switches*.

Virtual Chassis Support on EX Series Switches

NOTE: If your Virtual Chassis is managed through Juniper Mist, you can configure and manage it through the Mist portal. To know more, see Virtual Chassis Overview (Mist).

In an EX Series Virtual Chassis, you can interconnect standalone switches in the following combinations into one logical device, and manage the logical device as a single chassis:

- EX2300 Virtual Chassis, composed of up to four EX2300 switches or EX2300 multigigabit model switches (EX2300-24MP, EX2300-48MP).
  On EX2300 switches, the Virtual Chassis feature requires license. See Understanding Software Licenses for EX Series Switches.
- EX3400 Virtual Chassis, composed of up to ten EX3400 switches.
- EX4000 Virtual Chassis, composed off up to six EX4000 switches.
- EX4100 Virtual Chassis, composed of up to ten EX4100/EX4100-F switches (any EX4100 models, including EX4100 multigigabit models, the EX4100-H model, and the EX4100-F model)
- EX4300 Virtual Chassis, composed of up to ten EX4300 switches, including multigigabit models (EX4300-48MP). An EX4300 Virtual Chassis operates as a non-mixed Virtual Chassis if it is composed of only EX4300 multigigabit model switches, or composed of any combination of any other EX4300 switches excluding the multigigabit models. An EX4300 Virtual Chassis operates as a mixed EX4300 Virtual Chassis if it is composed of EX4300 multigigabit model (EX4300-48MP) switches mixed with any other EX4300 model switches.

- EX4400 Virtual Chassis, composed of up to ten EX4400 switches (any EX4400 models, including EX4400 multigigabit models)
- EX4400-24X Virtual Chassis, composed of up to ten EX4400 switches (any EX4400 models, including EX4400 multigigabit models using HGoE mode).
- EX4600 Virtual Chassis, composed of up to ten EX4600 switches.
- EX4650 Virtual Chassis, composed of up to four EX4650-48Y switches.
  Starting in Junos OS Release 19.3R1, an EX4650-48Y Virtual Chassis can have up to two member switches.
  Starting in Junos OS Release 20.1R1, an EX4650-48Y Virtual Chassis can have up to four member switches.
- Mixed EX4300 and EX4600 Virtual Chassis, composed of up to ten total EX4300 (excluding multigigabit models) and EX4600 switches. The member switches in the primary and backup Routing Engine roles must be EX4600 switches.

Table 1 on page 10 and No Link Title list the initial Junos OS release for combinations of switches interconnected into an EX Series Virtual Chassis. “N/A” indicates the combination is *not supported*. Switches must be running the same version of Junos OS software to join a Virtual Chassis, although the actual images might be different on different types of switches when mixed hardware models are supported together in a Virtual Chassis.

Table 1: Minimum Junos OS Release For EX Series Switch Combinations in a Virtual Chassis

Switch	EX2300 Switch	EX3400 Switch	EX4000 Switch	EX4100/ EX4100-F Switch	EX4100-H	EX4300 Switch	EX4400 Switch	EX4400-24X Switch	EX4600 Switch	EX4650
EX2300	15.1X53-D50, 18.1R2 for MP models, 18.4R1 for MP models combined with other models	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 1: Minimum Junos OS Release For EX Series Switch Combinations in a Virtual Chassis *(Continued)*

Switch	EX2300 Switch	EX3400 Switch	EX4000 Switch	EX4100/ EX4100-F Switch	EX4100-H	EX4300 Switch	EX4400 Switch	EX4400-24X Switch	EX4600 Switch	EX4650
EX3400	N/A	15.1X53-D50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EX4000	N/A	N/A	24.4R1-S2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EX4100/ EX4100-F	N/A	N/A	N/A	22.2R1	24.4R1	N/A	N/A	N/A	N/A	N/A
EX4100-H	N/A	N/A	N/A	24.4R1	24.4R1	N/A	N/A	N/A	N/A	N/A
EX4300	N/A	N/A	N/A	N/A	N/A	13.2X50-D10, 18.2R1 for MP models combined with other models	N/A	N/A	13.2X51-D25, excludes EX4300 MP models	N/A
EX4400	N/A	N/A	N/A	N/A	N/A	N/A	21.1R1, 21.2R1 for MP models combined with other models	23.1R1 (only in HGoE mode)	N/A	N/A

Table 1: Minimum Junos OS Release For EX Series Switch Combinations in a Virtual Chassis *(Continued)*

Switch	EX2300 Switch	EX3400 Switch	EX4000 Switch	EX4100/ EX4100-F Switch	EX4100-H	EX4300 Switch	EX4400 Switch	EX4400-24X Switch	EX4600 Switch	EX4650
EX4400-24X	N/A	N/A	N/A	N/A	N/A	N/A	23.1R1 (only in HGoE mode)	23.1R1	N/A	N/A
EX4600	N/A	N/A	N/A	N/A	N/A	13.2X51-D25, excludes EX4300 MP models	N/A		N/A	13.2X51-D25
EX4650	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A

Basic Configuration of EX Series Virtual Chassis

Some EX Series switches can only form a Virtual Chassis with the same type of switches, while some can connect with other types of switches into a mixed-mode Virtual Chassis. See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on the different types of switches that can be mixed in a Virtual Chassis.

You set up an EX Series Virtual Chassis by configuring Virtual Chassis ports (VCPs) on the member switches, and interconnecting the switches using the VCPs. VCPs are responsible for passing all data and control traffic between member switches in the Virtual Chassis. EX Series switches have one or more of the following VCP options:

- Network or uplink ports that you can configure into VCPs.

- Default-configured VCPs, which are configured as VCPs in the default factory configuration, but you can alternatively convert them into network or uplink ports if desired and reconvert them back into VCPs if needed.
- Dedicated VCPs, which you can only use as VCPs.

See "Virtual Chassis Port Options" on page 46 for details on which ports on different EX Series switches can be VCPs.

You can increase the VCP bandwidth between any two member switches by connecting multiple VCP links between the switches. When multiple VCP links interconnect the same two member switches, the links automatically form a Link Aggregation Group (LAG) bundle if they have the same speeds. For example, if you have four 40-Gbps links configured as VCPs between two member switches, the four links form a LAG with 160 Gbps of bandwidth. Similarly, connecting two 10-Gbps links configured as VCPs between two member switches creates a LAG with 2 member links at 20 Gbps total bandwidth. However, 10-Gbps and 40-Gbps links configured as VCPs between two Virtual Chassis member switches cannot be member links of the same VCP LAG.

Within a single wiring closet, you can add a new member switch to a Virtual Chassis by cabling the member switch into the Virtual Chassis using supported VCP links. You can also easily expand a Virtual Chassis configuration beyond a single wiring closet or over a longer distance by connecting member switches together using uplink ports that are supported as VCPs.

You can set up a Virtual Chassis using either a nonprovisioned or a preprovisioned configuration. If you want to deterministically control the role and member ID assigned to each member switch, use a preprovisioned configuration. Virtual Chassis member switches can have one of three roles: primary Routing Engine, backup Routing Engine, or linecard role. In some combinations of switches in a Virtual Chassis, we recommend or require that you configure certain switches into the Routing Engine roles. See "Understanding Virtual Chassis Components" on page 43 for more information about Virtual Chassis roles.

You can simplify adding switches to a preprovisioned configuration by using the automatic VCP conversion feature (see "Automatic Virtual Chassis Port (VCP) Conversion" on page 49), which automatically converts uplink ports into VCPs on the member switches on both sides of the new VCP links as you cable them. This Virtual Chassis expansion method is also called *autoprovisioning*.

EX2300 Switches in a Virtual Chassis

You can connect up to four EX2300 switches into a Virtual Chassis. You can't combine EX2300 switches into a mixed Virtual Chassis with any other EX Series or QFX Series switches, but you can create a non-mixed Virtual Chassis with different models of EX2300 switches as follows:

- Any combination of up to four EX2300 and EX2300-C switches.

- Any combination of up to four EX2300 multigigabit model (EX2300-24MP and EX2300-48MP) switches.
- (Starting in Junos OS Release 18.4R1) Any combination of up to four EX2300 multigigabit model switches and other EX2300 or EX2300-C model switches. You do not need to set mixed mode.

> **NOTE**: In Junos OS releases prior to 18.4R1, you cannot mix EX2300 multigigabit model switches with other EX2300 or EX2300-C model switches in an EX2300 Virtual Chassis.

EX2300 switches do not have default or dedicated VCP ports, but you can configure the 10-Gigabit Ethernet uplink ports as VCPs, and use those to interconnect the switches into a Virtual Chassis.

You connect EX2300 switches or EX2300 multigigabit switches into an EX2300 Virtual Chassis by configuring uplink ports as VCPs and using SFP+ transceivers. The uplink ports on EX2300 switches also support SFP transceivers, but you can't use SFP transceivers on uplink ports to form an EX2300 Virtual Chassis.

In all EX2300 Virtual Chassis, you can configure any EX2300 switch model into any member switch role (primary Routing Engine, backup Routing Engine, or linecard).

On EX2300 switches, the Virtual Chassis feature requires license. See Understanding Software Licenses for EX Series Switches.

You configure, monitor, and maintain an EX2300 Virtual Chassis in a similar way as other EX Series and QFX Series Virtual Chassis. See the following for details on configuring or changing the members in an EX2300 Virtual Chassis:

- "Configuring an EX2300, EX3400, or EX4300 Virtual Chassis" on page 77
- "Adding a New Switch to an Existing EX2300, EX3400, or EX4300 Virtual Chassis" on page 107
- *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*

EX3400 Switches in a Virtual Chassis

You can connect up to ten of any models of EX3400 switches into a Virtual Chassis. EX3400 switches can't be in a Virtual Chassis with any other EX Series or QFX Series switches.

By default, the QFSP+ uplink ports on EX3400 switches are configured as VCPs, or you can configure any SFP+ uplink module ports on EX3400 switches as VCPs. You can't use uplink ports with SFP tranceivers as VCPs to connect EX3400 switches into a Virtual Chassis.

You configure, monitor, and maintain an EX3400 Virtual Chassis in a similar way as other EX Series and QFX Series Virtual Chassis. See the following for details on configuring or changing the members in an EX3400 Virtual Chassis:

- "Configuring an EX2300, EX3400, or EX4300 Virtual Chassis" on page 77
- "Adding a New Switch to an Existing EX2300, EX3400, or EX4300 Virtual Chassis" on page 107
- *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*

EX4000 Switches in a Virtual Chassis

You can interconnect up to six EX4000 switches (any EX4000 models) to form an EX4000 Virtual Chassis. You can't mix EX4000 switches in a Virtual Chassis with any other type of switches.

By default, EX4000 switches come up in HiGig mode. The uplink ports on PIC slot 1 can be used as Virtual Chassis ports (VCPs). For all EX4000 models (except EX4000-8P), the first two uplink ports come up as VCPs and the last two uplink ports come up as network ports. For EX4000-8P, all four uplink ports come up as network ports. You can have a mix of network ports and VCPs on the PIC slot 1 ports.

You can convert network ports to VCPs or vice versa as required. Use the `request virtual-chassis vc-port set pic-slot 1 port` *<port>* command to convert the port to a VCP and the `request virtual-chassis vc-port delete pic-slot 1 port` *<port>* command to convert the port to a network port.

EX4100/EX4100-F Switches in a Virtual Chassis

You can interconnect up to ten EX4100/EX4100-F switches to form an EX4100 Virtual Chassis. All the member switches must be EX4100 switches (including EX4100 multigigabit models or any other EX4100 models); you can't mix EX4100 switches in a Virtual Chassis with any other type of switches.

NOTE: Starting from Junos OS Release 24.2R1, EX4100/EX4100-F Switches can be connected as a single VC using HGoE mode.

By default, EX4100/EX4100-F switches come up in the default/HiGig mode and the Virtual Chassis ports come up as HiGig ports. To change this to HGoE mode, enter the `request virtual-chassis mode hgoe` command and reboot the switch, using the `request system reboot` command. To change this back to default/HiGig mode, enter the `request virtual-chassis mode hgoe disable` command, and reboot the switch using the `request system reboot` command.

NOTE: Whenever you change the mode of any existing stack from the default HiGiG to HGoE mode, note that the Virtual Chassis formation usually takes additional time to come up in HGoE mode. This is because it creates a fresh stack that results in additional convergence time.

When HGoE mode is not disabled, the `nvram` variable for HGoE gets retained and this leads to unexpected behaviour. It is recommended to disable the HGoE mode using the `request virtual-chassis mode hgoe disable` command before downgrading to a non-HGoE supported release.

You can use any of the EX4100/EX4100-F switch models in either the Routing Engine or linecard role in an EX4100/EX4100-F Virtual Chassis. You can use the default/HiGig mode or HGoE mode to achieve this:

NOTE: All the switches in a stack can operate in either the default/HiGig mode or HGoE mode. Mixing these two modes in a stack is not supported. It is mandatory to set up Virtual Chassis using preprovisioned configuration when you change from HiGig to HGoE mode or HGoE to to HiGig mode.

- **Virtual Chassis in default/HiGig mode:**

  The default VCPs are in PIC slot 1 of EX4100/EX4100-F switches, so the VCP interfaces are named vcp-255/1/0, vcp-255/1/1, vcp-255/1/2, and vcp-255/1/3 respectively.

  Table 2: Default Speed for Virtual Chassis Ports in EX4100/EX4100-F Switches

Model	Default Speed for VCP
EX4100-48MP	4 x 25G
EX4100-24MP	4 x 25G
EX4100-48P	4 x 25G
EX4100-48T	4 x 25G
EX4100-24P	4 x 25G

Table 2: Default Speed for Virtual Chassis Ports in EX4100/EX4100-F Switches *(Continued)*

Model	Default Speed for VCP
EX4100-24T	4 x 25G
EX4100-F-48P	4 x 10G
EX4100-F-48T	4 x 10G
EX4100-F-24P	4 x 10G
EX4100-F-24T	4 x 10G
EX4100-F-12P	4 x 10G
EX4100-F-12T	4 x 10G

To use VCP ports as network ports, you need to change the mode to Network port mode. When you switch to Network port mode, Virtual Chassis does not get created and rear panel ports work as network ports. To change to Network port mode, enter the `request virtual-chassis mode network-port` command and reboot the switch, using the `request system reboot` command. To change back to default/HiGig mode, enter the `request virtual-chassis mode network-port disable` command and reboot the switch, using `request system reboot` command. Now, it gets switched to default/HiGig mode.

NOTE: In the default/HiGig mode, all ports of PIC slot 1 come up as Virtual Chassis ports. In the Network port mode, all ports of PIC slot 1 come up as Network ports.

- **Virtual Chassis in HGoE mode:**

  The HiGig protocol packets can be encapsulated in a standard ethernet frame before these are sent out on the Virtual Chassis interface. This feature is known as HiGig over Ethernet (HGoE). To enable HGoE mode, use the `request virtual-chassis mode hgoe <reboot>` command. In HGoE mode, the 4x10G/25G portsl come up as Virtual Chassis ports by default.

  The 4x10/25G interfaces can be configured as Virtual Chassis interfaces or network interfaces without rebooting the switch again. Use the `request virtual-chassis vc-port set pic-slot 1 port <port>` command to convert the interface to a Virtual Chassis port and the `request virtual-chassis vc-port delete pic-slot 1 port <port>` command to convert the interface to a network port . You can also

convert 4x10G network ports of the uplink module in PIC-slot 2 as Virtual Chassis ports. To convert the 4x10G network ports to Virtual ports and vice versa, use the `request virtual-chassis vc-port set pic-slot 2 port <port>` and `request virtual-chassis vc-port delete pic-slot 2 port <port>` commands.

NOTE: In HGoE mode, you can use one or more ports as Virtual Chassis ports and any of the other ports as network ports. In HiGig mode, you must use all the ports as Virtual Chassis ports or as network ports.

EX4100-H Switches in a Virtual Chassis

EX4100-H switches can be connected with other EX4100, EX4100-F, or EX4100-H switches in a Virtual Chassis. You can connect up to ten switches in a single Virtual Chassis configuration.

EX4100-H switches support Virtual Chassis on the dedicated VCPs (PIC 1) and on the uplink ports (PIC 2). EX4100-H switches can form a Virtual Chassis in either HiGig mode or HGoE mode. By default, the switch comes up in HGoE mode.

To form a Virtual Chassis between EX4100-H and EX4100/EX4100-F switches, you must:

- Convert the EX4100-H switch to HiGig mode, or
- Convert the EX4100/EX4100-F switch to HGoE mode

You can convert the VCPs (PIC1 ports) to network ports if required, using the `request virtual-chassis mode network-port` command. You must use all of the ports as either VCPs or network ports. You cannot use the ports as a combination of VCPs and network ports. When you convert the VCPs to network ports, they dynamically detect the port speed and are configured automatically.

To disable network port mode and return these ports to their default settings as VCPs, use the `request virtual-chassis mode network-port disable <reboot>` command. You must reboot the switch for the change to take effect.

NOTE: When the VCPs (PIC 1) are operating in HiGig mode, you cannot use the uplink (PIC 2) ports for any operation.

EX4200, EX4500, and EX4550 Switches in a Virtual Chassis

You can interconnect up to ten EX4200, EX4500, and EX4550 switches into a Virtual Chassis. You must set the Virtual Chassis to mixed mode if it is composed of EX4200 switches with EX4500 or EX4550

switches, but a Virtual Chassis with only one type of these switches or with only EX4500 and Ex4550 switches operates as a non-mixed Virtual Chassis.

EX4200 switches have two built-in dedicated VCPs. EX4500 or EX4550 switches have dedicated VCPs on the Virtual Chassis module, and the EX4500 or EX4550 switch must have the PIC mode set to Virtual Chassis mode to interconnect them into a Virtual Chassis. You can also configure any SFP, SFP+, and XFP uplink ports on all of these switches into VCPs. You can use the dedicated VCPs when the switches are close together, such as in the same wiring closet. Use uplink ports configured as VCPs for switches that located farther away, such as in different wiring closets.

You configure, monitor, and maintain an EX4200, EX4500, or EX4550 Virtual Chassis in a similar way as other EX Series Virtual Chassis. See the following for details on configuring a Virtual Chassis with these switches:

- *Configuring an EX4200, EX4500, or EX4550 Virtual Chassis (CLI Procedure)*
- *Configuring a Mixed Virtual Chassis with EX4200, EX4500, and EX4550 Member Switches (CLI Procedure)*

For procedures on adding a new switch to a Virtual Chassis composed of any of these switches in a wiring closet, see:

- *Adding a New EX4200 Switch to an Existing EX4200 Virtual Chassis (CLI Procedure)*
- *Adding an EX4200 Switch to a Preprovisioned EX4500 Virtual Chassis or a Preprovisioned Mixed EX4200 and EX4500 Virtual Chassis (CLI Procedure)*
- *Adding an EX4500 Switch to a Preprovisioned EX4200 Virtual Chassis (CLI Procedure)*
- *Adding an EX4500 Switch to a Nonprovisioned EX4200 Virtual Chassis (CLI Procedure)*

EX4300 Switches in a Virtual Chassis

You can interconnect up to ten EX4300 switches to form an EX4300 Virtual Chassis. EX4300 switches can form a Virtual Chassis composed entirely of EX4300 switches (not multigigabit models) *or* entirely of EX4300 multigigabit model (EX4300-48MP) switches as a non-mixed Virtual Chassis.

You can also connect EX4300 multigigabit model switches and other EX4300 model switches together into an EX4300 Virtual Chassis by configuring all of the member switches into mixed mode. In this case, you must also configure the non-multigigabit EX4300 member switches with a special option (`ieee-clause-82`) when setting mixed mode. The member switches in the Routing Engine role must be multitigabit model switches, and you must configure the non-multigigabit EX4300 switches into linecard role. Multigigabit model EX4300 switches can't be in a mixed Virtual Chassis with any other types of switches.

NOTE: If you remove an EX4300 member switch from a mixed EX4300 Virtual Chassis with multigigabit model members, you must disable `ieee-clause-82` port mode on the switch if you want to reconfigure it as a standalone switch or use it in any other type of mixed Virtual Chassis or any non-mixed Virtual Chassis. Otherwise, the VCPs will not connect with other members in the new Virtual Chassis.

You can have any EX4300 switches except multigigabit models in the linecard role in a mixed Virtual Chassis with EX4600 switches or QFX5100 switches. For more details on EX4300 member switches in a mixed Virtual Chassis, see "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32.

On EX4300 switches excluding the multitigabit models, all 40-Gigabit Ethernet QSFP+ optical ports are configured as VCPs by default, and you can also configure any 10-Gigabit Ethernet uplink module ports into VCPs as needed. As a result, an EX4300 Virtual Chassis can have either 40-Gbps or 10-Gbps VCP links, or a combination of both. You can easily add new switches to a Virtual Chassis whether the switch is installed in the same building or at a different site because the ports available to be used as VCPs are long-distance optical ports.

On EX4300 multigigabit models, the four 40-Gigabit Ethernet QSFP+ ports on the rear panel are dedicated VCPs. These are the only ports on EX4300 multigigabit model switches that you can use as VCPs, so any EX4300 Virtual Chassis that contains EX4300 multigigabit model switches can have only have VCP links that are 40-Gbps.

You configure, monitor, and maintain an EX4300 Virtual Chassis in a similar way as other EX Series and QFX Series Virtual Chassis. See the following for details on configuring and changing the members in an EX4300 Virtual Chassis:

- "Configuring an EX2300, EX3400, or EX4300 Virtual Chassis" on page 77
- "Adding a New Switch to an Existing EX2300, EX3400, or EX4300 Virtual Chassis" on page 107
- *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*

EX4400 Switches in a Virtual Chassis

You can interconnect up to ten EX4400 switches to form an EX4400 Virtual Chassis. All the member switches must be EX4400 switches (including EX4400 multigigabit models or any other EX4400 models); you can't mix EX4400 switches in a Virtual Chassis with any other type of switches.

NOTE: Starting from Junos OS Release 23.1R1, EX4400-24X and EX4400 Switches can be connected as a single VC using HGoE mode.

By default, EX4400 switches come up in the default/HiGig mode and the Virtual Chassis ports come up as HiGig ports. To change this to HGoE mode, enter the `request virtual-chassis mode hgoe` command and reboot the switch, using the `request system reboot` command. To change this back to default/HiGig mode, enter the `request virtual-chassis mode hgoe disable` command, and reboot the switch using the `request system reboot` command.

NOTE: Whenever you change the mode of any existing stack from the default HiGiG to HGoE mode, note that the Virtual Chassis formation usually takes additional time to come up in HGoE mode. This is because it creates a fresh stack that results in additional convergence time.

When HGoE mode is not disabled, the `nvram` variable for HGoE gets retained and this leads to unexpected behaviour. It is recommended to disable the HGoE mode using the `request virtual-chassis mode hgoe disable` command before downgrading to a non-HGoE supported release.

You can use any of the EX4400 switch models in either the Routing Engine or linecard role in an EX4400 Virtual Chassis. You can use the default/HiGig mode or HGoE mode to achieve this:

NOTE: All the switches in a stack can operate in either the default/HiGig mode or HGoE mode. Mixing these two modes in a stack is not supported. It is mandatory to set up Virtual Chassis using preprovisioned configuration when you change from HiGig to HGoE mode or HGoE to to HiGig mode.

- **Virtual Chassis in default/HiGig mode:**

  On EX4400 switches, each of the two 100-Gigabit Ethernet QSFP28 ports on the rear panel are set as two logical 50G VCPs, forming four logical 50G VCP interfaces by default. The 100GbE ports can also accept 40GbE optics for Virtual Chassis connection or uplink connectivity. The default VCPs are in PIC slot 1 of EX4400 switches, so the VCP interfaces are named vcp-255/1/0, vcp-255/1/1, vcp-255/1/2, and vcp-255/1/3 respectively.

  To use 2X100G ports as network ports, you need to change the mode to Network port mode. When you switch to Network port mode, Virtual Chassis does not get created and rear panel ports work as 2X100G network ports. To change to Network port mode, enter the `request virtual-chassis mode network-port` command and reboot the switch, using the `request system reboot` command. To change back to default/HiGig mode, enter the `request virtual-chassis mode network-port disable` command and reboot the switch, using `request system reboot` command. Now, it gets switched to default/HiGig mode.

NOTE: In the default/HiGig mode, all ports of PIC slot 1 come up as Virtual Chassis ports. In the Network port mode, all ports of PIC slot 1 come up as Network ports.

If you disable one of these ports as a VCP using the `request virtual-chassis vc-port set interface vcp-255/1/0 member 1 disable command` command, that action disables the port as a VCP. Also, disabling vcp-255/1/0 disables both logical ports 0 and 1 (vcp-255/1/0 and vcp-255/1/1), and disabling vcp-255/1/2 disables both logical ports 2 and 3 (vcp-255/1/2 and vcp-255/1/3).

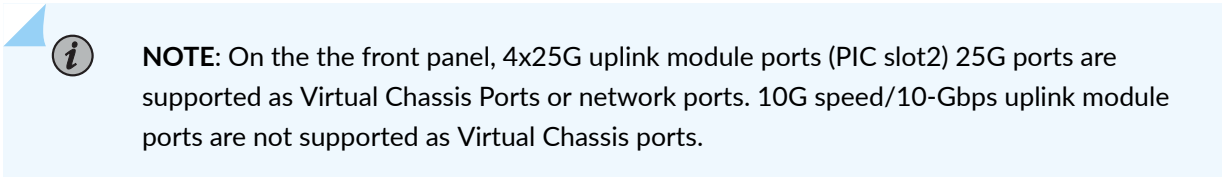
NOTE: You can't use one 100G/40G Ethernet port as a Virtual Chassis port and the other 100G/40G Ethernet port as Network port. The two ports must be both used simultaneously in Virtual Chassis port mode or Network port mode. When you insert a 40G transceiver, one `ifd` per physical port is enabled and the other `ifd` gets disabled. For the physical port 0, `vcp-255/1/0` is enabled and `vcp-255/1/1`is disabled. Similarly, for the physical port 1, `vcp-255/1/2` is enabled and `vcp-255/1/3`gets disabled."

EX4400-24X Switches in a Virtual Chassis

Starting with Junos OS Release 23.1R1, EX4400-24X Switches support Virtual Chassis. Note that the support is only on the HGoE mode and these switches do not support HiGiG mode. EX4400-24X swiches support Virtual Chassis functionality on 2x100G front panel ports, 4x25G uplink module, and the 1x100G uplink module. By default, none of the ports operate in the Virtual Chassis mode mode when the system comes up initially, and the 2x100G front panel ports operate as network ports by default.

NOTE: Starting from Junos OS Release 23.1R1, EX4400-24X and EX4400 Switches can be connected as a single VC using HGoE mode.

To enable the Virtual Chassis ports to get created on the 2x100G front panel ports, use the `request virtual-chassis mode hgoe <reboot>` command. The 2x100G interfaces or the optional 4x25G extension module interfaces can be configured as Virtual Chassis interfaces or network interfaces without rebooting the switch again. Use the `request virtual-chassis vc-port set pic-slot 1 port <port>` command to convert the interface to a Virtual Chassis port and the `request virtual-chassis vc-port delete pic-slot 1 port <port>` command to convert the interface to a network port . You can also also convert 4x25G network ports of the uplink module in PIC-slot 2 as Virtual Chassis ports. To convert the 4X25G network ports to Virtual ports and vice versa, use the `request virtual-chassis vc-port set pic-slot 2 port <port>` and `request virtual-chassis vc-port delete pic-slot 2 port <port>` commands.



NOTE: On the the front panel, 4x25G uplink module ports (PIC slot2) 25G ports are supported as Virtual Chassis Ports or network ports. 10G speed/10-Gbps uplink module ports are not supported as Virtual Chassis ports.

EX4600 Switches in a Virtual Chassis

EX4600 switches can act as member switches in a non-mixed Virtual Chassis—a Virtual Chassis composed entirely of EX4600 switches—and also operate in a mixed Virtual Chassis with EX4300 switches. You can interconnect EX4300 switches (except multigigabit models, EX4300-48MP) with EX4600 switches as a mixed EX4600 Virtual Chassis.

You can interconnect up to ten EX4600 switches or a combination of up to ten EX4600 and EX4300 switches into an EX4600 Virtual Chassis. However, in a mixed Virtual Chassis with EX4600 and EX4300 switches, EX4600 switches must be in the primary and backup Routing Engine roles, and EX4300 member switches must be in the linecard role. As a result, at least two of the member switches in a mixed EX4600 Virtual Chassis must be EX4600 switches in the primary and backup Routing Engine roles. See "Understanding Virtual Chassis Components" on page 43 for more information about Virtual Chassis member roles.

EX4600 switches do not have any ports that are configured into VCPs by default, but you can configure any 40-Gigabit Ethernet QSFP+ and 10-Gigabit Ethernet SFP+ optical ports on an EX4600 switch into VCPs. Because EX4300 switches support similar VCP options, both non-mixed and mixed EX4600 Virtual Chassis can have 40-Gbps VCP links, 10-Gbps VCP links, or a combination of both.

You configure, monitor, and maintain an EX4600 Virtual Chassis in a similar way as other EX and QFX Series Virtual Chassis. See the following for more details on configuring and changing the members in an EX4600 Virtual Chassis, including a mixed EX4600 Virtual Chassis with EX4300 switches:

- "Configuring EX4600 Switches in a Mixed or Non-Mixed Virtual Chassis" on page 91
- "Adding an EX4600 Switch to a Mixed or Non-mixed Virtual Chassis" on page 112
- *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*

EX4650 Switches in a Virtual Chassis

Starting in Junos OS Release 19.3R1, you can interconnect up to two EX4650 switches in an EX4650 Virtual Chassis. The two member switches must be in the primary and backup Routing Engine roles.

Starting in Junos OS Release 20.1R1, you can interconnect up to four EX4650 switches in an EX4650 Virtual Chassis. You should configure two member switches into the primary and backup Routing Engine roles, and the remaining member switches into the linecard role.

See "Understanding Virtual Chassis Components" on page 43 for more information about Virtual Chassis member roles.

EX4650 switches can't be combined with any other type of switches in a Virtual Chassis.

EX4650 switches do not have dedicated or default-configured VCPs, but you can set any of the 40-Gigabit Ethernet QSFP+ or 100-Gigabit Ethernet QSFP28 uplink ports on the front panel (non-channelized ports 48 through 55) as VCPs. You can't use any of the other ports (network ports 0 through 47) as VCPs. Running the `request virtual-chassis vc-port set` command on the network ports doesn't fail, but they will not function properly as VCPs.

An EX4650 Virtual Chassis operates the same as a QFX5120 Virtual Chassis, and you configure, monitor, and maintain it the same way as a QFX Series Virtual Chassis. See the following for more details on configuring and changing the members in an EX4650 Virtual Chassis:

- "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98
- "Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis" on page 114
- *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
23.1R1	Starting in Junos OS Release 23.1R1, EX4400-24X Switches support Virtual Chassis.
22.3R1	Starting in Junos OS Release 22.3R1, the default Virtual Chassis ports for EX4400 can be converted to Network Ports and vice versa without the need for further reboot using the High Gigabyte Stacking over Ethernet (HGoE) mode.
20.1R1	Starting in Junos OS Release 20.1R1, an EX4650-48Y Virtual Chassis can have up to four member switches.
19.3R1	Starting in Junos OS Release 19.3R1, an EX4650-48Y Virtual Chassis can have up to two member switches.
18.4R1	Starting in Junos OS Release 18.4R1, you can also combine EX2300 multigigabit model switches with other EX2300 switches in the same Virtual Chassis, which operates as a non-mixed Virtual Chassis.

RELATED DOCUMENTATION

Virtual Chassis Overview for Switches | 2

Understanding Virtual Chassis Components | 43

Understanding Virtual Chassis Port Link Aggregation | 61

Understanding QFX Series Virtual Chassis

IN THIS SECTION

NOTE: If your Virtual Chassis is managed through Juniper Mist, you can configure and manage it through the Mist portal. To know more, see Virtual Chassis Overview (Mist).

This topic introduces QFX Series Virtual Chassis. A QFX Series Virtual Chassis is a supported combination of interconnected QFX5110, QFX5120 or EX4650, QFX5200, and EX4300 switches operating as one logical device and managed as a single chassis. Switches in a Virtual Chassis are called *member switches* of the Virtual Chassis.

Virtual Chassis Support on QFX Series Switches

A QFX Series Virtual Chassis is a flexible, scaling switch solution for supported combinations of QFX5110, QFX5120, and QFX5200 switches. EX4650-48Y switches operate the same as QFX5120-48Y switches in a Virtual Chassis, so QFX Series Virtual Chassis configuration, monitoring and maintenance steps also apply to EX4650 Virtual Chassis. EX4300 switches can be included in some configurations of a QFX Series Virtual Chassis.

In a QFX Series Virtual Chassis, you can interconnect standalone switches in the following combinations into one logical device, and manage the logical device as a single chassis:

- Up to three QFX5200 switches (a non-mixed Virtual Chassis)
- Two QFX5120 switches or up to four EX4650 switches (a non-mixed Virtual Chassis), as follows:
  - Starting in Junos OS Release 19.3R1, you can interconnect two QFX5120-48Y or EX4650-48Y switches into a Virtual Chassis.
  - Starting in Junos OS Release 20.1R1, you can interconnect up to four EX4650-48Y switches into a Virtual Chassis.
  - Starting in Junos OS Release 20.2R1, you can interconnect two QFX5120-48T switches into a Virtual Chassis.
  - Starting in Junos OS Release 20.3R1, you can interconnect two QFX5120-32C switches into a Virtual Chassis.
  - Starting in Junos OS Release 23.1R1, you can interconnect four QFX5120-48YM switches into a Virtual Chassis.
- Up to ten QFX5110 switches or a combination of QFX5110 and QFX5100 switches (a non-mixed Virtual Chassis)
- Up to ten QFX5100 switches with any combination of QFX3500, QFX3600, or EX4300 switches (a mixed-mode Virtual Chassis)
- Up to ten QFX3500 or QFX3600 switches with supported EX4300 switches, or a combination of all three types of switches (a mixed-mode Virtual Chassis)

NOTE: EX4300 multigigabit model (EX4300-48MP) switches are not supported in a mixed-mode Virtual Chassis with any QFX Series switches. Also note that the JNP-QSFP-100G-BXSR transceiver is not supported on Virtual Chassis Ports (VCP) connections.

