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# Junos<sup>®</sup> OS for EX Series Ethernet Switches, Release 11.4: Device Security



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## How to Use This Guide

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Complete documentation for the EX Series product family is provided on webpages at [http://www.juniper.net/techpubs/en\\_US/release-independent/information-products/pathway-pages/ex-series/product/index.html](http://www.juniper.net/techpubs/en_US/release-independent/information-products/pathway-pages/ex-series/product/index.html). We have selected content from these webpages and created a number of EX Series guides that collect related topics into a book-like format so that the information is easy to print and easy to download to your local computer.

Software features for EX Series switches are listed by platform and by Junos OS release in a standalone document. See [EX Series Switch Software Features Overview](#).

The release notes are at [http://www.juniper.net/techpubs/en\\_US/junos11.4/information-products/topic-collections/release-notes/11.4/junos-release-notes-11.4.pdf](http://www.juniper.net/techpubs/en_US/junos11.4/information-products/topic-collections/release-notes/11.4/junos-release-notes-11.4.pdf).

## List of EX Series Guides for Junos OS Release 11.4

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| Title   | Description   |
|---|---|
| <i>Complete Hardware Guide for EX2200 Ethernet Switches</i> | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX2200 Ethernet switches |
| <i>Complete Hardware Guide for EX3200 Ethernet Switches</i> | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX3200 Ethernet switches |
| <i>Complete Hardware Guide for EX3300 Ethernet Switches</i> | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX3300 Ethernet switches |

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| Title  | Description  |
|--|--|
| <i>Complete Hardware Guide for EX4200 Ethernet Switches</i>  | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX4200 Ethernet switches  |
| <i>Complete Hardware Guide for EX4500 Ethernet Switches</i>  | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX4500 Ethernet switches  |
| <i>Complete Hardware Guide for EX6210 Ethernet Switches</i>  | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX6210 Ethernet switches  |
| <i>Complete Hardware Guide for EX8208 Ethernet Switches</i>  | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX8208 Ethernet switches  |
| <i>Complete Hardware Guide for EX8216 Ethernet Switches</i>  | Component descriptions, site preparation, installation, replacement, and safety and compliance information for EX8216 Ethernet switches  |
| <i>Complete Hardware Guide for the XRE200 External Routing Engine</i>                                      | Component descriptions, site preparation, installation, replacement, and safety and compliance information for the XRE200 External Routing Engine  |
| <i>Complete Software Guide for Junos® OS for EX Series Ethernet Switches, Release 11.4</i>                 | Software feature descriptions, configuration examples, and tasks for Junos OS for EX Series switches   |
| <b>Software Topic Collections</b>  | Software feature descriptions, configuration examples and tasks, and reference pages for configuration statements and operational commands (This information also appears in the <i>Complete Software Guide for Junos® OS for EX Series Ethernet Switches, Release 11.4.</i> ) |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Access and User Management</i>                 |  |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Access Control</i>                             |  |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Configuration Management</i>                   |  |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Class of Service</i>                           |  |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Device Security</i>                            |  |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Ethernet Switching</i>                         |  |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: EX3300, EX4200, and EX4500 Virtual Chassis</i> |  |





| Title   | Description |
|---|-------------|
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: EX8200 Virtual Chassis</i>              |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Fibre Channel over Ethernet</i>         |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: High Availability</i>                   |             |
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| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Layer 3 Protocols</i>                   |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: MPLS</i>                                |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Multicast</i>                           |             |
| <i>Junos® OS for EX Series Switches, Release 11.4: Network Management and Monitoring</i>            |             |
| <i>Junos® OS for EX Series Switches, Release 11.4: Port Security</i>                                |             |
| <i>Junos® OS for EX Series Switches, Release 11.4: Power over Ethernet</i>                          |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Routing Policy and Packet Filtering</i> |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Software Installation</i>               |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: Spanning-Tree Protocols</i>             |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: System Monitoring</i>                   |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: System Services</i>                     |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: System Setup</i>                        |             |
| <i>Junos® OS for EX Series Ethernet Switches, Release 11.4: User Interfaces</i>                     |             |

## Downloading Software

You can download Junos OS for EX Series switches from the Download Software area at <http://www.juniper.net/customers/support/> . To download the software, you must

have a Juniper Networks user account. For information about obtaining an account, see <http://www.juniper.net/entitlement/setupAccountInfo.do>.

## Documentation Symbols Key

| 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.   |
| Text and Syntax Conventions   |   |   |
| Convention  | Description   | Examples  |
| <b>Bold text like this</b>  | Represents text that you type.  | To enter configuration mode, type the <b>configure</b> command:<br><br>user@host> <b>configure</b>  |
| Fixed-width text like this  | Represents output that appears on the terminal screen.  | user@host> <b>show chassis alarms</b><br><br>No alarms currently active   |
| <i>Italic text like this</i>  | <ul style="list-style-type: none"> <li>Introduces important new terms.</li> <li>Identifies book names.</li> <li>Identifies RFC and Internet draft titles.</li> </ul>    | <ul style="list-style-type: none"> <li>A policy <i>term</i> is a named structure that defines match conditions and actions.</li> <li><i>Junos OS System Basics Configuration Guide</i></li> <li>RFC 1997, <i>BGP Communities Attribute</i></li> </ul> |
| <i>Italic text like this</i>  | Represents variables (options for which you substitute a value) in commands or configuration statements.  | Configure the machine's domain name:<br><br>[edit]<br>root@# <b>set system domain-name</b> <i>domain-name</i>   |
| Plain text like this  | Represents names of configuration statements, commands, files, and directories; IP addresses; configuration hierarchy levels; or labels on routing platform components. | <ul style="list-style-type: none"> <li>To configure a stub area, include the <b>stub</b> statement at the [edit protocols <b>ospf area area-id</b>] hierarchy level.</li> <li>The console port is labeled <b>CONSOLE</b>.</li> </ul>                  |



| Text and Syntax Conventions    |  |   |
|--------------------------------|--|---|
| Convention                     | Description  | Examples  |
| < > (angle brackets)           | Enclose optional keywords or variables.  | <code>stub &lt;default-metric <i>metric</i>&gt;;</code>   |
| (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. | <code>broadcast   multicast</code><br><code>(<i>string1</i>   <i>string2</i>   <i>string3</i>)</code>   |
| # (pound sign)                 | Indicates a comment specified on the same line as the configuration statement to which it applies.   | <code>rsvp { # Required for dynamic MPLS only</code>  |
| [ ] (square brackets)          | Enclose a variable for which you can substitute one or more values.  | <code>community name members [ <i>community-ids</i> ]</code>  |
| Indentation and braces ( { } ) | Identify 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.  |   |
| J-Web GUI Conventions          |  |   |
| <b>Bold text like this</b>     | Represents J-Web graphical user interface (GUI) items you click or select.   | <ul style="list-style-type: none"> <li>In the Logical Interfaces box, select <b>All Interfaces</b>.</li> <li>To cancel the configuration, click <b>Cancel</b>.</li> </ul> |
| > (bold right angle bracket)   | Separates levels in a hierarchy of J-Web selections.   | In the configuration editor hierarchy, select <b>Protocols&gt;Ospf</b> .  |

