



Junos[®] OS for EX Series Ethernet Switches

Device Security for EX4300 Switches

Release

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Release 14.1X53
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About the Documentation

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Documentation and Release Notes

To obtain the most current version of all Juniper Networks[®] technical documentation, see the product documentation page on the Juniper Networks website at <http://www.juniper.net/techpubs/>.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

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Supported Platforms

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

- EX Series

Using the Examples in This Manual

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

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

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

Merging a Full Example

To merge a full example, follow these steps:

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

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

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

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

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

Merging a Snippet

To merge a snippet, follow these steps:

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

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

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

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


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

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

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

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

Documentation Conventions

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

Table 1: Notice Icons

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

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

Table 2: Text and Syntax Conventions

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

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

Convention	Description	Examples
Fixed-width text like this	Represents output that appears on the terminal screen.	<pre>user@host> show chassis alarms</pre> <p>No alarms currently active</p>
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	<p>Configure the machine's domain name:</p> <pre>[edit] root@# set system domain-name domain-name</pre>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the <code>[edit protocols ospf area area-id]</code> hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Encloses optional keywords or variables.	stub <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast <i>(string1 string2 string3)</i>
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Encloses a variable for which you can substitute one or more values.	community name members [community-ids]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	<pre>[edit] routing-options { static { route default { nexthop <i>address</i>; retain; } } }</pre>
; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.

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

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

Documentation Feedback

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

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

Requesting Technical Support

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

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

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

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

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

Opening a Case with JTAC

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

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

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

PART 1

Overview

- [Storm Control Overview on page 3](#)
- [Unknown Unicast Forwarding Overview on page 7](#)

CHAPTER 1

Storm Control Overview

- [Understanding Storm Control on Switching Devices on page 3](#)

Understanding Storm Control on Switching Devices



NOTE: This topic uses Junos OS with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switching device is an EX Series switch and runs software that does not support ELS, see *Understanding Storm Control on EX Series Switches*. If your switching device is an EX Series switch and runs software that does support ELS, see *Getting Started with Enhanced Layer 2 Software*.

A traffic storm is generated when messages are broadcast on a network and each message prompts a receiving node to respond by broadcasting its own messages on the network. This, in turn, prompts further responses, creating a snowball effect. The LAN is suddenly flooded with packets, creating unnecessary traffic that leads to poor network performance or even a complete loss of network service.

Storm control enables the switching device to monitor traffic levels and to drop broadcast, multicast, and unknown unicast packets when a specified traffic level—called the *storm control level* or *storm control bandwidth*—is exceeded, thus preventing packets from proliferating and degrading the LAN. As an alternative to having the switching device drop packets, you can configure storm control to shut down interfaces or temporarily disable interfaces (see the [action-shutdown](#) statement and the [recovery-timeout](#) statement) when the storm control level is exceeded.



NOTE: On Juniper Networks EX4300 Ethernet Switches, the factory default configuration enables storm control on all Layer 2 interfaces, with the storm control level set to 80 percent of the combined broadcast, multicast, and unknown unicast traffic streams.

Storm control is not enabled by default on Juniper Networks EX9200 Ethernet Switches.

Storm control is not enabled by default on Juniper Networks MX Series routers.

You can customize the storm control level for a specific interface by explicitly configuring either bandwidth level or bandwidth percentage.

- **Bandwidth level**—Configures the storm control level as the bandwidth in kilobits per second of the applicable traffic streams on that interface.
- **Bandwidth percentage**—Configures the storm control level as a percentage of the available bandwidth used by the combined applicable traffic streams that are subject to storm control on that interface.



NOTE: You cannot configure both bandwidth level and bandwidth percentage for the same interface.

You can disable storm control selectively for broadcast, multicast, or unknown unicast traffic, or any combination of traffic types. When disabling storm control for multicast traffic, you can specify the traffic to be either registered multicast or unregistered multicast. Registered multicast MAC addresses are multicast MAC addresses that are within the range 01-00-5E-00-00-00 through 01-00-5E-7F-FF-FF. This range has been reserved by the Internet Assigned Numbers Association (IANA) for multicast Ethernet addresses. Multicast MAC addresses that are outside this range are called unregistered multicast addresses.

The sending and receiving of broadcast, multicast, and unicast packets are part of normal LAN operation. Therefore, to recognize a storm, you must be able to identify when traffic has reached a level that is abnormal for your LAN. Suspect a storm when operations begin timing out and network response times slow down. As more packets flood the LAN, network users might be unable to access servers or e-mail.

Monitor the level of broadcast, multicast, and unknown unicast traffic in the LAN when it is operating normally. Use this data as a benchmark to determine when traffic levels are too high. Then configure storm control to set the level at which you want the switching device to drop broadcast traffic, multicast traffic, unknown unicast traffic, or two or all three of those traffic types.



NOTE: When you configure storm control level on an aggregated Ethernet interface, the storm control level for each member of the aggregated Ethernet interface is set to that bandwidth or level. For example, if you configure a storm control level of 15,000 Kbps on ae1, and ae1 has two members, ge-0/0/0 and ge-0/0/1, each member has a storm control level of 15,000 Kbps. Thus, the storm control level on ae1 allows a traffic rate of up to 30,000 Kbps of combined traffic streams. Traffic might include broadcast, multicast, and unknown unicast traffic, depending upon the configuration.

Related Documentation

- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)
- [Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers](#)

- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 16](#)
- [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

CHAPTER 2

Unknown Unicast Forwarding Overview

- [Understanding Unknown Unicast Forwarding on page 7](#)

Understanding Unknown Unicast Forwarding

Unknown unicast traffic consists of unicast packets with unknown destination MAC addresses. By default, the switch floods these unicast packets that are traveling in a VLAN to all interfaces that are members of the VLAN. Forwarding this type of traffic can create unnecessary traffic that leads to poor network performance or even a complete loss of network service. This is known as a traffic storm.

To prevent a storm, you can disable the flooding of unknown unicast packets to all VLAN interfaces by configuring one VLAN or all VLANs to forward all unknown unicast traffic to a specific interface. This channels the unknown unicast traffic to a single interface.

Related Documentation

- [Configuring Unknown Unicast Forwarding \(CLI Procedure\)](#)
- [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 15](#)
- [Understanding Storm Control on EX Series Switches](#)
- [Understanding Storm Control on Switching Devices on page 3](#)
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches](#)
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)

PART 2

Configuration

- [Configuration Examples on page 11](#)
- [Configuration Tasks on page 15](#)
- [Configuration Statements on page 23](#)

CHAPTER 3

Configuration Examples

- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)

Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches



NOTE: This example uses Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

Storm control enables you to prevent network outages caused by broadcast storms on the LAN. You can configure storm control on an EX Series switch to rate-limit broadcast traffic, multicast traffic, and unknown unicast traffic at a specified level and to have packets dropped when the specified traffic level is exceeded, thereby preventing packets from proliferating and degrading the LAN.



NOTE: On EX4300 switches, the factory default configuration enables storm control on all Layer 2 interfaces, with the storm control level set to 80 percent of the available bandwidth used by the applicable traffic streams on that interface.

This example shows how to configure storm control on an EX Series switch running Junos OS with ELS.