Basic Configuration of QFX Series Virtual Chassis

Some QFX Series switches can only form a Virtual Chassis with the same type of switches, while others can be interconnected with other types of switches into a mixed-mode Virtual Chassis. See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on the different types of switches that can be mixed in a Virtual Chassis.

You set up a Virtual Chassis by configuring Virtual Chassis ports (VCPs) on the member switches, and interconnecting the switches using the VCPs . VCPs are responsible for passing all data and control traffic between member switches in the Virtual Chassis.

The following ports on QFX Series switches that support Virtual Chassis can be configured into VCPs to form a QFX Series Virtual Chassis:

- On QFX5200 switches: Any 40-Gigabit Ethernet QSFP+ ports

  NOTE: Starting in Junos OS Release 17.3R2-S4, 100-Gigabit Ethernet QSFP28 ports are also supported as VCPs on QFX5200 switches.

- On QFX5120 or EX4650 switches:
  - QFX5120-48Y or EX4650-48Y: Only the eight 40-Gigabit Ethernet QSFP+ or 100-Gigabit Ethernet QSFP28 front panel uplink ports (ports 48 through 55)
  - QFX5120-48T: Only the six 40-Gigabit Ethernet QSFP+ or 100-Gigabit Ethernet QSFP28 front panel uplink ports (ports 48 through 53)
  - QFX5120-32C: Any network ports installed with either 40-Gigabit Ethernet QSFP+ or 100-Gpbs QSFP28 transceivers
  - QFX5120-48YM: Only the eight QSFP+ front panel uplink port (ports 48 through 55)
- On QFX5110 switches: Any 40-Gigabit Ethernet QSFP+ or 100-Gigabit Ethernet QSFP28 ports
- Any fixed 10-Gigabit Ethernet SFP+ ports on any QFX Series switches that support these ports

EX4650 and QFX Series switches don't have any dedicated VCPs (ports that can only be used as VCPs) or default-configured VCPs (ports that are configured as VCPs in the default factory configuration). See "Virtual Chassis Port Options" on page 46 for details on which ports on different QFX Series switches can be VCPs.

NOTE: By default, QFX5120-48YM switches come up in the default/HiGig mode and the Virtual Chassis ports come up as HiGig ports. To change this to HGoE mode, enter the `request virtual-chassis mode hgoe` command and reboot the switch, using the `request system reboot` command. To change this back to default/HiGig mode, enter the `request virtual-chassis mode hgoe disable` command, and reboot the switch using the `request system reboot` command.

You can increase VCP bandwidth between member switches by connecting multiple VCP links between the switches. When multiple VCP links interconnect the same two member switches, the links automatically form a Link Aggregation Group (LAG) bundle if they have the same speeds. For example, if

you have two 40-Gigabit Ethernet QSFP+ interfaces configured as VCPs between member switches, the two links form a LAG with 80-Gbps of total bandwidth. However, 10-Gigabit Ethernet SFP+ and 40-Gigabit Ethernet QSFP+ interfaces configured as VCPs between two Virtual Chassis member switches will not become member links in the same VCP LAG.

You can set up a Virtual Chassis using either a nonprovisioned or a preprovisioned configuration. If you want to deterministically control the role and member ID assigned to each member switch, use a preprovisioned configuration. Virtual Chassis member switches can have one of three roles: primary Routing Engine, backup Routing Engine, or linecard role. In some combinations of switches in a Virtual Chassis, we recommend or require that you configure certain switches into the Routing Engine roles. See "Understanding Virtual Chassis Components" on page 43 for more information about Virtual Chassis roles.

Adding switches to a preprovisioned configuration is simpler if you use the automatic VCP conversion feature (see "Automatic Virtual Chassis Port (VCP) Conversion" on page 49), which automatically converts uplink ports into VCPs on the member switches on both sides of the new VCP links as they are cabled. This method to expand a Virtual Chassis is also called *autoprovisioning*.

QFX5200 Switches in a Virtual Chassis

Virtual Chassis is supported on QFX5200 switches starting in Junos OS Release 17.3R2 and 17.4R1 onward.

You can interconnect up to three QFX5200 switches into a QFX5200 Virtual Chassis. QFX5200 switches cannot be combined with other types of switches in a Virtual Chassis.

The following QFX5200 switches are supported in a QFX5200 Virtual Chassis:

- QFX5200-32C

QFX5120 or EX4650 Switches in a Virtual Chassis

QFX5120 and EX4650 switches are similar and operate the same way in a Virtual Chassis. Each QFX5120 or EX4650 switch model can only be combined with the same model of switches into a Virtual Chassis.

- Starting in Junos OS Release 19.3R1, you can interconnect two QFX5120-48Y switches or two EX4650-48Y switches into a Virtual Chassis.

  Starting in Junos OS Release 20.2R1, you can interconnect two QFX5120-48T switches into a Virtual Chassis.

Starting in Junos OS Release 20.3R1, you can interconnect two QFX5120-32C switches into a Virtual Chassis.

The two member switches must be in the primary and backup Routing Engine roles.

- Starting in Junos OS Release 20.1R1, you can interconnect up to four EX4650-48Y switches into a Virtual Chassis.

  We recommend that you configure two member switches in the primary and backup Routing Engine roles for Routing Engine redundancy, and the remaining switches in linecard role.

See "Understanding Virtual Chassis Components" on page 43 for more information about Virtual Chassis member roles.

QFX5120 and EX4650 switches do not have dedicated or default-configured VCPs, but you can set any of the following ports as VCPs:

- On QFX5120-48Y, QFX5120-48T, or EX4650-48Y switches: Any of the 40-Gigabit Ethernet QSFP+ or 100-Gigabit Ethernet QSFP28 uplink ports on the front panel (non-channelized). These are ports 48 through 55 on EX4650-48Y or QFX5120-48Y switches, and ports 48 through 53 on QFX5120-48T switches.

  NOTE: You can't use any of the other ports (network ports 0 through 47) as VCPs. Running the `request virtual-chassis vc-port set` command on the network ports doesn't fail, but they will not function properly as VCPs.

- On QFX5120-32C switches: Any of the 32 network ports installed with either 40-Gigabit Ethernet QSFP+ or 100-Gigabit Ethernet QSFP28 transceivers

You configure, monitor, and maintain a QFX5120 Virtual Chassis or an EX4650 Virtual Chassis in the same way as other QFX Series Virtual Chassis. See the following for more details:

- "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98
- "Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis" on page 114
- *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*

NOTE: Priority flow control (PFC) is not supported on a QFX5120-48Y Virtual Chassis if the ingress and egress interfaces are located on different FPCs and the VCPs are configured in HGoE mode. You will not be able to see the PFC statistics when you run the `show interfaces` *`interface-name`* `extensive` command.

QFX5110 Switches in a Virtual Chassis

Starting in Junos OS Release 17.3R1, QFX5110 switches support Virtual Chassis.

You can interconnect up to ten QFX5110 switches or a combination of QFX5110 and QFX5100 switches into a QFX5110 Virtual Chassis. All switches can run the same software image, and you do not need to configure mixed mode.

NOTE: When using the QFX5110 Virtual Chassis, sometimes the master could reboot and lose connection with dual-homed video streams along with issues related to vCMTS device's connectivity for about two to three minutes. This is because, each daemon including the rpd daemon, is terminated consecutively by the system when a user does a manual reboot. When rpd daemons are shut down, TCP FIN packets are produced. When the FIN packet is created, two scenarios are possible. Either the interface is offline or it is still online. It is more normal for the interface to be active at this period. The BGP connection is subsequently cut off by sending a FIN message to the peer. This explains the reason why the BGP session was terminated.

The following QFX5110 and QFX5100 switches are supported in a QFX5110 Virtual Chassis:

- QFX5110-32Q
- QFX5110-48S
- QFX5100-24Q
- QFX5100-48S
- QFX5100-48T

  Starting in Junos OS Release 17.3R2, you can include QFX5100-48T switches in a QFX5110 Virtual Chassis.

- QFX5100-96S

EX4300 Switches in a QFX Series Virtual Chassis

Starting in Junos OS Release 13.2X51-D20, EX4300 switches except multigigabit models (EX4300-48MP) can be interconnected into a mixed-mode QFX Series Virtual Chassis with up to ten member switches that can be any combination of EX4300, QFX3500 switches, QFX3600 switches, and QFX5100 switches.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
20.2R1	Starting in Junos OS Release 20.2R1, you can interconnect two QFX5120-48T switches into a Virtual Chassis.
19.4R1	Starting in Junos OS Release 20.3R1, you can interconnect two QFX5120-32C switches into a Virtual Chassis.
19.3R1	Starting in Junos OS Release 19.3R1, you can interconnect two EX4650-48Y switches into a Virtual Chassis.
19.3R1	Starting in Junos OS Release 19.3R1, you can interconnect two QFX5120-48Y switches into a Virtual Chassis.
17.3R2-S4	Starting in Junos OS Release 17.3R2-S4, 100-Gigabit Ethernet QSFP28 ports are also supported as VCPs on QFX5200 switches.
17.3R2	Virtual Chassis is supported on QFX5200 switches starting in Junos OS Release 17.3R2 and 17.4R1 onward.
17.3R2	Starting in Junos OS Release 17.3R2, you can include QFX5100-48T switches in a QFX5110 Virtual Chassis.
17.3R1	Starting in Junos OS Release 17.3R1, QFX5110 switches support Virtual Chassis.
13.2X53-D25	Starting in Junos OS release 13.2X51-D25, you can configure up to ten QFX5100-96S switches into a mixed or non-mixed QFX Series Virtual Chassis.
13.2X51-D20	Starting in Junos OS Release 13.2X51-D20, QFX5100 switches support Virtual Chassis.
13.2X51-D20	In Junos OS release 13.2X51-D20, you can interconnect only up to four QFX5100-96S switches in a non-mixed QFX5100 Virtual Chassis.
13.2X51-D20	Starting in Junos OS Release 13.2X51-D20, EX4300 switches except multigigabit models (EX4300-48MP) can be interconnected into a mixed-mode QFX Series Virtual Chassis with up to ten member switches that can be any combination of EX4300, QFX3500 switches, QFX3600 switches, and QFX5100 switches.

RELATED DOCUMENTATION

Virtual Chassis Overview for Switches | 2

Understanding Virtual Chassis Components | 43

Configuring an EX4650 or a QFX Series Virtual Chassis | 98

Understanding Mixed EX Series and QFX Series Virtual Chassis

IN THIS SECTION

This topic describes the requirements for a mixed Virtual Chassis.

A *mixed Virtual Chassis* includes two or more types of EX Series switches, two or more types of QFX Series switches, or a supported combination of EX and QFX Series switches, where architectural differences require the Virtual Chassis to be configured into mixed mode for the switches to interoperate.

A Virtual Chassis composed of all the same type of switch can usually operate as a *non-mixed Virtual Chassis*, which does not require you to set mixed mode. However, the following Virtual Chassis that include different models of the same product must operate in mixed mode due to architecture differences between the different models:

- An EX4300 Virtual Chassis composed of EX4300 multigigabit model (EX4300-48MP) switches mixed with any other EX4300 model switches

> **NOTE**: An EX4300 Virtual Chassis operates as a non-mixed Virtual Chassis if it is composed of only EX4300 multigigabit model switches, or composed of any combination of any other EX4300 switches (excluding the multigigabit models).

The following combinations of different switch types can be interconnected into a Virtual Chassis that does *not* require you to set mixed mode because the switches can run the same software image when in a Virtual Chassis:

- An EX2300 Virtual Chassis composed of any models of EX2300 and EX2300 multigigabit switches

> **NOTE**: Junos OS releases prior to 18.4R1 support forming an EX2300 Virtual Chassis using only EX2300 multigigabit switches or only EX2300 switches that are not multigigabit model switches. Starting in Junos OS Release 18.4R1, EX2300, EX2300-C, and EX2300 multigigabit switches can all be combined in the same non-mixed Virtual Chassis.

- An EX4400 Virtual Chassis composed of any models of EX4400 and EX4400 multigigabit switches
- A QFX Series Virtual Chassis composed of only QFX3500 and QFX3600 switches
- A QFX5110 Virtual Chassis composed of QFX5110 and supported QFX5100 switches

QFX5200, QFX5120, EX4650, EX4400, and EX2300 switches cannot be mixed with any other models of switches in a Virtual Chassis.

Mixed and Non-mixed EX Series and QFX Series Virtual Chassis Summary

Table 3 on page 33 provides a high-level overview of the EX Series and QFX Series switches allowed in the Routing Engine and line-card roles of supported mixed and non-mixed Virtual Chassis configurations. Any supported mixed or non-mixed combination of switches can be configured as a nonprovisioned or preprovisioned Virtual Chassis.

Table 3: Virtual Chassis Summary

Category	Allowed Routing Engine Members	Allowed Line Card Members
Non-mixed	QFX5200	QFX5200

Table 3: Virtual Chassis Summary *(Continued)*

Category	Allowed Routing Engine Members	Allowed Line Card Members
	QFX5120-48Y or QFX5120-48T or QFX5120-32C (2 switches of the same model only)	None, only 2 members of the same model switch are supported in any QFX5120 Virtual Chassis, and both must be in Routing Engine role
	QFX5110	QFX5110 QFX5100 (with a “-qfx-5e-” Junos OS image)
	EX4100	EX4100
	EX4650	None if only 2 members in the Virtual Chassis (both must be in Routing Engine role), or only other EX4650 switches otherwise. Starting in Junos OS Release 20.1R1, you can interconnect up to four EX4650 switches in an EX4650 Virtual Chassis. You should configure two member switches into the primary and backup Routing Engine roles, and the remaining member switches into the linecard role.
	EX4600	EX4600
	EX4400 (including multigigabit and any other models)	EX4400 (including multigigabit and any other models)
	EX4300 multigigabit models (EX4300-48MP) only	EX4300 multigigabit models (EX4300-48MP) only
	EX4300 (any models except multigigabit models)	EX4300 (any models except multigigabit models)
	EX3400	EX3400

Table 3: Virtual Chassis Summary *(Continued)*

Category	Allowed Routing Engine Members	Allowed Line Card Members
	(Prior to Junos OS Release 18.4R1) EX2300 multigigabit models (EX2300-24MP and EX2300-48MP) only, or EX2300 and EX2300-C (excluding multigigabit models) only	(Prior to Junos OS Release 18.4R1) EX2300 multigigabit models (EX2300-24MP and EX2300-48MP) only, or EX2300 and EX2300-C (excluding multigigabit models) only
	(Starting with Junos OS Release 18.4R1) EX2300, EX2300-C, and EX2300 multigigabit models (EX2300-24MP and EX2300-48MP) (any models in any combination)	(Starting with Junos OS Release 18.4R1) EX2300, EX2300-C, and EX2300 multigigabit models (EX2300-24MP and EX2300-48MP) (any models in any combination))
Mixed	EX4600	EX4600 EX4300 (any models except multigigabit models)
	EX4300 multigigabit models (EX4300-48MP)	EX4300 (any models including multigigabit models)

Understanding the Routing Engine Role in a Virtual Chassis With Different Types of Switches

When you have different types of switches in a Virtual Chassis, the combination of switches you are interconnecting determines which switches should be in the primary Routing Engine role. We also recommend always configuring the same type of switch into the primary and backup Routing Engine roles, to ensure that the switch operating as the primary remains the same type of switch in the event of a switchover.

- In a Virtual Chassis with QFX5110 and QFX5100 switches, which is considered to be a non-mixed QFX5110 Virtual Chassis, we recommend using QFX5110 switches in the primary or backup Routing

Engine roles, and you can use QFX5110 or supported QFX5100 switches for the remaining members in line-card role.

- In a mixed Virtual Chassis with QFX3600 or QFX3500 switches with EX4300 switches, you should use QFX3500 or QFX3600 switches in the Routing Engine role, and you can use QFX3600, QFX3500, or EX4300 switches in the line-card role.
- In a mixed EX4300 Virtual Chassis with EX4300 multigigabit model (EX4300-48MP) switches and any other models of EX4300 switches, you must use EX4300 multigigabit models in the Routing Engine role, and you can use any EX4300 switches in the line-card role.

In most mixed Virtual Chassis, you must configure your Virtual Chassis to ensure a switch that supports operating as a primary Routing Engine assumes the primary Routing Engine role. Without user configuration, any switch might assume the primary or backup Routing Engine role, with the exception of EX4300 switches in an EX4600 or QFX Series Virtual Chassis, which can never assume the Routing Engine role.

Understanding QFX5100 and QFX5110 Switches in a Virtual Chassis

Up to ten QFX5100 and QFX5110 switches can be interconnected using Virtual Chassis ports (VCPs) to form a *QFX5110 Virtual Chassis*, which is considered to be a non-mixed Virtual Chassis because both types of switches can run the same software image, and you do not need to configure mixed mode. A QFX5110 Virtual Chassis can contain QFX5110 and supported QFX5100 switches in any combination, but we recommend that only QFX5110 switches be in the primary and backup Routing Engine roles, and QFX5100 switches only be configured into line-card role.

NOTE: A QFX5110 Virtual Chassis with QFX5100 switches can only be set up using QFX5110 and QFX5100 switches running the same Junos OS image that includes "-qfx-5e-" in the Junos OS software package filename downloaded from the Software Center. QFX5100 switches running a Junos OS image filename that includes "-qfx-5-" must first be upgraded to the "-qfx-5e-" image to join a QFX5110 Virtual Chassis. (See *Upgrading a QFX5100 Switch with a USB Device to Join a QFX5110 Virtual Chassis or Virtual Chassis Fabric*.)

QFX5100 switches can also be interconnected into a mixed Virtual Chassis with QFX3500, QFX3600, and EX4300 switches. See the next section for more information on a mixed QFX5100 Virtual Chassis.

Understanding Mixed EX4300 and EX4600 Virtual Chassis

Any EX4300 switches (except for multigigabit models) and EX4600 switches can be interconnected into a Virtual Chassis.

In a mixed EX4300 and EX4600 Virtual Chassis:

- You can interconnect up to ten member switches.
- An EX4600 switch automatically assumes the primary Routing Engine role.
- EX4300 switches cannot assume the Routing Engine role.

EX4600 switches cannot be in a mixed Virtual Chassis with any other type of switch besides EX4300 switches that are not multigigabit model switches.

Understanding EX4300 Multigigabit and Other EX4300 Model Switches in a Mixed EX4300 Virtual Chassis

You can combine EX4300 multigigabit model (EX4300-48MP) switches with other EX4300 switches into a mixed EX4300 Virtual Chassis.

NOTE: If an EX4300 Virtual Chassis has only EX4300 multigigabit model switches, or only a combination of other models of EX4300 switches, the Virtual Chassis is a non-mixed Virtual Chassis and you should not configure mixed mode.

In a mixed EX4300 Virtual Chassis:

- You can interconnect up to ten member switches.
- You must include the `ieee-clause-82` option when setting mixed mode on the EX4300 switches in the Virtual Chassis that are not multigigabit model switches. This option sets a special port mode (IEEE Clause 82) on the Virtual Chassis ports (VCPs) that enables them to communicate when interconnected with VCPs on EX4300 multigigabit switches. See "Configuring an EX2300, EX3400, or EX4300 Virtual Chassis" on page 77 for details.
- Only EX4300 multigigabit model switches can be in the Routing Engine role.
- EX4300 switches that are not multigigabit model switches must be configured into line-card role.

EX4300 multigigabit switches cannot be in a mixed Virtual Chassis with any other type of switch besides other EX4300 switches.

NOTE: If you remove a non-multigigabit model EX4300 switch from a mixed EX4300 Virtual Chassis with multigigabit model members, you must disable `ieee-clause-82` port mode on the removed switch if you want to reconfigure it as a standalone switch or use it in any other type of mixed Virtual Chassis or any non-mixed Virtual Chassis. Otherwise, the VCPs will not connect with other members in the new Virtual Chassis. See *Removing or Replacing a Member Switch of a Virtual Chassis Configuration* for more details.

RELATED DOCUMENTATION

- Configuring an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis | **77**
- Virtual Chassis Overview for Switches | **2**
- Understanding EX Series Virtual Chassis | **8**
- Understanding QFX Series Virtual Chassis | **25**
- Understanding Virtual Chassis Components | **43**

Understanding HiGig and HGoE Modes in a Virtual Chassis

IN THIS SECTION

In a Virtual Chassis configuration, switches can operate in either HiGig mode or HiGig over Ethernet (HGoE) mode.

Changing the Virtual Chassis Mode

You can create a Virtual Chassis setup in one of two modes: HiGig or HiGig over Ethernet (HGoE).

To enable HGoE mode, use the following command:

```
request virtual-chassis mode hgoe <reboot>
```

To disable HGoE mode and use HiGig mode, use the following command.

```
request virtual-chassis mode hgoe disable <reboot>
```

Note that you must reboot the switch for the change to take effect.

Whenever you change the mode of any existing stack from HiGig mode to HGoE mode, the Virtual Chassis formation usually takes additional time to come up in HGoE mode. This is because it creates a fresh stack that results in additional convergence time.

All Virtual Chassis Ports (VCPs) simultaneously operate in either HGoE mode or HiGig mode. Mixing these two modes in a stack is not supported. It is mandatory to set up the Virtual Chassis using preprovisioned configuration when you change from HiGig mode to HGoE mode or HGoE mode to HiGig mode.

HiGig and HGoE Modes

HiGig Mode

The HiGig protocol enables you to connect member switches into a single logical unit or Virtual Chassis. By default, Virtual Chassis on most switches operates in HiGig mode. HiGig mode allows you to create multiple logical VCPs or `ifd`s in a single physical port. Disabling one of these logical ports as a VCP will disable all logical ports connected to that physical port.

Some switches have dedicated VCPs. On switches without dedicated VCPs, you can convert a specific set of ports to virtual chassis mode.

- To convert network ports to VCPs, use the command:

```
request virtual-chassis mode network-port disable <reboot>
```

- To convert VCPs back to network ports, use the command:

```
request virtual-chassis mode network-port <reboot>
```

Note that you must reboot the switch for the change to take effect.

In HiGig mode, you must use all of the VCPs simultaneously in either virtual chassis mode or network mode. You cannot use some of the ports in virtual chassis mode and the rest in network mode.

HGoE Mode

The HiGig protocol packets can be encapsulated in a standard Ethernet frame before sending them out on the Virtual Chassis interface. This feature is known as HiGig over Ethernet (HGoE). You can convert the Virtual Chassis from HiGig mode to HGoE mode as described in "Changing the Virtual Chassis Mode" on page 39. In HGoE mode, each physical port comes up as a single VCP. Each physical port has a single `ifd`.

You can convert some of the ports to virtual chassis mode or network mode as required.

- To convert network ports to VCPs, use the command:

```
request virtual-chassis vc-port set pic-slot pic-number port port-number
```

- To convert VCPs to network ports, use the command:

```
request virtual-chassis vc-port delete pic-slot pic-number port port-number
```

In HGoE mode, you can configure the VCPs as a mix of virtual chassis mode and network mode. You don't need to simultaneously use all the ports as VCPs or network ports.

HiGig and HGoE Mode Support

Different switches support different combinations of HiGig and HGoE modes for a Virtual Chassis. The table below lists the modes supported on HGoE-enabled switches.

Table 4: HiGig and HGoE Mode Support

Switch	HiGig Mode	HGoE Mode
EX4000	Yes (default)	No
EX4100	Yes (default)	Yes
EX4100-F	Yes (default)	Yes
EX4100-H	Yes	Yes (default)
EX4400 (except EX4400-24X)	Yes (default)	Yes
EX4400-24X	No	Yes (default)
EX4650	Yes (default)	No
QFX5120-48Y	Yes (default)	No
QFX5120-48YM	No	Yes (default)

HGoE Mode on EX4100 and EX4100-F Switches

By default, EX4100 and EX4100-F switches come up in HiGig mode. You can change the mode to HGoE mode as described in "Changing the Virtual Chassis Mode" on page 39.

In HGoE mode, the 10/25G ports (PIC 1) operate as VCPs by default. You can also use the 4x10G uplink ports (PIC 2) as VCPs, except on EX4100-F-12P and EX4100-F-12T switches. On EX4100-F-12P and EX4100-F-12T switches, the uplink ports cannot be used as VCPs. See "HGoE Mode " on page 40 for converting VCPs to network ports and vice versa.

HGoE Mode on EX4100-H Switches

By default, EX4100-H switches come up in HGoE mode. You can change the mode to HGoE mode as described in "Changing the Virtual Chassis Mode" on page 39.

In HGoE mode, the 1/10G VCPs (PIC 1) operate as VCPs by default. You can also use the 1/10G uplink ports (PIC 2) as VCPs. The VCPs support both HiGig and HGoE modes, while the uplink ports can be used in a Virtual Chassis only in HGoE mode. See "HGoE Mode " on page 40 for converting VCPs to network ports and vice versa.

HGoE Mode on EX4400 Switches

By default, EX4400 switches come up in HiGig mode. You can change the mode to HGoE mode as described in "Changing the Virtual Chassis Mode" on page 39.

In HGoE mode, the 100/40G ports on the rear panel (PIC 1) operate as VCPs by default. The optional 1x100G and 4x25G extension module ports (PIC 2) operate as network ports by default. 10G uplink ports are not supported as VCPs. You can convert the 100/40G ports, the 1x100G port, and the 4x25G ports to VCPs or network ports without rebooting the switch. See "HGoE Mode " on page 40 for converting VCPs to network ports and vice versa.

You can channelize 100G network ports as 4x25G network ports. Channelization is not supported on VCPs.

HGoE Mode on EX4400-24X Switches

EX4400-24X switches support only HGoE mode for forming a Virtual Chassis.

You can use the 100G ports on the front panel (PIC 1) and the optional 1x100G and 4x25G extension module ports (PIC 2) as VCPs. The EX4400-24X also supports Virtual Chassis formation in 40G mode. 10G uplink ports are not supported as VCPs. By default, the 100G ports, the 1x100G port, and the 4x25G ports operate as network ports. See "HGoE Mode " on page 40 for converting VCPs to network ports and vice versa.

HGoE Mode on QFX5120-48YM Switches

QFX5120-48YM switches support only HGoE mode for forming a Virtual Chassis.

You can use the 100/40G ports as VCPs if they are not channelized. By default, the 100/40G ports operate as network ports. See "HGoE Mode " on page 40 for converting VCPs to network ports and vice versa.

Understanding Virtual Chassis Components

IN THIS SECTION

This topic describes the components of an EX series or a QFX Series *Virtual Chassis*.

- An EX Series Virtual Chassis is a supported combination of standalone EX Series switches interconnected and managed as a single chassis.

  NOTE: We do not recommend using EX9200 switches in a Virtual Chassis, and we phased out support for that architecture as of Junos OS Release 17.1R1. For deployments with EX9200 switches, we recommend planning or moving to MC-LAG or Junos Fusion Enterprise architectures instead of using a Virtual Chassis.

- A QFX Series Virtual Chassis is a supported combination of standalone QFX5100, QFX5110, QFX5120, or QFX5200 switches interconnected and managed as a single chassis. EX4650 Virtual Chassis operate the same as QFX5120 Virtual Chassis, so most of the information in this topic about QFX Series Virtual Chassis in general also applies to an EX4650 Virtual Chassis, with a few platform-specific support differences.

NOTE: EX4300 switches (excluding multigigabit models [EX4300-48MP]) can also be interconnected into a mixed Virtual Chassis with QFX5100 switches.

Maximum Switch Support

The maximum number of switches that a Virtual Chassis supports varies by Virtual Chassis and might also depend on the Junos OS release running on the Virtual Chassis.

Maximum Number of Switches in an EX Series Virtual Chassis

Table 5 on page 44 lists the maximum number of member switches supported in an EX Series Virtual Chassis by Junos OS release.

Table 5: Maximum Member Switch Support for EX Series Virtual Chassis by Junos OS Release

Type of EX Series Virtual Chassis	Maximum Member Switches by Junos OS Release
EX2300 Virtual Chassis	18.4R1—Starting in Junos OS Release 18.4R1, up to 4 of any model EX2300 member switches (including multigigabit models and any other EX2300 switches) can be combined in the same Virtual Chassis.
EX3400 Virtual Chassis	15.1X53-D50—Initial release. Up to 10 EX3400 member switches.
EX4100 Virtual Chassis	22.2R1—Initial release. Up to 10 EX4100 member switches.
EX4300 Virtual Chassis	18.2R1—Starting in Junos OS Release 18.2R1 with the introduction of EX4300 multigigabit model switches (EX4300-48MP), an EX4300 Virtual Chassis can contain up to 10 EX4300 multigigabit model switches as a non-mixed Virtual Chassis or a combination of EX4300 multigigabit model switches with other EX4300 switches as a mixed EX4300 Virtual Chassis.

Table 5: Maximum Member Switch Support for EX Series Virtual Chassis by Junos OS Release *(Continued)*

Type of EX Series Virtual Chassis	Maximum Member Switches by Junos OS Release
EX4400 Virtual Chassis	21.1R1—Initial release. Up to 10 EX4400 member switches. 21.2R1—Starting in Junos OS Release 21.2R1, an EX4400 Virtual Chassis can also include EX4400 multigigabit model switches (EX4400-24MP and EX4400-48MP).
EX4650 Virtual Chassis	19.3R1—Initial release. Up to 2 EX4650 switches in Routing Engine roles only. 20.1R1—Starting in Junos OS Release 20.1R1, an EX4650 Virtual Chassis can have up to 4 members.

Maximum Number of Switches in a QFX Series Virtual Chassis (Including Mixed Virtual Chassis with EX Series Switches)

Table 6 on page 45 lists the maximum number of member switches supported in a QFX Series Virtual Chassis by Junos OS release, including mixed QFX Series Virtual Chassis with EX Series switch members.

Table 6: Maximum Member Switch Support for QFX Series Virtual Chassis by Junos OS Release

Type of QFX Series Virtual Chassis	Maximum Member Switches by Junos OS Release
QFX5110 Virtual Chassis: • QFX5110 switches in Routing Engine role with any combination of supported QFX5110 and QFX5100 switches in linecard role.	17.3R1—Initial release. Up to 10 member switches.

Table 6: Maximum Member Switch Support for QFX Series Virtual Chassis by Junos OS Release *(Continued)*

Type of QFX Series Virtual Chassis	Maximum Member Switches by Junos OS Release
QFX5120 Virtual Chassis:	19.3R1—Initial release on QFX5120-48Y switches. Up to 2 member switches, both in Routing Engine role. 20.2R1—Initial release on QFX5120-48T switches. Up to 2 member switches, both in Routing Engine role. 20.3R1—Initial release on QFX5120-32C switches. Up to 2 member switches, both in Routing Engine role.
QFX5200 Virtual Chassis— • Only QFX5200 switches.	17.3R2 and 17.4R1—Initial release. Up to 3 member switches.

Virtual Chassis Ports (VCPs)

You set up a Virtual Chassis by configuring Virtual Chassis ports (VCPs) on the member switches, and interconnecting the switches using the VCPs. VCPs are responsible for passing all data and control traffic between member switches in the Virtual Chassis.

Virtual Chassis Port Options

Some switches have dedicated VCPs; you can only use these ports as VCPs and you can't reconfigure them as network ports. Dedicated VCPs allow you to interconnect switches into a Virtual Chassis without requiring any additional interface configuration.

Some switches have ports that are configured as VCPs by default. You don't need to explicitly configure those as VCPs to use them to interconnect the switches into a Virtual Chassis.

Most switches have optical or uplink ports that you can also configure as VCPs.

You must configure VCPs to interconnect switches that do not have dedicated or default-configured VCPs or to interconnect switches across greater distances than allowed by a dedicated VCP connection. Otherwise, you can mix any of the supported VCP options among the members of a Virtual Chassis, and we recommend having redundant links between any two members for resiliency or to increase member communication bandwidth. VCPs automatically bundle into a Link Aggregation Group when two or more

ports operating at the same speed are configured into VCPs between the same two member switches. See "Understanding Virtual Chassis Port Link Aggregation" on page 61 for details.

When adding switches to an existing Virtual Chassis or adding new redundant links between existing members, if the automatic VCP conversion feature is enabled, under the right conditions the ports on both sides of the connection will convert into VCPs automatically (see "Automatic Virtual Chassis Port (VCP) Conversion" on page 49).

Table 7 on page 47 summarizes the available VCP options on switches in an EX Series or QFX Series Virtual Chassis. For complete details on where dedicated VCPs, default-configured VCPs, or ports that can be configured as VCPs are located on a switch, and the supported transceivers and cables that you can use for VCP connections on the switch, see the hardware documentation for that type of switch.

Table 7: VCP Options by Switch Type

Switch	Dedicated VCPs	Default VCPs	Ports that can be configured and are supported as VCPs
EX2300 (including EX2300 multigigabit models)	None	None	10-Gigabit Ethernet uplink ports with SFP+ tranceivers **NOTE**: You cannot use ports with SFP transceivers as VCPs on EX2300 switches to form a Virtual Chassis.
EX4100	4 25-Gbps SFP28 ports on the front panel	4 25-Gbps SFP28 ports on the front panel	None
EX4100-F	4 10-Gbps SFP + ports on the front panel	4 10-Gbps SFP+ ports on the front panel	None
EX4300	None	All QSFP+ ports	Any uplink ports installed with SFP+ or QSPF+ transceivers **NOTE**: On 32-port EX4300 switches, you can't use the four built-in 10-Gigabit Ethernet SFP+ ports as VCPs.