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We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. Send e-mail to [techpubs-comments@juniper.net](mailto:techpubs-comments@juniper.net) with the following:

- Document URL or title
- Page number if applicable
- Software version
- Your name and company

## Requesting Technical Support

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- 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: <https://www.juniper.net/alerts/>
- 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

# Device Security

- [Device Security Overview on page 3](#)
- [Example: Device Security Configuration on page 7](#)
- [Configuring Device Security on page 11](#)
- [Verifying Device Security Configuration on page 13](#)
- [Configuration Statements for Device Security on page 15](#)
- [Operational Commands for Device Security on page 33](#)



## CHAPTER 1

# Device Security Overview

- [Understanding Storm Control on EX Series Switches on page 3](#)
- [Understanding Unknown Unicast Forwarding on EX Series Switches on page 5](#)

### Understanding Storm Control on EX Series Switches

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

The default configuration of storm control differs according to the switch line:

- On EX2200, EX3200, EX4200 switches and on EX6200 access ports—Storm control does not apply to multicast traffic by default. The factory default configuration enables storm control for broadcast and unknown unicast traffic on all switch interfaces, with the storm control level set to 80 percent of the combined broadcast and unknown unicast streams.
- On EX4500 and EX8200 switches—The factory default configuration enables storm control on all switch interfaces, with the storm control level set to 80 percent of the combined broadcast, multicast, and unknown unicast streams.

You can customize the configuration of storm control, as follows:

- You can change the storm control level for a specific interface by configuring the bandwidth value for the combined traffic streams that are subject to storm control on that interface. The type of traffic stream (broadcast, unknown unicast, and multicast) that is included within the bandwidth consideration depends on which types of traffic are enabled for storm control monitoring on that interface.
- You can enable storm control selectively for multicast traffic on a specific interface or on all interfaces.



**NOTE:** We do not recommend enabling storm control for multicast traffic on aggregated Ethernet interfaces on EX2200, EX3200, EX3300, EX4200, and EX6200 switches.

- On all switches—You can disable storm control selectively for either broadcast streams, or multicast streams, or for unknown unicast streams.
- On EX8200 switches—You can also disable storm control selectively for either registered multicast traffic, or unregistered multicast traffic, or for both types of multicast traffic.

The sending and receiving of broadcast, multicast, and unicast packets are part of normal LAN operation, so 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 to drop broadcast traffic, multicast traffic, unknown unicast traffic, or two or all three of those traffic types.



**NOTE:** When you configure storm control bandwidth 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 bandwidth 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 7](#)
- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 12](#)
- [Disabling or Enabling Storm Control \(CLI Procedure\)](#)

## Understanding Unknown Unicast Forwarding on EX Series Switches

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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 to interfaces on the switch can trigger a security issue. The LAN is suddenly flooded with packets, creating 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 interfaces by configuring one VLAN or all VLANs to forward all unknown unicast traffic to a specific trunk interface. This channels the unknown unicast traffic to a single interface.

### **Related Documentation**

- [Understanding Storm Control on EX Series Switches on page 3](#)
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7](#)
- [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 11](#)





## CHAPTER 2

# Example: Device Security Configuration

- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7](#)

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

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



**NOTE:** Storm control does not apply to multicast traffic by default on EX2200, EX3200, EX3300, EX4200, and EX6200 switches.

This example shows how to configure storm control on a single EX Series switch:

- [Requirements on page 7](#)
- [Overview and Topology on page 7](#)
- [Configuration on page 8](#)

### Requirements

This example uses the following hardware and software components:

- One EX Series switch
- Junos OS Release 9.5 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 of the combined applicable traffic streams.



**NOTE:**

- On EX2200, EX3200, EX3300, and EX4200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the combined unknown unicast, unregistered multicast, and broadcast traffic.
- On EX4500 and EX8200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the combined broadcast, multicast, and unknown unicast streams.
- On EX6200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the combined unknown unicast and broadcast traffic. Storm-control can be disabled for each type of traffic individually.

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 it to shut down interfaces or temporarily disable interfaces (see the [action-shutdown](#) statement or the [port-error-disable](#) statement) when the storm control level is exceeded.

The topology used in this example consists of one switch with 24 ports. The switch is 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** To quickly configure storm control based on the traffic rate in kilobits per second of the combined traffic streams, copy the following command and paste it into the switch terminal window:

```
[edit]  
set ethernet-switching-options storm-control interface ge-0/0/0 bandwidth 15000
```

**Step-by-Step Procedure** To configure storm control:

1. Specify the traffic rate in kilobits per second of the combined traffic streams on a specific interface:

```
[edit ethernet-switching-options]  
user@switch# set storm-control interface ge-0/0/0 bandwidth 15000
```

**Results** Display the results of the configuration:

```
[edit ethernet-switching-options]  
user@switch# show storm-control
```

```
interface ge-0/0/0.0 {  
  bandwidth 15000;  
}
```

**Related  
Documentation**

- Disabling or Enabling Storm Control (CLI Procedure)
- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 12](#)
- [Understanding Storm Control on EX Series Switches on page 3](#)



## CHAPTER 3

# Configuring Device Security

- [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 11](#)
- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 12](#)

### Configuring Unknown Unicast Forwarding (CLI Procedure)

---

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 trunk interface. From there, the destination MAC address can be learned and added to the Ethernet switching table. You can configure each VLAN to divert unknown unicast traffic to different trunk interfaces or use one trunk interface for multiple VLANs.