- [Requirements on page 12](#)
- [Overview and Topology on page 12](#)
- [Configuration on page 12](#)
- [Verification on page 13](#)

Requirements

This example uses the following hardware and software components:

- One EX Series switch running Junos OS with ELS
- Junos OS Release 13.2 or later for EX Series switches

Overview and Topology

A storm is generated when messages are broadcast on a network and each message prompts a receiving node to respond by broadcasting its own messages on the network. This, in turn, prompts further responses, creating a snowball effect and resulting in a broadcast storm that can cause network outages.

You can use storm control to prevent broadcast storms by specifying the amount, also known as the *storm control level*, of broadcast traffic, multicast traffic, and unknown unicast traffic to be allowed on an interface. You specify the storm control level as the traffic rate in kilobits per second (Kbps) of the combined applicable traffic streams or as the percentage of available bandwidth used by the combined applicable traffic streams.

Storm control monitors the level of applicable incoming traffic and compares it with the level that you specify. If the combined level of the applicable traffic exceeds the specified level, the switch drops packets for the controlled traffic types. As an alternative to having the switch drop packets, you can configure storm control to shut down interfaces or temporarily disable interfaces (see the [action-shutdown](#) statement or the [recovery-timeout](#) statement) when the storm control level is exceeded.

The topology used in this example consists of one switch connected to various network devices. This example shows how to configure the storm control level on interface ge-0/0/0 by setting the level to a traffic rate of 15,000 Kbps, based on the traffic rate of the combined applicable traffic streams. If the combined traffic exceeds this level, the switch drops packets for the controlled traffic types to prevent a network outage.

Configuration

CLI Quick Configuration	<p>To quickly configure storm control based on the traffic rate in Kbps of the combined traffic streams, copy the following command and paste it into the switch terminal window:</p> <pre>[edit] set forwarding-options storm-control-profiles sc all bandwidth-level 15000 set interfaces ge-0/0/0 unit 0 family ethernet-switching storm-control sc</pre>
Step-by-Step Procedure	<p>To configure storm control:</p> <ol style="list-style-type: none">1. Configure a storm control profile, sc, and specify the traffic rate in Kbps of the combined traffic streams: <pre>[edit] user@switch> set forwarding-options storm-control-profiles sc all bandwidth-level 15000</pre>2. Bind the storm control profile, sc, to a logical interface: <pre>[edit] user@switch> set interfaces ge-0/0/0 unit 0 family ethernet-switching storm-control sc</pre>

Results Display the results of the configuration:

```
[edit forwarding-options]
user@switch> show storm-control-profiles sc
all {
  bandwidth 15000;
}

[edit]
user@switch> show interfaces ge-0/0/0
unit 0 {
  family ethernet-switching {
    vlan {
      members default;
    }
  }
  storm-control sc;
}
}
```

Verification

Verifying That the Storm Control Configuration Is in Effect

Purpose Confirm that storm control is limiting the rate of traffic on the interface.

Action Use the **show interfaces ge-0/0/0 detail** operational mode command to view traffic statistics on the storm controlled interface. The input rate (bps) must not exceed the storm control limit.

```
user@switch> show interfaces ge-0/0/0 detail
Physical interface: ge-0/0/0, Enabled, Physical link is Up
  Interface index: 160, SNMP ifIndex: 503, Generation: 163
  Link-level type: Ethernet, MTU: 1514, Speed: Auto, Duplex: Auto,
  BPDU Error: None, MAC-REWRITE Error: None, Loopback: Disabled,
  Source filtering: Disabled, Flow control: Enabled, Auto-negotiation: Enabled,
  Remote fault: Online
  Device flags   : Present Running
  Interface flags: SNMP-Traps Internal: 0x0
  Link flags     : None
  CoS queues     : 8 supported, 8 maximum usable queues
  Hold-times     : Up 0 ms, Down 0 ms
  Current address: b0:c6:9a:67:90:84, Hardware address: b0:c6:9a:67:90:84
  Last flapped   : 2013-05-16 22:46:42 UTC (14w3d 03:13 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :          312742788          512 bps
    Output bytes  :          245552919           0 bps
    Input packets :          3550009          1 pps
    Output packets:          2622101           0 pps
  IPv6 transit statistics:
    Input bytes   :           0
    Output bytes  :           0
    Input packets :           0
    Output packets:           0
  Egress queues: 8 supported, 4 in use
  Queue counters:      Queued packets  Transmitted packets  Dropped packets

    0 best-effort              0              1              0
```

1	assured-forw	0	0	0
5	expedited-fo	0	0	0
7	network-cont	0	2622100	0

Queue number:	Mapped forwarding classes
0	best-effort
1	assured-forwarding
5	expedited-forwarding
7	network-control

Active alarms : None

Active defects : None

Interface transmit statistics: Disabled

Meaning The **Input bytes** field shows the ingress traffic rate in bytes per second (bps). The input rate is within the storm control limit of 15,000 Kbps.

- Related Documentation**
- [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)
 - [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 16](#)
 - [Understanding Storm Control on Switching Devices on page 3](#)

CHAPTER 4

Configuration Tasks

- [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 15](#)
- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 16](#)
- [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

Configuring Unknown Unicast Forwarding (CLI Procedure)



NOTE: This task uses Junos OS for EX Series switches or QFX Series with support for the Enhanced Layer 2 Software (ELS) configuration style. If your EX Series switch runs software that does not support ELS, see *Configuring Unknown Unicast Forwarding (CLI Procedure)*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*

Unknown unicast traffic consists of packets with unknown destination MAC addresses. By default, the switch floods these packets to all interfaces associated with a VLAN. Forwarding such traffic to interfaces on the switch can create a security issue.

To prevent flooding unknown unicast traffic across the switch, configure unknown unicast forwarding to direct all unknown unicast packets within a VLAN out to a specific interface. You can configure each VLAN to divert unknown unicast traffic to different interfaces or use one interface for multiple VLANs.

To configure unknown unicast forwarding options:

- Configure unknown unicast forwarding for a specific VLAN (here, the VLAN name is employee), and specify the interface to which all unknown unicast traffic will be forwarded:

```
[edit switch-options]
user@switch# set unknown-unicast-forwarding vlan vlan-name interface ge-x/y/z.0
```

Related Documentation

- [Verifying That Unknown Unicast Packets Are Forwarded to a Single Interface on page 45](#)
- [Understanding Unknown Unicast Forwarding on page 7](#)

Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure)



NOTE: This example uses Junos OS with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switching device is an EX Series switch and runs software that does not support ELS, see *Understanding Storm Control on EX Series Switches*. If your switching device is an EX Series switch and runs software that does support ELS, see *Getting Started with Enhanced Layer 2 Software*.

An Ethernet switching access interface on a switching device might shut down or be disabled as a result of one of the following port-security or storm-control configurations:

- MAC limiting—(Not supported for MX Series routers) The **mac-limit** statement is configured with the **action-shutdown** statement.
- MAC move limiting—(Not supported on EX9200 switches or MX Series routers) The **mac-move-limit** statement is configured with the **action-shutdown** statement.
- Storm control—The **storm-control** statement is configured with the **action-shutdown** statement.

You can configure the switching device to automatically restore the disabled interfaces to service after a specified period of time. The specified time configured in the **recovery-timeout** statement applies to all the interfaces that have been disabled due to MAC limiting, MAC move limiting, or storm control errors.



NOTE: To enable autorecovery, specify the recovery timeout value for the interfaces to recover automatically. There is no default recovery timeout. If you do not specify a timeout value, you need to use the [clear ethernet-switching recovery-timeout](#) command for EX Series switches and the [clear bridge recovery-timeout](#) command for MX Series routers to clear the errors and restore the interfaces to service.