Table 7: VCP Options by Switch Type *(Continued)*

Switch	Dedicated VCPs	Default VCPs	Ports that can be configured and are supported as VCPs
EX4300 multigigabit models (EX4300-48MP)	4 40-Gbps QSFP+ ports on the rear panel	None	None
EX4400 (Including EX4400 multigigabit models)	None	4 logical 50-Gbps VCP interfaces using the two 100-Gbps QSFP28 ports on the rear panel (PIC slot 1)	None
EX4650	None	None	Any of the 40-Gigabit Ethernet or 100-Gigabit QSFP28 ports on the front panel (ports 48 through 55), non-channelized **NOTE**: The Junos OS doesn't prevent you from trying to set other ports as VCPs, but they don't operate properly as VCPs.
QFX5110	None	None	Any 40-Gigabit Ethernet or 100-Gigabit Ethernet QSFP28 ports Any non-channelized 40-Gigabit Ethernet QSFP+ interfaces Any non-channelized 10-Gigabit Ethernet SFP+ interfaces (on QFX5110 switch models that support these ports)

Table 7: VCP Options by Switch Type *(Continued)*

Switch	Dedicated VCPs	Default VCPs	Ports that can be configured and are supported as VCPs
QFX5120	None	None	(QFX5120-48Y) Any of the eight 40-Gigabit Ethernet or 100-Gigabit Ethernet QSFP+ or QSFP28 ports on the front panel (ports 48 through 55), non-channelized (QFX5120-48T) Any of the six 40-Gigabit Ethernet or 100-Gigabit Ethernet QSFP+ or QSFP28 ports on the front panel (ports 48 through 53), non-channelized **NOTE**: Any ports other than those specified above for QFX5120-48Y and QFX5120-48T switches are not supported as VCPs. The Junos OS CLI doesn't return an error if you try to set other ports as VCPs, but they will not work properly as VCPs. (QFX5120-32C) Any non-channelized network ports (ports 0 through 31) installed with either 40-Gbps QSFP+ or 100-Gpbs QSFP28 transceivers
QFX5200	None	None	Any 40-Gigabit Ethernet QSFP+ ports Starting in Junos OS Release 17.3R2-S4, you can also use 100-Gigabit Ethernet QSFP28 ports as VCPs on QFX5200 switches.

QSFP+ interfaces that have been channelized into SFP+ interfaces using a breakout cable cannot be configured into VCPs.

Automatic Virtual Chassis Port (VCP) Conversion

When the automatic VCP conversion feature is enabled and you cable a new link from a new switch being added into an existing Virtual Chassis, or add a redundant link between two members of a Virtual Chassis, ports that can be VCPs are automatically converted into VCPs under the following conditions:

- Link Layer Discovery Protocol (LLDP) or LLDP-Media Endpoint Discovery (LLDP-MED) is enabled on the interfaces for the members on both ends of the new link. The two sides exchange LLDP packets to accomplish the port conversion.

- The Virtual Chassis must be preprovisioned with the switches on both sides of the link already configured in the members list of the Virtual Chassis using the `set virtual-chassis member` command.
- The interfaces for the ports on both ends of the link are not already configured as VCPs. Both sides of the link must be in the same state to handshake and establish the VCP link.

Using automatic VCP conversion when adding a switch to a preprovisioned Virtual Chassis is also called *autoprovisioning* the new member.

For ports to be eligible for automatic VCP conversion, you must convert them back into network ports using the `request virtual-chassis vc-port delete` command if they are default-configured VCPs or you previously configured them into VCPs. Switches do not automatically convert VCPs back into network ports when you remove them from a Virtual Chassis and disconnect the links.

Automatic VCP conversion is enabled by default on all Virtual Chassis, except in the following cases:

- Automatic VCP conversion doesn't apply to EX4400 switches in a Virtual Chassis. On these switches, to convert the default VCPs into network ports or convert them from network ports back into VCP ports, you must explicitly set the port mode using the `request virtual-chassis mode network-port` command, and then reboot the switch.
- For any EX4650 and QFX5120 Virtual Chassis (which all have the automatic VCP conversion feature enabled by default), you can choose to disable the feature by configuring `no-auto-conversion` at the `[edit virtual-chassis]` hierarchy level on the Virtual Chassis. To return to the default behavior to re-enable automatic VCP conversion, delete the `no-auto-conversion` statement from the configuration.

Virtual Chassis Port Link Aggregation Groups

You can increase VCP bandwidth between member switches by configuring multiple links between the same two switches into VCP links. When multiple VCPs interconnect the same two member switches, the links automatically form a Link Aggregation Group (LAG) bundle if the VCP links are the same speed. For example, if you have two 40-Gbps QSFP+ VCP links connected between member switches, the links automatically form a LAG with 80-Gbps total bandwidth. However, 10-Gigabit SFP+ and 40-Gbps QSFP + VCP links will not become members of the same LAG.

Within a Virtual Chassis, you can also configure network interfaces located on different Virtual Chassis member switches to form a LAG, which provides load-balancing and redundancy for network traffic that the Virtual Chassis forwards. See "Understanding Virtual Chassis Port Link Aggregation" on page 61 for details on the difference between VCP LAGs and network interface LAGs within a Virtual Chassis.

Primary Routing Engine Role

In a Virtual Chassis, each member switch operates in one of two roles, Routing Engine role or linecard role. When in Routing Engine role, a member switch acts as the primary or backup Routing Engine.

The primary Routing Engine member in the Virtual Chassis:

- Manages the member switches.
- Runs Junos OS for the switches as a primary Routing Engine.
- Runs the chassis management processes and control protocols.
- Represents all the member switches interconnected within the Virtual Chassis configuration. (The hostname and other properties that you assign to this switch during setup apply to all members of the Virtual Chassis configuration.)

In a preprovisioned configuration, the Virtual Chassis primary-role election algorithm determines which member switch in the Routing Engine role acts as the Virtual Chassis primary and which acts as the backup. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56.

In a configuration that is not preprovisioned, called a *nonprovisioned* configuration, the Virtual Chassis selects the primary and backup using the primary-role priority value and secondary factors in the primary-role election algorithm.

The remaining switches in the Virtual Chassis that are not the primary or backup operate in the linecard role.

Use the following guidelines for assigning Routing Engine roles to the switches in a mixed Virtual Chassis:

- In a QFX5110 Virtual Chassis with QFX5110 and QFX5100 switches, we recommend configuring only QFX5110 switches into the Routing Engine role.
- In a two-member EX4650 or QFX5120 Virtual Chassis, configure both member switches into the Routing Engine role as primary and backup member switches only (no linecard role members).

Backup Routing Engine Role

The member that functions in the backup Routing Engine role in a Virtual Chassis:

- Maintains a state of readiness to take over the primary Routing Engine role if the primary fails.
- Runs Junos OS for the switches as a backup Routing Engine.

- Synchronizes with the primary in terms of protocol states, forwarding tables, and other information, so that it is prepared to preserve routing information and maintain network connectivity without disruption in case the primary is unavailable.

The Virtual Chassis configuration must have at least two member switches in order to have a backup Routing Engine member.

In a preprovisioned configuration, the Virtual Chassis primary-role election algorithm determines which member switch in the Routing Engine role acts as the Virtual Chassis primary and which acts as the backup. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56.

In a nonprovisioned configuration, the Virtual Chassis selects the primary and backup member switches using the primary-role priority value and secondary factors in the primary-role election algorithm.

Use the following guidelines for assigning Routing Engine roles to the switches in a mixed Virtual Chassis:

- In a mixed EX4300 Virtual Chassis composed of EX4300 multigigabit model (EX4300-48MP) and other EX4300 model switches, you should always have EX4300 multigigabit model switches in the primary and backup Routing Engine roles.
- In a QFX5110 Virtual Chassis with QFX5110 and QFX5100 switches, we recommend configuring only QFX5110 switches into the Routing Engine role.
- In a two-member EX4650 or QFX5120 Virtual Chassis, configure both member switches into the Routing Engine role as primary and backup member switches only (no linecard role members).

Linecard Role

A member that functions in the linecard role in a Virtual Chassis:

- Runs only a subset of Junos OS.
- Does not run the chassis control protocols.
- Can detect certain error conditions (such as an unplugged cable) on any interfaces that have been configured on it through the primary.

The Virtual Chassis configuration must have at least three members in order to include a linecard member.

In a preprovisioned configuration, you can explicitly configure a member with the linecard role, which means it can’t be a primary or backup Routing Engine.

In a nonprovisioned configuration, the members that are not selected as primary or backup operate as linecard members of the Virtual Chassis. The Virtual Chassis selects the primary and backup member switches using the primary-role priority value and secondary factors in the primary-role election algorithm. A switch with a primary-role priority of 0 is always in the linecard role.

In any two-member Virtual Chassis, for high availability you should configure both members into the Routing Engine role, and no members in the linecard role. Otherwise, in a Virtual Chassis with more than two members, any supported switch type can operate in linecard role.

Use the following guidelines for assigning Routing Engine and linecard roles to the switches in a QFX Series Virtual Chassis:

- In a QFX5110 Virtual Chassis made up of QFX5110 and QFX5100 switches, we recommend configuring only QFX5110 switches into the Routing Engine role.

Member Switch and Member ID

Each standalone switch that supports Virtual Chassis is a potential member of a Virtual Chassis configuration. When you power on one of those switches, it has a Virtual Chassis member ID that you can see on the front-panel LCD on some switches or in `show virtual-chassis` command output. If the switch is powered on as a standalone switch, its member ID is always `0`. When you interconnect the switch into a Virtual Chassis configuration, the primary member switch assigns it a member ID based on various factors such as the order in which the switch was added to the Virtual Chassis or if you defined member IDs based on switch serial numbers in the preprovisioning process.

If the Virtual Chassis configuration previously included a member switch and you physically disconnected or removed that member from the Virtual Chassis configuration, its member ID is not automatically available for assignment as part of the primary's standard sequential member ID assignment. For example, you might have a Virtual Chassis configuration with member 0, member 2, and member 3, because member 1 was removed. When you add another member switch and power it on, the primary assigns ID 4 to it, not ID 1. If you want to reuse a member ID from a member switch that was removed, you can *recycle* the member id (see the `request virtual-chassis recycle` command for details). .

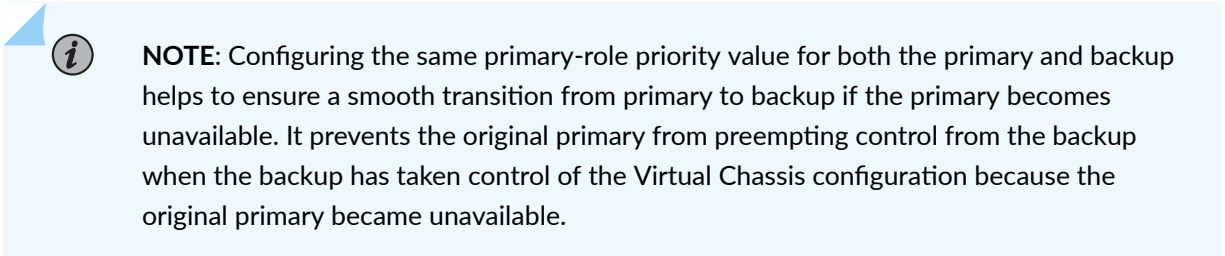
The member ID distinguishes the member switches from each other. You use the member ID to:

- assign a primary-role priority value to a member switch.
- configure interfaces for a member switch, similar to specifying a juniper Networks device slot number.
- apply some operational commands to a member switch.
- display status or characteristics of a member switch.

Primary-role Priority

In a nonprovisioned configuration, you can designate the role (primary or backup Routing Engine role or linecard role) that a member switch assumes by configuring its primary-role priority (a number from `0` through `255`). The primary-role priority value is the first consideration in the primary-role election algorithm for selecting the primary of the Virtual Chassis configuration. A switch with a primary-role priority of `0` never assumes the backup or primary Routing Engine role.

When you power on a standalone switch, it has the default primary-role priority value `128`. Because it's the only member switch in its own Virtual Chassis configuration, it's also the primary member. When you interconnect a standalone switch to an existing Virtual Chassis configuration (which already has its own primary), we recommend that you explicitly configure the primary-role priority of the members that you want to function as the primary and backup.



NOTE: Configuring the same primary-role priority value for both the primary and backup helps to ensure a smooth transition from primary to backup if the primary becomes unavailable. It prevents the original primary from preempting control from the backup when the backup has taken control of the Virtual Chassis configuration because the original primary became unavailable.

In a preprovisioned configuration, you can't configure primary-role priority values manually. You assign the role of each member switch, and the Virtual Chassis assigns the primary-role priority automatically based on the assigned role.

Virtual Chassis Identifier (VCID)

All members of a Virtual Chassis configuration share one Virtual Chassis identifier (VCID). The Virtual Chassis derives this identifier from internal parameters. When you monitor a Virtual Chassis configuration, certain interface views and the `show virtual-chassis` command display the VCID.

Nonvolatile Storage in a Virtual Chassis

EX Series and QFX Series switches store Junos OS system files in internal flash memory. In Virtual Chassis configurations, both the primary and the backup switch store the configuration information for all the member switches.

Junos OS optimizes the way a Virtual Chassis stores its configuration if a member switch or the Virtual Chassis configuration shuts down improperly, as follows:

- If the primary is not available, the backup switch takes on the role of the primary and its internal flash memory takes over as the alternate location for maintaining nonvolatile configuration memory.
- If you take a member switch offline for repair, the primary stores the configuration of the member switch.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
20.1R1	Starting in Junos OS Release 20.1R1, an EX4650 Virtual Chassis can have up to 4 members.
18.4R1	Starting in Junos OS Release 18.4R1, up to 4 of any model EX2300 member switches (including multigigabit models and any other EX2300 switches) can be combined in the same Virtual Chassis.
18.2R1	Starting in Junos OS Release 18.2R1 with the introduction of EX4300 multigigabit model switches (EX4300-48MP), an EX4300 Virtual Chassis can contain up to 10 EX4300 multigigabit model switches as a non-mixed Virtual Chassis or a combination of EX4300 multigigabit model switches with other EX4300 switches as a mixed EX4300 Virtual Chassis.
17.3R2-S4	Starting in Junos OS Release 17.3R2-S4, you can also use 100-Gigabit Ethernet QSFP28 ports as VCPs on QFX5200 switches.
15.1R7	Starting in Junos OS Releases 15.1R7 and 14.1X53-D47, in EX2200, EX3300, EX4200, EX4500, and EX4550 Virtual Chassis, automatic VCP conversion is disabled by default.
14.1X53-D47	Starting in Junos OS Releases 14.1X53-D47, 17.4R2, 18.1R3, 18.2R2, and 18.3R1 for EX4300, EX4600, QFX Series Virtual Chassis and for any EX4650 and QFX5120 Virtual Chassis (which all have the automatic VCP conversion feature enabled by default), you can choose to disable the feature by configuring `no-auto-conversion` at the `[edit virtual-chassis]` hierarchy level on the Virtual Chassis.
13.2X53-D25	Starting in Junos OS Release 13.2X51-D25, you can include up to 10 QFX5100-96S switches in a mixed or non-mixed QFX5100 Virtual Chassis.
13.2X50-D20	Starting in Junos OS Release 13.2X50-D20, a mixed QFX Series Virtual Chassis or VCF can also contain EX4300 switches.
12.2R1	Starting in Junos OS Release 12.2R1, an EX3300 Virtual Chassis can support up to 10 EX3300 member switches.

RELATED DOCUMENTATION

Understanding How the Primary in a Virtual Chassis Is Elected

All switches that are interconnected in a Virtual Chassis configuration are member switches of that Virtual Chassis. Each Virtual Chassis configuration has one member that functions as the *primary* in a Routing Engine role and controls the Virtual Chassis configuration. A second member functions as the backup in the Routing Engine role, and takes control if the primary fails.

When a Virtual Chassis configuration boots, it automatically runs a primary-role election algorithm to determine which member switch assumes the primary role. A Virtual Chassis also applies the same algorithm to choose a new primary or backup member if the member in either role fails.

The first factor the Virtual Chassis considers when choosing the primary member is the *primary-role priority*. On all members, the primary-role priority value is 128 by default. That value can change based on how you provision the Virtual Chassis, as follows:

- In a nonprovisioned Virtual Chassis, you can manually assign primary-role priority values from 0 to 255. A member with primary-role priority 0 will never be elected as primary (or backup), and always stays in the linecard role. In this way, you configure higher primary-role priority values to specify which members can take on the primary (or backup) role.
- In a preprovisioned Virtual Chassis, you can't manually set the primary-role priority on any members. Instead, you assign the Routing Engine role to two member switches. The Virtual Chassis automatically changes the default primary-role priority (128) to 129 on those two members. Then the Virtual Chassis assigns the primary operate in the linecard role by default (you can also explicitly configure them with that role). The Virtual Chassis will never elect a linecard role member as a primary or backup member.

The primary-role election algorithm compares the Virtual Chassis members against the following criteria, in the order listed, until only one member remains under consideration. That member becomes the primary:

1. Choose the member with the highest primary-role priority.
2. Choose the member that was the primary the last time you rebooted the Virtual Chassis.
3. Choose the member that has been in the Virtual Chassis configuration for the longest period of time. (The member switches under consideration must have more than 1 minute between power-up times for this condition to make a difference.)
4. Choose the member with the lowest MAC address.

The primary-role election algorithm does not consider the different switch models or platforms in the Virtual Chassis. For some Virtual Chassis that can contain different types of switches, we require or recommend you configure certain switches in the primary and backup Routing Engine roles. See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on the types of switches that can be mixed in a Virtual Chassis and which switches can or must be the primary or backup members.

To make sure a specific member is elected as the primary:

1. Power on only the switch that you want to be the primary in the Virtual Chassis.
2. (For a non-provisioned Virtual Chassis) Manually configure the primary-role priorities as follows:
   a. Configure the highest possible primary-role priority value (255) on the member from the first step.
   b. On the same member, which is now the primary, configure priority values on the other members. (For example, use the same value or next-highest value on the member you want to be the backup, and lower values on the other members.)
3. (For a preprovisioned Virtual Chassis) Configure the Routing Engine role on the two members that you want to act as the primary and backup members. (You can also explicitly configure the remaining members into the linecard role.)
4. Power on the other members.

You usually want to assign the same (highest) primary-role priority value to the members you want to be the primary and backup Routing Engine members to ensure reliable graceful Routing Engine switchover (GRES) operation. For either non-provisioned or preprovisioned Virtual Chassis, the other election considerations also help keep the primary role from switching back and forth rapidly between the two Routing Engine members under failover conditions.

For more information on configuring a Virtual Chassis, see *Configuring an EX3300 Virtual Chassis (CLI Procedure)*, *Configuring an EX4200, EX4500, or EX4550 Virtual Chassis (CLI Procedure)*, "Configuring an

EX2300, EX3400, or EX4300 Virtual Chassis" on page 77, or "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98.

RELATED DOCUMENTATION

Virtual Chassis Overview for Switches | 2
Understanding EX Series Virtual Chassis | 8
Understanding QFX Series Virtual Chassis | 25
Understanding Virtual Chassis Components | 43

Understanding Global Management of a Virtual Chassis

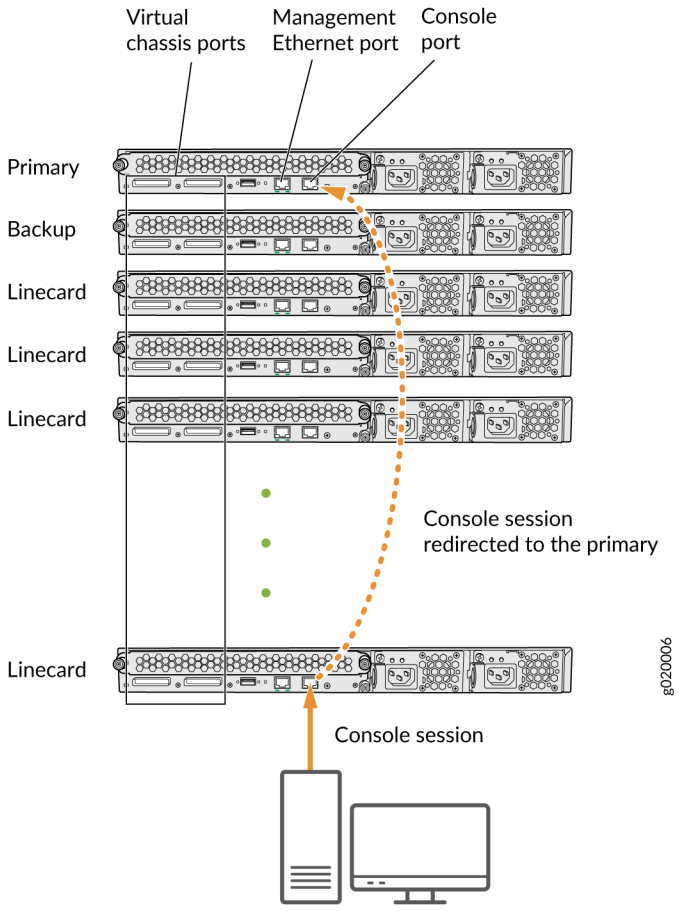
IN THIS SECTION

A Virtual Chassis is composed of multiple switches, so it has multiple console ports and multiple out-of-band management Ethernet ports located on the switches.

Console Port Session Redirection to Primary Switch

You can connect a PC or laptop directly to a console port of any member switch to set up and configure the Virtual Chassis. When you connect to the console port of any member switch, the console session is redirected to the primary switch, as shown in Figure 1 on page 59.

Figure 1: Console Session Redirection (EX4200 Virtual Chassis Pictured)



If the primary becomes unavailable, the console session is disconnected from the old primary and a new session is established with the newly elected primary.

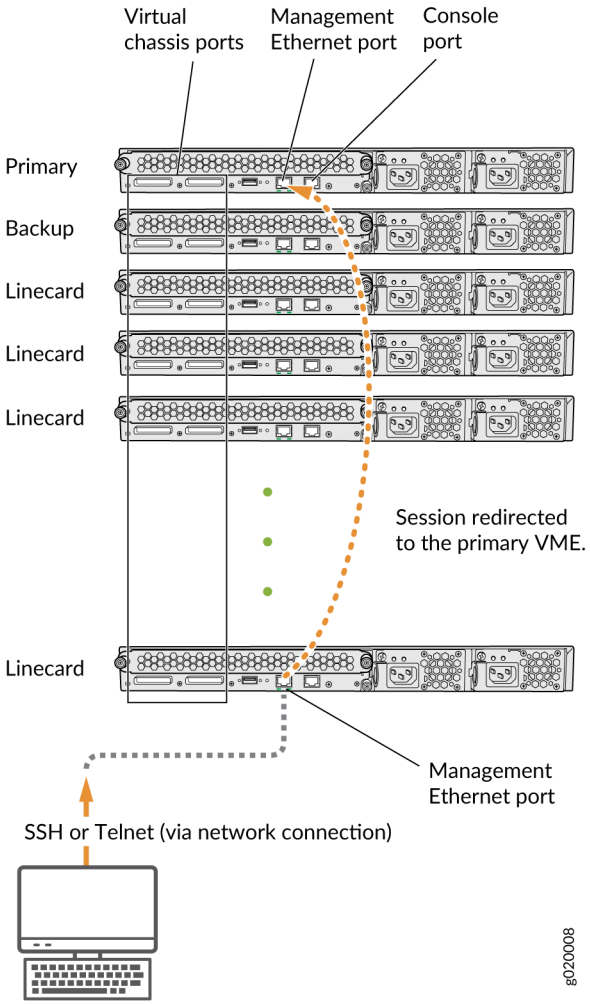
An out-of-band management Ethernet port is often referred to simply as a management Ethernet port. It uses a dedicated management channel for device maintenance and allows a system administrator to monitor and manage the switch by remote control.

Logical Port for Virtual Chassis Out-of-Band Management

An out-of-band management Ethernet port is often referred to simply as a management Ethernet port. It uses a dedicated management channel for device maintenance and allows a system administrator to monitor and manage the switch by remote control.

The Virtual Chassis configuration can be managed remotely through SSH or Telnet using a global management interface called the virtual management Ethernet (VME) interface. The VME interface is a *logical interface* representing all of the out-of-band management ports on the member switches. When you connect to the Virtual Chassis configuration using the VME interface's IP address, the connection is redirected to the primary member as shown in Figure 2 on page 60.

Figure 2: Management Ethernet Port Redirection to the VME Interface



You can configure an IP address for the VME global management interface at any time.

You can perform remote configuration and administration of all members of the Virtual Chassis configuration through the VME interface.

If the primary management Ethernet link is unavailable, the session is redirected through the backup management Ethernet link. If there is no active management Ethernet link on the backup, the VME interface chooses a management Ethernet link on one of the linecard members, selecting the linecard member with the lowest member ID as its first choice.

NOTE: In a QFX Series Virtual Chassis with QFX5110, QFX5120, or QFX5200 switches, the VME interface doesn't redirect properly to the management interface on the backup or linecard member switches if the management link on the primary member switch is down. Instead, you can use the console port on any member switch to globally configure or monitor the Virtual Chassis; this problem doesn't affect console port redirection (see "Console Port Session Redirection to Primary Switch" on page 58).

RELATED DOCUMENTATION

Understanding Virtual Chassis Components | 43

Example: Configuring an EX4200 Virtual Chassis with a Primary and Backup in a Single Wiring Closet

Configuring the Virtual Management Ethernet Interface for Global Management of an EX Series Virtual Chassis (CLI Procedure)

Understanding Virtual Chassis Port Link Aggregation

IN THIS SECTION

NOTE: This topic applies to all EX Series and QFX Series Virtual Chassis, except for EX8200 Virtual Chassis.

Within a Virtual Chassis, you can combine physical Ethernet ports to form a logical point-to-point link known as a *link aggregation group (LAG)* or *bundle*. The interfaces that are included in a LAG are sometimes referred to as member interfaces. Do not confuse this term with member switches, which refers to switches that are interconnected into a Virtual Chassis. A LAG in a Virtual Chassis can be

composed of member interfaces located in different member switches in the Virtual Chassis, or composed of multiple redundant Virtual Chassis Port (VCP) links between two member switches in the Virtual Chassis, as described in the following sections.

Virtual Chassis Network Interface LAG Among Virtual Chassis Members

When setting up interfaces in a Virtual Chassis, you can configure a combination of physical Ethernet ports belonging to different member switches to form a LAG. A LAG provides more bandwidth than a single Ethernet link can provide. Additionally, link aggregation provides network redundancy by load-balancing traffic across all available links. If one of the links fails, the system automatically load-balances traffic across all remaining links.

Similarly, if a Virtual Chassis member switch that has LAG member interfaces on multiple member switches fails for any reason, the traffic traversing the LAG can be redirected through the active member switch. This setup has benefits for failover purposes and can be especially beneficial in cases when a member switch needs to be inactive for some time, such as during a software upgrade using NSSU.

NOTE: During an NSSU operation, if you try to view LAG interface status on the primary Routing Engine member using the `show interfaces ae-`*`ae-interface-number`* CLI command, you might see incorrect or zero traffic counts. To work around this problem, run the command on the backup Routing Engine member instead if that member is already loaded and running.

Virtual Chassis Port LAG Between Two Virtual Chassis Members

You can configure optical uplink ports into Virtual Chassis ports (VCPs) that connect EX Series or QFX series switches together to form a Virtual Chassis. When you configure multiple uplink port VCPs connecting the same two member switches, those ports *automatically* form a LAG if the ports are configured to operate at the same link speeds. Each LAG is assigned a positive-integer identifier called a *trunk ID*. Up to 8 redundant VCP links can form a VCP LAG connecting two members in a Virtual Chassis, depending on the number of available ports that can be VCPs.

A VCP LAG automatically forms when any two member switches are interconnected with two or more VCP links of the same link speed in any of these configurations:

- If the VCP ports on both switches are ports you configured into VCPs or default-configured VCPs (for switches that have default VCPs).
- If the VCP ports on both switches are dedicated VCPs (for switches that have dedicated VCPs).

- In a mixed Virtual Chassis when the VCP links interconnect two different switch models.

A LAG over uplink VCPs provides higher overall bandwidth for forwarding traffic between the member switches connected by the optical VCPs, faster management communications, and greater redundancy of operations among the members than would be available without the LAG.

See "Setting an Uplink Port on an EX Series or QFX Series Switch as a Virtual Chassis Port" on page 130 or "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98 for information about configuring uplink ports into VCPs.

RELATED DOCUMENTATION

Understanding EX Series Virtual Chassis | 8

Understanding Aggregated Ethernet Interfaces and LACP for Switches

Understanding QFX Series Virtual Chassis | 25

Configuring an EX4650 or a QFX Series Virtual Chassis | 98

Understanding Split and Merge in a Virtual Chassis

IN THIS SECTION

In a Virtual Chassis, you connect two or more switches together to form a unit that is managed as a single chassis. If member switches in the Virtual Chassis fail or you remove member switches, this disrupts the Virtual Chassis configuration. In some situations, the Virtual Chassis configuration splits into two separate Virtual Chassis, which can cause disruptions in the network if the two resulting Virtual Chassis share common resources such as global IP addresses.

The Virtual Chassis split and merge feature is a method to prevent the separate Virtual Chassis configurations from adversely affecting the network. It also enables the two parts to merge back into a single Virtual Chassis configuration.

NOTE: If a Virtual Chassis configuration splits into separate parts, we recommend that you resolve the problem that caused the Virtual Chassis configuration to split as soon as possible.

You can also use this feature to merge two active, separate Virtual Chassis (that have not previously been part of the same configuration) into one Virtual Chassis configuration.

The split and merge feature is enabled by default on EX Series and QFX Series Virtual Chassis. You can disable this feature by using the `set virtual-chassis no-split-detection` command.

What Happens When a Virtual Chassis Configuration Splits

When a Virtual Chassis configuration splits into two separate Virtual Chassis configurations, the individual member switches detect this topology change and run the primary-role election algorithm to select a new primary for each of the two Virtual Chassis configurations. The new primaries then determine whether their Virtual Chassis configuration remains active. One of the configurations remains active based on the following:

- It contains both the stable primary and the stable backup (that is, the primary and backup from the original Virtual Chassis configuration before the split).
- It contains the stable primary and the configuration is greater than half the Virtual Chassis size.
- It contains the stable backup and is at least half the Virtual Chassis size.

In accordance with the rules given in the second and third list items, if the Virtual Chassis configuration splits into two equal parts and the stable primary and stable backup are in different parts, then the part that contains the stable backup becomes active.

NOTE: The number of members in the Virtual Chassis configuration includes all member switches connected to date minus the number whose Virtual Chassis member IDs have been recycled (that is, made available for reassignment). Therefore, the size of the Virtual Chassis configuration increases when a new member switch is detected and decreases when a member switch's ID is recycled.

These rules ensure that only one of the two separate Virtual Chassis configurations created by the split remains active. The member switches in the inactive Virtual Chassis configuration remain in a linecard role. For the inactive members to become active again, one of the following things must happen:

- The problem that caused the original Virtual Chassis configuration to split is resolved, allowing the two Virtual Chassis configurations to merge.
- You load the factory default configuration on the inactive members, which causes the inactive members to function as standalone switches or become part of a different Virtual Chassis configuration.

NOTE: When any member (mostly linecard or backup) goes offline for a prolonged duration, it is strongly recommended to recycle member ID using the `request virtual-chassis recycle` command for non-provisioned virtual chassis scenarios and the `delete virtual-chassis member` command for pre-provisioned virtual chassis scenarios. This is strongly recommended to prevent any issues that could result in an unstable virtual chassis.

Merging Virtual Chassis Configurations

There are two scenarios in which separate Virtual Chassis merge:

- A Virtual Chassis configuration that had split into two is now merging back into a single configuration because the problem that had caused it to split has been resolved.
- You want to merge two Virtual Chassis that had not previously been configured together.

Every Virtual Chassis configuration has a unique ID (VCID) that is automatically assigned when the Virtual Chassis configuration is formed. You can also explicitly assign a VCID using the `set virtual-chassis id` command. A VCID that you assign takes precedence over automatically assigned VCIDs.

When you reconnect the separate Virtual Chassis configurations or connect them for the first time, the members determine whether or not the separate Virtual Chassis configurations can merge. The members use the following rules to determine whether a merge is possible:

- If the Virtual Chassis configurations have the same VCID, then the configurations can merge. If the two Virtual Chassis were formed as the result of a split, they have the same VCID.
- If the VCIDs are different, then the two configurations can merge only if both are active (inactive configurations cannot merge, ensuring that members removed from one Virtual Chassis configuration do not become members of another Virtual Chassis configuration). If the configurations to merge are both active and one of them has a user-configured VCID, this ID becomes the ID of the merged Virtual Chassis. If neither Virtual Chassis has a user-configured VCID, then the VCID of the configuration with the highest primary-role priority becomes the ID of the merged Virtual Chassis. The resulting merged Virtual Chassis configuration is active.

When you connect two Virtual Chassis configurations:

1. Connecting the two split Virtual Chassis configurations triggers the shortest-path-first (SPF) algorithm. The SPF algorithm computes the network topology and then triggers the primary-role election algorithm. The primary-role election algorithm waits for the members to synchronize the topology information before running.
2. The primary-role election algorithm merges the VCIDs of all the members.
3. Each member runs the primary-role election algorithm to select a primary and a backup from among all members with the same VCIDs. For more information, see "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56.
4. The primary determines whether the Virtual Chassis configuration is active or inactive. (See "What Happens When a Virtual Chassis Configuration Splits" on page 64.)
5. If the Virtual Chassis configuration is active, the primary assigns roles to all members. If the Virtual Chassis configuration is inactive, the primary assigns all members the role of linecard.
6. When the other members receive their role from the primary, they change their role to backup or linecard. They also use the active or inactive state information sent by the primary to set their own state to active or inactive and to construct the Virtual Chassis member list from the information sent by the primary.
7. If the Virtual Chassis state is active, the primary waits for messages from the members indicating that they have changed their roles to the assigned roles, and then the primary changes its own role to primary.