To configure unknown unicast forwarding options:



**NOTE:** Before you can configure unknown unicast forwarding within a VLAN, you must first configure that VLAN.

1. Configure unknown unicast forwarding for a specific VLAN (here, the VLAN name is **employee**):

```
[edit ethernet-switching-options]
user@switch# set unknown-unicast-forwarding vlan employee
```

2. Specify the trunk interface to which all unknown unicast traffic will be forwarded:

```
[edit ethernet-switching-options]
user@switch# set unknown-unicast-forwarding vlan employee interface ge-0/0/3.0
```

#### Related Documentation

- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7](#)
- [Verifying That Unknown Unicast Packets Are Forwarded to a Trunk Interface on page 13](#)
- [Understanding Unknown Unicast Forwarding on EX Series Switches on page 5](#)

- [Understanding Storm Control on EX Series Switches on page 3](#)

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

---

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

- MAC limiting—**mac-limit** statement is configured with action **shutdown**.
- MAC move limiting—**mac-move-limit** statement is configured with action **shutdown**.
- Storm control—**storm-control** statement is configured with the action **shutdown**.

You can configure the switch to automatically restore the disabled interfaces to service after a specified period of time. Autorecovery applies to all the interfaces that have been disabled due to MAC limiting, MAC move limiting, or storm control errors.



**NOTE:** You must specify the disable timeout value for the interfaces to recover automatically. There is no default disable timeout. If you do not specify a timeout value, you need to use the `clear ethernet-switching port-error` command to clear the errors and restore the interfaces or the specified interface to service.

To configure autorecovery from the disabled state due to MAC limiting, MAC move limiting, or storm control shutdown actions:

```
[edit ethernet-switching-options]  
user@switch# set port-error-disable disable-timeout 60
```

### Related Documentation

- [Example: Configuring Basic Port Security Features on an EX Series Switch](#)
- [Configuring MAC Limiting \(CLI Procedure\)](#)
- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7](#)
- [Understanding MAC Limiting and MAC Move Limiting for Port Security on EX Series Switches](#)
- [Understanding Storm Control on EX Series Switches on page 3](#)

## CHAPTER 4

# Verifying Device Security Configuration

- [Verifying That Unknown Unicast Packets Are Forwarded to a Trunk Interface on page 13](#)
- [Verifying That the Port Error Disable Setting Is Working Correctly on page 14](#)

### Verifying That Unknown Unicast Packets Are Forwarded to a Trunk Interface

---

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

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

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

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

Display the Ethernet switching table:

```
user@switch> show ethernet-switching table vlan v1
```

Ethernet-switching table: 3 unicast entries

| VLAN | MAC address       | Type  | Age | Interfaces  |
|------|-------------------|-------|-----|-------------|
| v1   | *                 | Flood | -   | All-members |
| v1   | 00:01:09:00:00:00 | Learn | 24  | ge-0/0/7.0  |
| v1   | 00:11:09:00:01:00 | Learn | 37  | ge-0/0/3.0  |

**Meaning** The sample output from the **show configuration ethernet-switching-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 11](#)

## Verifying That the Port Error Disable Setting Is Working Correctly

**Purpose** Verify that the port error disable setting is working as expected on MAC limited, MAC move limited and rate-limited interfaces on an EX Series switch.

**Action** Display information about interfaces:

```
user@switch> show ethernet-switching interfaces
```

| Interface   | State | VLAN members | Blocking                |
|-------------|-------|--------------|-------------------------|
| ge-0/0/0.0  | up    | T1122        | unblocked               |
| ge-0/0/1.0  | down  | default      | MAC limit exceeded      |
| ge-0/0/2.0  | down  | default      | MAC move limit exceeded |
| ge-0/0/3.0  | down  | default      | Storm control in effect |
| ge-0/0/4.0  | down  | default      | unblocked               |
| ge-0/0/5.0  | down  | default      | unblocked               |
| ge-0/0/6.0  | down  | default      | unblocked               |
| ge-0/0/7.0  | down  | default      | unblocked               |
| ge-0/0/8.0  | down  | default      | unblocked               |
| ge-0/0/9.0  | up    | T111         | unblocked               |
| ge-0/0/10.0 | down  | default      | unblocked               |
| ge-0/0/11.0 | down  | default      | unblocked               |
| ge-0/0/12.0 | down  | default      | unblocked               |
| ge-0/0/13.0 | down  | default      | unblocked               |
| ge-0/0/14.0 | down  | default      | unblocked               |
| ge-0/0/15.0 | down  | default      | unblocked               |
| ge-0/0/16.0 | down  | default      | unblocked               |
| ge-0/0/17.0 | down  | default      | unblocked               |
| ge-0/0/18.0 | down  | default      | unblocked               |
| ge-0/0/19.0 | up    | T111         | unblocked               |
| ge-0/1/0.0  | down  | default      | unblocked               |
| ge-0/1/1.0  | down  | default      | unblocked               |
| ge-0/1/2.0  | down  | default      | unblocked               |
| ge-0/1/3.0  | down  | default      | unblocked               |

**Meaning** The sample output from the **show ethernet-switching interfaces** command shows that three of the down interfaces specify the reason that the interface is disabled:

- **MAC limit exceeded**—The interface is temporarily disabled due to a mac-limit error. The disabled interface is automatically restored to service when the **disable-timeout** expires.
- **MAC move limit exceeded**—The interface is temporarily disabled due to a mac-move-limit error. The disabled interface is automatically restored to service when the **disable-timeout** expires.
- **Storm control in effect**—The interface is temporarily disabled due to a **storm-control** error. The disabled interface is automatically restored to service when the **disable-timeout** expires.

- Related Documentation**
- [Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces \(CLI Procedure\) on page 12](#)



## CHAPTER 5

# Configuration Statements for Device Security

- [\[edit ethernet-switching-options\] Configuration Statement Hierarchy on page 15](#)