To specify the recovery timeout period for the interface:

- Set the **recovery-timeout** statement.

For EX Series switches:

```
[edit interfaces interface-name family unit 0 ethernet-switching]
user@switch# set recovery-timeout seconds
```

For MX Series routers:

```
[edit interfaces interface-name family unit 0 bridge]
user@switch# set recovery-timeout seconds
```

**Related
Documentation**

- [Configuring MAC Limiting \(CLI Procedure\)](#)
- [Configuring MAC Move Limiting \(CLI Procedure\)](#)
- [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

Configuring or Disabling Storm Control (CLI Procedure)



NOTE: This task uses Junos OS with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switching device is an EX Series switch and runs software that does not support ELS, see *Understanding Storm Control on EX Series Switches*. If your switching device is an EX Series switch and runs software that does support ELS, see *Getting Started with Enhanced Layer 2 Software*.

On EX4300 switches, the factory default configuration enables storm control on all Layer 2 switch interfaces. The default storm control level is set to 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams.

Storm control is not enabled by default on EX9200 switches or MX Series routers.

You can customize the storm control level for a specific interface. You specify the storm control level as the traffic rate in kilobits per second (Kbps) of the combined traffic streams or as the percentage of available bandwidth used by the combined traffic streams.

You can selectively disable storm control for broadcast, multicast, or unknown unicast traffic on all interfaces or on a specified interface. You can additionally disable storm control on registered or unregistered multicast traffic.

This topic describes the following tasks. In these tasks, you use the **[edit interfaces *interface-name* unit 0 family ethernet-switching]** hierarchy level to bind the storm control profile for EX Series switches and the **[edit interfaces *interface-name* unit 0 family bridge]** hierarchy level to bind the storm control profile for MX Series routers.

- [Configuring Storm Control on page 18](#)
- [Disabling Storm Control on Broadcast Traffic on page 18](#)
- [Disabling Storm Control on All Multicast Traffic on page 19](#)
- [Disabling Storm Control on Registered Multicast Traffic on page 19](#)
- [Disabling Storm Control on Unregistered Multicast Traffic on page 19](#)
- [Disabling Storm Control on Unknown Unicast Traffic on page 20](#)
- [Disabling Storm Control on Multiple Types of Traffic on page 20](#)

Configuring Storm Control

You can configure storm control for a specific interface. The storm control level can be customized by explicitly configuring either the bandwidth level or the bandwidth percentage.

- **bandwidth-level**—Configures the storm control level as the bandwidth in kilobits per second of the combined traffic streams.
- **bandwidth-percentage**—Configures the storm control level as a percentage of the available bandwidth used by the combined traffic streams.

To configure storm control:

1. Create a storm control profile and set the storm control level as the traffic rate in kilobits per second of the combined traffic streams:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps
```

2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Disabling Storm Control on Broadcast Traffic

To disable storm control on broadcast traffic:

1. Create a storm control profile with the storm control level set as the traffic rate in kilobits per second of the combined traffic streams and exclude broadcast traffic:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps no-broadcast
```

2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Disabling Storm Control on All Multicast Traffic

To disable storm control on all multicast traffic:

1. Create a storm control profile with the storm control level set as the traffic rate in kilobits per second of the combined traffic streams but exclude multicast traffic:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps no-multicast
```
2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Disabling Storm Control on Registered Multicast Traffic

To disable storm control on only registered multicast traffic:

1. Create a storm control profile with the storm control level set as the traffic rate in kilobits per second of the combined traffic streams but exclude registered multicast traffic:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps
no-registered-multicast
```

2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Disabling Storm Control on Unregistered Multicast Traffic

To disable storm control on only unregistered multicast traffic:

1. Create a storm control profile with the storm control level set as the traffic rate in kilobits per second of the combined traffic streams but exclude unregistered multicast traffic:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps
no-unregistered-multicast
```

2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Disabling Storm Control on Unknown Unicast Traffic

To disable storm control on only unknown unicast traffic:

1. Create a storm control profile with the storm control level set as the traffic rate in kilobits per second of the combined traffic streams but exclude unregistered multicast traffic:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps
no-unknown-unicast
```

2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Disabling Storm Control on Multiple Types of Traffic

To disable storm control on broadcast and multicast traffic:

1. Create a storm control profile with the storm control level set as the traffic rate in kilobits per second of the combined traffic streams but exclude broadcast and multicast traffic:

```
[edit forwarding-options]
user@device# set storm-control-profiles profile-name all bandwidth-level kbps no-broadcast
no-multicast
```

2. Bind the storm control profile to a logical interface:

For EX Series switches:

```
[edit]
user@device# set interfaces interface-name unit 0 family ethernet-switching storm-control
profile-name
```

For MX Series routers:

```
[edit]
user@device# set interfaces interface-name unit 0 family bridge storm-control profile-name
```

Related Documentation

- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)
- [Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers](#)

- [Understanding Storm Control on Switching Devices on page 3](#)

CHAPTER 5

Configuration Statements

- [\[edit forwarding-options storm-control-profiles\]](#) Configuration Statement Hierarchy for EX Series Switches on page 23
- [\[edit switch-options\]](#) Configuration Statement Hierarchy on EX Series Switches on page 24
- [action-shutdown](#) on page 27
- [bandwidth-level](#) on page 29
- [bandwidth-percentage](#) on page 30
- [interface \(Unknown Unicast Forwarding\)](#) on page 31
- [no-broadcast](#) on page 32
- [no-multicast](#) on page 34
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- [no-unknown-unicast](#) on page 36
- [no-unregistered-multicast](#) on page 38
- [recovery-timeout](#) on page 39
- [storm-control](#) on page 40
- [storm-control-profiles](#) on page 41
- [unknown-unicast-forwarding](#) on page 42

[\[edit forwarding-options storm-control-profiles\]](#) Configuration Statement Hierarchy for EX Series Switches

This topic lists supported and unsupported configuration statements in the **[edit forwarding-options storm-control-profiles]** hierarchy level on EX Series switches.

- *Supported* statements are those that you can use to configure some aspect of a software feature on the switch.
- *Unsupported* statements are those that appear in the command-line interface (CLI) on the switch, but that have no effect on switch operation if you configure them.
- Not all features are supported on all switch platforms. For detailed information about feature support on specific EX Series switch platforms, see [Feature Explorer](#).

This topic lists:

- [Supported Statements in the \[edit forwarding-options storm-control-profiles\] Hierarchy Level on page 24](#)
- [Unsupported Statements in the \[edit forwarding-options storm-control-profiles\] Hierarchy Level on page 24](#)

Supported Statements in the [edit forwarding-options storm-control-profiles] Hierarchy Level

The following hierarchy shows the **[edit forwarding-options storm-control-profiles]** configuration statements supported on EX Series switches:

```
forwarding-options {
  storm-control-profiles profile-name{
    action-shutdown;
    all {
      bandwidth-level bandwidth-level;
      bandwidth-percentage bandwidth-percentage;
      no-broadcast;
      no-multicast;
      no-registered-multicast;
      no-unknown-unicast;
      no-unregistered-multicast;
    }
  }
}
```

Unsupported Statements in the [edit forwarding-options storm-control-profiles] Hierarchy Level

All statements in the **[edit forwarding-options storm-control-profiles]** hierarchy level that are displayed in the command-line interface (CLI) on the switch are supported on the switch and operate as documented.