NOTE: When you merge two Virtual Chassis that had not previously been part of the same Virtual Chassis configuration, any configuration settings (such as the settings for Telnet and FTP services, graceful Routing Engine switchover (GRES), fast failover, VLANs, and so on) that exist on the new primary become the configuration settings for all members of the new Virtual Chassis, overwriting any other configuration settings.

RELATED DOCUMENTATION

Disabling Split and Merge in a Virtual Chassis | **136**

Assigning the Virtual Chassis ID to Determine Precedence During a Virtual Chassis Merge | **140**

Example: Assigning the Virtual Chassis ID to Determine Precedence During an EX4200 Virtual Chassis Merge

Understanding EX Series Virtual Chassis | **8**

Understanding QFX Series Virtual Chassis | **25**

Understanding Automatic Software Update on Virtual Chassis Member Switches

IN THIS SECTION

You can use the automatic software update feature to automatically update the Juniper Networks Junos operating system (Junos OS) version on prospective member switches as you add them to an EX Series or QFX Series *Virtual Chassis*.

Automatic Software Update Basics

When you have configured automatic software update on a Virtual Chassis, the Junos OS version is updated on the new member switch when you add it to the Virtual Chassis. The new member switch immediately joins the Virtual Chassis configuration and is put in the active state.

For a standalone switch to join an existing Virtual Chassis, it must be running the same version of Junos OS that is running on the Virtual Chassis primary. When the primary in a Virtual Chassis detects that a new switch has been added to the configuration, it checks the software version on the new switch. If the software version on the new switch is not the same as the version running on the primary, the primary keeps the new switch in the inactive state. If you have not enabled the automatic software update feature, you have to manually install the correct software version on each prospective member switch as it is added to the Virtual Chassis.

Automatic Software Update Restrictions

Refer to Feature Explorer to see the EX Series and QFX Series Virtual Chassis that support automatic software updates, and the Junos OS release versions where the feature was introduced on each platform. Where the automatic software update feature is supported, see the Junos OS Release Notes for the release version running on the primary for any limitations in using automatic software updates between that release version and any prospective member switch release versions.

CAUTION: A QFX5100 switch running a Junos OS software image with "-qfx-5-" in the package filename *must* first be upgraded to a Junos OS software image with "-qfx-5e-" in the package filename before it can be added to a QFX5110 Virtual Chassis or VCF. The automatic software update process cannot update a switch from a "-qfx-5-" image to a "-qfx-5e-" image. See *Upgrading a QFX5100 Switch with a USB Device to Join a QFX5110 Virtual Chassis or Virtual Chassis Fabric*.

After a QFX5100 switch is installed with a "-qfx-5e-" Junos OS software image, the automatic software update process can successfully update the switch automatically with a different version of a "-qfx-5e-" Junos OS image to match the other members in the Virtual Chassis or VCF.

RELATED DOCUMENTATION

Understanding Software Upgrades in a Virtual Chassis | 168

Configuring Automatic Software Update on Virtual Chassis Member Switches | 138

Example: Configuring Automatic Software Update on EX4200 Virtual Chassis Member Switches

Understanding MAC Address Assignment on a Virtual Chassis

In a *Virtual Chassis*, multiple switches—each with its own set of interfaces with unique MAC addresses—are connected together to form one chassis that can be managed as a single switch. The MAC address assigned to each network-facing interface on the switch changes when the switch joins a Virtual Chassis. Because all Layer 2 traffic decisions are based on an interface's MAC address, understanding MAC address assignment is important to understanding how network traffic is forwarded and received by the Virtual Chassis. For additional information about how a network uses MAC addresses to forward and receive traffic, see Understanding Bridging and VLANs on Switches.

When a Virtual Chassis is formed, the MAC address of the switch in the primary role becomes the system MAC base address. The Virtual Chassis assigns the system MAC base address as the MAC address for all Layer 3 interfaces within the Virtual Chassis. The Virtual Chassis also assigns the system MAC base address to the virtual management Ethernet (VME) interface and to all of the virtual LANs (VLANs) in the Virtual Chassis.

The system MAC base address does not change in the event of a switchover if the switch that was originally configured in the primary role remains a member of the Virtual Chassis. If the switch that was

originally configured in the primary role is removed from the Virtual Chassis, the MAC address of the current member switch in the primary role is assigned as the system MAC base address after the MAC persistence timer interval has expired. You can configure the MAC persistence timer interval.

The Virtual Chassis assigns a root ID to the spanning tree bridge based on the system MAC based address. If the system base MAC address changes, the spanning tree bridge continues to use the same root ID. You must run the `restart layer2-control` command for the spanning tree bridge to use a new root ID based on the new system base MAC address.

For Layer 2 and aggregated Ethernet interfaces, the Virtual Chassis assigns a unique MAC address that is derived from the member switch MAC address to each interface. The assignment of a unique MAC address to each network interface helps ensure that functions that require MAC address differentiation —such as redundant trunk groups (RTGs), Link Aggregation Control Protocol (LACP), and general monitoring functions—can function properly.

If you reconfigure a Layer 2 interface into a Layer 3 interface, or the reverse, within a Virtual Chassis, the MAC address of that interface changes accordingly.

MAC addresses are assigned to interfaces in a Virtual Chassis automatically—no user configuration is possible or required. You can view the MAC addresses that are assigned to the interfaces by using the `show interfaces` command.

RELATED DOCUMENTATION

- Understanding MAC Address Assignment on an EX Series Switch
- Configuring the Timer for the Backup Member to Start Using Its Own MAC Address as Primary of a Virtual Chassis | **129**
- Understanding EX Series Virtual Chassis | **8**
- *EX8200 Virtual Chassis Overview*
- Understanding QFX Series Virtual Chassis | **25**

Understanding High Availability on an EX Series Virtual Chassis

You increase your network's high availability (HA) when you interconnect a Juniper Networks EX Series Ethernet switch into a *Virtual Chassis*. A Virtual Chassis is more fault tolerant then a standalone EX series switch because it remains up when a single member switch fails, and provides sub-second convergence in the case of a device or link failure.

You can further improve HA by configuring the HA features available for your EX Series Virtual Chassis. You can, for instance, configure Link Aggregation Groups (LAG) bundles to include member links on multiple member switches in the same Virtual Chassis. This configuration increases fault tolerance because traffic traversing the LAG can be redirected to an active member switch when a single member switch fails.

A Virtual Chassis has dual Routing Engines—the switch in the primary role and the switch in the backup role—and therefore supports many HA features not supported on standalone EX Series switches, such as Graceful Routing Engine Switchover (GRES) for hitless failover. For information on which of the High Availability features listed in Table 8 on page 70 are supported in your EX Series Virtual Chassis, see Feature Explorer.

Many HA features for the EX Series Virtual Chassis are designed to improve network resiliency after a Routing Engine switchover. Table 8 on page 70 describes the effects of a Routing Engine switchover when no high availability features are enabled and when some High Availability features are enabled.

Table 8: Effects of a Routing Engine Switchover

High Availability Feature	Effect of Routing Engine Switchover
No HA features enabled	Kernel and forwarding state information is not preserved to the backup Routing Engine. A convergence process that requires all interfaces on the Virtual Chassis to be taken offline has to be performed before the Virtual Chassis returns online. The switchover can take several minutes and the Virtual Chassis does not send or receive traffic until the switchover is complete.
Graceful Routing Engine switchover (GRES) enabled	Kernel and forwarding state information is preserved on both Routing Engines, so the convergence process does not occur and the switchover happens quickly with minimal traffic loss.

Table 8: Effects of a Routing Engine Switchover *(Continued)*

High Availability Feature	Effect of Routing Engine Switchover
Nonstop active routing (NSR), Nonstop bridging (NSB), or both enabled	Layer 2 protocols that are supported by NSB are not disrupted by a Routing Engine switchover when NSB is enabled. Layer 2 protocol information for all active Layer 2 protocols is stored on both Routing Engines when NSB is enabled. Layer 3 protocols that are supported by NSR are not disrupted by a Routing Engine switchover when NSR is enabled. Layer 3 protocol information for all active Layer protocols is stored on both Routing Engines when NSR is enabled.
Graceful Protocol Restart enabled	Traffic is not interrupted during the switchover. Interface and kernel information is preserved. Graceful restart protocol extensions quickly collect and restore routing information for supported protocols from the neighboring devices.

RELATED DOCUMENTATION

Understanding EX Series Virtual Chassis | 8

2

CHAPTER

Virtual Chassis Configuration

IN THIS CHAPTER

Virtual Chassis Cabling

You can install EX and QFX switches in a single rack or multiple racks, or in different wiring closets, and interconnect them to form a virtual chassis. Depending upon your device, you might have dedicated virtual chassis ports (VCPs) or network ports configured as VCPs. You can also configure the ports on uplink modules as VCPs.

You can physically connect the virtual chassis member switches in a ring topology, a mesh topology, or a chain topology.

- **Ring Topology**

  We recommend using a ring topology when cabling a virtual chassis. In a ring topology, each switch is connected to the preceding switch and the following switch. The switches at the edges are connected to each other. If one of the links goes down, the virtual chassis will be intact because of the circular structure and redundant links.

  Figure 3 on page 75 show the switches mounted on a single rack or cabinet connected in a ring topology.

Figure 3: Virtual Chassis Switches on a Single Rack Connected in a Ring Topology

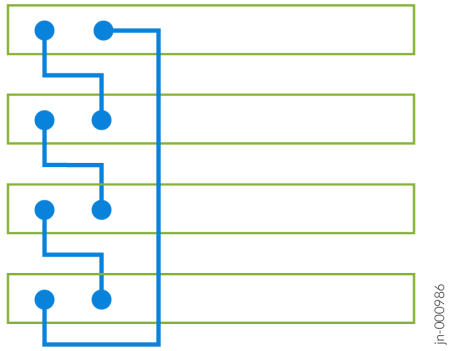


Figure 4: Virtual Chassis Switches on a Single Rack Connected in a Ring Topology (Alternative)

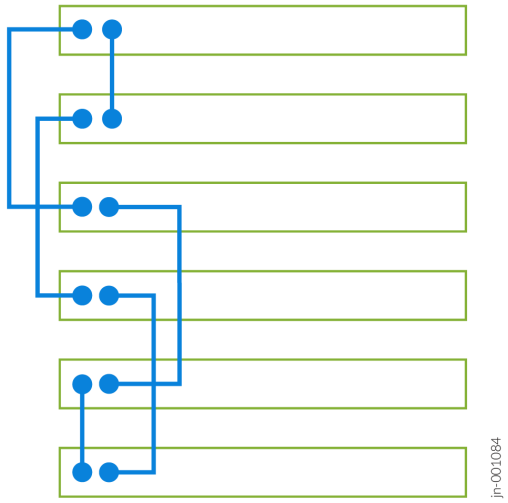
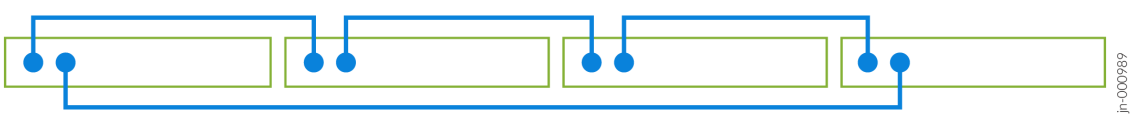


Figure 5 on page 75shows the switches mounted on different racks or cabinets connected in a ring topology.

Figure 5: Virtual Chassis Switches on Different Racks Connected in a Ring Topology



- **Mesh Topology**

  In a mesh topology, each switch is connected to all other switches in a fully redundant structure. The virtual chassis is intact even if multiple links go down. However, this topology is not scalable in larger virtual chassis as it uses a large number of VCPs.

  Figure 6 on page 76 shows the switches mounted on a single rack or cabinet connected in a mesh topology.

  Figure 6: Virtual Chassis Switches on a Single Rack Connected in a Mesh Topology

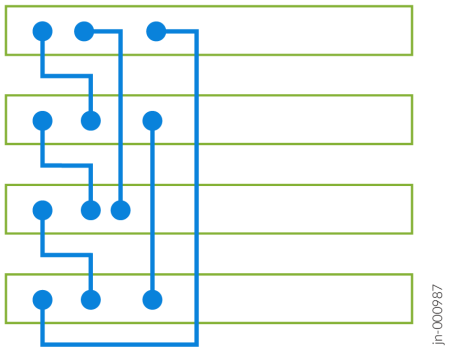
  

  Figure 7 on page 76 shows the switches mounted on different racks or cabinets connected in a mesh topology.

  Figure 7: Virtual Chassis Switches on Different Racks Connected in a Mesh Topology

- **Chain Topology**

  In a chain topology, the switches are connected in a linear structure. The switches at the end are not connected to each other. If one of the links goes down, the virtual chassis is split into two and exhibits unexpected behavior.

  Figure 8 on page 77 shows the switches mounted on a single rack or cabinet connected in a chain topology.

Figure 8: Virtual Chassis Switches on a Single Rack Connected in a Chain Topology

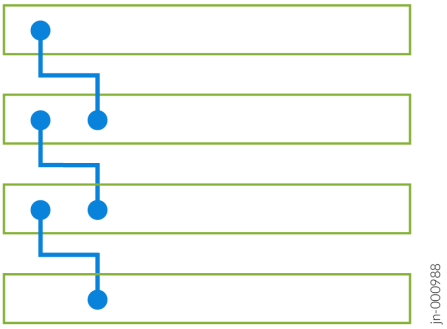


Figure 9 on page 77 shows the switches mounted on different racks or cabinets connected in a ring topology.

Figure 9: Virtual Chassis Switches on Different Racks Connected in a Chain Topology

Configuring an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis

IN THIS SECTION

NOTE: To configure a Virtual Chassis through Juniper Mist Wired Assurance, use the instructions in the following topics:

- Configure a Virtual Chassis Using EX2300, EX4650, or QFX5120 Switches
- Configure a Virtual Chassis Using EX3400, EX4100, EX4100-F, EX4300, or EX4400 Switches

You can use the procedures in this topic to configure:

- An EX2300 Virtual Chassis

  NOTE: Junos OS releases prior to 18.4R1 support forming an EX2300 Virtual Chassis using only EX2300 multigigabit switches or only EX2300 switches that are not multigigabit model switches.

  Starting in Junos OS Release 18.4R1, EX2300, EX2300-C, and EX2300 multigigabit switches can all be combined in the same non-mixed Virtual Chassis.

- An EX3400 Virtual Chassis
- A non-mixed EX4300 Virtual Chassis

  NOTE: An EX4300 Virtual Chassis operates as a non-mixed Virtual Chassis if it is composed of only EX4300 multigigabit model switches, or composed only of any combination of any other EX4300 switches excluding the multigigabit models.

  You must configure mixed mode if you combine EX4300 multigigabit models with other EX4300 models in an EX4300 Virtual Chassis.

- A mixed EX4300 Virtual Chassis with EX4300 multigigabit model (EX4300-48MP) switches interconnected with other EX4300 model switches
- An EX4100 Virtual Chassis

  NOTE: You can combine any models of EX4100 switches, including EX4100 multigigabit models, and EX4100-F into a Virtual Chassis without needing to configure mixed mode.

- An EX4400 Virtual Chassis

NOTE: You can combine any models of EX4400 switches, including multigigabit models, into an EX4400 Virtual Chassis without needing to configure mixed mode.

You can mix non-multigigabit model EX4300 switches with other switches in a Virtual Chassis or Virtual Chassis Fabric (VCF) in the following supported combinations. In these cases, use the following configuration procedures instead of the procedures in this topic:

- A mixed EX4600 Virtual Chassis that includes EX4600 and EX4300 member switches: "Configuring EX4600 Switches in a Mixed or Non-Mixed Virtual Chassis" on page 91.
- A mixed QFX Series Virtual Chassis that includes supported QFX Series and EX4300 switches: "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98.
- A mixed VCF with EX4300 switches as leaf nodes: *Preprovisioning a Virtual Chassis Fabric* or *Autoprovisioning a Virtual Chassis Fabric*.

Use the following requirements and guidelines to plan the devices to include in your Virtual Chassis:

- EX2300 switches:

  In Junos OS releases prior to 18.4R1, you can interconnect EX2300 and EX2300-C switches into a Virtual Chassis, or you can interconnect EX2300 multigigabit model switches (EX2300-24MP and EX2300-48MP) into a Virtual Chassis. You can't combine EX2300 or EX2300-C switches with EX2300 multigigabit model switches in a Virtual Chassis.

  Starting in Junos OS Release 18.4R1, you can combine EX2300, EX2300-C, and EX2300 multigigabit switches in the same non-mixed Virtual Chassis, and use any of these switches in any role (primary Routing Engine role, backup Routing Engine role, or linecard role).

- EX3400 switches:

  You can interconnect EX3400 switches only with other EX3400 switches in a Virtual Chassis (no mixed mode).

- EX4300 switches:

  You can interconnect EX4300 switches excluding multigigabit models into a *non-mixed* EX4300 Virtual Chassis.

  You can also connect EX4300 multigigabit model switches (EX4300-48MP) together into a *non-mixed* EX4300 Virtual Chassis.

  You can combine EX4300 multigigabit model switches with other EX4300 model switches as a *mixed* EX4300 Virtual Chassis with the following configuration:

  - You must configure the Virtual Chassis into mixed mode.

- You must also include a special port mode option (`ieee-clause-82`) when you configure mixed mode on the EX4300 switches that are not multigigabit models. This port mode enables the Virtual Chassis ports (VCPs) on EX4300 non-multigigabit model switches to communicate with VCPs on multigigabit model members.

  NOTE: If you remove a non-multigigabit model EX4300 switch from a mixed EX4300 Virtual Chassis with multigigabit model members, remember to disable `ieee-clause-82` port mode on the removed switch if you want to reconfigure it as a standalone switch or use it in any other type of mixed Virtual Chassis or non-mixed Virtual Chassis. Otherwise, the VCPs will not connect with other members in the new Virtual Chassis. (See *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*.)

- The members in the Routing Engine role must be multigigabit model (EX4300-48MP) switches.

- EX4100 switches:

  You can interconnect EX4100 switches only with other EX4100 switches in a Virtual Chassis, including EX4100 multigigabit models, and EX4100-F model. You do not need to configure mixed mode when combining EX4100 multigigabit models with other EX4100 and EX4100-F models.

- EX4400 switches:
  You can interconnect EX4400 switches only with other EX4400 switches in a Virtual Chassis, including EX4400 multigigabit models. You do not need to configure mixed mode when combining EX4400 multigigabit models with other EX4400 models.

Use these guidelines to plan the VCP connections:

- In a non-mixed EX4300 Virtual Chassis with only EX4300 multigigabit model (EX4300-48MP) switches, interconnect the member switches using the dedicated VCPs—the 40-Gpbs QSFP+ ports on the rear panel. These are the only ports that can be used as VCPs on EX4300-48MP switches.

- In a mixed EX4300 Virtual Chassis with a combination of EX4300 multigigabit model switches and other EX4300 model switches, you must use 40-Gbps QSFP+ ports on the other EX4300 model switches as VCPs and interconnect those ports with the dedicated VCPs on the multigigabit model switch members.

  NOTE: All QSFP+ ports on EX4300 non-multigigabit switches are configured as VCPs in the default factory configuration.

- In non-mixed EX2300, EX3400, and non-multigigabit model EX4300 Virtual Chassis, use uplink ports that you configure as VCPs or that are VCPs by default to interconnect the member switches. Keep the following in mind about VCPs on these switches:

- EX2300 switches do not have any ports that are configured by default as VCPs. You must explicitly configure the ports you want to use as VCPs.
- The QSFP+ uplink ports on EX3400 and EX4300 switches support 40-Gbps speeds. These ports are set as VCPs by default, so you don't need to explicitly configure them.
- You can configure the SFP+ uplink ports on any of these switches as VCPs. These ports support 10-Gbps speeds and can connect switches that are up to 6.2 miles (10 km) apart.

  NOTE: The only exceptions are the four *built-in* 10-Gbps SFP+ ports on 32-port EX4300 switches. You can't use the built-in ports as VCPs.

  Also, for uplink ports on these switches that support SFP or SFP+ transceivers, you can't form a Virtual Chassis using ports that have SFP transceivers installed. The ports must have SFP+ transceivers installed for them to function properly as VCPs.

- The simplest way to interconnect EX3400 or EX4300 switches into a non-mixed EX3400 or EX4300 Virtual Chassis is to interconnect them into a Virtual Chassis by using the QSFP+ ports (the default VCPs).

  For an EX3400 or EX4300 Virtual Chassis, if you are using the QSFP+ ports for another purpose, or for any EX2300 Virtual Chassis, you must configure SFP+ uplink module ports into VCPs.

- In an EX4400 Virtual Chassis, you must use the default VCPs to interconnect the member switches, which are the only ports that can be used as VCPs on any model of these switches. The default VCPs on the EX4400 and multigigabyte models are the two 100-Gbps ports on the rear panel, which operate as two logical 50-Gbps VCPs each for a total of four logical VCP interfaces on the switch. If you previously converted the default VCPs into network ports, you must convert them back into VCPs using the request virtual- chassis mode network-port disable command. You must then reboot the switch for the port mode conversion to take effect.
- In an EX4100 Virtual Chassis, you must use the default VCPs to interconnect the member switches, which are the only ports that can be used as VCPs on any model of these switches. The default VCPs on the EX4100 and EX4100 multigigabyte models are the four 25-Gbps ports on the front panel. If you previously converted the default VCPs into network ports, you must convert them back into VCPs using the request virtual- chassis mode network-port disable command. You must then reboot the switch for the port mode conversion to take effect.
- In an EX4100-F Virtual Chassis, you must use the default VCPs to interconnect the member switches, which are the only ports that can be used as VCPs on any model of these switches. The default VCPs on the EX4100-F models are the four 10-Gbps ports on the front panel. If you previously converted the default VCPs into network ports, you must convert them back into VCPs using the request virtual- chassis mode network-port disable command. You must then reboot the switch for the port mode conversion to take effect.

- If you need additional VCP bandwidth between two member switches, you can configure additional ports as VCPs and create redundant links between the member switches.

  Redundant VCP links are not required to be the same speed, but the links with identical speeds automatically form a VCP link aggregation group (LAG) to provide resiliency to the Virtual Chassis. For example, if you have two 40-Gbps QSFP+ ports and two 10-Gbps SFP+ ports configured as VCPs connecting the same two member switches to each other, the member switches form two LAGs—one LAG with two 40-Gbps QSFP+ port links and another with two 10-Gbps SFP+ port links.

NOTE: A Virtual Chassis configuration has two Routing Engines—the primary switch and the backup switch. We recommend that you always use `commit synchronize` rather than simply `commit` to save configuration changes made for a Virtual Chassis. This ensures that you save the configuration changes on both Routing Engines at the same time.

You can configure the Virtual Chassis using either of the following options:

- A nonprovisioned configuration—The primary sequentially assigns a member ID to other member switches. The role is determined by the primary-role priority value and other factors in the primary-role election algorithm.
- A preprovisioned configuration—You can deterministically control the member ID and role assigned to a member switch by tying the member switch to its serial number.

All member switches must be running the same version of Junos OS to form a Virtual Chassis.

NOTE: You must configure a VLAN on all interfaces in the Virtual Chassis, except on member switch 0, before the interfaces can send or receive traffic. This is because the interfaces on member switch 0 are initially placed into the default VLAN, but the interfaces on all other member switches are not placed into any VLAN. See Configuring VLANs for EX Series Switches with ELS Support (CLI Procedure).

NOTE: On an EX4300 Virtual Chassis, STP is disabled on all interfaces except the interfaces on member switch 0 until some type of spanning-tree protocol is enabled. See Configuring RSTP on EX Series Switches (CLI Procedure) (RSTP is the default spanning-tree protocol), Configuring MSTP on Switches, or Configuring VSTP Protocol to enable a spanning-tree protocol on the interfaces in your EX4300 Virtual Chassis.

Configuring an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis with a Nonprovisioned Configuration File

You can use a nonprovisioned configuration to configure an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis.

This procedure shows example configuration steps for a Virtual Chassis with two to ten members. You can have up to 4 members in an EX2300 Virtual Chassis, and up to 10 members in an EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis.

NOTE: We recommend that you physically cable the interconnecting ports as the final step of this procedure.

You can, however, configure the Virtual Chassis while the cables are physically connected.

1. Power on only the switch that you will use as the primary switch.

   NOTE: For a mixed EX4300 Virtual Chassis with EX4300 multigigabit model (EX4300-48MP) switches and other EX4300 model switches, the members in the primary and backup Routing Engine roles must be EX4300 multigigabit model switches.

2. (Required for a mixed EX4300 Virtual Chassis only) Set the primary switch into mixed mode, and reboot the switch for the change to take effect:

   ```
   user@device> request virtual-chassis mode mixed reboot
   ```

3. If you are configuring a mixed Virtual Chassis, wait for the reboot to complete before performing this step. Run the EZSetup program on the primary switch, specifying the identification parameters. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* for details.

   NOTE: The properties that you specify for the primary switch apply to the entire Virtual Chassis configuration.

4. (Optional) Configure the primary switch with the virtual management Ethernet (VME) interface for out-of-band management of the Virtual Chassis (see "Understanding Global Management of a Virtual Chassis" on page 58):

```
[edit]
user@switch# set interfaces vme unit 0 family inet address /ip-address/mask/
```

5. (Optional) Configure primary-role priority for the other member switches. For example, for a ten-member Virtual Chassis:

```
[edit virtual-chassis]
user@switch# set member 0 mastership-priority 255
user@switch# set member 1 mastership-priority 255
user@switch# set member 2 mastership-priority 10
user@switch# set member 3 mastership-priority 9
user@switch# set member 4 mastership-priority 8
user@switch# set member 5 mastership-priority 7
user@switch# set member 6 mastership-priority 6
user@switch# set member 7 mastership-priority 5
user@switch# set member 8 mastership-priority 4
user@switch# set member 9 mastership-priority 3
```

The primary-role priority value determines the roles in a non-provisioned Virtual Chassis configuration. The switches with the highest primary-role priority values assume the primary and backup roles. All other switches assume the linecard role.

If you do not configure the primary-role priority for any switch in your Virtual Chassis, including when you do not configure the Virtual Chassis, all switches assume the default primary-role priority of 128. The primary-role election algorithm selects the roles for the member switches. In most cases, the switches that have been powered on the longest assume the primary and backup roles when all Virtual Chassis member switches are configured with the same primary-role priority. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56 for additional information on the primary-role election algorithm.

A switch with a primary-role priority of 0 never assumes the primary or backup role.

NOTE: We recommend that you specify the same primary-role priority value for the intended primary and backup members.

6. (Optional: Recommended for a two-member Virtual Chassis) On the primary switch, disable the split and merge feature:

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

7. Commit the configured items.
8. Power on the other member switches.
9. (Required for a mixed EX4300 Virtual Chassis only) Set each additional individual EX4300 multigigabit model (EX4300-48MP) switch into mixed mode and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

Set each of the other EX4300 switches that are not multigigabit model switches into mixed mode with the `ieee-clause-82` option, and reboot the reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode ieee-clause-82 mixed reboot
```

10. If needed, on each individual member switch, configure SFP+ uplink ports that will be used as VCPs to interconnect the member switches. Use the `request virtual-chassis vc-port` command to convert the network ports to VCPs.

This step is not needed for:

- EX4300 multigigabit model (EX4300-48MP) switches, which have dedicated VCPs on the rear panel of the switch. Dedicated VCPs do not require configuration, and you must use the dedicated ports on these switches because no other ports on these switches are supported as VCPs.
- EX3400 switches and EX4300 member switches that are not multigigabit model switches, if you are using the QSFP+ ports that are VCPs by default. You only need to configure a QSFP+ port as a VCP if you previously configured the QSFP+ port into a network port. In that case, you can perform this step to configure the QSFP+ port back into a VCP.

For example:

```
user@switch> request virtual-chassis vc-port pic-slot pic-slot-number port port-number
```

11. (EX4100, EX-4100-F, and EX4400 switches only) If the ports that you will use as VCPs were previously converted into network ports on any member switches, convert them back into VCPs in this step using the `request virtual-chassis mode network-port disable` command, and reboot the affected

switches for the change to take effect. The `request virtual-chassis vc-port` command doesn't convert a network port into a VCP on EX4100, EX4100-F, and EX4400 switches.

> **NOTE**: This command changes the port mode for all of the VCPs on the switch. The four ports must both operate together as VCPs or as network ports. You are also required to reboot the switch for any mode command changes to take affect. You can optionally include the reboot option with the mode command to reboot the switch immediately, as shown here. Otherwise, you can alternatively reboot the switch later with a separate reboot command.

For example:

```
user@switch> request virtual-chassis mode network-port disable reboot
```

12. Cable the ports interconnecting the members if they were not connected earlier.

> **NOTE**: If you want to change the member ID that the primary has assigned to a member switch, use the `request virtual-chassis renumber` command.

Configuring an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis with a Preprovisioned Configuration File

Preprovisioning a Virtual Chassis configuration allows you to assign the member ID and role for each switch in the Virtual Chassis.

This procedure shows example configuration steps applicable to a Virtual Chassis with two to ten members; up to 4 members are supported in an EX2300 Virtual Chassis, and up to 10 members are supported in an EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis.

To configure a Virtual Chassis using a preprovisioned configuration:

> **NOTE**: We recommend that you physically cable the optical ports as the final step of this procedure.
>
> You can, however, configure the Virtual Chassis while the cables are physically connected.

1. Make a list of the serial numbers of all the switches to be connected in a Virtual Chassis configuration.

NOTE: Serial number values are case-sensitive.

2. Note the intended role (`routing-engine` or `line-card`) of each switch. If you configure the member with a `routing-engine` role, it is eligible to function in the primary or backup role. If you configure the member with a `line-card` role, it is not eligible to function in the primary or backup role.

NOTE: For a mixed EX4300 Virtual Chassis with EX4300 multigigabit model (EX4300-48MP) switches and other EX4300 model switches, the members in the primary and backup Routing Engine roles must be EX4300 multigigabit model switches.

3. Power on only the switch that you plan to use as the primary switch.
4. (Required for a mixed EX4300 Virtual Chassis only) Set the primary switch into mixed mode, and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

5. If you are configuring a mixed Virtual Chassis, wait for the reboot to complete before performing this step. Run the EZSetup program on the primary switch, specifying the identification parameters. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* for details.

NOTE: The properties that you specify for the primary switch apply to the entire Virtual Chassis configuration.

6. (Optional) Configure the primary switch with the virtual management Ethernet (VME) interface for out-of-band management of the Virtual Chassis (see "Understanding Global Management of a Virtual Chassis" on page 58):

```
[edit]
user@switch# set interfaces vme unit 0 family inet address /ip-address/mask/
```

7. Specify the preprovisioned configuration mode:

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

8. Specify all the members that you want included in the Virtual Chassis, listing each switch's serial number with the desired member ID and role. For example, for a ten-member Virtual Chassis:

NOTE: You can retrieve the switch's serial number using the **show chassis hardware** command output or by viewing the serial number ID label on the switch. See *Locating the Serial Number on an EX2300 Switch or Component*, *Locating the Serial Number on an EX3400 Switch or Component*, or *Locating the Serial Number on an EX4300 Switch or Component*. Serial number values are case-sensitive.

```
[edit virtual-chassis]
user@switch# set member 0 serial-number abc123 role routing-engine
user@switch# set member 1 serial-number def456 role routing-engine
user@switch# set member 2 serial-number ghi789 role line-card
user@switch# set member 3 serial-number jkl012 role line-card
user@switch# set member 4 serial-number mno013 role line-card
user@switch# set member 5 serial-number pqr014 role line-card
user@switch# set member 6 serial-number stu015 role line-card
user@switch# set member 7 serial-number vwx016 role line-card
user@switch# set member 8 serial-number yzz017 role line-card
user@switch# set member 9 serial-number aaa018 role line-card
```

9. (Optional: Recommended for a two-member Virtual Chassis) Disable the split and merge feature:

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

10. Commit the configured items.
11. Power on the other member switches. The member IDs and roles have been determined by the configuration, so you can power on the member switches in any order.
12. (Required for a mixed EX4300 Virtual Chassis only) Set each additional individual EX4300 multigigabit model (EX4300-48MP) switch into mixed mode and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

Set each of the other EX4300 switches that are not multigigabit model switches into mixed mode with the `ieee-clause-82` option, and reboot the reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode ieee-clause-82 mixed reboot
```

13. If needed, on each individual member switch, configure the SFP+ uplink ports that will be used as VCPs to interconnect the member switches.

    This step is not needed for:

    - EX4300 multigigabit model (EX4300-48MP) switches, which have dedicated VCPs on the rear panel of the switch. Dedicated VCPs do not require configuration, and you must use the dedicated ports on these switches because no other ports on these switches are supported as VCPs.
    - EX3400 switches and EX4300 member switches that are not multigigabit model switches, if you are using the QSFP+ ports that are VCPs by default. You only need to configure a QSFP+ port as a VCP if you previously configured the QSFP+ port into a network port. In that case, you can perform this step to configure the QSFP+ port back into a VCP.
    - EX4400 switches, which have the rear panel 100 Gigabit Ethernet QSFP28 ports set as VCPs by default. Those are the only ports that you can use as VCPs on these switches. If you previously converted the default VCPs into network ports, you can't convert them back into VCPs using the command in this step. See Step 15 instead.