### [\[edit ethernet-switching-options\] Configuration Statement Hierarchy](#)

---

```
ethernet-switching-options {
  analyzer {
    name {
      loss-priority priority;
      ratio number;
      input {
        ingress {
          interface (all | interface-name);
          vlan (vlan-id | vlan-name);
        }
        egress {
          interface (all | interface-name);
          vlan (vlan-id | vlan-name);
        }
      }
    }
    output {
      interface interface-name;
      vlan (vlan-id | vlan-name) {
        no-tag;
      }
    }
  }
  bpd-block {
    disable-timeout timeout;
    interface (all | [interface-name]);
  }
  dot1q-tunneling {
    ether-type (0x8100 | 0x88a8 | 0x9100);
  }
  interfaces interface-name {
    no-mac-learning;
  }
  mac-notification {
    notification-interval seconds;
  }
}
```

```
}
mac-table-aging-time seconds;
nonstop-bridging;
port-error-disable {
  disable-timeout timeout;
}
redundant-trunk-group {
  group name {
    preempt-cutover-timer seconds;
    interface
      primary;
    }
    interface
  }
}
secure-access-port {
  dhcp-snooping-file {
    location local_pathname | remote_URL;
    timeout seconds;
    write-interval seconds;
  }
  interface (all | interface-name) {
    allowed-mac {
      mac-address-list;
    }
    (dhcp-trusted | no-dhcp-trusted );
    fcoe-trusted;
    mac-limit limit action action;
    no-allowed-mac-log;
    persistent-learning;
    static-ip ip-address {
      vlan vlan-name;
      mac mac-address;
    }
  }
}
vlan (all | vlan-name) {
  (arp-inspection | no-arp-inspection) [
    forwarding-class class-name;
  ]
}
dhcp-option82 {
  circuit-id {
    prefix hostname;
    use-interface-description;
    use-vlan-id;
  }
  remote-id {
    prefix hostname | mac | none;
    use-interface-description;
    use-string string;
  }
  vendor-id [string];
}
(examine-dhcp | no-examine-dhcp) {
  forwarding-class class-name;
}
examine-fip {
```

```

        fc-map fc-map-value;
    }
    (ip-source-guard | no-ip-source-guard);
    mac-move-limit limit action action;
}
}
static {
    vlan name {
        mac mac-address {
            next-hop interface-name;
        }
    }
}
storm-control {
    action-shutdown;
    interface (all | interface-name) {
        bandwidth bandwidth;
        no-broadcast;
        no-multicast;
        no-registered-multicast;
        no-unknown-unicast;
        no-unregistered-multicast;
    }
}
traceoptions {
    file filename <files number> <no-stamp> <replace> <size size> <world-readable |
        no-world-readable>;
    flag flag <disable>;
}
unknown-unicast-forwarding {
    vlan (all | vlan-name) {
        interface interface-name;
    }
}
voip {
    interface (all | [interface-name | access-ports]) {
        vlan vlan-name;
        forwarding-class (assured-forwarding | best-effort | expedited-forwarding |
            network-control);
    }
}
}

```

#### Related Documentation

- [Understanding Port Mirroring on EX Series Switches](#)
- [Port Security for EX Series Switches Overview](#)
- [Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches](#)
- [Understanding Redundant Trunk Links on EX Series Switches](#)
- [Understanding Storm Control on EX Series Switches on page 3](#)
- [Understanding 802.1X and VoIP on EX Series Switches](#)
- [Understanding Q-in-Q Tunneling on EX Series Switches](#)
- [Understanding Unknown Unicast Forwarding on EX Series Switches on page 5](#)

- Understanding MAC Notification on EX Series Switches
- Understanding FIP Snooping
- Understanding Nonstop Bridging on EX Series Switches
- Understanding Persistent MAC Learning (Sticky MAC)


---

## action-shutdown

---

|                          |   |
|--------------------------|---|
| Syntax                   | action-shutdown;  |
| Hierarchy Level          | [edit <a href="#">ethernet-switching-options storm-control</a> ]  |
| Release Information      | Statement introduced in Junos OS Release 9.6 for EX Series switches.  |
| Description              | <p>Shut down or disable interfaces when the storm control level is exceeded, as follows:</p> <ul style="list-style-type: none"><li>• If you set both the <b>action-shutdown</b> and the <b>port-error-disable</b> statements, the interfaces are disabled temporarily and recover automatically when the disable timeout expires.</li><li>• If you set the <b>action-shutdown</b> statement and do not specify the <b>port-error-disable</b> 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. You must issue the <b>clear ethernet-switching port-error</b> command to clear the port error and restore the interfaces to service.</li></ul> |
| Default                  | The <b>action-shutdown</b> option is not enabled. When the storm control level is exceeded, the switch drops applicable types of traffic on the specified interfaces. Depending upon the configuration, applicable traffic could include broadcast, unknown unicast, and multicast traffic.   |
| Required Privilege Level | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.   |
| Related Documentation    | <ul style="list-style-type: none"><li>• <a href="#">port-error-disable on page 29</a></li><li>• <a href="#">disable-timeout on page 20</a></li><li>• clear ethernet-switching port-error</li><li>• <a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li><li>• <a href="#">Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure) on page 12</a></li></ul>  |

## bandwidth

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | <code>bandwidth <i>bandwidth</i>;</code>   |
| <b>Hierarchy Level</b>          | [edit <code>ethernet-switching-options storm-control interface</code> (all   <i>interface-name</i> )]  |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.5 for EX Series switches.   |
| <b>Description</b>              | <p>Configure the storm control level as the bandwidth in kilobits per second of the applicable traffic streams, as follows:</p> <ul style="list-style-type: none"> <li>On EX2200, EX3200, and EX4200 switches—Applies to the combined broadcast and unknown unicast streams by default. Storm control does not apply to multicast traffic by default on these switches. If you enable storm control for multicast traffic on a specific interface, the configured bandwidth allocation applies to the combined broadcast, unknown unicast, and multicast traffic on that interface.</li> <li>On EX4500 and EX8200 switches—Applies to the combined broadcast, multicast, and unknown unicast streams.</li> </ul> |
|                                 | <div>  <p><b>NOTE:</b> When you configure storm control bandwidth 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 bandwidth 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>  |
| <b>Default</b>                  | If you omit the <b>bandwidth</b> statement when you configure storm control on an interface, the storm control level defaults to 80 percent of the combined applicable traffic streams. Depending upon the configuration, applicable traffic could include broadcast, unknown unicast, and multicast traffic.  |
| <b>Options</b>                  | <p><b>bandwidth</b>—Traffic rate in kilobits per second of the combined applicable traffic streams.</p> <p><b>Range:</b> 100 through 100000000</p> <p><b>Default:</b> None</p>   |
| <b>Required Privilege Level</b> | <p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li><a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li> <li>Disabling or Enabling Storm Control (CLI Procedure)</li> </ul>   |