Related Documentation

- [Notational Conventions Used in Junos OS Configuration Hierarchies](#)
- [\[edit forwarding-options\] Configuration Statement Hierarchy on EX Series Switches](#)

[edit switch-options] Configuration Statement Hierarchy on EX Series Switches

This topic lists supported and unsupported configuration statements in the **[edit switch-options]** hierarchy level on EX Series switches.

- *Supported* statements are those that you can use to configure some aspect of a software feature on the switch.
- *Unsupported* statements are those that appear in the command-line interface (CLI) on the switch, but that have no effect on switch operation if you configure them.
- Not all features are supported on all switch platforms. For detailed information about feature support on specific EX Series switch platforms, see *EX Series Switch Software Features Overview*.

This topic lists:

- [Supported Statements in the \[edit switch-options\] Hierarchy Level on page 25](#)
- [Unsupported Statements in the \[edit switch-options\] Hierarchy Level on page 25](#)

Supported Statements in the [edit switch-options] Hierarchy Level

The following hierarchy shows the **[edit switch-options]** configuration statements supported on EX Series switches:

```
switch-options {
  authentication-whitelist mac-address {
    interface interface-name;
    vlan-assignment (vlan-id | vlan-name);
  }
  interface interface-name {
    interface-mac-limit number {
      packet-action action;
    }
    no-mac-learning;
    persistent-learning
  }
  no-mac-learning;
  redundant-trunk-group {
    group name {
      description text;
      interface interface-name {
        primary;
      }
      preempt-cutover-timer seconds
    }
  }
  unknown-unicast-forwarding {
    vlan (all | vlan-name | vlan-tag) {
      interface interface-name;
    }
  }
  voip {
    interface (all | [interface-name | access-ports]) {
      forwarding-class (assured-forwarding | best-effort | expedited-forwarding | mcast-af
        | mcast-be | mcast-ef | mcast-nc | network-control);
      vlan vlan-name;
    }
  }
}
```

Unsupported Statements in the [edit switch-options] Hierarchy Level

All statements in the **[edit switch-options]** hierarchy level that are displayed in the command-line interface (CLI) on the switch are supported on the switch and operate as documented with the following exceptions:

Table 3: Unsupported [edit switch-options] Configuration Statements on EX Series Switches

Statement	Hierarchy Level
NOTE: Variables, such as <i>filename</i> , are not shown in the statements or hierarchies.	
port-error-disable	[edit switch-options]
disable-timeout	[edit switch-options port-error-disable]


action-shutdown

Syntax	action-shutdown;
Hierarchy Level	<ul style="list-style-type: none"> For platforms with Enhanced Layer 2 Software (ELS) (EX Series switches and MX Series routers): [edit forwarding-options storm-control-profiles <i>profile-name</i>] For platforms without ELS: [edit ethernet-switching-options storm-control]
Release Information	<p>Statement introduced in Junos OS Release 9.6 for EX Series switches.</p> <p>Hierarchy level [edit forwarding-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	<p>Shut down or temporarily disable interfaces when the storm control level is exceeded, as follows:</p> <ul style="list-style-type: none"> If you set both the action-shutdown and the port-error-disable statements, the interfaces are disabled temporarily and recover automatically when the disable timeout expires. (The port-error-disable statement is not available for MX Series routers.) If you set both the action-shutdown and the recovery-timeout statements, the interfaces are disabled temporarily and recover automatically when the recovery timeout expires. If you set the action-shutdown statement and do not specify the port-error-disable statement (the port-error-disable statement is not available for MX Series routers), the interfaces that are enabled for storm control are shut down when the storm control level is exceeded and they do not recover automatically from that port-error condition. You must issue the clear ethernet-switching port-error command to clear the port error and restore the interfaces to service. (The clear ethernet-switching port-error command is not available for MX Series routers.) If you set the action-shutdown statement and do not specify the recovery-timeout statement, the interfaces that are enabled for storm control are shut down when the storm control level is exceeded and they do not recover automatically from that port-error condition. For EX Series switches you must issue the clear ethernet-switching recovery-timeout command and for MX Series routers you must issue the clear bridge recovery-timeout command to clear the port error and restore the interfaces to service.
Default	The action-shutdown option is not enabled by default. The switching device drops packets for the controlled traffic types if the ingress rate of the combined traffic streams exceeds the specified storm control level. Depending upon the configuration, applicable traffic could include broadcast, unknown unicast, and multicast traffic.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>


**Related
Documentation**

- *port-error-disable*
- *disable-timeout*
- [recovery-timeout on page 39](#)
- *clear ethernet-switching port-error*
- *clear bridge recovery-timeout*
- [clear ethernet-switching recovery-timeout on page 48](#)
- *Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches*
- *Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers*
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)
- *Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure)*
- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 16](#)

bandwidth-level

Syntax	<code>bandwidth-level <i>kbps</i>;</code>
Hierarchy Level	[edit forwarding-options storm-control-profiles <i>profile-name</i> all]
Release Information	Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Statement introduced in Junos OS Release 13.2 for the QFX Series. Statement introduced in Junos OS Release 14.1 for MX Series routers.
Description	Configure the storm control level as the bandwidth in kilobits per second of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams.
<div>  <p>NOTE: When you configure storm control level on an aggregated Ethernet interface, the storm control level for each member of the aggregated Ethernet interface is set to that bandwidth. For example, if you configure a storm control level of 15,000 Kbps on ae1, and ae1 has two members, ge-0/0/0 and ge-0/0/1, each member has a storm control level of 15,000 Kbps. Thus, the storm control level on ae1 allows a traffic rate of up to 30,000 Kbps of combined broadcast, multicast, and unknown unicast traffic.</p> </div>	
Default	<p>On EX4300 switches—If you do not specify the storm control level using either the bandwidth-level or the bandwidth-percentage statements, the storm control level defaults to 80 percent of the available bandwidth used by the combined broadcast, unknown unicast, and multicast traffic streams.</p> <p>On EX9200 switches—Storm control is not enabled by default.</p> <p>On MX Series routers—Storm control is not enabled by default.</p>
Options	<p>bandwidth-level <i>kbps</i>—Traffic rate in kilobits per second of the combined broadcast, multicast, and unknown unicast traffic streams.</p> <p>Range: 100 through 10,000,000</p> <p>Default: None</p>
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • bandwidth-percentage on page 30 • Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11 • Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers • Configuring or Disabling Storm Control (CLI Procedure) on page 17

bandwidth-percentage

Syntax	<code>bandwidth-percentage <i>percentage</i>;</code>
Hierarchy Level	[edit forwarding-options storm-control-profiles <i>profile-name</i> all]
Release Information	Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Statement introduced in Junos OS Release 13.2 for the QFX series. Statement introduced in Junos OS Release 14.1 for MX Series routers.
Description	Configure the storm control level as the percentage of available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams on an interface. The storm control level is configured as part of the storm control profile.
<hr/>	
<div> NOTE: When you configure storm control level on an aggregated Ethernet interface, the storm control level for each member of the aggregated Ethernet interface is set to that bandwidth. For example, if you configure a storm control level of 15,000 Kbps on ae1, and ae1 has two members, ge-0/0/0 and ge-0/0/1, each member has a storm control level of 15,000 Kbps. Thus, the storm control level on ae1 allows a traffic rate of up to 30,000 Kbps of combined broadcast, multicast, and unknown unicast traffic.</div> <hr/>	
Default	On EX4300 switches—The storm control level is 80 percent of the available bandwidth used by the combined broadcast, unknown unicast, and multicast traffic streams. On EX9200 switches—Storm control is not enabled by default. On MX Series routers—Storm control is not enabled by default.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• bandwidth-level on page 29• Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11• Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers• Configuring or Disabling Storm Control (CLI Procedure) on page 17

interface (Unknown Unicast Forwarding)