    Use the *request virtual-chassis vc-port* command to configure SFP+ or QSFP+ ports into VCPs. For example, for a four-member Virtual Chassis:

```
user@switch-0> request virtual-chassis vc-port set pic-slot 1 port 0
user@switch-0> request virtual-chassis vc-port set pic-slot 1 port 1
```

```
user@switch-1> request virtual-chassis vc-port set pic-slot 1 port 0
user@switch-1> request virtual-chassis vc-port set pic-slot 1 port 1
```

```
user@switch-2> request virtual-chassis vc-port set pic-slot 1 port 0
user@switch-2> request virtual-chassis vc-port set pic-slot 1 port 1
```

```
user@switch-3> request virtual-chassis vc-port set pic-slot 1 port 0
user@switch-3> request virtual-chassis vc-port set pic-slot 1 port 1
```

14. (EX4100, EX-4100-F switches only) If the ports that you will use as VCPs were previously converted into network ports on any member switches, convert them back into VCPs in this step using the `request virtual-chassis mode network-port disable` command, and reboot the affected switches for the change to take effect. The `request virtual-chassis vc-port` command shown in Step 10 doesn't convert a network port into a VCP on EX4100 and EX4100-F switches.

    NOTE: This command changes the port mode for all of the VCPs on the switch. The four ports must both operate together as VCPs or as network ports. You are also required to reboot the switch for any mode command changes to take affect. You can optionally include the reboot option with the mode command to reboot the switch immediately, as shown here. Otherwise, you can alternatively reboot the switch later with a separate reboot command.

    For example:

    ```
    user@switch> request virtual-chassis mode network-port disable reboot
    ```

15. EX4400 switches only) If the ports that you will use as VCPs were previously converted into network ports on any member switches, convert them back into VCPs in this step using the `request virtual-chassis mode network-port disable` command, and reboot the affected switches for the change to take effect. The `request virtual-chassis vc-port` command shown in Step 13 doesn't convert a network port into a VCP on EX4400 switches.

    EX4400 switches have the two rear panel 100 Gigabit Ethernet QSFP28 ports configured into four logical 50-Gbps VCP interfaces by default. These are the only ports that you can use to connect member switches into an EX4400 Virtual Chassis. If you previously converted them to network port mode, you must disable network port mode to restore them to the default VCP mode for the Virtual Chassis to form when you cable the member switches together. You can use the `show virtual-chassis mode` command to check whether the switch has network port mode enabled or not.

    NOTE: This command changes the port mode for all of the VCPs on the switch. The two ports must both be set together to VCP port mode or to network port mode. You are also required to reboot the switch for any mode command changes to take affect. You can optionally include the reboot option with the mode command to reboot the switch immediately, as shown here. (Otherwise, you can alternatively reboot the switch later with a separate reboot command.)

For example:

```
user@switch> request virtual-chassis mode network-port disable reboot
```

16. Cable the ports interconnecting the members if they were not connected earlier.

NOTE: You cannot modify the primary-role priority when you are using a preprovisioned configuration. The primary-role priority values are generated automatically and controlled by the role that is assigned to the member switch in the configuration file. The two Routing Engines are assigned the same primary-role priority value. However, the member that was powered on first has higher prioritization according to the primary-role election algorithm. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56.

RELATED DOCUMENTATION

Configuring Primary Role of a Virtual Chassis | 126

Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis

Configuring EX4600 Switches in a Mixed or Non-Mixed Virtual Chassis

IN THIS SECTION

NOTE: To configure a Virtual Chassis through Juniper Mist Wired Assurance, use the instructions in the following topic: Configure a Virtual Chassis Using EX3400, EX4100, EX4100-F, EX4300, EX4400, or EX4600 Switches.

This topic provides information about configuring a non-mixed EX4600 Virtual Chassis or a mixed EX4600 Virtual Chassis that includes EX4600 switches and EX4300 switches. It does not cover EX4650 Virtual Chassis, which is more like a QFX5120 Virtual Chassis than an QFX4600 Virtual Chassis; instead, see "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98.

NOTE: A mixed EX4600 Virtual Chassis can include any models of EX4300 switches except multigigabit EX4300 models (EX4300-48MP).

You configure 40-Gbps QSFP+ and 10-Gbps SFP+ uplink ports as Virtual Chassis ports (VCPs) to interconnect members in an EX4600 Virtual Chassis. Uplink ports can connect switches that are several miles apart in different buildings into the same Virtual Chassis.

You must configure QSFP+ or SFP+ uplink module ports into VCPs to create a non-mixed or mixed EX4600 Virtual Chassis. If you need additional VCP bandwidth between two member switches, you can configure additional ports as VCPs between the member switches. The ports that have identical speeds become links in a link aggregation group (LAG) to provide resiliency to the Virtual Chassis; for instance, if you had two QSFP+ ports and two SFP+ ports configured as VCPs connecting to the same switch, you would have two LAGs—one LAG with two 40Gbps QSFP+ port member links and another with two 10Gbps SFP+ port member links—between the member switches.

NOTE: A Virtual Chassis configuration has two Routing Engines—the primary switch and the backup switch. We recommend that you always commit Virtual Chassis changes by using the `commit synchronize` command rather than `commit`. This ensures that the configuration changes are saved on both Routing Engines at the same time.

You can set up a EX4600 Virtual Chassis with either:

- A nonprovisioned configuration—The primary sequentially assigns a member ID to other member switches, and determines the role from the primary-role priority value and other factors in the primary-role election algorithm.
- A preprovisioned configuration—You deterministically control the member ID and role assigned to a member switch by tying the member switch to its serial number.

Configuring an EX4600 Virtual Chassis with a Nonprovisioned Configuration File

You can use nonprovisioned configuration to configure an EX4600 Virtual Chassis.

To configure the Virtual Chassis using a nonprovisioned configuration:

NOTE: You can configure a EX4600 Virtual Chassis while the cables are or are not physically connected.

1. Power on only the switch that you plan to use as the primary switch.

   If you are configuring a mixed EX4300 and EX4600 Virtual Chassis, you must use an EX4600 switch. We don't support a mixed EX4300 and EX4600 Virtual Chassis with an EX4300 in the primary routing engine role.

2. (Required for a mixed Virtual Chassis only) Set the primary switch into mixed mode, and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

3. If you are configuring a mixed Virtual Chassis, wait for the reboot to complete before performing this step.Specify the identification parameters for the switch by completing the initial configuration. See *Configuring Junos OS on the EX4600*.

   NOTE: The properties that you specify for the primary switch apply to the entire Virtual Chassis configuration.

4. (Optional) Configure the primary switch with the virtual management Ethernet (VME) interface for out-of-band management of the Virtual Chassis:

```
user@switch# set interfaces vme unit 0 family inet address /ip-address/mask/
```

5. (Required for mixed EX4300 and EX4600 Virtual Chassis, optional for other Virtual Chassis) Configure primary-role priority for the member switches:

   NOTE: If you are configuring a mixed EX4300 and EX4600 Virtual Chassis, configure the EX4600 switches with the highest primary role priorities to ensure EX4300 switches do not assume the primary role. We don't support a mixed EX4300 and EX4600 switch operating with an EX4300 switch in the primary role.

```
[edit virtual-chassis]
user@switch# set member 0 mastership-priority 255
user@switch# set member 1 mastership-priority 255
```

6. (Optional. Recommended for a two-member Virtual Chassis) On the primary switch, disable the split and merge feature:

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

7. Power on the other member switches.
8. (Required for a mixed Virtual Chassis only) Set each individual switch into mixed mode, and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

9. On each individual member switch, use the following command to configure the ports that will be used to interconnect the member switches into VCPs:

```
user@switch> request virtual-chassis vc-port set pic-slot pic-slot-number port port-number
local
```

where *pic-slot-number* is the PIC slot number.

For instance, if you wanted to set port 0 on the QSFP+ interface on PIC slot 2 as a VCP:

```
user@switch> request virtual-chassis vc-port set pic-slot 2 port 0 local
```

The VCPs automatically bundle into a Link Aggregation Group when two or more interfaces of the same speed are configured into VCPs between the same two member switches. See "Understanding Virtual Chassis Port Link Aggregation" on page 61.

NOTE: By default, a Virtual Chassis forms with a nonprovisioned configuration if you don't set the member roles and primary role priorities. In a non-provisioned configuration, the primary-role priority value for each member switch is 128, and the primary role is selected by default. You can modify the primary-role priority to change the role a member takes on. See "Configuring Primary Role of a Virtual Chassis" on page 126.

We recommend that you specify the same primary-role priority value for the primary and backup members. In this example, the highest possible primary-role priority has been assigned to two members. However, the member that was powered on first is given priority according to the primary-role election algorithm. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56. The other members use the default primary-role priority in this example, and they take on the linecard role.

NOTE: Use the `request virtual-chassis renumber` command if you want to change the member ID that the primary assigns to a member switch.

Configuring an EX4600 Virtual Chassis with a Preprovisioned Configuration File

When you preprovision a Virtual Chassis configuration, you assign the member ID and role for each switch in the Virtual Chassis.

To set up a Virtual Chassis using a preprovisioned configuration:

NOTE: You can configure a EX4600 Virtual Chassis while the cables are or are not physically connected.

1. Make a list of the serial numbers of all the switches to be connected in a Virtual Chassis configuration.
2. Note the desired role (`routing-engine` or `line-card`) of each switch. If you configure the member with a `routing-engine` role, it is eligible to function in the primary or backup role. If you configure the member with a `line-card` role, it is not eligible to function in the primary or backup role.

   If you are configuring a mixed EX4300 and EX4600 Virtual Chassis, EX4300 switches must be configured into the `line-card` role only. A mixed EX4300 and EX4600 Virtual Chassis
3. Power on only the switch that you plan to use as the primary switch.
4. (Required for a mixed Virtual Chassis only) Set the primary switch into mixed mode, and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

5. If you are configuring a mixed Virtual Chassis, wait for the reboot to complete before performing this step.Specify the identification parameters for the switch by completing the initial configuration. See *Configuring Junos OS on the EX4600*.

   NOTE: The properties that you specify for the primary switch apply to the entire Virtual Chassis configuration.

6. (Optional) Configure the primary switch with the virtual management Ethernet (VME) interface for out-of-band management of the Virtual Chassis:

```
user@switch# set interfaces vme unit 0 family inet address /ip-address/mask/
```

7. Specify the preprovisioned configuration mode:

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

8. Specify all the members that you want included in the Virtual Chassis, listing each switch's serial number with the desired member ID and role:

```
[edit virtual-chassis]
user@switch# set member 0 serial-number abc123 role routing-engine
user@switch# set member 1 serial-number def456 role routing-engine
user@switch# set member 2 serial-number ghi789 role line-card
user@switch# set member 3 serial-number jkl012 role line-card
```

9. (Optional. Recommended for a two-member Virtual Chassis) Disable the split and merge feature:

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

   See "Disabling Split and Merge in a Virtual Chassis" on page 136 for more details.

10. Power on the other member switches. The member IDs and roles have been determined by the configuration, so you can power on the member switches in any order.

11. (Required if you are configuring a mixed Virtual Chassis) Set each individual switch into mixed mode, and reboot the switch for the change to take effect:

```
user@device> request virtual-chassis mode mixed reboot
```

12. On each individual member switch, configure the ports you will use to interconnect the member switches into VCPs using the following command:

```
user@switch> request virtual-chassis vc-port set pic-slot pic-slot-number port port-number
local
```

where *pic-slot-number* is the PIC slot number.

For instance, if you wanted to set port 0 on the QSFP+ interface on PIC slot 2 as a VCP:

```
user@switch> request virtual-chassis vc-port set pic-slot 2 port 0 local
```

The VCPs automatically bundle into a Link Aggregation Group when two or more interfaces of the same speed are configured into VCPs between the same two member switches. See "Understanding Virtual Chassis Port Link Aggregation" on page 61.

NOTE: You cannot modify the primary-role priority when you use a preprovisioned configuration. The primary-role priority values are generated automatically and controlled by the role that is assigned to the member switch in the configuration file. The two Routing Engines are assigned the same primary-role priority value. However, the member that was powered on first has higher prioritization according to the primary-role election algorithm. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56.

RELATED DOCUMENTATION

Configuring Primary Role of a Virtual Chassis | **126**

Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis

Configuring an EX4650 or a QFX Series Virtual Chassis

IN THIS SECTION

NOTE: To configure a Virtual Chassis through Juniper Mist Wired Assurance, use the instructions in the following topic: Configure a Virtual Chassis Using EX2300, EX4650, or QFX5120 Switches.

This topic discusses configuring an EX4650 or a QFX Series Virtual Chassis.

You configure a Virtual Chassis by configuring Virtual Chassis ports (VCPs) on the member switches and interconnecting the switches using the VCPs. The VCPs pass all data and control traffic between member switches in the Virtual Chassis. See "Understanding QFX Series Virtual Chassis" on page 25 and "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on the switches that can be interconnected into a Virtual Chassis, and the ports on those switches that can be used as VCPs.

When you set up a Virtual Chassis, ideally all the proposed member switches should have the default factory configuration and operating in standalone mode.

- All the switches interconnected into a Virtual Chassis must be running the same version of Junos OS. See Installing Software Packages on QFX Series Devices.
- For QFX5100 and EX4300 switches in a QFX5100 Virtual Chassis, you must download the software image for the standalone switch. EX Series and QFX switches that are in a Junos Fusion cannot be part of a Virtual Chassis.
- For a QFX5110 Virtual Chassis with both QFX5110 and QFX5100 switches, all the switches must be running the same Junos OS image that includes “-qfx-5e-” in the Junos OS software package filename.

> ⚠ **CAUTION**: You *must* upgrade QFX5100 switches running a Junos OS image with "-qfx-5-" in the software package filename to a "-qfx-5e-" image filename before adding them to a QFX5110 Virtual Chassis, or the Virtual Chassis will not form. See *Upgrading a QFX5100 Switch with a USB Device to Join a QFX5110 Virtual Chassis or Virtual Chassis Fabric*.

- For a QFX5120-48YM Virtual Chassis, you need to enable HGoE mode on the switches using the `request virtual-chassis mode hgoe` command. Reboot the switches after converting them to HGoE mode.

You can set up the Virtual Chassis with either:

- A preprovisioned configuration—With preprovisioning, you deterministically control the member ID and role assigned to a member switch by tying it to its serial number.
- A nonprovisioned configuration—Without provisioning, the primary sequentially assigns a member ID to other member switches, and determines the role of each member switch using the primary-role priority value and other factors in the primary-role election algorithm.

A Virtual Chassis configuration has two switches acting in the Routing Engine role—the primary switch and the backup switch. With any Virtual Chassis configuration, we recommend that you always use `commit synchronize` rather than simply `commit` to save configuration changes. This make sure the configuration changes are saved to both switches acting as Routing Engines.

Be sure that all switches that are interconnected into a Virtual Chassis are running the same version of Junos OS. See Installing Software Packages on QFX Series Devices.

Understanding the Licensing Requirements for a Virtual Chassis

Feature licenses are required to configure higher tier features on a Virtual Chassis. WIth Juniper Flex licensing, a license is required on all members of a Virtual Chassis.

For information on the feature licensing requirements for a Virtual Chassis, see Licenses for EX Series or Software Features That Require Licenses on the QFX Series.

You can install the feature licenses after configuring the Virtual Chassis.

Configuring an EX4650 or QFX Series Virtual Chassis with a Preprovisioned Configuration

Preprovisioning a Virtual Chassis configuration allows you to assign the member ID and role for each switch in the Virtual Chassis.

Before you begin, note that you can configure a Virtual Chassis while the cables are or are not physically connected. However, when committing a preprovisioned configuration on the member switches, under certain conditions the switches will *autoprovision* the ports cabling the member switches together, which means that those ports are automatically converted into Virtual Chassis ports (VCPs) when the Virtual Chassis members detect the link. Conditions for autoprovisioning include having LLDP enabled on the interfaces being used for the VCP links, and neither side of the link already has the port set as a VCP.

Automatic conversion of VCP links can cause links to come up unexpectedly, so if you want to control when the VCP links become active during Virtual Chassis configuration on the member switches, before you start the configuration, you can disable the VCP auto-conversion feature or any of the conditions required for the feature. See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details. If the conditions for autoprovisioning the links are not present, you must manually set the ports connecting the member switches as VCPs as described in this procedure.

To set up a Virtual Chassis using a preprovisioned configuration:

1. Make a list of the serial numbers of all the switches to be connected in a Virtual Chassis configuration.

   NOTE: Serial number values are case-sensitive.

2. Note the desired role (`routing-engine` or `line-card`) of each switch. If you configure the member with a `routing-engine` role, it is eligible to function as the primary or backup Routing Engine . If you configure the member with a `line-card` role, it is not eligible to function as the primary or backup. See "Understanding Virtual Chassis Components" on page 43 and "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on which switches are recommended or required to be configured into each role depending on the types of switches in the Virtual Chassis.
3. Power on only the switch that you plan to use as the primary switch.
4. Specify the identification parameters for the switch by completing the initial configuration. See *Configuring Junos OS on the EX4650*, Configure a QFX5100 Device, Configuring a QFX5110, Configure Junos OS on the QFX5120, or Performing the Initial Software Configuration for QFX5200 Switches.

NOTE: The properties that you specify for the primary switch apply to the entire Virtual Chassis configuration.

5. (Optional) Configure the primary switch with the virtual management Ethernet (VME) interface for out-of-band management of the Virtual Chassis:

```
user@switch# set interfaces vme unit 0 family inet address /ip-address/mask/
```

6. (Required for a mixed Virtual Chassis only) Set the primary switch into mixed mode and reboot the switch to complete the configuration:

NOTE: You must complete this step if your Virtual Chassis includes a combination of different types of switches, except when you are configuring a Virtual Chassis that includes only QFX5110 and QFX5100 switches (which are considered to be non-mixed Virtual Chassis). See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details.

```
user@device> request virtual-chassis mode mixed reboot
```

7. After the reboot is complete, specify the preprovisioned configuration mode:

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

8. Specify all the members that you want included in the Virtual Chassis, listing each switch's serial number with the desired member ID and role:

```
[edit virtual-chassis]
user@switch# set member 0 serial-number abc123 role routing-engine
user@switch# set member 1 serial-number def456 role routing-engine
user@switch# set member 2 serial-number ghi789 role line-card
user@switch# set member 3 serial-number jkl012 role line-card
```

9. (Optional. Recommended for a two-member Virtual Chassis) Disable the split and merge feature:

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

10. Commit the configured items.
11. Power on the other member switches. The member IDs and roles have been determined by the configuration, so you can power on the member switches in any order.
12. (Required if you are configuring a mixed Virtual Chassis) Set each individual switch into mixed mode and reboot the switch to complete the configuration:

NOTE: You must complete this step if your Virtual Chassis includes a combination of different types of switches, except when you are configuring a Virtual Chassis that includes only QFX5110 and QFX5100 switches (which are considered to be non-mixed Virtual Chassis). See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details.

```
user@device> request virtual-chassis mode mixed reboot
```

13. (Optional, if the VCP links will not be autoprovisioned) On each individual member switch, configure the ports that you will use to interconnect the member switches into VCPs:

NOTE: SFP+, QSFP+, and 10-Gbps copper links between two member switches will be automatically set as VCPs (auto-provisioned) in a preprovisioned configuration under certain conditions. The required conditions on both sides of the link include having automatic VCP conversion enabled on the switches, LLDP enabled on the interfaces being used as VCPs, and those ports are not already set as VCPs. . (See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49.)

This step is optional and should only be used when a VCP link is not automatically created.

```
user@switch> request virtual-chassis vc-port set pic-slot pic-slot-number port port-number
```

where *pic-slot-number* is the PIC slot number.

For example, if you wanted to set port 0 on the QSFP+ interface on PIC slot 2 as a VCP:

```
user@switch> request virtual-chassis vc-port set pic-slot 2 port 0
```

NOTE: You can include the `local` option if you want to make sure the command applies only to that port locally on the switch where you're running the command.

The VCPs automatically bundle into a Link Aggregation Group when two or more interfaces of the same speed are configured into VCPs between the same two member switches. See "Understanding Virtual Chassis Port Link Aggregation" on page 61.

NOTE: You cannot modify the primary-role priority when you are using a preprovisioned configuration. The primary-role priority values are generated automatically and controlled by the role that is assigned to the member switch in the configuration file. The two Routing Engines are assigned the same primary-role priority value. However, the member that was powered on first has higher priority according to the primary-role election algorithm. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56.

NOTE: If you want to change the member ID of a preprovisioned member switch later, you must re-configure the member information for that member switch using the `member` configuration statement. For example, to re-configure member 3 (which has serial number "jkl012") to have 6 as its new member ID, you associate member ID 6 with the serial number of member 3, and then delete the configuration item for member ID 3, as follows:

```
[edit virtual-chassis]
user@switch# set member 6 serial-number jkl012
user@switch# delete member 3
```

The `request virtual-chassis renumber` command can only be used to change a Virtual Chassis member ID in a nonprovisioned Virtual Chassis.

Configuring an EX4650 or a QFX Series Virtual Chassis with a Nonprovisioned Configuration

You can use a nonprovisioned configuration to set up an EX4650 or a QFX Series Virtual Chassis.

To configure the Virtual Chassis using a nonprovisioned configuration:

> **NOTE**: You can configure the Virtual Chassis while the cables are or are not physically connected.

1. Power on only the switch that you plan to use as the primary switch.
2. (Required for a mixed Virtual Chassis only) Set the primary switch into mixed mode and reboot the switch to complete the configuration:

   > **NOTE**: You must complete this step if your Virtual Chassis includes a combination of different types of switches, except when you are configuring a Virtual Chassis that includes only QFX5110 and QFX5100 switches (which are considered to be non-mixed Virtual Chassis). See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details.

   ```
   user@device> request virtual-chassis mode mixed reboot
   ```

3. After the primary switch reboots, specify the identification parameters for the switch by completing the initial configuration. See *Configuring Junos OS on the EX4650*, Configure a QFX5100 Device, Configuring a QFX5110, Configure Junos OS on the QFX5120, or Performing the Initial Software Configuration for QFX5200 Switches for details.

   > **NOTE**: The properties that you specify for the primary switch apply to the entire Virtual Chassis configuration.

4. (Optional) Configure the primary switch with the virtual management Ethernet (VME) interface for out-of-band management of the Virtual Chassis:

   ```
   user@switch# set interfaces vme unit 0 family inet address /ip-address/mask/
   ```

5. (Optional) Configure primary-role priority for the member switches:

```
[edit virtual-chassis]
user@switch# set member 0 mastership-priority 255
user@switch# set member 1 mastership-priority 255
```

6. (Optional. Recommended for a two-member Virtual Chassis) On the primary switch, disable the split and merge feature:

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

7. Commit the configured items.
8. Power on the other member switches.
9. (Required for a mixed Virtual Chassis only) Set each individual switch into mixed mode and reboot the switch to complete the configuration:

NOTE: You must complete this step if your Virtual Chassis includes a combination of different types of switches, except when you are configuring a Virtual Chassis that includes only QFX5110 and QFX5100 switches (which are considered to be non-mixed Virtual Chassis). See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details.

```
user@device> request virtual-chassis mode mixed reboot
```

10. On each individual member switch, configure the ports that will be used to interconnect the member switches into VCPs using the following command:

```
user@switch> request virtual-chassis vc-port set pic-slot pic-slot-number port port-number
```

where *pic-slot-number* is the PIC slot number.

For example, if you wanted to set port 0 on the QSFP+ interface on PIC slot 2 as a VCP:

```
user@switch> request virtual-chassis vc-port set pic-slot 2 port 0
```

NOTE: You can include the `local` option if you want to make sure the command applies only to that port locally on the switch where you're running the command.

The VCPs automatically bundle into a Link Aggregation Group when two or more interfaces of the same speed are configured into VCPs between the same two member switches. See "Understanding Virtual Chassis Port Link Aggregation" on page 61.

NOTE: If you don't set primary role priorities on any member switches, the default primary-role priority value is`128`. If the primary role priorities are the same on all members, the primary-role election algorithm determines the member switches in the primary and backup Routing Engine roles based on the other factors in the algorithm. You control the role settings by configuring the primary-role priority to a higher number on the switches you want to be the primary and backup members. .(see "Configuring Primary Role of a Virtual Chassis" on page 126). We recommend that you specify the same primary-role priority value for the members you want to be the primary and backup members. This example assigns the highest possible primary-role priority to two members. However, the member that was powered on first has higher priority according to the primary-role election algorithm. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56 for details on all the factors considered when electing the primary. The other members have the default primary-role priority in this example, and they become linecard role members.

NOTE: If you want to change the member ID that the primary automatically assigned to a member switch, use the `request virtual-chassis renumber` command.

RELATED DOCUMENTATION

Understanding QFX Series Virtual Chassis | **25**

Understanding Mixed EX Series and QFX Series Virtual Chassis | **32**

Configuring Primary Role of a Virtual Chassis | **126**

Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis

Adding a New Switch to an Existing EX2300, EX3400, EX4300, or EX4400 Virtual Chassis

NOTE: If the Virtual Chassis is managed through Juniper Mist, see the following topic for instructions to add a member switch: Add a Member Switch to a Virtual Chassis.

You can use this procedure to:

- Add an EX2300 switch to an existing EX2300 Virtual Chassis.

  NOTE: Starting with Junos OS Release 18.4R1, you can combine any models of EX2300 switches, including EX2300 multigigabit models, into the same EX2300 Virtual Chassis using this procedure. In releases prior to Junos OS Release 18.4R1, EX2300 multigigabit switches cannot be combined with any other models of EX2300 switches in the same Virtual Chassis.

- Add an EX3400 switch to an existing EX3400 Virtual Chassis.
- Add an EX4300 switch to an existing non-mixed EX4300 Virtual Chassis. For example:
  - Add an EX4300 multigigabit model (EX4300-48MP) switch to a Virtual Chassis consisting of all EX4300 multigigabit model switches.
  - Add any other type of EX4300 switch to a Virtual Chassis that contains only EX4300 switches and no EX4300 multigigabit model switches.
- Add an EX4300 switch to a mixed EX4300 Virtual Chassis that consists of a supported combination of EX4300 multigigabit model switches and any other EX4300 switches.
- Add any model EX4400 switch (including EX4400 multigigabit models) to an existing EX4400 Virtual Chassis.

You can't use this procedure to:

- Add an EX4300 multigigabit model (EX4300-48MP) switch to an existing EX4300 Virtual Chassis that consists only of other non-multigigabit EX4300 model switches.

  EX4300 multigigabit model switches must be in the primary and backup Routing Engine roles in an EX4300 Virtual Chassis that contains both types of switches. As a result, in that case, you should first create a new multigigabit EX4300 Virtual Chassis with multigigabit EX4300 switches in the primary

and backup roles, and then merge the other non-multigigabit EX4300 model switches from the original non-mixed Virtual Chassis into a new mixed-mode EX4300 Virtual Chassis.

- Add an EX4300 switch (non-multigigabit models) to a supported mixed Virtual Chassis or VCF.

  EX4300 switches that are not multigigibit model can be part of a mixed Virtual Chassis with EX4600 switches or a mixed Virtual Chassis or VCF with particular QFX Series switches. See these other references for how to add an EX4300 switch in those cases:

  - Adding an EX4300 switch to a mixed Virtual Chassis with EX4600 switches: "Adding an EX4600 Switch to a Mixed or Non-mixed Virtual Chassis" on page 112.
  - Adding an EX4300 switch to a mixed Virtual Chassis with QFX Series switches: "Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis" on page 114
  - Adding an EX4300 switch to a mixed VCF: *Adding a Device to a Virtual Chassis Fabric*.

Before you begin, be sure you have:

- Confirmed that the new switch is supported as a member of the Virtual Chassis and in the role in which you want to add it. See "Understanding EX Series Virtual Chassis" on page 8 and "Understanding Virtual Chassis Components" on page 43 for details on the different EX Series switches, switch combinations, and switch roles that are supported or recommended in a Virtual Chassis.
- Ensured the new switch has the same version of Junos OS that is running on the Virtual Chassis primary switch, or the existing Virtual Chassis has the automatic software update feature configured.

  If you have configured the automatic software update feature in the existing Virtual Chassis, the primary switch updates newly added members with the correct software version automatically, if necessary. Otherwise, you must manually install the correct software version. See "Understanding Automatic Software Update on Virtual Chassis Member Switches" on page 67.
- Mounted the new switch in a rack.
- Determined which ports you will use as Virtual Chassis ports on the new switch, and the member ports in the existing Virtual Chassis to which you will interconnect the new switch.

  See "Virtual Chassis Port Options" on page 46 for the ports that can be used as VCPs on switches that support Virtual Chassis.
- If you are expanding a preprovisioned configuration:
  - Made a note of the serial number (the number is on the back of the switch). You will need to edit the Virtual Chassis configuration to include the serial number of the new member switch.

    NOTE: Serial number values are case-sensitive.

- Edited the existing Virtual Chassis configuration to include the serial number of the new member switch. The parameters specified in the primary Virtual Chassis configuration file are applied to the new switch after it has been interconnected to an existing member switch.
- (If you are using the autoprovisioning feature to add a member switch to an existing preprovisioned Virtual Chassis) Confirmed that the member ports in the Virtual Chassis to which you will interconnect the new switch are not already configured as VCPs. One condition for automatic VCP conversion is that the ports on both sides of the new link must not already be configured as VCPs. See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details on the requirements and conditions under which this feature will be invoked.

- (Optional) Configured Ethernet interfaces on different member switches into the same LAG. For example, see *Example: Configuring Aggregated Ethernet High-Speed Uplinks Between an EX4200 Virtual Chassis Access Switch and an EX4200 Virtual Chassis Distribution Switch*.

  An active member switch might temporarily go down before coming back up as part of this procedure. Having traffic load-balanced across member switches using a LAG helps alleviate traffic loss during this procedure.

- Deleted the `no-split-detection` configuration item if you are expanding a two-member Virtual Chassis with this option configured. We very strongly recommend that you enable the split detection and merge feature for Virtual Chassis configurations with more than two members. This feature is enabled in the default configuration when you initially set up a Virtual Chassis.

To add a new member switch to an existing Virtual Chassis configuration:

1. If the new member switch has been previously configured, revert that switch's configuration to the factory defaults before interconnecting it into the Virtual Chassis. See *Reverting to the Default Factory Configuration for the EX Series Switch*.
2. (Required for a mixed EX4300 Virtual Chassis only) A mixed EX4300 Virtual Chassis contains a combination of EX4300 multigigabit model (EX4300-48MP) switches and other EX4300 switches.

   If you are adding a new switch in this case, set the new switch into mixed mode, and reboot the switch for the mode change to take effect as follows:

   - If the new switch is an EX4300 multigigabit model (EX4300-48MP) switch:

     ```
     user@device> request virtual-chassis mode mixed reboot
     ```

   - If the new switch is any other EX4300 model switch, you must also configure the switch with a special port mode by including the `ieee-clause-82` option when you set mixed mode. This port

mode enables VCPs on the EX4300 switch to communicate with VCPs on multigigabit model member switches:

```
user@device> request virtual-chassis mode ieee-clause-82 mixed reboot
```

If adding this switch to the Virtual Chassis converts a non-mixed EX4300 Virtual Chassis into a mixed EX4300 Virtual Chassis, log into the Virtual Chassis and set all the existing member switches into mixed mode as well, and reboot the Virtual Chassis to complete the configuration:

```
user@vc-master> request virtual-chassis mode mixed reboot all-members
```

For example, if you have an EX4300 Virtual Chassis consisting of all EX4300 multigigabit model member switches, that is a non-mixed EX4300 Virtual Chassis. If you add an EX4300 switch that isn't a multigigabit model to that Virtual Chassis, you must change the mode to `mixed` on all existing members when you add the new switch.

Wait for the reboot operation to complete on any affected switches in this step before moving to the next step.

3. Power off the new switch, and interconnect the unpowered new switch to one member of the existing Virtual Chassis configuration using a supported VCP.

   If you connect the new switch to the Virtual Chassis member while the new switch is powered on, the new switch may not be provisioned properly.

   Connect only one VCP on the unpowered new switch to a VCP on a member switch in the existing Virtual Chassis at this point in the procedure.

4. Power on the new switch.

5. Set the interconnecting ports as Virtual Chassis Ports (VCPs), if needed:

   ```
   user@switch> request virtual-chassis vc-port set pic-slot 1 port port-number
   ```

   You do not need to perform this step in the following cases:

   - You are using dedicated VCPs, which do not need to be configured. EX4300 multigigabit model (EX4300-48MP) switches have dedicated VCPs on the rear panel, which are the only VCP port options on those switches.

   - You do not typically need to perform this step with QSFP+ ports on EX3400 and EX4300 switches that are not multigigabit models. All QSFP+ ports on these switches are configured as VCPs by default. However, you might use the `request virtual-chassis vc-port` command to set a

QSFP+ port back into a VCP if the QSFP+ port had previously been reconfigured as a network port.

- The default VCPs on EX4400 switches are the only ports that can be used as VCPs, so you must use those ports to interconnect member switches in an EX4400 Virtual Chassis. However, if you previously converted the default VCPs into network ports by enabling network port mode on the switch, you must disable network port mode and reboot the switch to convert them back into VCPs. Use the `request virtual-chassis mode network-port disable <reboot>` command to do this if needed. You can enter the `show virtual-chassis mode` command to see whether network port mode is enabled.on the switch.

- If you have the right conditions to use the autoprovisioning feature, after the new switch is provisioned and cabled into the Virtual Chassis, the interconnecting links automatically convert into VCP links. You do not need to manually set the ports on either side of the links as VCPs.