## disable-timeout

---

|                                 |   |
|---------------------------------|---|
| <b>Syntax</b>                   | <code>disable-timeout <i>timeout</i>;</code>  |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options port-error-disable</a> ]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.6 for EX Series switches.  |
| <b>Description</b>              | Specify how long the Ethernet-switching interfaces remain in a disabled state due to the MAC limiting, MAC move limiting, or storm control errors.  |
| <b>Default</b>                  | The disable timeout is not enabled.   |
| <b>Options</b>                  | <b><i>timeout</i></b> —Amount of time, in seconds, that the disabled state remains in effect. The disabled interface is automatically restored to service when the specified timeout is reached.<br><b>Range:</b> 10 through 3600 seconds   |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Configuring Port Security (CLI Procedure)</a></li><li>• <a href="#">Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure) on page 12</a></li><li>• <a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li></ul> |

## ethernet-switching-options

```

Syntax ethernet-switching-options {
    analyzer {
        name {
            loss-priority priority;
            ratio number;
            input {
                ingress {
                    interface (all | interface-name);
                    vlan (vlan-id | vlan-name);
                }
                egress {
                    interface (all | interface-name);
                }
            }
        }
        output {
            interface interface-name;
            vlan (vlan-id | vlan-name) {
                no-tag;
            }
        }
    }
}
bpdu-block {
    disable-timeout timeout;
    interface (all | [interface-name]);
}
dot1q-tunneling {
    ether-type (0x8100 | 0x88a8 | 0x9100);
}
interfaces interface-name {
    no-mac-learning;
}
mac-notification {
    notification-interval seconds;
}
mac-table-aging-time seconds;
nonstop-bridging;
port-error-disable {
    disable-timeout timeout;
}
redundant-trunk-group {
    group name {
        interface interface-name <primary>;
        interface interface-name;
    }
}
secure-access-port {
    dhcp-snooping-file {
        location local_pathname | remote_URL;
        timeout seconds;
        write-interval seconds;
    }
}

```

```
interface (all | interface-name) {
  allowed-mac {
    mac-address-list;
  }
  (dhcp-trusted | no-dhcp-trusted);
  fcoe-trusted;
  mac-limit limit action action;
  no-allowed-mac-log;
  persistent-learning;
  static-ip ip-address {
    vlan vlan-name;
    mac mac-address;
  }
}

vlan (all | vlan-name) {
  (arp-inspection | no-arp-inspection) [
    forwarding-class class-name;
  ]
  dhcp-option82 {
    circuit-id {
      prefix hostname;
      use-interface-description;
      use-vlan-id;
    }
    remote-id {
      prefix hostname | mac | none;
      use-interface-description;
      use-string string;
    }
    vendor-id [string];
  }
  (examine-dhcp | no-examine-dhcp) {
    forwarding-class class-name;
  }
  examine-fip {
    fc-map fc-map-value;
  }
  (ip-source-guard | no-ip-source-guard);
  mac-move-limit limit action action;
}

static {
  vlan name {
    mac mac-address {
      next-hop interface-name;
    }
  }
}

storm-control {
  action-shutdown;
  interface (all | interface-name) {
    bandwidth bandwidth;
    no-broadcast;
    no-multicast;
    no-registered-multicast;
    no-unknown-unicast;
    no-unregistered-multicast;
```



```

    }
  }
  traceoptions {
    file filename <files number> <no-stamp> <replace> <size size> <world-readable |
      no-world-readable>;
    flag flag <disable>;
  }
  unknown-unicast-forwarding {
    vlan (all | vlan-name) {
      interface interface-name;
    }
  }
  voip {
    interface (all | [interface-name | access-ports]) {
      vlan vlan-name ;
      forwarding-class (assured-forwarding | best-effort | expedited-forwarding |
        network-control);
    }
  }
}

```

|                          |   |
|--------------------------|---|
| Hierarchy Level          | [edit]  |
| Release Information      | Statement introduced in Junos OS Release 9.0 for EX Series switches.  |
| Description              | <p>Configure Ethernet switching options.</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"> <li>• Understanding Port Mirroring on EX Series Switches</li> <li>• Port Security for EX Series Switches Overview</li> <li>• Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches</li> <li>• Understanding Redundant Trunk Links on EX Series Switches</li> <li>• <a href="#">Understanding Storm Control on EX Series Switches on page 3</a></li> <li>• Understanding 802.1X and VoIP on EX Series Switches</li> <li>• Understanding Q-in-Q Tunneling on EX Series Switches</li> <li>• <a href="#">Understanding Unknown Unicast Forwarding on EX Series Switches on page 5</a></li> <li>• Understanding MAC Notification on EX Series Switches</li> <li>• Understanding FIP Snooping</li> <li>• Understanding Nonstop Bridging on EX Series Switches</li> </ul> |

## interface

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | <pre>interface (all   <i>interface-name</i>) {<br/>    <i>bandwidth bandwidth</i>;<br/>    no-broadcast;<br/>    no-multicast;<br/>    no-registered-multicast;<br/>    no-unknown-unicast;<br/>    no-unregistered-multicast;<br/>}</pre>   |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options storm-control</a> ]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.1 for EX Series switches.   |
| <b>Description</b>              | Enable and configure storm control on all interfaces or on the specified interface.  |
| <b>Default</b>                  | <ul style="list-style-type: none"><li>On EX2200, EX3200, and EX4200 switches—Storm control does not apply by default to multicast traffic. The factory default configuration enables storm control for broadcast and unknown unicast traffic on all switch interfaces, with the storm control level set to 80 percent of the combined broadcast and unknown unicast streams.</li><li>On EX4500 and EX8200 switches—Storm control applies to broadcast, multicast, and unknown unicast traffic. The factory default configuration enables storm control on all switch interfaces, with the storm control level set to 80 percent of the combined broadcast, multicast, and unknown unicast streams.</li></ul> |
| <b>Options</b>                  | <p><b>all</b>—All interfaces. The storm control settings configured with the <b>all</b> option affect only those interfaces that have not been individually configured for storm control.</p> <p><b><i>interface-name</i></b>—Name of an interface. The storm control settings configured with the <b><i>interface-name</i></b> option override any settings configured with the <b>all</b> option.</p> <p>The remaining statements are explained separately.</p>  |
| <b>Required Privilege Level</b> | <p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li><a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li><li>Disabling or Enabling Storm Control (CLI Procedure)</li></ul>  |

## interface

---

|                                 |   |
|---------------------------------|---|
| <b>Syntax</b>                   | <code>interface <i>interface-name</i>;</code>   |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options unknown-unicast-forwarding vlan</a> (all  <i>vlan-name</i> )]  |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.3 for EX Series switches.  |
| <b>Description</b>              | Specify the interface to which unknown unicast packets will be forwarded.   |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">show vlans</a></li> <li>• <a href="#">show ethernet-switching table on page 38</a></li> <li>• <a href="#">Configuring Unknown Unicast Forwarding (CLI Procedure) on page 11</a></li> <li>• <a href="#">Understanding Unknown Unicast Forwarding on EX Series Switches on page 5</a></li> </ul> |