Syntax	<code>interface <i>interface-name</i>;</code>
Hierarchy Level	<ul style="list-style-type: none"> For platforms with ELS: [edit switch-options unknown-unicast-forwarding vlan <i>vlan-name</i>] For platforms without ELS: [edit ethernet-switching-options unknown-unicast-forwarding vlan <i>vlan-name</i>]
Release Information	<p>Statement introduced in Junos OS Release 9.3 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p> <p>Hierarchy level [edit switch-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p>
Description	Specify the interface to which unknown unicast packets will be forwarded.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> <code>show vlans</code> show ethernet-switching table on page 51 Configuring Unknown Unicast Forwarding (CLI Procedure) Understanding Unknown Unicast Forwarding on page 7

no-broadcast

Syntax	no-broadcast;
Hierarchy Level	<ul style="list-style-type: none">For platforms with Enhanced Layer 2 Software (ELS) (EX Series switches and MX Series routers): [edit forwarding-options storm-control-profiles <i>profile-name</i> all]For platforms without ELS: [edit ethernet-switching-options storm-control interface (all <i>interface-name</i>)]
Release Information	<p>Statement introduced in Junos OS Release 9.1 for EX Series switches.</p> <p>Hierarchy level [edit forwarding-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	Disable storm control for broadcast traffic for the specified interface or for all interfaces.
Default	<ul style="list-style-type: none">On EX2200, EX3200, EX3300, and EX4200 switches—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined unknown unicast and broadcast traffic streams. You can selectively disable storm control on broadcast, multicast, or unknown-unicast traffic.On EX4300 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams. You can selectively disable storm control on any type of traffic.On EX4500 and EX8200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams. On EX8200 switches, you can selectively disable storm control on registered multicast traffic, on unregistered multicast traffic, or on both types of multicast traffic.On EX6200 switches—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined unknown unicast and broadcast traffic streams. You can selectively disable storm control for each type of traffic individually.On EX9200 switches—Storm control is not enabled by default.On MX Series routers—Storm control is not enabled by default.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

**Related
Documentation**

- *Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches*
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)
- *Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers*
- *Disabling or Enabling Storm Control (CLI Procedure)*
- [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

no-multicast

Syntax	no-multicast;
Hierarchy Level	<ul style="list-style-type: none">For platforms with Enhanced Layer 2 Software (ELS) (EX Series switches and MX Series routers): [edit forwarding-options storm-control-profiles <i>profile-name</i> all]For platforms without ELS: [edit ethernet-switching-options storm-control interface (all <i>interface-name</i>)]
Release Information	<p>Statement introduced in Junos OS Release 10.3 for EX Series switches.</p> <p>Hierarchy level [edit forwarding-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	Disable storm control for all multicast traffic (both registered multicast and unregistered multicast) for the specified interface or for all interfaces.
Default	<ul style="list-style-type: none">On EX2200, EX3200, EX3300, and EX4200 switches—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined unknown unicast and broadcast traffic streams.On EX4300 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams. You can selectively disable storm control on any type of traffic.On EX4500 and EX8200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams. On EX8200 switches, you can selectively disable storm control on registered multicast traffic, on unregistered multicast traffic, or on both types of multicast traffic.On EX6200 switches—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined unknown unicast and broadcast traffic streams. You can selectively disable storm control for each type of traffic individually.On EX9200 switches—Storm control is not enabled by default.On MX Series routers—Storm control is not enabled by default.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

- Related Documentation**
- [no-registered-multicast on page 35](#)
 - [no-unregistered-multicast on page 38](#)
 - *Disabling or Enabling Storm Control (CLI Procedure)*
 - [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

no-registered-multicast

Syntax	no-registered-multicast;
Hierarchy Level	<ul style="list-style-type: none"> • For platforms with Enhanced Layer 2 Software (ELS) (EX Series switches and MX Series routers): [edit forwarding-options storm-control-profiles <i>profile-name</i> all] • For platforms without ELS: [edit ethernet-switching-options storm-control interface (all <i>interface-name</i>)]
Release Information	<p>Statement introduced in Junos OS Release 10.3 for EX Series switches.</p> <p>Hierarchy level [edit forwarding-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX series.</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	<p>(EX8200 switches only) Disable storm control for registered multicast traffic for the specified interface or for all interfaces.</p> <p>(EX4300 and EX9200 switches only) Exclude storm control for registered multicast traffic from a storm control profile.</p> <p>(MX Series routers only) Exclude storm control for registered multicast traffic from a storm control profile.</p>
Default	<p>EX4300 and EX8200 switches—Storm control is enabled for unknown unicast traffic, multicast traffic, and broadcast traffic. The default storm control level is 80 percent of the available bandwidth used by the combined applicable traffic streams.</p> <p>EX9200 switches—Storm control is not enabled by default.</p> <p>MX Series routers—Storm control is not enabled by default.</p>
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • no-multicast on page 34 • no-unregistered-multicast on page 38 • <i>Understanding Storm Control on EX Series Switches</i> • Understanding Storm Control on Switching Devices on page 3

no-unknown-unicast

Syntax	no-unknown-unicast;
Hierarchy Level	<ul style="list-style-type: none">For platforms with Enhanced Layer 2 Software (ELS) (EX Series switches and MX Series routers): <code>[edit forwarding-options storm-control-profiles profile-name all]</code>For platforms without ELS: <code>[edit ethernet-switching-options storm-control interface (all interface-name)]</code>
Release Information	<p>Statement introduced in Junos OS Release 9.1 for EX Series switches.</p> <p>Hierarchy level <code>[edit forwarding-options]</code> introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	Disable storm control for unknown unicast traffic for the specified interface or for all interfaces.
Default	<ul style="list-style-type: none">On EX2200, EX3200, EX3300, and EX4200 switches—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined unknown unicast and broadcast traffic streams. You can selectively disable storm control on broadcast, multicast, or unknown-unicast traffic.On EX4300 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams. You can selectively disable storm control on any type of traffic.On EX4500 and EX8200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined broadcast, multicast, and unknown unicast traffic streams. On EX8200 switches, you can selectively disable storm control on registered multicast traffic, on unregistered multicast traffic, or on both types of multicast traffic.On EX6200 switches—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control on all interfaces at 80 percent of the available bandwidth used by the combined unknown unicast and broadcast traffic streams. You can selectively disable storm control for each type of traffic individually.On EX9200 switches—Storm control is not enabled by default.MX Series routers—Storm control is not enabled by default.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>