6. Confirm that the new member switch is now included within the Virtual Chassis configuration by entering the `show virtual-chassis` command. The new member switch should be listed in the output and the `Status` is `Prsnt`.
7. Cable the next port into the Virtual Chassis, configuring the ports into VCPs if needed.

> **CAUTION**: If you immediately cable both VCPs on the new switch into the existing Virtual Chassis at the same time, a member switch that was already part of the Virtual Chassis might become nonoperational for several seconds. Network traffic to this switch is dropped during the downtime.
>
> The member switch will return to the normal operational state with no user intervention, and normal operation of the Virtual Chassis will resume after this downtime.

RELATED DOCUMENTATION

Configuring an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis | 77

Understanding Virtual Chassis Components | 43

Adding an EX4600 Switch to a Mixed or Non-mixed Virtual Chassis

You can use this procedure to add an EX4600 switch to a mixed or non-mixed Virtual Chassis or to add an EX4300 switch to an existing mixed EX4300 and EX4600 Virtual Chassis. For EX4650 Virtual Chassis, which is more like a QFX5120 Virtual Chassis than an QFX4600 Virtual Chassis, see "Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis" on page 114.

NOTE: EX4300 multigigabit model (EX4300-48MP) switches are not supported in a mixed Virtual Chassis with EX4600 switches.

Before you begin, be sure you have:

- Mounted the new switch in a rack.
- Determined which ports you will use as Virtual Chassis ports on the new switch, and the member ports in the existing Virtual Chassis to which you will interconnect the new switch.
- If you are expanding a preprovisioned configuration:
  - Made a note of the serial number (the number is on the back of the switch). You will need to edit the Virtual Chassis configuration to include the serial number of the new member switch.

    NOTE: Serial number values are case-sensitive.

  - Edited the existing Virtual Chassis configuration to include the serial number of the new member switch. The parameters specified in the primary Virtual Chassis configuration file are applied to the new switch after it has been interconnected to an existing member switch.
  - (If you are using the autoprovisioning feature to add a member switch to an existing preprovisioned Virtual Chassis) Confirmed that the member ports in the Virtual Chassis to which you will interconnect the new switch are not already configured as VCPs. One condition for automatic VCP conversion is that the ports on both sides of the new link must not already be configured as VCPs. See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details.
- (Optional) Configured Ethernet interfaces on different member switches into the same LAG. See *Example: Configuring Aggregated Ethernet High-Speed Uplinks Between an EX4200 Virtual Chassis Access Switch and an EX4200 Virtual Chassis Distribution Switch*.

An active member switch might temporarily go down before coming back up as part of this procedure. Having traffic load-balanced across member switches using a LAG helps alleviate traffic loss during this procedure.

To add a new member switch to an existing Virtual Chassis configuration:

1. If the new member switch has been previously configured, revert that switch's configuration to the factory defaults before interconnecting it into the Virtual Chassis. See *Reverting to the Default Factory Configuration for the EX Series Switch*.
2. (Required for a mixed Virtual Chassis) Set the new switch into mixed mode, and reboot the switch to complete the configuration:

   ```
   user@device> request virtual-chassis mode mixed reboot
   ```

   If adding this switch to the Virtual Chassis converts a non-mixed Virtual Chassis into a mixed Virtual Chassis, log into the Virtual Chassis and set the switches into mixed mode. Reboot the Virtual Chassis to complete the configuration:

   ```
   user@device> request virtual-chassis mode mixed reboot all-members
   ```

3. If you are rebooting the switch or the Virtual Chassis to complete a mixed mode setting change, wait for the reboot to complete before performing this step.Power off the new switch, and interconnect the unpowered new switch to one member of the existing Virtual Chassis configuration using a port that is supported as a VCP.

   Connect only one VCP on the unpowered new switch to a VCP on a member switch in the existing Virtual Chassis at this point of the procedure.
4. Set the interconnecting QSFP+ or SFP+ ports as Virtual Chassis ports (VCPs) on the new member switch and the existing Virtual Chassis member switch where you connected the new switch, if needed:

   ```
   user@switch> request virtual-chassis vc-port set pic-slot pic-slot port port-number
   ```

   NOTE: Include the `local` option in this command if you want to make sure the command applies only to that port locally on the switch where you're running the command.

   You do not need to perform this step in a preprovisioned Virtual Chassis if you set up the right conditions to use the autoprovisioning feature (see "Automatic Virtual Chassis Port (VCP) Conversion" on page 49). After the new switch is provisioned and cabled into the Virtual Chassis, the

interconnecting links automatically convert into VCP links. You do not need to manually set the ports on either side of the links as VCPs.

5. Confirm that the new member switch is now included within the Virtual Chassis configuration by entering the `show virtual-chassis` command. The new member switch should be listed in the output and the `Status` is `Prsnt`.
6. Cable the next port into the Virtual Chassis, using Steps 2 through 5.

> **CAUTION**: If you immediately cable both VCPs on the new switch into the existing Virtual Chassis at the same time, a member switch that was already part of the Virtual Chassis might become nonoperational for several seconds. Network traffic to this switch is dropped during the downtime.
>
> The member switch will return to the normal operational state with no user intervention, and normal operation of the Virtual Chassis will resume after this downtime.

RELATED DOCUMENTATION

Configuring EX4600 Switches in a Mixed or Non-Mixed Virtual Chassis | 91

Understanding Virtual Chassis Components | 43

Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis

IN THIS SECTION

> **NOTE**: If the Virtual Chassis is managed through Juniper Mist, see the following topic for instructions to add a member switch: Add a Member Switch to a Virtual Chassis.

Use this procedure to add a new switch to an EX4650 or a QFX Series Virtual Chassis.

Add a New Switch to an EX4650 or QFX Series Virtual Chassis

You can use this procedure to add a switch in a supported combination to an existing EX4650 or QFX Series Virtual Chassis. A Virtual Chassis is a supported combination of switches interconnected using Virtual Chassis ports (VCPs). EX4650, QFX5120 and QFX5200 switches can be members of a non-mixed Virtual Chassis only (all members must be the same type of switch). QFX series switches that can be members of a mixed or non-mixed Virtual Chassis include QFX5100, and QFX5110 switches. EX4300 switches can also be members of a mixed QFX Series Virtual Chassis with QFX5100 switches. See "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32 for details on the types and combinations of switches that can make up a mixed QFX Series Virtual Chassis.

NOTE: EX4300 multigigabit model (EX4300-48MP) switches are not supported in a mixed Virtual Chassis with QFX Series switches.

Before you begin, make sure you have:

- Mounted the new switch in a rack.
- Enabled automatic software updates on the Virtual Chassis. See "Configuring Automatic Software Update on Virtual Chassis Member Switches" on page 138.
- Determined which ports you will use as Virtual Chassis ports on the new switch, and the member ports in the existing Virtual Chassis to which you will interconnect the new switch.
- If you are expanding a preprovisioned configuration:
  - Made a note of the serial number (the number is on the back of the switch). You'll need to edit the Virtual Chassis configuration to include the serial number of the new member switch.

    NOTE: Serial number values are case-sensitive.

  - Edited the existing Virtual Chassis configuration to include the serial number of the new member switch. The Virtual Chassis applies the parameters in the primary's configuration file to the new switch after it has been interconnected with an existing member switch.
  - (If you are using the autoprovisioning feature to add a member switch to an existing preprovisioned Virtual Chassis) Confirmed that the member ports in the Virtual Chassis to which you will interconnect the new switch are not already configured as VCPs. One condition for automatic VCP conversion is that the ports on both sides of the new link must not already be configured as VCPs. See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details.

- (Optional) Configured Ethernet interfaces on different member switches into the same LAG. See Configuring Link Aggregation.

  An active member switch might temporarily go down before coming back up as part of this procedure. If you configure the Virtual Chassis members so that traffic is load-balanced across member switches using a LAG, you can alleviate traffic loss during this procedure.

To add a new member switch to an existing EX4650 or QFX Series Virtual Chassis configuration:

1. If you previously configured the new member switch, we recommend you revert that switch's configuration to the factory defaults before interconnecting it into the Virtual Chassis. See *Reverting to the Default Factory Configuration*.
2. (Required for a mixed Virtual Chassis only) Set the new switch into mixed mode and reboot the switch to complete the configuration:

   NOTE: You do not need to configure your Virtual Chassis into mixed mode if the Virtual Chassis is composed of only QFX5110 and QFX5100 switches (which is considered a non-mixed Virtual Chassis).

   ```
   user@device> request virtual-chassis mode mixed reboot
   ```

   If you are adding a switch that converts a non-mixed Virtual Chassis into a mixed Virtual Chassis, you must also log onto the Virtual Chassis and enter the **request virtual-chassis mode mixed all-members reboot** command either before or after interconnecting the new switch into your Virtual Chassis. This step makes sure all switches in the Virtual Chassis can communicate with the new mixed-mode member switch.
3. Interconnect the new switch to one member of the existing Virtual Chassis using an interface that can be configured into a VCP. See "Virtual Chassis Port Options" on page 46 for details on ports you can use as VCPs on different switches.

   Connect only one interface on the new switch to a VCP on a member switch in the existing Virtual Chassis at this point of the procedure.
4. Set the interconnecting ports for the new member switch as Virtual Chassis Ports (VCPs) on the new member switch and the existing Virtual Chassis member switch where you connected the new switch, if needed:

   ```
   user@switch> request virtual-chassis vc-port set pic-slot slot-number port port-number
   ```

> **NOTE**: Include the `local` option in this command if you want to make sure the command applies only to that port locally on the switch where you're running the command.

You do not need to perform this step in a preprovisioned Virtual Chassis if you set up the right conditions to use the autoprovisioning feature (see "Automatic Virtual Chassis Port (VCP) Conversion" on page 49). After the new switch is provisioned and cabled into the Virtual Chassis, the interconnecting links automatically convert into VCP links. You do not need to manually set the ports on either side of the links as VCPs.

5. Confirm that the new member switch is now included within the Virtual Chassis configuration by entering the `show virtual-chassis` command on a Virtual Chassis console or management port. You should see the new member switch listed in the output with `Status` displayed as `Prsnt`.
6. Cable the next port into the Virtual Chassis. Refer to Steps 3 through 5 in this procedure.

> **CAUTION**: If you immediately cable both VCPs on the new switch into the existing Virtual Chassis at the same time, a member switch that was already part of the Virtual Chassis might become non-operational for several seconds. The Virtual Chassis drops network traffic to this switch during the downtime.
>
> The member switch returns to the normal operational state with no user intervention, and normal operation of the Virtual Chassis resumes after this downtime.

7. Split detection is enabled in a Virtual Chassis by default. We recommend configuring the `no-split-detection` option to disable it in a Virtual Chassis that has only two members. We very strongly recommend keeping it enabled in a Virtual Chassis that has more than two members. See "Understanding Split and Merge in a Virtual Chassis" on page 63 for details.

   If your Virtual Chassis had only two members with `no-split-detection` configured, now that you've added another member switch in this procedure, enable split detection again (in other words, remove the `no-split-detection` setting):

```
[edit]
user@switch# delete virtual-chassis no-split-detection
```

8. If you need to customize your Virtual Chassis configuration further, see "Configuring an EX4650 or a QFX Series Virtual Chassis" on page 98 or *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*.

SEE ALSO

Configuring an EX4650 or a QFX Series Virtual Chassis | 98

Understanding Virtual Chassis Components | 43

RELATED DOCUMENTATION

Removing or Replacing a Member Switch of a Virtual Chassis Configuration

Removing or Replacing a Member Switch of a Virtual Chassis Configuration

IN THIS SECTION

NOTE: If the Virtual Chassis is being managed through Juniper Mist, see the following topics for instructions to delete or replace a Virtual Chassis:

- Delete Virtual Chassis Members
- Replace a Member Switch in a Virtual Chassis

You can remove or replace a member switch in a Virtual Chassis without disrupting network service on the other member switches.

If you remove a member switch, you can free up the member ID so it is available to be assigned to a new member switch later.

When you add a new member switch, the Virtual Chassis assigns the next available member ID to it. The Virtual Chassis retains the existing configuration items specific to particular member IDs. The Virtual Chassis applies those items to a replacement member switch that has the same member ID. By default, the Virtual Chassis applies configuration items that are not member-specific to all member switches.

NOTE: When you add or delete member switches in a Virtual Chassis configuration, internal routing changes might cause a sub-second temporary traffic loss. Also, if removing a member switch changes a mixed Virtual Chassis into a non-mixed Virtual Chassis, you must remove the mixed mode setting on all member switches of the Virtual Chassis and reboot the Virtual Chassis; network services are disrupted until the Virtual Chassis is up again.

This topic does not apply to:

- A Virtual Chassis Fabric (VCF).

  Instead, see Removing a Device From a Virtual Chassis Fabric for VCF information.

- A mixed Virtual Chassis that contains EX4200, EX4500, or EX4550 switches.

  Instead, see Removing an EX4200, EX4500, or EX4550 Switch From a Mixed Virtual Chassis (CLI Procedure).

- An EX8200 Virtual Chassis.

To remove or replace a member switch of any other EX Series or QFX Series Virtual Chassis, use one of the following procedures that matches what you want to do.

Remove a Member Switch and Make Its Member ID Available for Reassignment to a Different Switch

To remove a switch from a Virtual Chassis without replacing it:

1. Power off and disconnect the member switch you want to remove from the Virtual Chassis.
2. If the Virtual Chassis configuration is preprovisioned, on the Virtual Chassis primary, remove the removed switch's member setting from the preprovisioned configuration.

   ```
   [edit virtual-chassis]
   user@vc-primary# delete member removed-member-id
   ```

   If the Virtual Chassis configuration is nonprovisioned, change the `mastership-priority` values of each member switch as needed to reconfigure the Virtual Chassis roles. See Configuring Primary Role of a Virtual Chassis.

3. (Optional) If removing a member switch leaves only two remaining member switches in the Virtual Chassis, we recommend you disable split detection in a two-member Virtual Chassis. See Disabling Split and Merge in a Virtual Chassis for details.
4. Commit any configuration changes made in previous steps.
5. (For a mixed Virtual Chassis only) If removing this member switch changes the Virtual Chassis from a mixed to a non-mixed Virtual Chassis, you must also remove the mixed-mode setting from the Virtual Chassis. See Understanding Mixed EX Series and QFX Series Virtual Chassis for details on the combinations of switches that comprise a mixed Virtual Chassis. You must reboot the Virtual Chassis for the mode change to take effect. To do this, you can include the `reboot` option with the `request virtual-chassis mode mixed disable` command that turns off mixed mode, or reboot all member switches of the Virtual Chassis separately when ready to do so, as shown below.

```
user@vc-primary> request virtual-chassis mode mixed disable all-members
user@vc-primary> request system reboot all-members
```

NOTE: Step 7 describes how to remove the mixed mode and other settings from the removed switch if needed.

6. When you remove a member switch from a Virtual Chassis configuration, the primary keeps that member switch's member ID in reserve. Use the following command on the Virtual Chassis primary to make that member ID available for reassignment:

```
user@vc-primary> request virtual-chassis recycle member-id member-id
```

7. If you want to use the removed switch as a standalone switch, you must remove any Virtual Chassis configuration items and settings on that switch. For a smooth transition to a new role as a standalone switch, we recommend to revert the switch to its default factory configuration using the `request system zeroize` command, and then apply the configuration items you want on the switch.

   If you do not want to revert to default factory settings, use commands such as the following to remove Virtual Chassis settings for the mode and VCPs from the removed switch:

   a. If you removed the switch from a mixed-mode Virtual Chassis that is not an EX4300 mixed Virtual Chassis, disable the mixed-mode setting on the switch as follows:

   ```
   user@switch> request virtual-chassis mode mixed disable
   ```

   If you removed a non-multigigabit model EX4300 switch from a mixed EX4300 Virtual Chassis that contains multigigabit EX4300 switches (EX4300-48MP), when you disable mixed mode, you must also disable the special `ieee-clause-82` port mode on the removed switch if you want to

reconfigure it as a standalone switch or use it in any other type of mixed Virtual Chassis or non-mixed Virtual Chassis. Otherwise, the VCPs on the switch will not connect with other Virtual Chassis members or those ports will not operate properly as network ports.

In this case, to disable mixed mode and the port mode on the switch:

```
user@switch> request virtual-chassis mode mixed ieee-clause-82 disable
```

See Understanding EX4300 Multigigabit and Other EX4300 Model Switches in a Mixed EX4300 Virtual Chassis for more information about this special port mode on EX4300 switches.

b. Delete the VCP settings for any ports that were used as VCPs:

For EX4100 and EX4400 switches in HGoE mode:

```
user@switch> request virtual-chassis mode network-port
```

For all other switches and for EX4100 and EX4400 switches in HiGig mode:

```
user@switch> request virtual-chassis vc-port delete pic-slot pic-slot port port-number
```

c. The removed member will retain the member ID that it had in the original Virtual Chassis. You must make the member ID available for reassignment and reset the member ID of the removed member to 0.

```
user@switch> request virtual-chassis recycle member-id 0
user@switch> request virtual-chassis renumber member-id id-of-removed-switch new-member-id
0
```

d. Reboot the standalone switch for settings such as mode changes to take effect.

Remove, Repair, and Reinstall the Same Switch

If you need to repair a member switch, you can remove it from the Virtual Chassis configuration without disrupting network service for the other member switches. The primary stores the configuration for the member ID so that it can be reapplied when the member switch (with the same base MAC address) is reconnected.

To remove, repair, and reinstall the member switch:

1. Power off and disconnect the member switch to be repaired.
2. Repair, as necessary.
3. Reconnect the switch and power it on.

Remove a Member Switch, Replace It with a Different Switch, and Reapply the Old Configuration

If you are unable to repair a member switch, you can replace it with a different member switch of the same type while retaining the previous configuration. The primary stores the configuration of the member switch that was removed. When you connect a different member switch, the primary assigns a new member ID, but the old configuration is still stored under the previous member ID of the previous member switch.

To remove and replace a switch and reapply the old configuration:

1. Power off and disconnect the member switch to be replaced.

   NOTE: See Step 7 in "Remove a Member Switch and Make Its Member ID Available for Reassignment to a Different Switch" on page 119 for information on how to disable Virtual Chassis settings from the removed switch if you want to use that switch in a different configuration.

2. If the replacement member switch has been previously configured, revert that switch's configuration to the factory defaults. See the `request system zeroize` command.

   The replacement member switch should be powered on and running with the factory default configuration at the end of this step.

3. (Recommended for a QFX5100 Virtual Chassis under certain conditions) When you add or replace a QFX5100-24Q switch that is configured in the Routing Engine role in a QFX5100 Virtual Chassis, if the new switch has two EX4600-EM-8F expansion modules, we recommend that you set the primary role priorities on the routing engine members and the new switch to prevent a primary-role switchover to the new switch until after the new switch is completely initialized in the Virtual Chassis.

   Before interconnecting the new switch into the Virtual Chassis in this case, see Add or Replace a QFX5100-24Q Switch with Two Expansion Modules in a QFX5100 Virtual Chassis for details on why, when, and how you should do this step.

   NOTE: You might need to do this even if the new switch has the default factory configuration.

4. (Required when automatic software update is not enabled on the Virtual Chassis and the new member switch is running a version of Junos OS that is different than the version of Junos OS running on the Virtual Chassis) Ensure that the correct version of Junos OS is or will be installed on the new member switch by performing *either* of the following tasks:

   - Enable automatic software update on the Virtual Chassis. See Configuring Automatic Software Update on Virtual Chassis Member Switches. The Virtual Chassis will automatically update the software on the replacement switch in a later step when it is interconnected and recognized as part of the Virtual Chassis. The replacement switch does not require any action in this case for this step.

   - Install the version of Junos OS running on the Virtual Chassis onto the new member switch before interconnecting it into the Virtual Chassis. For EX series switches, see Installing Software on an EX Series Switch with a Virtual Chassis or Single Routing Engine (CLI Procedure), or for QFX Series switches, see Software Installation and Upgrade Overview and Installing Software Packages on QFX Series Devices. In this case, at the end of this step, the replacement switch will be running with the new version of the software and should have the factory default configuration.

     CAUTION: You can only set up a QFX5110 Virtual Chassis with both QFX5110 and QFX5100 switches if they are running the same Junos OS image that includes "-qfx-5e-" in the software package filename (from the Junos OS Software Center). If the switch you are replacing in a QFX5110 Virtual Chassis is a QFX5100 switch that you previously installed with a "-qfx-5-" Junos OS image file, you *must* upgrade the replacement switch to a "-qfx-5e-" image instead before inserting it into the QFX5110 Virtual Chassis. See Upgrading a QFX5100 Switch with a USB Device to Join a QFX5110 Virtual Chassis or Virtual Chassis Fabric. The automatic software update feature can't update a "-qfx-5-" image to a "-qfx-5e-" image.

5. Connect one link from the replacement member switch to the Virtual Chassis as follows, depending on which type of ports you are using:

   - If you are interconnecting a switch using dedicated Virtual Chassis Ports (VCPs), connect one dedicated VCP on the replacement member switch to a dedicated VCP on another member switch in the Virtual Chassis.

   - If you are interconnecting a switch using optical ports configured as VCPs:

     On the replacement switch, configure the optical ports that you are using to connect to the Virtual Chassis as VCPs. (You should also configure the optical ports on the existing member

switches in the Virtual Chassis where the replacement member switch will be connected, if they are not already configured.) To configure an optical port as a VCP:

```
user@switch> request
virtual-chassis vc-port set pic-slot 1 port port-number
```

Connect one configured optical port VCP on the replacement switch to a configured optical port VCP on another member switch in the Virtual Chassis.

NOTE: You can set optical port VCPs on a standalone switch before interconnecting one link into an existing Virtual Chassis, or set them after connecting the link. In either case, you must set the ports as VCPs for the primary to detect and complete the process of adding the switch as a member. For more information on setting up VCPs on EX Series switches, see Setting an Uplink Port on an EX Series or QFX Series Switch as a Virtual Chassis Port, and for details on which ports can be configured as VCPs in a QFX Series Virtual Chassis, see Understanding Virtual Chassis Components.

6. Confirm that the new member switch is now included in the Virtual Chassis configuration on switches with a front-panel LCD by checking the display for the member ID. It should show a member ID in the range from 0 through 9.

   If you are using a switch that does not have an LCD interface, enter the`show virtual-chassis` command and view the output to confirm the switch is part of the Virtual Chassis configuration.

7. Cable the other VCP on the replacement member switch into the Virtual Chassis based on how you planned to interconnect the switch in Step 5 of this procedure.

   CAUTION: If you immediately cable both VCPs on the new switch into the existing Virtual Chassis at the same time, a member switch that was already part of the Virtual Chassis might become nonoperational for several seconds. Network traffic to this switch is dropped during the downtime.

   The member switch will return to the normal operational state with no user intervention, and normal operation of the Virtual Chassis will resume after this downtime.

8. IF you need to update the new member switch's current member ID to the member ID of the switch that was removed from the Virtual Chassis configuration:

   - In a nonprovisioned Virtual Chassis, issue the `request virtual-chassis renumber` command on the primary member switch.

- In a preprovisioned Virtual Chassis, on the primary member switch, reconfigure the member information for the new member switch using the `[edit virtual-chassis] member` configuration statement.

  To use the same member ID as the member that was replaced, associate the new switch's serial number (on the back of the switch) with the replaced member ID, as follows:

```
[edit virtual-chassis]
user@switch# set member replaced-member-ID serial-number new-member-serial-number
```

  NOTE: You can alternatively use the `replace` configuration editing command to substitute the serial number of the replacement member switch for the replaced member's serial number in the existing configuration item for the replaced member.

  To configure the new member switch with a different member ID, associate the new switch's serial number with the desired member ID and then delete the configuration item for the replaced member switch, as follows:

```
[edit virtual-chassis]
user@switch# set member new-member-ID serial-number new-member-serial-number
user@switch# delete member replaced-member-ID
```

Replace a Member Switch With a Different Type of Switch That Changes the Virtual Chassis to Mixed Mode

If you want to replace a member switch with a different type of switch that changes the Virtual Chassis from a non-mixed to a mixed Virtual Chassis:

1. Remove the member switch as described in "Remove a Member Switch and Make Its Member ID Available for Reassignment to a Different Switch" on page 119.
2. Use the configuration procedure for *adding a new switch to an existing Virtual Chassis* based on the type of switch you are adding. (See the list of related documentation at the bottom of this page.)

See Understanding Mixed EX Series and QFX Series Virtual Chassis for the combinations of switches that comprise a mixed Virtual Chassis.

RELATED DOCUMENTATION

- Adding a New Switch to an Existing EX2300, EX3400, or EX4300 Virtual Chassis
- Adding an EX4600 Switch to a Mixed or Non-mixed Virtual Chassis
- Adding a New Switch to an Existing EX4650 or QFX Series Virtual Chassis
- *Adding a New EX4200 Switch to an Existing EX4200 Virtual Chassis (CLI Procedure)*
- Adding an EX4200 Switch to a Preprovisioned EX4500 Virtual Chassis or a Preprovisioned Mixed EX4200 and EX4500 Virtual Chassis (CLI Procedure)
- Adding an EX4500 Switch to a Preprovisioned EX4200 Virtual Chassis (CLI Procedure)
- Adding an EX4500 Switch to a Nonprovisioned EX4200 Virtual Chassis (CLI Procedure)
- Adding or Replacing a Member Switch or an External Routing Engine in an EX8200 Virtual Chassis (CLI Procedure)
- Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis
- Setting an Uplink Port on an EX Series or QFX Series Switch as a Virtual Chassis Port

Configuring Primary Role of a Virtual Chassis

IN THIS SECTION

NOTE:

- This topic applies to all QFX Virtual Chassis and all EX Series Virtual Chassis except EX8200 Virtual Chassis.
- If the Virtual Chassis is being managed through Juniper Mist, see the following topic for instructions to reassign member roles: Reassign the Virtual Chassis Member Roles.

A Virtual Chassis configuration has two Routing Engines—one is the switch in the primary Routing Engine role and the other is the switch in the backup Routing Engine role. The remaining members operate in the linecard role. You can designate the role (primary, backup, or linecard) that a member switch performs within any Virtual Chassis whether or not you are using a preprovisioned configuration. For details on which switches in a mixed Virtual Chassis we recommend or require you to configure into

the primary or backup Routing Engine role, see "Understanding Mixed EX Series and QFX Series Virtual Chassis" on page 32.

NOTE: We recommend that you always use `commit synchronize` rather than `commit` to save configuration changes for a Virtual Chassis to ensure that the changes are saved on both Routing Engines.

Configuring Primary Role Using a Preprovisioned Configuration File

To configure primary role using a preprovisioned configuration:

1. Note the serial numbers of the switches that you want to function as the primary and backup Routing Engines.

   NOTE: Serial number values are case-sensitive.

2. Power on only the switch that you want to function as the primary Routing Engine.
3. Edit the configuration to specify the preprovisioned configuration mode:

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

4. Specify the serial numbers of the member switches that you want to function as primary and backup, specifying their role as `routing-engine`:

```
[edit]
user@switch# set virtual-chassis member 0 serial-number abc123 role routing-engine
user@switch# set virtual-chassis member 1 serial-number def456 role routing-engine
```

   NOTE:

   You cannot directly modify the primary-role priority value when you configure a member switch in a preprovisioned Virtual Chassis. The Virtual Chassis generates the primary-role priority values automatically. The values depend on the role you assign to the member switches in the configuration file. The default primary-role priority on any switch is 128. When you configure the primary and backup Routing Engine members,

the primary-role priority changes to 129 on those members. According to the primary-role election algorithm, the member that you powered on first gets priority and becomes the primary. See "Understanding How the Primary in a Virtual Chassis Is Elected" on page 56. You can configure only two members with the `routing-engine` role.

5. Specify the serial numbers of any other member switches you are including in the Virtual Chassis configuration. You can also explicitly configure their role as `line-card`.

Configuring Primary Role Using a Configuration File That Is Not Preprovisioned

To configure primary role of the Virtual Chassis through a configuration that is not preprovisioned:

1. Power on only the switch that you want to function as the primary Routing Engine.
2. Configure the highest possible primary-role priority value (255) for the member that you want to function as the primary Routing Engine:

```
[edit virtual-chassis]
user@switch# set member 0 mastership-priority 255
```

3. Configure the same primary-role priority value (continue to edit the Virtual Chassis configuration on the primary) for the member that you want to be the backup Routing Engine:

```
[edit virtual-chassis]
user@switch# set member 1 mastership-priority 255
```

NOTE: You should assign the same (highest) primary-role priority value to both the primary and backup Routing Engine members for reliable graceful Routing Engine switchover (GRES) operation. This and the other primary-role election considerations also help keep primary role from switching back and forth rapidly between the two members under failover conditions.

4. Use the default primary-role priority value (128) for the remaining member switches or configure the primary-role priority to a value that is lower than the value specified for members acting in the primary and backup Routing Engine roles.

RELATED DOCUMENTATION

Understanding Mixed EX Series and QFX Series Virtual Chassis | 32

Configuring an EX4650 or a QFX Series Virtual Chassis | 98

Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis

Configuring the Timer for the Backup Member to Start Using Its Own MAC Address as Primary of a Virtual Chassis

When a backup member takes control of a Virtual Chassis because of a reset or other temporary failure, the backup member uses the MAC address of the old primary switch as the system MAC base address. This process helps ensure a smooth transition of the primary role with no disruption to network connectivity.

The MAC persistence timer is used in situations in which the primary switch is no longer a member of the Virtual Chassis because it has been physically disconnected or removed. If the old primary switch does not rejoin the Virtual Chassis before the timer elapses, the new primary switch starts using its own MAC address as the system's MAC base address. For information regarding how the system MAC base address is used to assign MAC addresses to ports in a Virtual Chassis, see "Understanding MAC Address Assignment on a Virtual Chassis" on page 68.

The default timer value is 10 minutes. The maximum timer value is 60 minutes.

You can disable the MAC persistence timer starting in Junos OS Release 12.1R3. When the MAC persistence timer is disabled, the MAC address of the old primary switch is used as the system MAC base address; no MAC address changes occur within the Virtual Chassis even when the old primary switch is no longer a member of the Virtual Chassis because it has been physically disconnected or removed.

To configure or modify the MAC persistence timer:

```
[edit virtual-chassis]
user@switch# set mac-persistence-timer minutes
```

To disable the MAC persistence timer:

```
[edit virtual-chassis]
user@switch# set mac-persistence-timer disable
```

RELATED DOCUMENTATION

Configuring an EX4650 or a QFX Series Virtual Chassis | 98

Understanding Virtual Chassis Components | 43

Setting an Uplink Port on an EX Series or QFX Series Switch as a Virtual Chassis Port

IN THIS SECTION

Use the procedures described in this topic to set up Virtual Chassis ports (VCPs) to connect two switches together in an EX Series or a QFX Series Virtual Chassis.

Switches that can be members of a Virtual Chassis might have:

- Dedicated VCPs—Ports you can use only as VCPs.
- Default-configured VCPs—Ports that are already configured into VCPs with the default factory configuration. On some switches these ports can alternatively be converted back into and used as uplink or network ports.

- Uplink or network ports that are also supported as VCPs—Ports you can configure into VCPs and convert back into uplink or network ports as needed.

If you don't have or are not using dedicated or default-configured VCPs, you need to convert supported ports into VCPs to interconnect Virtual Chassis members. When a switch has uplink or network ports that can be converted into VCPs, you can use some ports as VCPs and others as network ports or uplinks to other devices in trunk mode. When you set a port as a VCP, you can't use it for any other purpose.

NOTE: You don't use the procedures in this topic to set the VCPs on EX4400 switches. EX4400 switches have ports that operate as VCPs by default, and no other ports on the switch can be used as VCPs. If you change the operational mode of the default VCPs to network port mode to use them as network ports instead of as VCPs, to subsequently use the switch in a Virtual Chassis, you must disable network port mode to return those ports to their default VCP mode. To change the default VCPs to network port mode, use the `request virtual-chassis mode network-port <reboot>` command. To disable network port mode to convert the ports back into VCPs, use the `request virtual-chassis mode network-port disable <reboot>` command. (When you enable or disable network port mode, you must reboot the switch for the change to take effect.)

You can set ports as VCPs on a standalone switch before interconnecting any links into a Virtual Chassis, or set them after interconnecting one link on the switch into an existing Virtual Chassis. Either way, after the VCP is connected into the Virtual Chassis, the primary switch uses the link to detect the switch and complete the process of adding it as a member.

NOTE: Most Virtual Chassis also support *autoprovisioning*, which means that under certain conditions, when you interconnect a member switch into an existing Virtual Chassis, ports that are supported as VCPs will convert automatically into VCPs when you cable the link. This is an easy way to add member switches to a Virtual Chassis without needing to explicitly configure VCPs, but it only works if the ports on *both* sides of the link are *not already configured as VCPs*. If you want to use autoprovisioning, you might need to delete VCP settings (whether default-configured or those you previously set explicitly) on either or both sides of the links you are using to interconnect the new member switch. See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details.

See "Virtual Chassis Port Options" on page 46 for a list of supported VCP ports on each type of switch. For complete details about where a switch has dedicated VCPs, default-configured VCPs, or ports that can be configured as VCPs, and what transceivers and cables are supported to use for VCP connections on that switch, see the hardware documentation for the switch. In general, even if a port is supported as a VCP, you can't use it as a VCP if it's channelized.

When to Configure VCPs

You typically configure a port as a Virtual Chassis Port (VCP) for one of the following reasons:

- You are configuring a Virtual Chassis composed of switches that support Virtual Chassis but do not have default-configured VCPs or dedicated VCPs.
- You are using default-configured VCPs or dedicated VCPs to interconnect members in a Virtual Chassis, and want to add redundant VCP links between members using additional ports that can be configured into VCPs.
- You want to interconnect two switches into a Virtual Chassis that have dedicated VCPs but are located in different wiring closets or sites, and the switches are farther apart than the maximum length of a dedicated VCP cable.
- You previously changed a default-configured VCP to use it as a network or uplink port, and now you want to use it as a VCP again.