## no-broadcast

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | <code>no-broadcast;</code>   |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options storm-control interface</a> (all   <i>interface-name</i> )]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.1 for EX Series switches.   |
| <b>Description</b>              | Disable storm control for broadcast traffic for the specified interface or for all interfaces.   |
| <b>Default</b>                  | Storm control is enabled for broadcast traffic.  |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li> <li>• <a href="#">Disabling or Enabling Storm Control (CLI Procedure)</a></li> </ul> |

## no-multicast

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | no-multicast;  |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options storm-control interface</a> (all   <i>interface-name</i> )]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 10.3 for EX Series switches.  |
| <b>Description</b>              | Disable storm control for all multicast traffic (both registered multicast and unregistered multicast) for the specified interface or for all interfaces.  |
| <b>Default</b>                  | <ul style="list-style-type: none"><li>• On EX2200, EX3200, EX3300, and EX4200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the combined unknown unicast, unregistered multicast, and broadcast traffic.</li><li>• On EX4500 and EX8200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the combined broadcast, multicast, and unknown unicast 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.</li><li>• On EX6200 switches—The factory default configuration enables storm control on all interfaces at 80 percent of the combined unknown unicast, and broadcast traffic. Storm-control can be disabled for each type of traffic individually.</li></ul> |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">no-registered-multicast on page 27</a></li><li>• <a href="#">no-unregistered-multicast on page 28</a></li><li>• Disabling or Enabling Storm Control (CLI Procedure)</li></ul>  |

## no-registered-multicast

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | no-registered-multicast;   |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options storm-control interface</a> (all   <i>interface-name</i> )]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 10.3 for EX Series switches.  |
| <b>Description</b>              | (EX8200 switches only) Disable storm control for registered multicast traffic for the specified interface or for all interfaces.   |
| <b>Default</b>                  | Storm control is enabled for unknown unicast traffic, multicast traffic, and broadcast traffic.  |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">no-multicast on page 26</a></li> <li>• <a href="#">no-unregistered-multicast on page 28</a></li> <li>• <a href="#">Understanding Storm Control on EX Series Switches on page 3</a></li> </ul> |

## no-unknown-unicast

---


|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | no-unknown-unicast;  |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options storm-control interface</a> (all   <i>interface-name</i> )]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.1 for EX Series switches.   |
| <b>Description</b>              | Disable storm control for unknown unicast traffic for the specified interface or for all interfaces.   |
| <b>Default</b>                  | Storm control is enabled for unknown unicast traffic.  |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li> <li>• <a href="#">Disabling or Enabling Storm Control (CLI Procedure)</a></li> </ul> |

## no-unregistered-multicast

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | no-unregistered-multicast;   |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options storm-control interface</a> (all   <i>interface-name</i> )]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 10.3 for EX Series switches.  |
| <b>Description</b>              | (EX8200 switches only) Disable storm control for unregistered multicast traffic for the specified interface or for all interfaces.   |
| <b>Default</b>                  | Storm control is enabled for unknown unicast traffic, multicast traffic, and broadcast traffic.  |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.  |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">no-multicast on page 26</a></li><li>• <a href="#">no-registered-multicast on page 27</a></li><li>• <a href="#">Understanding Storm Control on EX Series Switches on page 3</a></li></ul> |

## port-error-disable

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | <code>port-error-disable {<br/>    disable-timeout <i>timeout</i> ;<br/>}</code>   |
| <b>Hierarchy Level</b>          | [edit <a href="#">ethernet-switching-options</a> ]   |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.6 for EX Series switches.   |
| <b>Description</b>              | <p>Disable rather than block an interface when enforcing MAC limiting, MAC move limiting, and rate-limiting configuration options for shutting down the interface, and allow the interface to recover automatically from the error condition after a specified period of time:</p> <ul style="list-style-type: none"> <li>• If you have enabled <b>mac-limit</b> with the <b>shutdown</b> option and enable <b>port-error-disable</b>, the switch disables (rather than shuts down) the interface when the MAC address limit is reached.</li> <li>• If you have enabled <b>mac-move-limit</b> with the <b>shutdown</b> option and you enable <b>port-error-disable</b>, the switch disables (rather than shuts down) the interface when the maximum number of moves to a new interface is reached.</li> <li>• If you have enabled <a href="#">storm-control</a> with the <b>action-shutdown</b> option and you enable <b>port-error-disable</b>, 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.</li> </ul> |
|                                 | <div>  <p><b>NOTE:</b> The <b>port-error-disable</b> configuration does not apply to pre-existing error conditions. It impacts only error conditions that are detected after <b>port-error-disable</b> has been enabled and committed. To clear a pre-existing error condition and restore the interface to service, use the <code>clear ethernet-switching port-error</code> command.</p> </div>   |
| <b>Default</b>                  | Not enabled.   |
| <b>Required Privilege Level</b> | <p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">action-shutdown on page 18</a></li> <li>• <a href="#">Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7</a></li> <li>• <a href="#">Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure) on page 12</a></li> <li>• <a href="#">Configuring Port Security (CLI Procedure)</a></li> </ul>  |

## storm-control

---

**Syntax**    storm-control {  
              action-shutdown;  
              interface (all | *interface-name*) {  
                  bandwidth *bandwidth*;  
                  no-broadcast;  
                  no-multicast;  
                  no-registered-multicast;  
                  no-unknown-unicast;  
                  no-unregistered-multicast;  
              }  
          }

**Hierarchy Level**    [edit [ethernet-switching-options](#)]

**Release Information**    Statement introduced in Junos OS Release 9.1 for EX Series switches.

**Description**    Configure storm control on the switch.

The remaining statements are explained separately.

**Required Privilege Level**    system—To view this statement in the configuration.  
                                  system-control—To add this statement to the configuration.

**Related Documentation**

- [Example: Configuring Storm Control to Prevent Network Outages on EX Series Switches on page 7](#)
- [Understanding Storm Control on EX Series Switches on page 3](#)



## unknown-unicast-forwarding

**Syntax**    unknown-unicast-forwarding {  
                   vlan (all | *vlan-name*){  
                     interface *interface-name*;  
                   }  
                 }

**Hierarchy Level**    [edit [ethernet-switching-options](#)]

**Release Information**    Statement introduced in Junos OS Release 9.3 for EX Series switches.

**Description**    Configure the switch to forward all unknown unicast packets in a VLAN or on all VLANs to a particular interface.