**Related
Documentation**

- *Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches*
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11](#)
- *Example: Configuring Storm Control to Prevent Network Outages on MX Series Routers*
- *Disabling or Enabling Storm Control (CLI Procedure)*
- [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

no-unregistered-multicast

Syntax	no-unregistered-multicast;
Hierarchy Level	<ul style="list-style-type: none">For platforms with Enhanced Layer 2 Software (ELS) (EX Series switches and MX Series routers): [edit forwarding-options storm-control-profiles <i>profile-name</i> all]For platforms without ELS: [edit ethernet-switching-options storm-control interface (all <i>interface-name</i>)],
Release Information	<p>Statement introduced in Junos OS Release 10.3 for EX Series switches.</p> <p>Hierarchy level [edit forwarding-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX series.</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	<p>(EX8200 switches only) Disable storm control for unregistered multicast traffic for the specified interface or for all interfaces.</p> <p>(EX4300 and EX9200 switches only) Exclude storm control for unregistered multicast traffic from a storm control profile.</p> <p>(MX Series routers) Exclude storm control for unregistered multicast traffic from a storm control profile.</p>
Default	<p>EX4300 and EX8200 switches—Storm control is enabled for unknown unicast traffic, multicast traffic, and broadcast traffic. The default storm control level is 80 percent of the available bandwidth used by the combined applicable traffic streams.</p> <p>EX9200 switches—Storm control is not enabled by default.</p> <p>MX Series routers—Storm control is not enabled by default.</p>
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">no-multicast on page 34no-registered-multicast on page 35Understanding Storm Control on EX Series SwitchesUnderstanding Storm Control on Switching Devices on page 3

recovery-timeout

Syntax	<code>recovery-timeout seconds;</code>
Hierarchy Level (EX Series and QFX Series)	[edit interfaces <i>interface-name</i> unit 0 family ethernet-switching]
Hierarchy Level (MX Series)	[edit interfaces <i>interface-name</i> unit 0 family bridge]
Release Information	Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Statement introduced in Junos OS Release 13.2 for the QFX Series. Statement introduced in Junos OS Release 14.1 for the MX Series routers.
Description	<p>Disable rather than block an interface when enforcing MAC limiting, MAC move limiting, or rate-limiting configuration options for shutting down the interface, and allow the interface to recover automatically from the error condition after the specified period of time:</p> <ul style="list-style-type: none"> • If you have enabled MAC limiting with the shutdown option and you enable recovery-timeout, the switch disables (rather than shuts down) the interface when the MAC address limit is reached. • If you have enabled MAC move limiting (not supported on EX9200) with the shutdown option and you enable recovery-timeout, the switch disables (rather than shuts down) the interface when the maximum number of moves to a new interface is reached. • If you have enabled storm control with the action-shutdown option and you enable recovery-timeout, the switch disables (rather than shuts down) the interface when applicable traffic exceeds the specified levels. Depending upon the configuration, applicable traffic could include broadcast, unknown unicast, and multicast traffic.
	<p> NOTE: The recovery-timeout configuration does not apply to pre-existing error conditions. It impacts only error conditions that are detected after the recovery-timeout statement has been enabled and committed. To clear a pre-existing error condition and restore the interface to service, use the operational mode command clear ethernet-switching recovery-timeout for EX Series and QFX Series and clear bridge recovery-timeout for MX Series routers.</p>
Default	Not enabled.
Options	<p>seconds— Number of seconds that the interface remains in a disabled state due to a port error prior to automatic recovery.</p> <p>Range: 10 through 3600</p>
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

- Related Documentation**
- [action-shutdown on page 27](#)
 - [Configuring MAC Limiting \(CLI Procedure\)](#)
 - [Configuring MAC Move Limiting \(CLI Procedure\)](#)
 - [Configuring or Disabling Storm Control \(CLI Procedure\) on page 17](#)

storm-control

Syntax	<code>storm-control storm-control-profile;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>number</i> family ethernet-switching], [edit interfaces <i>interface-name</i> unit <i>number</i> family bridge]
Release Information	Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Statement introduced in Junos OS Release 13.2 for the QFX series. Statement introduced in Junos OS Release 14.1 for the MX Series routers.
Description	<p>Bind a storm control profile to a logical interface.</p> <p>On switches running ELS software, storm control is enabled by default on all switch interfaces at a level of 80 percent of the combined broadcast and unknown unicast streams. (For the equivalent statement for platforms running non-ELS software, see <i>storm-control</i>.)</p>
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11• Understanding Storm Control on Switching Devices on page 3

storm-control-profiles

Syntax	<pre>storm-control-profiles <i>profile-name</i> { action-shutdown; all { bandwidth-level; bandwidth-percentage; no-broadcast; no-multicast; no-registered-multicast; no-unknown-unicast; no-unregistered-multicast; } }</pre>
Hierarchy Level	[edit forwarding-options]
Release Information	<p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 14.1 for MX Series routers.</p>
Description	<p>Configure a storm control profile on a switch or router.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 11 • Understanding Storm Control on Switching Devices on page 3

unknown-unicast-forwarding

Syntax	<pre>unknown-unicast-forwarding { vlan <i>vlan-name</i> { interface <i>interface-name</i>; } }</pre>
Hierarchy Level	<ul style="list-style-type: none">For platforms with ELS: [edit switch-options on page 24]For platforms without ELS: [edit ethernet-switching-options]
Release Information	<p>Statement introduced in Junos OS Release 9.3 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p> <p>Hierarchy level [edit switch-options] introduced in Junos OS Release 13.2X50-D10. (See <i>Getting Started with Enhanced Layer 2 Software</i> for information about ELS.)</p>
Description	<p>Configure the switch to forward all unknown unicast packets in a VLAN or on all VLANs to a particular interface.</p> <p>The remaining statements are explained separately.</p>
Default	Unknown unicast packets are flooded to all interfaces that belong to the same VLAN.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">show vlansshow ethernet-switching table on page 51Configuring Unknown Unicast Forwarding (CLI Procedure)Configuring Unknown Unicast Forwarding (CLI Procedure) on page 15Understanding Unknown Unicast Forwarding on page 7

PART 3

Administration

- [Routine Monitoring on page 45](#)
- [Operational Commands on page 47](#)

Routine Monitoring

- [Verifying That Unknown Unicast Packets Are Forwarded to a Single Interface on page 45](#)

Verifying That Unknown Unicast Packets Are Forwarded to a Single Interface

Purpose Verify that a VLAN is forwarding all unknown unicast packets (those with unknown destination MAC addresses) to a single interface instead of flooding unknown unicast packets across all interfaces that are members of the same VLAN.



NOTE: This example uses Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, See: *Verifying That Unknown Unicast Packets Are Forwarded to a Trunk Interface*. For ELS details see: *Getting Started with Enhanced Layer 2 Software*.

Action Display the forwarding interface for unknown unicast packets for a VLAN (here, the VLAN name is v1):

```
user@switch> show configuration switch-options
```

```
unknown-unicast-forwarding {
  vlan v1 {
    interface ge-0/0/7.0;
  }
}
```

Meaning The sample output from the **show configuration switch-options** command shows that the unknown unicast forwarding interface for VLAN v1 is interface ge-0/0/7. The **show ethernet-switching table** command shows that an unknown unicast packet is received on interface ge-0/0/3 with the destination MAC address (DMAC) 00:01:09:00:00:00 and the source MAC address (SMAC) of 00:11:09:00:01:00. This shows that the SMAC of the packet is learned in the normal way (through the interface ge-0/0/3.0), while the DMAC is learned on interface ge-0/0/7.