We recommend that you have two uplink VCP connections within each wiring closet for redundancy. VCPs automatically bundle into a Link Aggregation Group (LAG) when two or more ports operating at the same speed are configured into VCPs between the same two member switches. See "Understanding Virtual Chassis Port Link Aggregation" on page 61 for details.

Prepare Virtual Chassis Member Switches Before Converting VCPs

Before converting a port into a VCP and interconnecting the switch into a Virtual Chassis:

1. Verify which ports can be used as VCPs in your particular configuration. See "Virtual Chassis Port Options" on page 46 for a summary of the VCP options on switches that support Virtual Chassis, and the hardware documentation for each type of switch for complete details about the ports and installed transceivers that can be used as VCPs.
2. If you are configuring an uplink module port as a VCP, if needed, install the uplink module in the member switches that you want to interconnect.
3. Log into the switch that is or will be the primary of the Virtual Chassis.

   NOTE: Do not power on the other switches at this point.

4. (EX Series switches only) Run EZSetup on the switch that you are configuring to be the primary member switch. Make sure the hostname and other identification, time zone, and network properties are set up on the primary. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* for

details. The parameters you specify for the primary apply to the entire Virtual Chassis, including all the member switches that you interconnect later.

5. If you want to configure and manage the Virtual Chassis remotely, specify the VME global management interface. You can configure the VME global management interface when you are setting up the primary or you can do it after completing the other configuration steps for the Virtual Chassis. See *Configuring the Virtual Management Ethernet Interface for Global Management of an EX Series Virtual Chassis (CLI Procedure)*.
6. Configure primary role of the Virtual Chassis using either a nonprovisioned or preprovisioned configuration. See "Configuring Primary Role of a Virtual Chassis" on page 126 for details.

NOTE: A Virtual Chassis has two Routing Engines, one in the primary role and the other in the backup role. Therefore, we recommend that you always use `commit synchronize` rather than simply `commit` to save configuration changes made for a Virtual Chassis. This ensures that the configuration changes are saved in both Routing Engines.

Before you begin to interconnect new Virtual Chassis members across long distances, such as between wiring closets:

- Prepare the existing Virtual Chassis for interconnecting with a potential member switch that is beyond the reach of a dedicated Virtual Chassis cable by setting at least one uplink VCP on an existing member of the Virtual Chassis.
- Prepare the potential member switch for interconnecting with the existing Virtual Chassis by setting at least one uplink VCP on the standalone switch.

Set Uplink Ports to Form VCP Links Between Member Switches in a Virtual Chassis

From the Virtual Chassis, you can set an uplink port on the local member or on a specified member as a VCP.

To set the uplink ports for the local member switch (for example, member 0) and for a different member switch (for example, member 1) to function as VCPs:

1. Set one uplink port of member 0 as a VCP. You don't need to specify the `member` *`member-id`* option, because the command applies by default on the member where it is executed. You can alternatively

include the `local` option if you want to make sure the command applies only to that port locally on the switch where you're running the command.

```
user@switch> request virtual-chassis vc-port set pic-slot 1 port 0
```

2. Set one uplink port of member 1 as a VCP. This step includes the member *member-id* option because it acts on a different member switch than the local member switch.

```
user@switch> request virtual-chassis vc-port set pic-slot 1 port 0 member 1
```

NOTE: You can also connect to a member switch individually using the *request session member* command and set a VCP locally on that member. (You don't specify the `member` option in that case.)

Set an Uplink Port as a VCP on a Standalone Switch

You can set an uplink VCP on a standalone switch before interconnecting the link into an existing Virtual Chassis. You must set the port as a VCP for the Virtual Chassis primary to detect the switch and complete the process of adding it as a member.

To set one uplink VCP on the potential member, which is currently operating as a standalone switch:

1. Power on the standalone switch.
2. Set one uplink port as a VCP. You do not need to specify the `member` *member-id* option, because the command applies by default on the member where it is executed.

```
user@switch> request virtual-chassis vc-port set pic-slot 1 port 0
```

NOTE: If you do specify the `member` *member-id* option, use member ID `0`. Because the switch is not yet interconnected with the other members of the Virtual Chassis, its current member ID is `0`. Its member ID will change when it is interconnected with the

Virtual Chassis. It does not impact the functioning of the uplink VCP that its VCP is set with `0` as the member ID. The VCP has significance only on the local switch.

3. After you have set the uplink VCP on the standalone switch, physically interconnect its uplink port with a VCP uplink port on one of the members in the existing Virtual Chassis.

   The new member switch reboots and joins the now expanded Virtual Chassis with a different member ID.

   NOTE: The setting for the new member switch's uplink VCP remains intact and is not affected by the change of member ID.

4. Repeat the steps above to interconnect the new switch to another member of the Virtual Chassis or to create redundant VCP links to the same member.

Remove a VCP Setting on an Uplink or Network Port

You might want to convert a VCP back into an uplink or network port if:

- You want to use a default-configured VCP on a switch as a network or uplink port instead of as a VCP.
- You want to add a new member switch or a new VCP link in an existing Virtual Chassis using autoprovisioning, where the VCP links form automatically when you cable them *only* if the ports on both sides of the link are not already set as VCPs. (See "Automatic Virtual Chassis Port (VCP) Conversion" on page 49 for details.)
- You remove a switch from a Virtual Chassis and want to use it as a standalone switch again.

  NOTE: In this case, whenever possible we recommend that you revert the switch back to its default factory configuration to guarantee the smoothest transition back to standalone operation. See *Removing or Replacing a Member Switch of a Virtual Chassis Configuration*.

To remove the VCP setting on a port:

```
user@switch> request virtual-chassis vc-port delete pic-slot slot-number port port-number
```

You usually do this on the switch with the VCP itself, so you don't need to include the `member member-id` option because the command applies by default on the member where you run it.

RELATED DOCUMENTATION

Configuring an EX2300, EX3400, EX4100, EX4100-F, EX4300, or EX4400 Virtual Chassis | 77

Configuring an EX4650 or a QFX Series Virtual Chassis | 98

Removing or Replacing a Member Switch of a Virtual Chassis Configuration

Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis

Disabling Split and Merge in a Virtual Chassis

The split and merge feature is enabled by default on all EX Series switches and QFX Series devices that are connected into a Virtual Chassis.

If a Virtual Chassis splits:

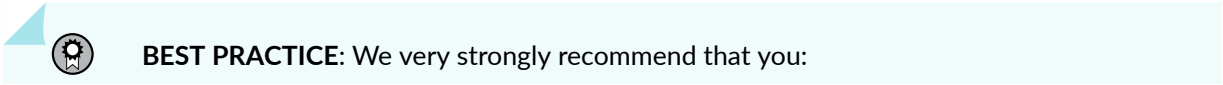
- Each part detects the members they can still reach and elects a new primary for those members to form a smaller Virtual Chassis.
- Each part determines if it will remain the active new configuration of the original Virtual Chassis. The feature's rules ensure only one part remains active after a split.

See "Understanding Split and Merge in a Virtual Chassis" on page 63 for complete details on what happens during a Virtual Chassis split or merge.

You can disable the split and merge feature in a Virtual Chassis by configuring the `no-split-detection` option on the Virtual Chassis. In this case, if the Virtual Chassis splits, both parts of the split Virtual Chassis configuration usually remain active.

However, with split detection disabled, be aware that the two resulting Virtual Chassis might not form as you might expect. For example, in a preprovisioned Virtual Chassis:

- If both of the Routing Engines end up in the same Virtual Chassis configuration after a split, the other part of the split Virtual Chassis configuration can't form and remains inactive (because it has no members that can take on the primary or backup Routing Engine).
- If the Routing Engines end up in different parts of the split Virtual Chassis configuration and the rest of the member switches are configured in linecard roles, then the resulting Virtual Chassis parts might not be able to select a backup Routing Engine.



BEST PRACTICE: We very strongly recommend that you:

- Keep the default setting with the split and merge feature enabled for any Virtual Chassis with more than two members.

  This provides the most predictable results when a split happens, and enables the split and merge feature to perform a merge after the issues that caused the split are resolved.

- Disable split and merge on a Virtual Chassis with only two member switches by setting the `no-split-detection` option.

  We have found that a two-member switch Virtual Chassis with split and merge disabled re-forms more quickly with fewer complications when a split occurs.

  If you expand a two-member Virtual Chassis to include more members, delete the `no-split-detection` setting to re-enable split and merge feature again.

To disable the split and merge feature in a Virtual Chassis:

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

To remove this configuration item to restore the default configuration with the split and merge feature again—we very strongly recommend that you do this when a two-member Virtual Chassis is expanded to have more members:

```
[edit]
user@switch# delete virtual-chassis no-split-detection
```

RELATED DOCUMENTATION

Understanding Split and Merge in a Virtual Chassis | 63

Configuring Automatic Software Update on Virtual Chassis Member Switches

The automatic software update feature allows you to automatically update the software version on prospective member switches as they are added so that they can join the Virtual Chassis.

NOTE: The version of Junos OS running on the Virtual Chassis must be compatible with the software running on the prospective member switch for an automatic software update to occur. For information on Junos OS compatibility and other automatic software update restrictions, see "Understanding Automatic Software Update on Virtual Chassis Member Switches" on page 67.

Before you begin, ensure that you know the name or the URL of the software package to be used by the automatic software update feature.

To configure the automatic software update feature for an EX Series or QFX Series Virtual Chassis that is not a mixed-mode Virtual Chassis:

```
[edit]
user@switch# set virtual-chassis auto-sw-update package-name package-name
```

NOTE: An EX4300 Virtual Chassis with a combination of EX4300 multigigabit model switches (EX4300-48MP) and other EX4300 switches must be configured in mixed mode, and the automatic software update feature is not supported in this case.

NOTE: A QFX5110 Virtual Chassis is considered to be a non-mixed Virtual Chassis. Because both QFX5110 and QFX5100 switches in a QFX5110 Virtual Chassis run the same software image, you can use the `auto-sw-update` command with one software package name for all members.

CAUTION: A QFX5100 switch running a Junos OS software image with “-qfx-5-” in the package filename *must* first be upgraded to a Junos OS software image with “-qfx-5e-” in the package filename before it can be added to a QFX5110 Virtual Chassis or VCF. The automatic software update process cannot update a switch from a “-qfx-5-” image to a “-

qfx-5e-" image. See *Upgrading a QFX5100 Switch with a USB Device to Join a QFX5110 Virtual Chassis or Virtual Chassis Fabric*.

After a QFX5100 switch is installed with a "-qfx-5e-" Junos OS software image, the automatic software update process can successfully update the switch automatically with a different version of a "-qfx-5e-" Junos OS image to match the other members in the Virtual Chassis or VCF.

To configure the automatic software update feature on a mixed QFX5100 Virtual Chassis composed of QFX5100 switches and at least one other supported type of device (]EX4300 switches), you must specify a software package name for each type or family of device in the mixed Virtual Chassis:

- Specify the `qfx-5` option with the path to the Junos OS package for QFX5100 switches
- Specify the `ex4300` option with the path to the Junos OS package for EX4300 switches

as follows:

```
[edit]
user@device# set virtual-chassis auto-sw-update qfx-5 package-name package-name
user@device# set virtual-chassis auto-sw-update ex-4300 package-name package-name
```

You can similarly specify different package names using the `ex-4600` and `ex-4300` options with the `auto-sw-update` statement to configure the automatic software update feature for a mixed EX4600 Virtual Chassis that contains EX4600 and EX4300 member switches.

If the software package is located on a local directory on the switch, use the following format for *package-name*:

/pathname/package-name

If the software package is to be downloaded and installed from a remote location, use one of the following formats:

`ftp://`*hostname/pathname/package-name*

`ftp://`*username*`:`*prompt*`@ftp.`*hostname.net/package-name*

`http://`*hostname/pathname/package-name*

RELATED DOCUMENTATION

Understanding Automatic Software Update on Virtual Chassis Member Switches | 67

Understanding Mixed EX Series and QFX Series Virtual Chassis | 32

Assigning the Virtual Chassis ID to Determine Precedence During a Virtual Chassis Merge

Every Virtual Chassis has a unique ID that is automatically assigned when the Virtual Chassis configuration is formed. You can also explicitly assign a Virtual Chassis ID using the **set virtual-chassis id** command. When two Virtual Chassis configurations attempt to merge, the Virtual Chassis ID that you assigned takes precedence over the automatically assigned Virtual Chassis IDs and becomes the ID for the newly merged Virtual Chassis configuration.

To configure the Virtual Chassis ID:

```
[edit]
user@switch# set virtual-chassis id                              id
```

RELATED DOCUMENTATION

Understanding Split and Merge in a Virtual Chassis | 63

Configuring Graceful Routing Engine Switchover in a Virtual Chassis

In a Virtual Chassis, one member switch is assigned the primary role and has the primary Routing Engine. Another member switch is assigned the backup role and has the backup Routing Engine. Graceful Routing Engine switchover (GRES) enables the primary and backup Routing Engines in a Virtual Chassis configuration to switch from the primary to backup without interruption to packet forwarding as a hitless failover solution. When you configure graceful Routing Engine switchover, the backup Routing Engine automatically synchronizes with the primary Routing Engine to preserve kernel state information and the forwarding state.

To set up the Virtual Chassis configuration to use graceful Routing Engine switchover (GRES):

1. Set up a minimum of two switches in a Virtual Chassis configuration with primary-role priority of 255:

```
[edit]
user@switch# set virtual-chassis member 0 mastership-priority 255

[edit]
user@switch# set virtual-chassis member 1 mastership-priority 255
```

2. Set up graceful Routing Engine switchover:

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

Commit the configuration.

NOTE: We recommend that you use the `commit synchronize` command to save any configuration changes that you make to a multimember Virtual Chassis.

Synchronize Configuration Data Using SCP in a Virtual Chassis

SUMMARY

Follow these steps to use Secure Copy Protocol (SCP) to secure the transfer and synchronization of configuration data in a Virtual Chassis.

This configuration is applicable only to Juniper Networks® EX Series Switches and Juniper Networks® QFX Series Switches.

If you want to enable FIPS mode, see Enabling FIPS Mode before configuring Secure Copy Protocol (SCP).

In a Virtual Chassis, the primary member and the members in backup or linecard roles exchange configuration data and foreign files when you:

- Commit a new configuration.
- Reboot a linecard member.
- Add a new linecard member to the Virtual Chassis.

You can configure the management process (mgd) to use SCP instead of Remote Copy Protocol (RCP) for transferring configuration data and foreign files between the Virtual Chassis members. SCP encrypts the data before transfer, whereas RCP transfers the data in plaintext. SCP ensures that the configuration and foreign files are securely synchronized among Virtual Chassis members, maintaining the integrity and confidentiality of your network configurations.

To enable configuration synchronization using SCP on the Virtual Chassis:

1. Configure SSH to read authorized keys from a nondefault location. Execute the following commands on each member of the Virtual Chassis.

   ```
   [edit]
   root@host# set system services ssh authorized-keys-command /usr/libexec/ui/get-authkeys-
   internal.sh
   root@host# set system services ssh authorized-keys-command-user nobody
   root@host# commit
   ```

   The system stores the authorization keys needed for SCP-based configuration synchronization in an authorized keys file. However, this file is not the default location for the SSH keys. You need to configure the `authorized-keys-command` and `authorized-keys-command-user` statements for SSH to access the internal authorized-keys file.

2. Create SSH keys for each member and distribute the keys to all other members. Update the host keys in the known host file for each member.

   This step prepares the system for passwordless and promptless transfer of configuration data using SCP.

   You must execute the `request chassis internal-ssh` command only on the primary member and as a root user.

   ```
   root@host> request chassis internal-ssh prepare-setup
   ```

3. Enable SCP for synchronization of configuration data and commit the configuration.

If you have enabled FIPS mode, you can skip this step. FIPS mode automatically activates the SCP feature.

```
[edit]
root@host# set system commit config-sync-with-scp
root@host# commit
```

The mgd uses SCP to synchronize the configuration data and foreign files between the primary Virtual Chassis member and other members. You don't require a password or prompts for mgd to synchronize the files.

RELATED DOCUMENTATION

- *config-sync-with-scp*

3

CHAPTER

Virtual Chassis Routine Monitoring and Troubleshooting

IN THIS CHAPTER

Command Forwarding Usage with EX Series and QFX Series Virtual Chassis

Some CLI commands can be run either on all members or on a specific member of a Virtual Chassis configuration. This functionality is referred to as command forwarding.

You can always specify that these commands be applied to all member switches in the Virtual Chassis by using the `all-members` option, or to a specific member switch by using the `member-`*`member-id`* option. If neither option is specified, the default command forwarding behavior, which varies by command, is used. See the **Default** row in Table 9 on page 146 to learn the command forwarding behavior for a specific command.

For example, to collect information about a particular member switch prior to contacting Juniper Networks Technical Assistance Center (JTAC), use the `request support information member` *`member-id`* command to gather data for the specified member switch. If you want to gather this data for all member switches in the Virtual Chassis, you can enter the `request support information` command, which by default uses the `all-members` option, or the `request support information all-members` command.

Table 9 on page 146 provides a list of commands that can be run either on all members of the Virtual Chassis configuration or on a specific member switch.

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`request support information`	Use this command when you contact JTAC about your component problem. This command is the equivalent of using the following CLI commands: • `show version` • `show chassis firmware` • `show chassis hardware` • `show chassis environment` • `show interfaces extensive` (for each configured interface) • `show configuration` (excluding any SECRET-DATA) • `show system virtual-memory`	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration *(Continued)*

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`request system partition hard-disk`	Set up the hard disk for partitioning. After this command is issued, the hard disk is partitioned the next time the system is rebooted. When the hard disk is partitioned, the contents of **/altroot** and **/altconfig** are saved and restored. All other data on the hard disk is at risk of being lost.	Partitions the hard disk on all members of the Virtual Chassis configuration.	Partitions the hard disk on the specified member switch.	`all-members`
`request system reboot`	Reboot Junos OS for EX Series or QFX Series switches after a software upgrade and occasionally to recover from an error condition.	Reboots all members of the Virtual Chassis configuration.	Reboots the specified member switch.	`all-members`
`request system snapshot`	Back up the currently running and active file system.	Backs up the file systems on all members of the Virtual Chassis configuration.	Backs up the file system on the specified member switch.	`all-members`

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration *(Continued)*

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`request system storage cleanup`	Free storage space on the switch by rotating log files and proposing a list of files for deletion. User input is required for file deletion.	Runs cleanup on all members of the Virtual Chassis configuration.	Runs cleanup on the specified member switch.	`all-members`
`show log user`	Display users who are viewing the system log.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	primary switch only
`show system alarms`	Display active system alarms.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system audit`	Display the state and checksum values for file systems.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration *(Continued)*

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`show system boot-messages`	Display initial messages generated by the system kernel upon startup. These messages are the contents of **/var/run/dmesg.boot**.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system buffers`	Display information about the buffer pool that the Routing Engine uses for local traffic. Local traffic is the routing and management traffic that is exchanged between the Routing Engine and the Packet Forwarding Engine within the switch, as well as the routing and management traffic from IP (that is, from OSPF, BGP, SNMP, ping operations, and so on).	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration *(Continued)*

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`show system connections`	Display information about the active IP sockets on the Routing Engine. Use this command to verify which servers are active on a system and which connections are currently in progress.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system core-dumps`	Display a core file generated by an internal Junos OS process.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system directory-usage`	Display directory usage information.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	primary switch only
`show system processes`	Display information about software processes that are running on the switch and that have controlling terminals.	Displays information for all members of the Virtual Chassis configuration.		`all-members`

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration *(Continued)*

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`show system reboot`	Display pending system reboots or halts.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system snapshot`	Display information about the backup software that is located in the **/altroot** and **/altconfig** file systems. To back up software, use the request system snapshot command.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system software`	Display the Junos OS extensions loaded on your switch.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system statistics`	Display systemwide protocol-related statistics.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`

Table 9: Commands That Can be Run on All or Specific Members of the Virtual Chassis Configuration *(Continued)*

Command	Purpose	`all-members`	`member-`*`member-id`*	Default
`show system storage`	Display statistics about the amount of free disk space in the switch's file systems.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system uptime`	Display the current time and information about how long the switch, the switch software, and any existing protocols have been running	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`
`show system users`	Show all users who are currently logged in.	Shows all users who are currently logged in to any members of the Virtual Chassis configuration.	Shows all users who are currently logged in to the specified member switch.	`all-members`
`show system virtual-memory`	Display the usage of Junos OS kernel memory, listed first by size of allocation and then by type of usage. Use `show system virtual-memory` for troubleshooting with JTAC.	Displays information for all members of the Virtual Chassis configuration.	Displays information for the specified member switch.	`all-members`

RELATED DOCUMENTATION

Monitoring the Virtual Chassis Status and Statistics on EX Series Virtual Chassis

Virtual Chassis Overview for Switches | 2

Understanding Virtual Chassis Components | 43

Verifying the Member ID, Role, and Neighbor Member Connections of a Virtual Chassis Member

IN THIS SECTION

Purpose

You can designate the role that a member performs within a Virtual Chassis or you can allow the role to be assigned by default. You can designate the member ID that is assigned to a specific switch by creating a permanent association between the switch's serial number and a member ID, using a preprovisioned configuration. Or you can let the member ID be assigned by the primary, based on the sequence in which the member switch is powered on and on which member IDs are currently available.

The role and member ID of the member switch are displayed on the front-panel LCD (for switches that have an LCD) or in the output from the `show virtual-chassis` CLI command.

Each member switch can be cabled to one or two other member switches, using either the dedicated Virtual Chassis ports (VCPs) on the rear panel, an uplink port that has been configured as a VCP, or an optical port that has been configured as a VCP. The members that are cabled together are considered neighbor members.

Action

To display the role and member ID assignments using the CLI:

```
user@switch>                    show virtual-chassis

Virtual Chassis ID: 0000.e255.00e0

                                     Mastership            Neighbor List
Member ID  Status  Serial No   Model     Priority  Role      ID, Interface

0 (FPC 0)  Prsnt   abc123      ex4200-48p    255  Master*    1 vcp-0
                                                             2 vcp-1

1 (FPC 1)  Prsnt   def456      ex4200-24t    255  Backup     2 vcp-0
                                                             0 vcp-1

2 (FPC 2)  Prsnt   abd231      ex4200-24p    128  Linecard   0 vcp-0
                                                             1 vcp-1
```

Meaning

This output verifies that three EX] switches have been interconnected as a Virtual Chassis configuration through their dedicated VCPs to create an EX Virtual Chassis. The display shows which of the VCPs is connected to which neighbor. The first port (**vcp-0**) of member **0** is connected to member **1** and the second port of member **0** (**vcp-1**) is connected to member **2**. The FPC slots for the switches are the same as the member IDs.

The **Mastership Priority** values indicate that the primary and backup members have been explicitly configured, because they are not using the default value (**128**).

NOTE: This example uses output from an EX4200 Virtual Chassis. The output, with the exception of the **Model** column, would be identical on all other Virtual Chassis.

RELATED DOCUMENTATION

Configuring Primary Role of a Virtual Chassis | 126

Verifying That Virtual Chassis Ports Are Operational

IN THIS SECTION

Purpose

Display the status of Virtual Chassis ports (VCPs) in a Virtual Chassis or Virtual Chassis Fabric (VCF).

NOTE: VCPs are not displayed when you issue the `show interfaces` command.

Action

Display the VCPs:

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


fpc0:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status       Speed        Neighbor
or                             ID                (mbps)       ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up           32000        1   vcp-0
```

```
vcp-1       Dedicated           2    Up          32000        1   vcp-1
1/0         Configured          3    Up          1000         2   vcp-255/1/0
1/1         Configured          3    Up          1000         2   vcp-255/1/1
1/2         Configured          4    Up          1000         4   vcp-255/0/20
1/3         Configured          4    Up          1000         4   vcp-255/0/21

fpc1:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status      Speed        Neighbor
or                             ID                (mbps)       ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up          32000        0   vcp-0
vcp-1       Dedicated           2    Up          32000        0   vcp-1
1/0         Configured          3    Up          10000        3   vcp-255/1/0
1/1         Configured          3    Up          10000        3   vcp-255/1/1

fpc2:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status      Speed        Neighbor
or                             ID                (mbps)       ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up          32000        3   vcp-0
vcp-1       Dedicated           2    Up          32000        3   vcp-1
1/0         Configured          3    Up          1000         0   vcp-255/1/0
1/1         Configured          3    Up          1000         0   vcp-255/1/1
1/2                            -1    Down        1000
1/3                            -1    Down        1000

fpc3:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status      Speed        Neighbor
or                             ID                (mbps)       ID  Interface
PIC / Port
vcp-0       Dedicated           1    Up          32000        2   vcp-0
vcp-1       Dedicated           2    Up          32000        2   vcp-1
1/0         Configured          3    Up          10000        1   vcp-255/1/0
1/1         Configured          3    Up          10000        1   vcp-255/1/1

fpc4:
--------------------------------------------------------------------------
Interface   Type              Trunk  Status      Speed        Neighbor
or                             ID                (mbps)       ID  Interface
PIC / Port
```

```
vcp-0       Dedicated       1    Down       32000
vcp-1       Dedicated       2    Down       32000
0/20        Configured      3    Up         1000        0   vcp-255/1/2
0/21        Configured      3    Up         1000        0   vcp-255/1/3
```

Meaning

The dedicated VCPs are displayed as **vcp-0** and **vcp-1**. The uplink interfaces that have been set as uplink VCPs are displayed as **1/0**, **1/1**, **1/2**, and **1/3**. The network interfaces that have been set as VCPs are displayed as **0/20** and **0/21**. The neighbor interface names of uplink and network VCPs are of the form **vcp-255/*pic*/*port***—for example, **vcp-255/1/0**. In that name, **vcp-255** indicates that the interface is a VCP, **1** is the uplink PIC number, and **0** is the port number. The **fpc** number is the same as the member ID. The trunk ID is a positive number ID assigned to the link aggregation group (LAG) formed by the Virtual Chassis. If no LAG is formed, the value is **–1**.

Verifying That Graceful Routing Engine Switchover Is Working in the Virtual Chassis

IN THIS SECTION

Purpose

Verify that a Graceful Routing Engine switchover (GRES) between two member switches acting as the primary and backup routing engines in a Virtual Chassis has occurred.

Action

On the primary switch, verify the member ID of the backup Routing Engine:

```
{master:0}
user@switch> show virtual-chassis
Virtual Chassis ID: 5efa.4b7a.aae6
                                     Mastership            Neighbor List
Member ID  Status   Serial No    Model    priority    Role      ID  Interface
0 (FPC 0)  Prsnt    BM0208105281 ex4200-24t      255  Master*    1  vcp-0
1 (FPC 1)  Prsnt    BP0208192350 ex4200-48t      255  Backup     0  vcp-0

Member ID for next new member: 2 (FPC 2)
```

1. Connect to the backup Routing Engine:

```
{master:0}
user@switch> request session member 1

{backup:1}
user@switch>
```

2. Verify that the backup Routing Engine is ready for switchover on member ID 1:

```
{backup:1}
user@switch> show system switchover

Graceful switchover: On
Configuration database: Ready
Kernel database: Ready
Peer state: Steady State
```

3. Switch the current backup Routing Engine to primary Routing Engine:

NOTE: You must wait a minimum of two minutes between Routing Engine failovers for the Routing Engines to synchronize.

```
{backup:1}
user@switch> request chassis routing-engine master acquire
```

4. Verify that the primary and backup Routing Engines have switched roles:

NOTE: Member ID **1** is now the primary and member ID **0** is now the backup.

```
{master:1}
user@switch> show virtual-chassis

Virtual Chassis ID: 5efa.4b7a.aae6
                                     Mastership            Neighbor List
Member ID  Status   Serial No    Model    priority    Role      ID  Interface
0 (FPC 0)  Prsnt    BM0208105281 ex4200-24t      255  Backup     1  vcp-0
1 (FPC 1)  Prsnt    BP0208192350 ex4200-48t      255  Master*    0  vcp-0

Member ID for next new member: 2 (FPC 2)
```

Meaning

With graceful Routing Engine switchover enabled, when you initiated a switchover from the backup Routing Engine, the backup Routing Engine became the primary and the primary Routing Engine became the backup.

Troubleshooting an EX Series Virtual Chassis

IN THIS SECTION

This topic describes the following troubleshooting issues for a Virtual Chassis:

A Disconnected Member Switch's ID Is Not Available for Reassignment

IN THIS SECTION

Problem

Description

You disconnected a switch from the Virtual Chassis, but the disconnected switch’s member ID is still displayed in the status output. You cannot reassign that member ID to another switch.

Solution

When you disconnect a member of a Virtual Chassis configuration, the primary retains the member ID and member configuration in its configuration database. Output from the `show virtual-chassis` command continues to display the member ID of the disconnected member with a status of `NotPrsnt`.

If want to permanently disconnect the member switch, you can free up the member ID by using the `request virtual-chassis recycle` command. This will also clear the status of that member.

Load Factory Default Does Not Commit on a Multimember Virtual Chassis

IN THIS SECTION

Problem

Description

The `load factory-default` command fails on a multimember Virtual Chassis.

Solution

The `load factory-default` command is not supported on a multimember Virtual Chassis configuration. For information on how to revert the switches in the Virtual Chassis to factory default settings, see *Reverting to the Default Factory Configuration for the EX Series Switch*.

The Member ID Persists When a Member Switch Is Disconnected From a Virtual Chassis

IN THIS SECTION

Problem

Description

Gigabit Ethernet interfaces retain their previous slot numbers when a member switch is disconnected from the Virtual Chassis.

Solution

If a switch had been previously connected as a member of a Virtual Chassis configuration, it retains the member ID that it was assigned as a member of that configuration even after it is disconnected and operating as a standalone switch. The interfaces that were configured while the switch was a member of the Virtual Chassis configuration retain the old member ID as the first digit of the interface name.

For example, if the switch was previously member 1, its interfaces are named `ge-1/0/0` and so on.

To change the switch's member ID, so that its member ID is 0, and to rename the switch's interfaces accordingly:

1. To change the member ID to 0:

```
user@switch> request virtual-chassis renumber member-id 1 new-member-id 0
```

2. To rename the interfaces to match the new member ID:

```
[edit virtual-chassis]
user@switch# replace pattern ge-1/ with ge-0/
```

A Member Switch Is Not Participating in a Mixed Virtual Chassis

IN THIS SECTION

Problem

Description

A member switch in a mixed Virtual Chassis is not participating in the Virtual Chassis. The `show virtual-chassis` output indicates the member switch status is `Inactive` or `NotPrsnt`.

This issue is most likely to occur immediately after you have cabled a mixed Virtual Chassis.

Solution

The Virtual Chassis mode on the switch might not be set to `mixed` mode. If the member switch is an EX4500 switch and is cabled into the Virtual Chassis through the dedicated Virtual Chassis port (VCP), the PIC mode might also be set to `Intraconnect` instead of `virtual-chassis`.

To verify the Virtual Chassis mode:

```
user@switch> show virtual-chassis mode

fpc0:
--------------------------------------------------------------------------
Mixed Mode: Enabled
fpc1:
--------------------------------------------------------------------------
Mixed Mode: Enabled
fpc2:
--------------------------------------------------------------------------
Mixed Mode: Enabled
fpc3:
--------------------------------------------------------------------------
Mixed Mode: Enabled
```

```
fpc4:
--------------------------------------------------------------------------
Mixed Mode: Disabled
fpc5:
--------------------------------------------------------------------------
Mixed Mode: Enabled
```

To change the Virtual Chassis mode on a member switch (in this case, member ID 4) to `mixed` mode:

```
user@switch> request virtual-chassis mode mixed member 4
```

(EX4500 switch only) To verify the PIC mode:

```
user@switch> show chassis pic-mode
fpc0:
--------------------------------------------------------------------------
    Pic Mode: Not-Applicable
fpc1:
--------------------------------------------------------------------------
    Pic Mode: Not-Applicable
fpc2:
--------------------------------------------------------------------------
    Pic Mode: Not-Applicable
fpc3:
--------------------------------------------------------------------------
    Pic Mode: Not-Applicable
fpc4:
--------------------------------------------------------------------------
    Pic Mode: PIC 3: Intraconnect
fpc5:
--------------------------------------------------------------------------
    Pic Mode: PIC 3: virtual-chassis
```

To change the PIC mode on an EX4500 switch to `virtual-chassis` mode (in this case, member ID 4):

```
user@switch> request chassis pic-mode virtual-chassis member 4
```

The member switch must be rebooted for the Virtual Chassis mode or PIC mode setting change to take effect. To reboot the member switch (in this case, member ID 4):