**NOTE:** Before you can configure unknown unicast forwarding within a VLAN, you must first configure that VLAN.

The remaining statements are explained separately.

**Default**    Unknown unicast packets are flooded to all interfaces that belong to the same VLAN.

**Required Privilege Level**    system—To view this statement in the configuration.  
   system-control—To add this statement to the configuration.

**Related Documentation**

- [show vlans](#)
- [show ethernet-switching table on page 38](#)
- [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 11](#)
- [Understanding Unknown Unicast Forwarding on EX Series Switches on page 5](#)

## vlan

---

**Syntax**    `vlan (all | vlan-name) {  
                  interface interface-name;  
                  }`

**Hierarchy Level**    `[edit ethernet-switching-options unknown-unicast-forwarding]`

**Release Information**    Statement introduced in Junos OS Release 9.3 for EX Series switches.  
Statement updated with enhanced ? (CLI completion feature) functionality in Junos OS Release 9.5 for EX Series switches.

**Description**    Specify a VLAN from which unknown unicast packets will be forwarded or specify that the packets will be forwarded from all VLANs. Unknown unicast packets are forwarded from a VLAN to a specific trunk interface.

The `interface` statement is explained separately.



**TIP:** To display a list of all configured VLANs on the system, including VLANs that are configured but not committed, type ? after `vlan` or `vlands` in your configuration mode command line. Note that only one VLAN is displayed for a VLAN range.

**Options**    `all`—All VLANs.

`vlan-name`—Name of a VLAN.

**Required Privilege Level**    `system`—To view this statement in the configuration.  
                                  `system-control`—To add this statement to the configuration.

**Related Documentation**

- `show vlans`
- [show ethernet-switching table on page 38](#)
- [Configuring Unknown Unicast Forwarding \(CLI Procedure\) on page 11](#)
- [Verifying That Unknown Unicast Packets Are Forwarded to a Trunk Interface on page 13](#)
- [Understanding Unknown Unicast Forwarding on EX Series Switches on page 5](#)

## CHAPTER 6

# Operational Commands for Device Security

## show ethernet-switching interfaces

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | <code>show ethernet-switching interfaces</code><br><code>&lt;brief   detail   summary&gt;</code><br><code>&lt;interface <i>interface-name</i>&gt;</code>   |
| <b>Release Information</b>      | <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>In Junos OS Release 9.6 for EX Series switches, the following updates were made:</p> <ul style="list-style-type: none"><li>• <b>Blocking</b> field output was updated.</li><li>• The default view was updated to include information about 802.1Q tags.</li><li>• The <b>detail</b> view was updated to include information on VLAN mapping.</li></ul> <p>In Junos OS Release 11.1 for EX Series switches, the <b>detail</b> view was updated to include reflective relay information.</p>  |
| <b>Description</b>              | Display information about Ethernet switching interfaces.   |
| <b>Options</b>                  | <p><code>none</code>—Display brief information for Ethernet switching interfaces.</p> <p><code>brief   detail   summary</code>—(Optional) Display the specified level of output.</p> <p><code>interface <i>interface-name</i></code>—(Optional) Display Ethernet switching information for a specific interface.</p>   |
| <b>Required Privilege Level</b> | view   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show ethernet-switching mac-learning-log</a></li><li>• <a href="#">show ethernet-switching table on page 38</a></li><li>• <a href="#">Configuring Autorecovery From the Disabled State on Secure or Storm Control Interfaces (CLI Procedure) on page 12</a></li></ul>  |
| <b>List of Sample Output</b>    | <p><a href="#">show ethernet-switching interfaces on page 36</a></p> <p><a href="#">show ethernet-switching interfaces ge-0/0/15 brief on page 36</a></p> <p><a href="#">show ethernet-switching interfaces ge-0/0/2 detail (Blocked by RTG rtggroup) on page 36</a></p> <p><a href="#">show ethernet-switching interfaces ge-0/0/15 detail (Blocked by STP) on page 37</a></p> <p><a href="#">show ethernet-switching interfaces ge-0/0/17 detail (Disabled by bpdu-control) on page 37</a></p> <p><a href="#">show ethernet-switching interfaces detail (C-VLAN to S-VLAN Mapping) on page 37</a></p> <p><a href="#">show ethernet-switching interfaces detail (Reflective Relay Is Configured) on page 37</a></p> |
| <b>Output Fields</b>            | <p><a href="#">Table 1 on page 35</a> lists the output fields for the <b>show ethernet-switching interfaces</b> command. Output fields are listed in the approximate order in which they appear.</p>   |

Table 1: show ethernet-switching interfaces Output Fields

| Field Name                          | Field Description   | Level of Output                                     |
|-------------------------------------|---|---|
| <b>Interface</b>                    | Name of a switching interface.  | none, <b>brief</b> , <b>detail</b> , <b>summary</b> |
| <b>Index</b>                        | VLAN index internal to Junos OS.  | <b>detail</b>                                       |
| <b>State</b>                        | Interface state. Values are <b>up</b> and <b>down</b> .   | none, <b>brief</b> , <b>detail</b>                  |
| <b>Port mode</b>                    | The <b>access</b> mode is the port mode default and works with a single VLAN. Port mode can also be <b>trunk</b> , which accepts tagged packets from multiple VLANs on other switches. The third port mode value is <b>tagged-access</b> , which accepts tagged packets from access devices.  | <b>detail</b>                                       |
| <b>Reflective Relay Status</b>      | Reflective relay allows packets to use the same interface for both upstream and downstream traffic. When reflective relay has been configured, the status displayed is always <b>enabled</b> . When reflective relay is not configured, this entry does not appear in the command output.   | <b>detail</b>                                       |
| <b>Ether type for the interface</b> | Ether type is a two-octet field in an Ethernet frame used to indicate which protocol is encapsulated in the payload of an incoming Ethernet packet. Both 802.1Q packets and Q-in-Q packets use this field. The output displayed for this particular field indicates the interface's Ether type, which is used to match the Ether type of incoming 802.1Q packets and Q-in-Q packets. The indicated Ether type field is also added to the interface's outgoing 802.1Q and Q-in-Q packets.  | <b>detail</b>                                       |
| <b>VLAN membership</b>              | Names of VLANs that belong to this interface.   | none, <b>brief</b> , <b>detail</b> ,                |
| <b>Tag</b>                          | Number of the 802.1Q tag.   | none, <b>brief</b> , <b>detail</b> ,                |
| <b>Tagging</b>                      | Specifies whether the interface forwards 802.1Q <b>tagged</b> or <b>untagged</b> traffic.   | none, <b>brief</b> , <b>detail</b> ,                |
| <b>Blocking</b>                     | <p>The forwarding state of the interface:</p> <ul style="list-style-type: none"> <li>• <b>unblocked</b>—Traffic is forwarded on the interface.</li> <li>• <b>blocked</b>—Traffic is not being forwarded on the interface.</li> <li>• <b>Disabled by bpdu control</b>—The interface is disabled due to receiving BPDUs on a protected interface. If the <b>disable-timeout</b> statement has been included in the BPDU configuration, the interface automatically returns to service after the timer expires.</li> <li>• <b>blocked by RTG</b>—The specified redundant trunk group is disabled.</li> <li>• <b>blocked by STP</b>—The interface is disabled due to a spanning-tree protocol error.</li> <li>• <b>MAC limit exceeded</b>—The interface is temporarily disabled due to a MAC limit error. The disabled interface is automatically restored to service when the disable timeout expires.</li> <li>• <b>MAC move limit exceeded</b>—The interface is temporarily disabled due to a MAC move limit error. The disabled interface is automatically restored to service when the disable timeout expires.</li> <li>• <b>Storm control in effect</b>—The interface is temporarily disabled due to a storm control error. The disabled interface is automatically restored to service when the disable timeout expires.</li> </ul> | none, <b>brief</b> , <b>detail</b> ,                |