Related Documentation • [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 15](#)

CHAPTER 7


Operational Commands

- `clear ethernet-switching recovery-timeout`
- `clear ethernet-switching table`
- `show ethernet-switching table`

clear ethernet-switching recovery-timeout

Syntax	clear ethernet-switching recovery-timeout
Release Information	Command introduced in Junos OS Release 13.2X50-D10 for EX Series switches.
Description	Clear all MAC limiting, MAC move limiting, and storm control errors from all the Ethernet switching interfaces on the switch, and restore the interfaces to service.
Options	none —Clear all MAC limiting, MAC move limiting, and storm control errors from all the Ethernet switching interfaces on the switch and restore these interfaces to service.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure) on page 16
Output Fields	This command produces no output.

clear ethernet-switching table

Syntax	clear ethernet-switching table <interface <i>interface-name</i> > <mac <i>mac-address</i> > <management-vlan> <persistent-mac < <i>interface</i> <i>mac-address</i> >> <vlan <i>vlan-name</i> >
Syntax (QFX Series)	clear ethernet-switching table <interface <i>interface-name</i> > <mac <i>mac-address</i> > <persistent-mac < <i>interface</i> <i>mac-address</i> >> <vlan <i>vlan-name</i> >
Release Information	Command introduced in Junos OS Release 9.3 for EX Series switches. Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	<div>  <p>NOTE: On a QFabric system, using this command on an FCoE-enabled VLAN when FCoE sessions are active can cause traffic flooding and FCoE traffic drop. The FCoE sessions are not terminated and the traffic reconverges after a short period of time.</p> </div> <p>Clear learned entries, which are media access control (MAC) addresses, in the Ethernet switching table (also called the forwarding database table).</p>
Options	<p>none—Clear learned entries in the Ethernet switching table, except for persistent MAC addresses.</p> <p>interface <i>interface-name</i>—(Optional) Clear all learned MAC addresses for the specified interface from the Ethernet switching table.</p> <p>mac <i>mac-address</i>—(Optional) Clear the specified learned MAC address from the Ethernet switching table.</p> <p>management-vlan—(Optional) Clear all MAC addresses learned for the management VLAN from the Ethernet switching table. Note that you do not specify a VLAN name because only one management VLAN exists.</p> <p>persistent-mac <<i>interface</i> <i>mac-address</i>>—(Optional) Clear all MAC addresses, including persistent MAC addresses. Use the interface option to clear all MAC addresses on an interface, or use the mac-address option to clear all entries for a specific MAC address.</p> <p>Use this command whenever you move a device in your network that has a persistent MAC address on the switch. If you move the device to another port on the switch and do not clear the persistent MAC address from the original port it was learned on, then the new port will not learn the MAC address and the device will not be able to connect. If the original port is down when you move the device, then the new port</p>

will learn the MAC address and the device can connect—however, unless you cleared the MAC address on the original port, when the port comes back up, the system reinstalls the persistent MAC address in the forwarding table for that port. If this occurs, the address is removed from the new port and the device loses connectivity.

vlan *vlan-name*—(Optional) Clear all MAC addresses learned for the specified VLAN from the Ethernet switching table.

Required Privilege Level

view

Related Documentation

- [show ethernet-switching table on page 51](#)
- *show ethernet-switching table*
- *Verifying That Persistent MAC Learning Is Working Correctly*

List of Sample Output [clear ethernet-switching table on page 50](#)


Output Fields This command produces no output.

Sample Output

[clear ethernet-switching table](#)

```
user@switch> clear ethernet-switching table
```

show ethernet-switching table

Syntax	<pre>show ethernet-switching table <brief detail extensive summary> <interface <i>interface-name</i>> <management-vlan> <persistent-mac <interface <i>interface-name</i>>> <sort-by (<i>name</i> <i>tag</i>)> <vlan <i>vlan-name</i>></pre>
Release Information	<p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Options summary, management-vlan, and vlan <i>vlan-name</i> introduced in Junos OS Release 9.6 for EX Series switches.</p> <p>Option sort-by and field name tag introduced in Junos OS Release 10.1 for EX Series switches.</p> <p>Option persistent-mac introduced in Junos OS Release 11.4 for EX Series switches.</p>
Description	<p> NOTE: If your EX Series switch CLI displays different options for the show ethernet-switching table command than the options shown in this document, see <i>show ethernet-switching table</i>.</p> <p>Display the Ethernet switching table.</p>
Options	<p>none—(Optional) Display brief information about the Ethernet switching table.</p> <p>brief detail extensive summary—(Optional) Display the specified level of output.</p> <p>interface <i>interface-name</i>—(Optional) Display the Ethernet switching table for a specific interface.</p> <p>management-vlan—(Optional) Display the Ethernet switching table for a management VLAN.</p> <p>persistent-mac <interface <i>interface-name</i>>—(Optional) Display the persistent MAC addresses learned for all interfaces or a specified interface. You can use this command to view entries that you want to clear for an interface that you intentionally disabled.</p> <p>sort-by (<i>name</i> <i>tag</i>)—(Optional) Display VLANs in ascending order of VLAN IDs or VLAN names.</p> <p>vlan <i>vlan-name</i>—(Optional) Display the Ethernet switching table for a specific VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear ethernet-switching table on page 49 • <i>Example: Setting Up Basic Bridging and a VLAN for an EX Series Switch</i>

- *Example: Setting Up Bridging with Multiple VLANs for EX Series Switches*
- *Example: Setting Up Q-in-Q Tunneling on EX Series Switches*

List of Sample Output [show ethernet-switching table on page 53](#)
[show ethernet-switching table brief on page 53](#)
[show ethernet-switching table detail on page 54](#)
[show ethernet-switching table extensive on page 54](#)
[show ethernet-switching table persistent-mac on page 55](#)
[show ethernet-switching table persistent-mac interface ge-0/0/16.0 on page 55](#)

Output Fields [Table 4 on page 52](#) lists the output fields for the **show ethernet-switching table** command. Output fields are listed in the approximate order in which they appear.

Table 4: show ethernet-switching table Output Fields

Field Name	Field Description	Level of Output
VLAN	The name of a VLAN.	All levels
Tag	The VLAN ID tag name or number.	extensive
MAC or MAC address	The MAC address associated with the VLAN.	All levels
Type	The type of MAC address. Values are: <ul style="list-style-type: none"> • static—The MAC address is manually created. • learn—The MAC address is learned dynamically from a packet's source MAC address. • flood—The MAC address is unknown and flooded to all members. • persistent—The learned MAC addresses that will persist across restarts of the switch or interface-down events. 	All levels except persistent-mac
Type	The type of MAC address. Values are: <ul style="list-style-type: none"> • installed—addresses that are in the Ethernet switching table. • uninstalled—addresses that could not be installed in the table or were uninstalled in an interface-down event and will be reinstalled in the table when the interface comes back up. 	persistent-mac
Age	The time remaining before the entry ages out and is removed from the Ethernet switching table.	All levels
Interfaces	Interface associated with learned MAC addresses or All-members (flood entry).	All levels
Learned	For learned entries, the time which the entry was added to the Ethernet switching table.	detail, extensive
Nexthop index	The next-hop index number.	detail, extensive

Table 4: show ethernet-switching table Output Fields (*continued*)

Field Name	Field Description	Level of Output
persistent-mac	installed indicates MAC addresses that are in the Ethernet switching table and uninstalled indicates MAC addresses that could not be installed in the table or were uninstalled in an interface-down event (and will be reinstalled in the table when the interface comes back up).	