```
user@switch> request system reboot member 4
```

Interface-Related Configuration Changes Are Not Applied After Switchover

IN THIS SECTION

Problem

Description

After a graceful routing engine switchover, the commit operation for interface-related configuration changes succeeds, but the configuration changes are not applied. No error messages are generated as part of the commit operation.

Solution

When a new member interface is added to an aggregated Ethernet bundle, the validation might fail in case of a speed mismatch between the bundle and the new member interface. After a graceful routing engine switchover, the DCD process exits at startup due to the failed validation. Any interface-related configuration changes are not applied from then on.

Check the logs for any error messages related to speed mismatch between the aggregated Ethernet bundle and the new member interface. If these errors occur during DCD startup, then the DCD process exits.

To fix this:

1. Remove the member interface mentioned in the error message from the aggregated Ethernet bundle and commit the configuration.

2. Restart the DCD process by using the `restart interface-control` command.
3. Verify that the DCD process is running.

CHAPTER 4

Upgrading Software on a Virtual Chassis

IN THIS CHAPTER

Understanding Software Upgrades in a Virtual Chassis

IN THIS SECTION

This topic discusses software upgrades on EX Series and QFX Series *Virtual Chassis*.

In a Virtual Chassis, each member switch must be running the same version of Juniper Networks Junos operating system (Junos OS) that supports Virtual Chassis. You can install a new Junos OS release on the entire Virtual Chassis or on individual members in the Virtual Chassis by using the same CLI command that you use to install Junos OS on standalone switches—the `request system software add` command.

In a mixed Virtual Chassis, the member switches must also be running the same version of Junos OS, but you might need to specify multiple Junos OS images when manually or automatically upgrading a mixed Virtual Chassis. For example, for the same Junos OS release, an EX4300 switch runs a different Junos OS image than a QFX5100 switch in a QFX5100 Virtual Chassis. You can upgrade all member switches simultaneously by specifying a path to multiple Junos OS images in the same `request system software add` command.

You can also use the following features to upgrade software on members of a Virtual Chassis:

Automatic Software Updates

You can use the automatic software update feature on a non-mixed or mixed Virtual Chassis to automatically update the Junos OS version on member switches as you add them to the Virtual Chassis. See "Understanding Automatic Software Update on Virtual Chassis Member Switches" on page 67 for more information.

If you are not configuring the automatic software update feature, we recommend that you update the new member switch to the version of Junos OS running on the Virtual Chassis before adding the member switch to the Virtual Chassis.

Nonstop Software Upgrade

You can also use nonstop software upgrade (NSSU) to upgrade Junos OS on all members of a Virtual Chassis for EX Series and QFX Series Virtual Chassis that support NSSU. NSSU provides an orderly upgrade of each member of the Virtual Chassis and takes advantage of *graceful Routing Engine switchover*, *nonstop active routing*, and link aggregation to minimize traffic disruption during the upgrade.

For more information about NSSU, see:

- "Understanding Nonstop Software Upgrade on a Virtual Chassis and Mixed Virtual Chassis" on page 176
- "Upgrading Software on a Virtual Chassis and Mixed Virtual Chassis Using Nonstop Software Upgrade" on page 184
- (For legacy EX Series switches in a Virtual Chassis) *Upgrading Software Using Nonstop Software Upgrade on EX Series Virtual Chassis and Mixed Virtual Chassis (CLI Procedure)*

If NSSU is not supported to upgrade a Virtual Chassis from the currently-installed release to the release you need, refer to procedures like these for some guidance:

- Two-Member QFX Series Virtual Chassis Upgrade Procedure, a network configuration example on how to manually upgrade a two-member QFX Series Virtual Chassis when NSSU isn't available.

RELATED DOCUMENTATION

Understanding Virtual Chassis Components | **43**

Configuring Automatic Software Update on Virtual Chassis Member Switches | **138**

Installing Software on an EX Series Switch with a Virtual Chassis or Single Routing Engine (CLI Procedure)

Installing Software on a Mixed Virtual Chassis with EX4200, EX4500, and EX4550 Switches (CLI Procedure)

Upgrading a QFX5100 Switch with a USB Device to Join a QFX5110 Virtual Chassis or Virtual Chassis Fabric

IN THIS SECTION

Use this procedure to upgrade a standalone QFX5100 switch running "QFX 5 Series" Junos OS software to a "QFX 5e Series" software image so the QFX5100 switch can join a QFX5110 Virtual Chassis or Virtual Chassis Fabric (VCF).

A QFX5110 Virtual Chassis or VCF can have a combination of QFX5110 and QFX5100 switches all running compatible Junos OS "QFX 5e Series" software. This procedure explains how you identify the compatible "QFX 5e Series" install package for QFX5100 switches, create a USB boot device as the installation media, and use the boot device to upgrade the software on a QFX5100 switch to the "QFX 5e Series" image. After installing the new software image, when you reboot the QFX5100, the switch is running a compatible software image and you can successfully add it into a QFX5110 Virtual Chassis or VCF.

NOTE: With releases prior to Junos OS Release 17.3R2 or 17.4R1, you must use this USB install method due to the differences in the boot structure and host OS software of the two types of devices.

Starting in Junos OS Releases 17.3R2 and 17.4R1, you are not required to use the USB install method to upgrade a QFX5100 switch from a "QFX 5 Series" to a "QFX 5e Series" image. Instead, you can install the "QFX 5e Series" package directly using the CLI command *request system software add*. See Installing a Standard Software Package on QFX5000 and EX4600 Switches for details on using the CLI install method.

If a QFX5100 switch is already running a "QFX 5e Series" image (software package filename contains the string "-qfx-5e-"), a QFX5110 Virtual Chassis or VCF can automatically update it to the right release

when you add it to the Virtual Chassis or VCF. See Understanding Software Upgrades in a Virtual Chassis and *Understanding Software Upgrades in a Virtual Chassis Fabric*.

Identifying Compatible Software for QFX5100 Switches to Run in a QFX5110 Virtual Chassis or VCF

Standalone QFX5100 switches traditionally run Junos OS “QFX 5 Series” software, and the corresponding install media and installation software package file names include the string “-qfx-5-”. For example:

```
install-media-qfx-5-17.2R1.13.tgz
jinstall-host-qfx-5-17.2R1.13-signed.tgz
```

QFX5110 switches run Junos OS “QFX 5e Series” software and use a secure-boot method at startup, so the install media and software package filenames for QFX5110 switches include “-qfx-5e-” and “secure”. For example:

```
install-media-host-usb-qfx-5e-x86-64-17.2R1.13-secure.tgz
jinstall-host-qfx-5e-x86-64-17.2R1.13-secure-signed.tgz
```

QFX5100 switches can also run “5e Series” software, but in releases prior to Junos OS Release 17.3R2 or 17.4R1 they do not use the same secure boot method as QFX5110 switches, so the “QFX 5e Series” install media and software package filenames for QFX5100 switches include “-qfx-5e-” without the “secure” keyword. For example:

```
install-media-host-usb-qfx-5e-x86-64-17.3R1.6-signed.tgz
```

To add a QFX5100 switch to a QFX5110 Virtual Chassis or VCF, the QFX5100 must be running the same “QFX 5e Series” software version as the other switches in the Virtual Chassis or VCF. If the QFX5100 switch has a "QFX 5 Series” image, you must first upgrade it manually to a “QFX 5e Series” image using a USB boot device that does not employ the secure-boot method.

To create the USB boot device (see "Creating a USB Boot Device for a QFX5100 Switch" on page 172), use the same install media filename *without* the “secure” keyword that matches what’s running on the other QFX5110 Virtual Chassis or VCF members. For example:

If the Virtual Chassis or VCF is running the software from this install media package for QFX5110 switches (with the secure-boot method):

```
install-media-host-usb-qfx-5e-x86-64-17.3R1.6-secure-signed.tgz
```

Then the matching install media package for QFX5100 switches (without the secure-boot method) is:

```
install-media-host-usb-qfx-5e-x86-64-17.3R1.6-signed.tgz
```

After any QFX5100 switches are running a “QFX 5e Series” image, you can just use the same “jinstall-host-qfx-5e-” package file *with* the “secure” keyword to update the “QFX 5e Series” software running on all members of the Virtual Chassis or VCF, because when it starts up, the secure-boot install software determines whether or not to use the secure-boot method based on the type of switch on which it’s running. The Virtual Chassis or VCF can also successfully update any “QFX 5e Series” member switches as needed in the same way with the automatic software update feature for adding or replacing members, or even during initial Virtual Chassis or VCF configuration.

NOTE: If you remove a QFX5100 switch from a QFX5110 Virtual Chassis or VCF and want to revert the QFX5100 switch to a “QFX 5 Series” software image to run as a standalone switch, you need to reinstall the image on the switch using a USB boot device with a “qfx-5-” install media file that does not use the secure-boot method.

Creating a USB Boot Device for a QFX5100 Switch

Use the following procedure to create a USB boot device with a Junos OS “QFX 5e Series” install media package (contains “-qfx-5e-” in the package filename) for a QFX5100 switch. You can then use the USB boot device to upgrade a QFX5100 switch to run that image.

NOTE: You can create the USB boot device on the switch you want to upgrade, on another Juniper Networks switch or router, or on any PC or laptop that supports Linux. The following steps describe creating the boot device from a Junos OS device, and might differ based on the device you use to create the boot device.

Before you begin, download the installation media file from https://www.juniper.net/customers/support/ to the device where you are creating the boot device. The install media filename should include the string “-qfx-5e-” for the same Junos OS release as the QFX5110 Virtual Chassis or VCF, but without a “secure” keyword in the filename, because you must initially upgrade QFX5100 switches without using

the same secure-boot method employed by QFX5110 switches. (See "Identifying Compatible Software for QFX5100 Switches to Run in a QFX5110 Virtual Chassis or VCF" on page 171 for details.)

> **NOTE**: The Junos OS software running on the QFX5110 members must be the "QFX 5e Series" image that uses the secure-boot method, so the install media and package filenames used on QFX5110 switches include the "secure" keyword. After initial USB installation of a "QFX 5e Series" software image on a QFX5100 switch, the same software image that supports secure boot runs on either switch model, and determines the appropriate boot method to use based on the switch on which it is running. As a result, for future updates, you can directly install the same image with the "secure" keyword on both QFX5110 and QFX5100 switches in your Virtual Chassis or VCF.

On a Junos OS device where you are creating the USB boot device:

1. Use FTP to copy the installation media file into the **/var/tmp** directory.
2. Insert the USB storage device into the USB port.
3. From the Junos OS command-line interface (CLI), start the shell:

```
user@device> start shell
%
```

4. Switch to the root account using the `su` command:

```
% su
Password: password
```

> **NOTE**: The password is the root password for the device on which you are creating the boot media. If you logged in to the device as root, you do not need to perform this step.

5. (Optional) Before copying the installation media file to the USB device, erase the boot sector of the USB device. In some cases, depending on how the USB device was formatted previously, this step can help avoid unexpected behavior during the USB boot process. For example, enter the following command:

```
root@device% dd if=/dev/zero of=/dev/da1 count=20
20+0 records in
20+0 records out
10240 bytes (10 kB) copied, 0.008281 seconds, 1.2 MB/s
```

6. Enter the following command to copy the installation media file (see "Identifying Compatible Software for QFX5100 Switches to Run in a QFX5110 Virtual Chassis or VCF" on page 171) to the USB device:

```
root@device% dd if=/var/tmp/filename of=/dev/da1 bs=1m
```

   The device writes the installation media image to the USB device. For example:

```
root@device% dd if=install-media-host-qfx-5e-17.3R1.5-domestic.img of=/dev/da0 bs=1m
1399+0 records in
1399+0 records out
1466957824 bytes transferred in 394.081902 secs (3722469 bytes/sec)
```

7. Log out of the shell:

```
root@device% exit
% exit
user@device>
```

8. Remove the USB storage device from the USB port.

You can now use the USB storage device to install the “QFX 5e Series” Junos OS software image on a QFX5100 switch.

Upgrading a QFX5100 Switch from Junos OS “QFX 5 Series” to “QFX 5e Series” Software Using a USB Boot Device

You must upgrade a standalone QFX5100 switch running “QFX 5 Series” software to “QFX 5e Series” software before the switch can join a QFX5110 Virtual Chassis or VCF. For this upgrade, you need to boot and install the software using a USB boot device.

Before you begin, have a USB boot device ready with the required Junos OS software install package as described in "Creating a USB Boot Device for a QFX5100 Switch" on page 172. The upgrade process overwrites the contents of the internal flash storage on the QFX5100 switch, so if desired, before proceeding with the upgrade, save existing configuration, backup configurations, and other stored files to a remote system, server, or other storage device. Then:

1. Insert the USB boot device into a USB port on the QFX5100 switch you need to upgrade, and power-cycle the QFX5100 switch.

2. The switch comes up, booting from the USB device and running the `Juniper Linux Installer`.

   NOTE: If the switch doesn't automatically boot from the USB device, press the ESC key while the switch reboots to bring up the BIOS boot manager so you can manually select to boot from the USB device.

   The installer menu prompts you to with the following options:

   ```
   Juniper Linux Installer - (c) Juniper Networks 2014
   Reboot
   Install Juniper Linux Platform
   Boot to host shell [debug]
   ```

   Tab through the options to select `Install Juniper Linux Platform`, and press Enter.

3. The installer displays status messages during the install process, creates and formats the local storage partitions, and installs the host OS and Junos OS software on the switch.

   After completing installation, the installer displays a list of boot options and after a few seconds automatically selects the default option to boot `Juniper Linux`. The switch boots the host OS and automatically selects and brings up Junos OS. Upon completion of the install and reboot process, the switch displays the Junos OS login prompt.

4. Log in to Junos OS on the switch, enter operational mode, and verify that the new version of software has been properly installed by running the show version command.

   ```
   user@switch> show version
   ```

   After the QFX5100 switch is running the "QFX 5e Series" software image, you can continue with any other configuration and setup to add the QFX5100 to a QFX5110 Virtual Chassis or VCF, such as configuring the Virtual Chassis ports (VCPs).

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
17.4R1	Starting in Junos OS Releases 17.3R2 and 17.4R1, you are not required to use the USB install method to upgrade a QFX5100 switch from a "QFX 5 Series" to a "QFX 5e Series" image. Instead, you can install the "QFX 5e Series" package directly using the CLI command *request system software add*

RELATED DOCUMENTATION

- Understanding Mixed EX Series and QFX Series Virtual Chassis
- *Understanding Mixed Virtual Chassis Fabric*
- Configuring an EX4650 or a QFX Series Virtual Chassis
- *Understanding Virtual Chassis Fabric Configuration*

Understanding Nonstop Software Upgrade on a Virtual Chassis and Mixed Virtual Chassis

IN THIS SECTION

Nonstop software upgrade (NSSU) enables you to upgrade the software running on all member switches in a *Virtual Chassis* with minimal network traffic disruption during the upgrade. This topic describes NSSU on EX Series and QFX Series Virtual Chassis that support this feature.

NOTE: Because NSSU upgrades the software on each Virtual Chassis member one at a time, upgrading using NSSU can take longer than an upgrade using the `request system software add` command.

You can reduce the amount of time an upgrade takes by configuring line-card upgrade groups on larger Virtual Chassis that support this feature. The Virtual Chassis upgrades the member switches in an upgrade group simultaneously, reducing the amount of time it takes to complete an upgrade. See "Configuring Line-Card Upgrade Groups for Nonstop Software Upgrade" on page 181.

Benefits of NSSU

- No disruption to the control plane—NSSU uses *graceful Routing Engine switchover* (GRES) (and *nonstop active routing* (NSR) on applicable platforms) to ensure no disruption occurs to the control plane. During the upgrade process, the Virtual Chassis preserves interface, kernel, and routing protocol information.
- Minimal disruption to network traffic—NSSU minimizes network traffic disruption by upgrading member switches one at a time, enabling the primary and backup members to maintain their primary and backup roles (although primary role will change) without disrupting traffic, and permitting traffic to continue to flow through members in the linecard role that are not being upgraded.

Requirements for Performing an NSSU

Requirements for performing NSSU for a Virtual Chassis include:

- All Virtual Chassis members and all Routing Engines must be running the same Junos OS release.
- You must enable Graceful Routing Engine switchover (GRES).
- You must enable nonstop active routing (NSR) for applicable platforms.

  Although nonstop bridging (NSB) is not required to perform an NSSU, we also recommend enabling NSB before performing an NSSU on applicable platforms. NSB ensures that all NSB-supported Layer 2 protocols operate seamlessly when the Routing Engine switches over during NSSU. See *Configuring Nonstop Bridging on Switches (CLI Procedure)*.
- To minimize traffic disruption, you must configure link aggregation groups (LAGs) such that the member links of each LAG reside on different Virtual Chassis members, and configure Link Aggregation Control Protocol (LACP) to monitor LAG member link states. When one member link of a LAG is down, the remaining links are up, and traffic continues to flow through the LAG. For more information on configuring LAGs and LACP, see Configuring Link Aggregation and Configuring Aggregated Ethernet LACP (CLI Procedure).

  NOTE: During an NSSU operation, if you try to view LAG interface status on the primary Routing Engine member using the `show interfaces ae-`*`ae-interface-number`* CLI command, you might see incorrect or zero traffic counts. To work around this problem, run the command on the backup Routing Engine member instead if that member is already loaded and running.

Requirements for the Virtual Chassis or mixed Virtual Chassis members being upgraded using NSSU:

- The member switches must be connected in a ring topology so that no member is isolated as a result of another member being rebooted. This topology prevents the Virtual Chassis from splitting during an NSSU.
- The primary and backup member switches must be adjacent to each other in the ring topology. Adjacent placement ensures the primary and backup are always in sync while the member switches in linecard roles are rebooting.
- The Virtual Chassis is preprovisioned and you have explicitly assigned the linecard role to the member switches acting in a linecard role. The Virtual Chassis primary and backup member switches change primary role while one or the other is being upgraded during NSSU, but they must maintain their primary and backup routing engine roles, and the remaining switches must maintain their linecard roles.
- A two-member Virtual Chassis must have `no-split-detection` configured so that the Virtual Chassis doesn't split when an NSSU upgrades a member. See "Understanding Split and Merge in a Virtual Chassis" on page 63.

How an NSSU Works on a Virtual Chassis and Mixed Virtual Chassis

When you request an NSSU on a Virtual Chassis or mixed Virtual Chassis:

1. The Virtual Chassis primary verifies that:
   - The backup is online and running the same software version.
   - You enabled Graceful Routing Engine switchover (GRES), and, if applicable, nonstop active routing (NSR).
   - You used a preprovisioned configuration to set up the Virtual Chassis.
2. The primary copies the new software image to the backup and remaining linecard role members in sequence using `rcp`.

   To optimize the time needed to complete an NSSU operation for a Virtual Chassis, the primary uses parallel `rcp` sessions to copy the new software to multiple members at a time (rather than waiting for the copy operation to complete to each member before starting to copy the software image to the next member). The primary uses a default algorithm to determine the number of parallel copy operations based on the number of members in the Virtual Chassis, or you can configure a specific number using the `rcp-count` configuration statement. See *rcp-count* for details.

> **NOTE**: If copying the new software to any member fails, NSSU terminates the upgrade process for the entire Virtual Chassis without rebooting any members, and logs the error condition.

3. The primary restarts the backup member switch with the new software, and the backup resynchronizes with the primary.
4. The primary loads and reboots member switches that are in the linecard role, one at a time. The primary waits for each member to become online and active running the new software before rebooting the next member.
   - If you configured upgrade groups, the Virtual Chassis members in the first upgrade group load the new image and restart. When the members in that upgrade group are online again, the members in the next upgrade group load the new image and restart. (NSSU upgrades the groups in the order that they appear in the configuration.)
   - Traffic continues to flow through the other members during this process.
5. Rebooting continues until all active members have restarted with the new software.

> **NOTE**: If any linecard role member fails to reboot successfully, NSSU terminates the upgrade process and logs the error condition. In this case, to avoid Virtual Chassis instability, you should either back out the partial upgrade by restoring the old software and rebooting the members that were already rebooted with the new software, or try to manually reboot all members with the new software that was copied to them, so all members come online again running the same version of the software.

6. After the primary has upgraded all members in the linecard role, it performs a graceful Routing Engine switchover and the upgraded backup member switch becomes the new primary.
7. The new primary upgrades the software on the original primary and automatically reboots it. After the original primary has rejoined the Virtual Chassis, you can optionally revert primary role to that switch by explicitly requesting another graceful Routing Engine switchover.

NSSU Limitations

You can't use NSSU to downgrade the software—that is, to install an earlier version of the software than is currently running on the switch. To install an earlier software version, use the `request system software add` command.

You can't roll back to the previous software version after you perform an upgrade using NSSU. If you need to roll back to the previous software version, you can reboot from the alternate root partition if you have not already copied the new software version into the alternate root partition.

NSSU and Junos OS Release Support

NSSU works only on some Virtual Chassis with particular *from* and *to* Junos OS Releases. Contact Juniper Networks Technical Assistance Center (JTAC) to confirm supported *from* and *to* releases if you are considering upgrading your Virtual Chassis using NSSU.

If your Virtual Chassis is running a software version that does not support NSSU or does not support the combination of *from* and *to* releases with NSSU, use the `request system software add` command to upgrade the member switches in the Virtual Chassis individually.

You can also refer to this network configuration example on how to manually upgrade a two-member QFX Series Virtual Chassis with minimal impact to traffic flow when NSSU is not supported:

- Two-Member QFX Series Virtual Chassis Upgrade Procedure

Overview of NSSU Configuration and Operation

For NSSU to succeed, the Virtual Chassis and member switches must meets the requirements in "Requirements for Performing an NSSU" on page 177. NSSU requires only those configuration steps.

If your Virtual Chassis meets the NSSU requirements, simply enter the `request system software nonstop-upgrade` command to start NSSU. See "Upgrading Software on a Virtual Chassis and Mixed Virtual Chassis Using Nonstop Software Upgrade" on page 184 for details.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
14.1X53-D40	(For QFX5100 Virtual Chassis only) Starting with Junos OS Release 14.1X53-D40, to optimize the time needed to complete an NSSU operation for a Virtual Chassis, the primary uses parallel `rcp` sessions to copy the new software to multiple members at a time (rather than waiting for the copy operation to complete to each member before starting to copy the software image to the next member).

14.1X53-D40	Starting with Junos OS Release 14.1X53-D40, if an NSSU copy operation to a member fails, the primary performs an additional error recovery measure to remove the new software from the members to which it was already transferred.
14.1X53-D40	Starting with Junos OS Release 14.1X53-D40, NSSU automatically invokes recovery measures if the reboot fails on any linecard role member, stopping the sequential reboot process and bringing down and rebooting the entire Virtual Chassis.

RELATED DOCUMENTATION

- Upgrading Software on a Virtual Chassis and Mixed Virtual Chassis Using Nonstop Software Upgrade | **184**
- Understanding Aggregated Ethernet Interfaces and LACP for Switches
- *Configuring Graceful Routing Engine Switchover in a Virtual Chassis*

Configuring Line-Card Upgrade Groups for Nonstop Software Upgrade

IN THIS SECTION

You can configure line-card upgrade groups for nonstop software upgrade (NSSU) operations on supporting platforms. Line-card upgrade groups can reduce the total time required to complete an NSSU operation and enable you to control the upgrade sequence among the switches being upgraded.

How Line-card Upgrade Groups Work with Nonstop Software Upgrade

With NSSU, you can upgrade software on supporting switches with redundant Routing Engines, a Virtual Chassis, or a Virtual Chassis Fabric (VCF) using a single command with minimal disruption to network traffic.

In its default configuration, NSSU upgrades each line card in a switch or linecard role member in a Virtual Chassis or VCF one at a time. Traffic continues to flow through the other line cards or members while each one is being restarted as part of the upgrade. This behavior minimizes traffic disruption if you configure link aggregation groups (LAGs) such that the member links of each LAG reside on different line cards or members. As a result, when one member link of a LAG is down, the remaining links are up, and traffic continues to flow through the LAG.

When you configure line-card upgrade groups for NSSU, NSSU upgrades all of the devices in each upgrade group at the same time instead of sequentially, reducing the total time needed to complete the upgrade on all line cards or members.

To achieve minimal traffic disruption during an NSSU operation, you must define the line-card upgrade groups such that the member links of the LAGs reside on line cards or members that are in different upgrade groups. For information on how to configure LAGs, see Configuring Aggregated Ethernet Links (CLI Procedure).

NSSU upgrades the groups in the order that they appear in the configuration (in other words, in the order you configure them). As a result, you can also define upgrade groups to control the upgrade sequence during an NSSU operation.

To configure upgrade groups, use the `upgrade-group` configuration statement in the `[edit chassis nssu]` hierarchy.

Line-card Upgrade Groups Support

The following platforms support NSSU line-card upgrade groups:

- EX4650 Virtual Chassis with more than three member switches
- QFX3500, QFX3600, and QFX5100 Virtual Chassis
- QFX5100 Virtual Chassis Fabric (VCF)

Configure Line-Card Upgrade Groups on an EX4650 Virtual Chassis, a QFX Series Virtual Chassis or a QFX5100 VCF

When you configure line-card upgrade groups on an EX4650 Virtual Chassis, a QFX Series Virtual Chassis, or a QFX5100 VCF, whose switches do not have separate line cards, you use only the `fpcs` option to specify the Virtual Chassis or VCF member IDs that you want to include in an upgrade group. You don't need to use the `member` option.

- To create an upgrade group and add a Virtual Chassis or VCF member switch to the upgrade group, configure the upgrade group name and specify the member number using the `fpcs` option:

  ```
  [edit chassis]
  user@switch# set nssu upgrade-group group-name fpcs member-number
  ```

  For example, to create an upgrade group called `vcf` and add linecard role member 2 to that group:

  ```
  [edit chassis]
  user@switch# set nssu upgrade-group vcf fpcs 2
  ```

  If `vcf` already exists, this command adds member 2 to `vcf`.

- To create an upgrade group that contains multiple members in a Virtual Chassis or VCF, specify multiple member numbers enclosed in square brackets after the `fpcs` option:

  ```
  [edit chassis]
  user@switch# set nssu upgrade-group group-name fpcs [list-of-member-numbers]
  ```

  For example, to create an upgrade group called `vc1` that contains members 1 and 2:

  ```
  [edit chassis]
  user@switch# set nssu upgrade-group vc1 fpcs [1 2]
  ```

Make sure you commit the configuration before starting an NSSU operation.

RELATED DOCUMENTATION

- Understanding Nonstop Software Upgrade on a Virtual Chassis and Mixed Virtual Chassis
- Upgrading Software on a Virtual Chassis and Mixed Virtual Chassis Using Nonstop Software Upgrade

Upgrading Software on a Virtual Chassis and Mixed Virtual Chassis Using Nonstop Software Upgrade

IN THIS SECTION

Nonstop software upgrade (NSSU) enables you to upgrade the software running on all member switches of supported Virtual Chassis with minimal traffic disruption during the upgrade.

NOTE: NSSU works only on some Virtual Chassis with certain *from* and *to* Junos OS Releases. Use the `request system software add` command to upgrade the member switches in the Virtual Chassis individually if the Virtual Chassis is running a software version that does not support NSSU or does not support the combination of *from* and *to* releases.

You can also refer to Two-Member QFX Series Virtual Chassis Upgrade Procedure, a network configuration example on how to manually upgrade a two-member QFX Series Virtual Chassis with minimal impact to traffic flow when NSSU is not supported.

Preparing the Switch for Software Installation

Before you begin installing the new software using NSSU:

- Ensure that the Virtual Chassis is connected and configured correctly to support the NSSU process. See "Requirements for Performing an NSSU" on page 177.

- Verify that the members are running the same version of the software:

```
user@switch> show version
```

  If the Virtual Chassis or mixed Virtual Chassis members are not running the same version of the software, use the `request system software add` command to upgrade the software on the inconsistent members.

- Ensure that graceful Routing Engine switchover (GRES) is enabled, or for applicable platforms, make sure nonstop active routing (NSR) is enabled, which also enables graceful Routing Engine switchover. See *Configuring Nonstop Active Routing* for more information.

  To check the nonstop active routing state to verify both NSR and GRES are enabled:

```
user@switch> show task replication
```

- (Optional for applicable platforms) Enable nonstop bridging (NSB), which ensures that all NSB-supported Layer 2 protocols operate seamlessly during the Routing Engine switchover that is part of the NSSU. See *Configuring Nonstop Bridging on Switches (CLI Procedure)* for details.

- For a two-member Virtual Chassis, make sure you configured `no-split-detection` so the Virtual Chassis does not split when NSSU upgrades one of the members. See "Disabling Split and Merge in a Virtual Chassis" on page 136.

- On a QFX5100 Virtual Chassis with line-card upgrade groups configured, you should enable the `lc-reboot-delay` option to configure a delay for when adjacent members in a line card group reboot. Without this option, when the next member reboots, approximately two minutes after the previous member reboots and joins the Virtual Chassis, the previous rebooted member might not be ready to carry traffic. This delay helps prevent dropping traffic when there are two adjacent line card members with interfaces that are part of a common link aggregation group (LAG).

  We recommend setting a 200-second delay (the allowable range is 0 to 600 seconds). To configure this delay:

```
[edit chassis]
user@switch# set chassis nssu lc-reboot-delay 200
```

- (Optional) Back up the system software (Junos OS, the active configuration, and log files) on each member to an external storage device as desired using the `request system snapshot` command.

Upgrading the Software Using NSSU

This procedure describes how to upgrade the software running on all Virtual Chassis or mixed Virtual Chassis members using NSSU. When the upgrade completes, all members are running the new version of the software. The upgrade includes a graceful Routing Engine switchover, so the original Virtual Chassis backup member switch becomes the new primary.

During NSSU, the primary copies the new software image to all the members in the Virtual Chassis and reboots them in turn. If copying the new software to a member fails or rebooting a member fails, NSSU terminates the upgrade process and logs the error. In this case, you must manually perform recovery measures for members left in an incompatible state to restore all members to running the same version of the software. NSSU automatically invokes recovery measures after either of these failures, as follows:

- If NSSU terminates due to a copy error, the primary removes the new image from any members to which it was already copied.
- If any member fails to reboot, NSSU automatically initiates a clean Virtual Chassis restart by bringing down and rebooting the entire Virtual Chassis. All members come up running the new software at the same time. This action cleanly recovers correct Virtual Chassis operation more quickly than having an unstable Virtual Chassis running different versions of the software trying to converge.

NOTE: Junos OS software images with enhanced automation are only supported on a non-mixed Virtual Chassis with QFX5100 switches. Also, you can't perform an NSSU from a standard Junos OS software image to a Junos OS software image with enhanced automation, or from a Junos OS software image with enhanced automation to a standard Junos OS software image.

To upgrade all members in a Virtual Chassis using NSSU:

1. Download the software package as described in Installing Software Packages on QFX Series Devices. If you are upgrading a mixed Virtual Chassis, download the software packages for the different switch types.
2. Copy the software package or packages to the Virtual Chassis. We recommend that you copy the file or files to the `/var/tmp` directory on the primary.
3. Use the console connection or the virtual management Ethernet (VME) interface to log in to the Virtual Chassis or mixed Virtual Chassis. You can monitor the progress of the primary switch reboot if you use a console connection.
4. Start the NSSU:

- On a Virtual Chassis where all members use the same software image, enter:

```
user@switch> request system software nonstop-upgrade force-host /var/tmp/package-name.tgz
```

  where *package-name*.tgz is the software package name, for example, jinstall-qfx-3-13.2X50-D15.3-domestic-signed.tgz.

- On a mixed Virtual Chassis where members might use different software images, enter the request system software nonstop-upgrade command with the set option to specify more than one software package name:

```
user@switch> request system software nonstop-upgrade set [/var/tmp/package-name1.tgz /var/tmp/package-name2.tgz]
```

  For example, /var/tmp/*package-name1*.tgz and /var/tmp/*package-name2*.tgz might specify software packages for different types of switches in a mixed Virtual Chassis.

The switch displays status messages similar to the following messages as the upgrade executes:

```
Chassis ISSU Check Done
NSSU: Validating Image
NSSU: Preparing Backup RE
Installing image on other FPC's along with the backup

Checking pending install on fpc1
Pushing bundle to fpc1
WARNING: A reboot is required to install the software
WARNING:     Use the 'request system reboot' command immediately
Completed install on fpc1

Checking pending install on fpc2
Pushing bundle to fpc2
WARNING: A reboot is required to install the software
WARNING:     Use the 'request system reboot' command immediately
Completed install on fpc2

Rebooting fpc1
NSSU: Backup RE Prepare Done
Waiting for Backup RE reboot
GRES operational
```

```
Initiating Chassis In-Service-Upgrade
Chassis NSSU Started
NSSU: Preparing Daemons
NSSU: Daemons Ready for NSSU
NSSU: Starting Upgrade for FRUs
NSSU: Preparing for Switchover
NSSU: Ready for Switchover
Checking In-Service-Upgrade status
  Item           Status                  Reason
  FPC 0          Online
  FPC 1          Online
  FPC 2          Online (ISSU)
Going to install image on master
WARNING: A reboot is required to install the software
WARNING:     Use the 'request system reboot' command immediately
relinquish mastership
NSSU: IDLE

*** FINAL System shutdown message from user@switch ***

System going down IMMEDIATELY



Shutdown NOW!
[pid 9336]
```

5. Log in after the original primary switch reboot completes. To verify that the software is upgraded on all Routing Engines in the Virtual Chassis, enter the following command:

```
user@switch> show version
```

6. To ensure the resilient dual-root partitions feature operates correctly, copy the new Junos OS image into the alternate root partitions of all members:

```
user@switch> request system snapshot slice alternate all-members
```

With resilient dual-root partitions, the switch can boot transparently from the alternate root partition if the system fails to boot from the primary root partition.

NOTE: After an upgrade is complete, please verify `syslog`, `show chassis fabric errors`, `show chassis fabric fpcs`, and `show system alarms`.

If the FPCs or fabric display any errors, set alarms for specific errors. Configure `pfe-offline` as error action to mitigate outages.

RELATED DOCUMENTATION

Understanding Nonstop Software Upgrade on a Virtual Chassis and Mixed Virtual Chassis | **176**

Configuring Dual-Root Partitions

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CHAPTER

Configuration Statements and Operational Commands

IN THIS CHAPTER

Junos CLI Reference Overview

We've consolidated all Junos CLI commands and configuration statements in one place. Read this guide to learn about the syntax and options that make up the statements and commands. Also understand the contexts in which you'll use these CLI elements in your network configurations and operations.

- Junos CLI Reference

Click the links to access Junos OS and Junos OS Evolved configuration statement and command summary topics.

- Configuration Statements
- Operational Commands

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CHAPTER

Knowledge Base

IN THIS CHAPTER