Sample Output

show ethernet-switching table

```

user@switch> show ethernet-switching table
Ethernet-switching table: 57 entries, 15 learned, 2 persistent
VLAN      MAC address      Type      Age Interfaces
F2         *                Flood     - All-members
F2         00:00:05:00:00:03 Learn     0 ge-0/0/44.0
F2         00:19:e2:50:7d:e0 Static    - Router
Linux      *                Flood     - All-members
Linux      00:19:e2:50:7d:e0 Static    - Router
Linux      00:30:48:90:54:89 Learn     0 ge-0/0/47.0
T1         *                Flood     - All-members
T1         00:00:05:00:00:01 Persistent 0 ge-0/0/46.0
T1         00:00:5e:00:01:00 Static    - Router
T1         00:19:e2:50:63:e0 Persistent 0 ge-0/0/46.0
T1         00:19:e2:50:7d:e0 Static    - Router
T10        *                Flood     - All-members
T10        00:00:5e:00:01:09 Static    - Router
T10        00:19:e2:50:63:e0 Learn     0 ge-0/0/46.0
T10        00:19:e2:50:7d:e0 Static    - Router
T111       *                Flood     - All-members
T111       00:19:e2:50:63:e0 Learn     0 ge-0/0/15.0
T111       00:19:e2:50:7d:e0 Static    - Router
T111       00:19:e2:50:ac:00 Learn     0 ge-0/0/15.0
T2         *                Flood     - All-members
T2         00:00:5e:00:01:01 Static    - Router
T2         00:19:e2:50:63:e0 Learn     0 ge-0/0/46.0
T2         00:19:e2:50:7d:e0 Static    - Router
T3         *                Flood     - All-members
T3         00:00:5e:00:01:02 Static    - Router
T3         00:19:e2:50:63:e0 Learn     0 ge-0/0/46.0
T3         00:19:e2:50:7d:e0 Static    - Router
T4         *                Flood     - All-members
T4         00:00:5e:00:01:03 Static    - Router
T4         00:19:e2:50:63:e0 Learn     0 ge-0/0/46.0
[output truncated]

```

show ethernet-switching table brief

```

user@switch> show ethernet-switching table brief
Ethernet-switching table: 57 entries, 15 learned, 2 persistent entries
VLAN      MAC address      Type      Age Interfaces
F2         *                Flood     - All-members
F2         00:00:05:00:00:03 Learn     0 ge-0/0/44.0
F2         00:19:e2:50:7d:e0 Static    - Router
Linux      *                Flood     - All-members
Linux      00:19:e2:50:7d:e0 Static    - Router
Linux      00:30:48:90:54:89 Learn     0 ge-0/0/47.0
T1         *                Flood     - All-members

```

```

T1          00:00:05:00:00:01 Persistent 0 ge-0/0/46.0
T1          00:00:5e:00:01:00 Static      - Router
T1          00:19:e2:50:63:e0 Persistent 0 ge-0/0/46.0
T1          00:19:e2:50:7d:e0 Static      - Router
T10         *                          Flood - All-members
T10         00:00:5e:00:01:09 Static      - Router
T10         00:19:e2:50:63:e0 Learn      0 ge-0/0/46.0
T10         00:19:e2:50:7d:e0 Static      - Router
T111        *                          Flood - All-members
T111        00:19:e2:50:63:e0 Learn      0 ge-0/0/15.0
T111        00:19:e2:50:7d:e0 Static      - Router
T111        00:19:e2:50:ac:00 Learn      0 ge-0/0/15.0
T2          *                          Flood - All-members
T2          00:00:5e:00:01:01 Static      - Router
T2          00:19:e2:50:63:e0 Learn      0 ge-0/0/46.0
T2          00:19:e2:50:7d:e0 Static      - Router
T3          *                          Flood - All-members
T3          00:00:5e:00:01:02 Static      - Router
T3          00:19:e2:50:63:e0 Learn      0 ge-0/0/46.0
T3          00:19:e2:50:7d:e0 Static      - Router
T4          *                          Flood - All-members
T4          00:00:5e:00:01:03 Static      - Router
T4          00:19:e2:50:63:e0 Learn      0 ge-0/0/46.0
[output truncated]

```

show ethernet-switching table detail

```

user@switch> show ethernet-switching table detail
Ethernet-switching table: 5 entries, 2 learned entries
VLAN: default, Tag: 0, MAC: *, Interface: All-members
  Interfaces:
    ge-0/0/11.0, ge-0/0/20.0, ge-0/0/30.0, ge-0/0/36.0, ge-0/0/3.0
  Type: Flood
  Nexthop index: 1307

VLAN: default, Tag: 0, MAC: 00:1f:12:30:b8:83, Interface: ge-0/0/3.0
  Type: Learn, Age: 0, Learned: 20:09:26
  Nexthop index: 1315

VLAN: v1, Tag: 101, MAC: *, Interface: All-members
  Interfaces:
    ge-0/0/31.0
  Type: Flood
  Nexthop index: 1313

VLAN: v1, Tag: 101, MAC: 00:1f:12:30:b8:89, Interface: ge-0/0/31.0
  Type: Learn, Age: 0, Learned: 20:09:25
  Nexthop index: 1312

VLAN: v2, Tag: 102, MAC: *, Interface: All-members
  Interfaces:
    ae0.0
  Type: Flood
  Nexthop index: 1317

```

show ethernet-switching table extensive

```

user@switch> show ethernet-switching table extensive
Ethernet-switching table: 3 entries, 1 learned, 5 persistent entries

VLAN: v1, Tag: 10, MAC: *, Interface: All-members

```

```

Interfaces:
    ge-0/0/14.0, ge-0/0/1.0, ge-0/0/2.0, ge-0/0/3.0, ge-0/0/4.0,
    ge-0/0/5.0, ge-0/0/6.0, ge-0/0/7.0, ge-0/0/8.0, ge-0/0/10.0,
    ge-0/0/0.0
Type: Flood
Nexthop index: 567

VLAN: v1, Tag: 10, MAC: 00:21:59:c6:93:22, Interface: Router
Type: Static
Nexthop index: 0

VLAN: v1, Tag: 10, MAC: 00:21:59:c9:9a:4e, Interface: ge-0/0/14.0
Type: Learn, Age: 0, Learned: 18:40:50
Nexthop index: 564

```

show ethernet-switching table persistent-mac

```

user@switch> show ethernet-switching table persistent-mac
VLAN      MAC address      Type      Interface
default   00:10:94:00:00:02 installed      ge-0/0/42.0
default   00:10:94:00:00:03 installed      ge-0/0/42.0
default   00:10:94:00:00:04 installed      ge-0/0/42.0
default   00:10:94:00:00:05 installed      ge-0/0/42.0
default   00:10:94:00:00:06 installed      ge-0/0/42.0
default   00:10:94:00:05:02 uninstalled   ge-0/0/16.0
default   00:10:94:00:06:03 uninstalled   ge-0/0/16.0
default   00:10:94:00:07:04 uninstalled   ge-0/0/16.0

```

show ethernet-switching table persistent-mac interface ge-0/0/16.0

```

VLAN      MAC address      Type      Interface
default   00:10:94:00:05:02 uninstalled   ge-0/0/16.0
default   00:10:94:00:06:03 uninstalled   ge-0/0/16.0
default   00:10:94:00:07:04 uninstalled   ge-0/0/16.0

```