Table 1: show ethernet-switching interfaces Output Fields (*continued*)

| Field Name                           | Field Description  | Level of Output |
|--------------------------------------|--|-----------------|
| <b>Number of MACs learned on IFL</b> | Number of MAC addresses learned by this interface.   | <b>detail</b>   |
| <b>mapping</b>                       | <p>When mapping is configured, the status is one of the following C-VLAN to S-VLAN mapping types:</p> <ul style="list-style-type: none"> <li><b>dot1q-tunneled</b>—The interface maps all traffic to the S-VLAN (all-in-one bundling).</li> <li><b>native</b>—The interface maps untagged and priority tagged packets to the S-VLAN.</li> <li><b>push</b>—The interface maps packets to a firewall filter to an S-VLAN.</li> <li><b>policy-mapped</b>—The interface maps packets to a specifically defined S-VLAN.</li> <li><b>integer</b>—The interface maps packets to the specified S-VLAN.</li> </ul> <p>When mapping is not configured, this entry does not appear in the command output.</p> | <b>detail</b>   |

## Sample Output

```

show user@switch> show ethernet-switching interfaces
ethernet-switching
interfaces
Interface      State  VLAN members      Tag  Tagging  Blocking
-----
ae0.0          up     default
ge-0/0/2.0     up     vlan300           300  untagged unblocked
ge-0/0/3.0     up     default           blocked by STP
ge-0/0/4.0     down   default           MAC limit exceeded
ge-0/0/5.0     down   default           MAC move limit exceeded
ge-0/0/6.0     down   default           Storm control in effect
ge-0/0/7.0     down   default           unblocked
ge-0/0/13.0    up     default           untagged unblocked
ge-0/0/14.0    up     vlan100           100  tagged  unblocked
ge-0/0/14.0    up     vlan200           200  tagged  unblocked
ge-0/0/15.0    up     vlan100           100  tagged  blocked by STP
ge-0/0/15.0    up     vlan200           200  tagged  blocked by STP
ge-0/0/16.0    down   default           untagged unblocked
ge-0/0/17.0    down   vlan100           100  tagged  Disabled by bpdu-control
ge-0/0/17.0    down   vlan200           200  tagged  Disabled by bpdu-control

show user@switch> show ethernet-switching interfaces ge-0/0/15 brief
ethernet-switching
interfaces ge-0/0/15
brief
Interface      State  VLAN members      Tag  Tagging  Blocking
-----
ge-0/0/15.0    up     vlan100           100  tagged  blocked by STP
ge-0/0/15.0    up     vlan200           200  tagged  blocked by STP

show user@switch> show ethernet-switching interfaces ge-0/0/2 detail
ethernet-switching
interfaces ge-0/0/2
detail (Blocked by RTG
rtggroup)
Interface: ge-0/0/2.0, Index: 65, State: up, Port mode: Access
Ether type for the interface: 0X8100
VLAN membership:
vlan300, 802.1Q Tag: 300, untagged, msti-id: 0, blocked by RTG(rtgroup)

```

Number of MACs learned on IFL: 0

**show  
ethernet-switching  
interfaces ge-0/0/15  
detail (Blocked by  
STP)**

user@switch> show ethernet-switching interfaces ge-0/0/15 detail

Interface: ge-0/0/15.0, Index: 70, State: up, Port mode: Trunk  
Ether type for the interface: 0X8100  
VLAN membership:  
    vlan100, 802.1Q Tag: 100, tagged, msti-id: 0, blocked by STP  
    vlan200, 802.1Q Tag: 200, tagged, msti-id: 0, blocked by STP

Number of MACs learned on IFL: 0

**show  
ethernet-switching  
interfaces ge-0/0/17  
detail (Disabled by  
bpdu-control)**

user@switch> show ethernet-switching interfaces ge-0/0/17 detail

Interface: ge-0/0/17.0, Index: 71, State: down, Port mode: Trunk  
Ether type for the interface: 0X8100  
VLAN membership:  
    vlan100, 802.1Q Tag: 100, tagged, msti-id: 1, Disabled by bpdu-control  
    vlan200, 802.1Q Tag: 200, tagged, msti-id: 2, Disabled by bpdu-control  
Number of MACs learned on IFL: 0

**show  
ethernet-switching  
interfaces detail  
(C-VLAN to S-VLAN  
Mapping)**

user@switch> show ethernet-switching interfaces ge-0/0/6.0 detail

Interface: ge-0/0/6.0, Index: 73, State: up, Port mode: Access  
Ether type for the interface: 0X8100  
VLAN membership:  
    map, 802.1Q Tag: 134, Mapped Tag: native, push, dot1q-tunneled, unblocked  
    map, 802.1Q Tag: 134, Mapped Tag: 20, push, dot1q-tunneled, unblocked

**show  
ethernet-switching  
interfaces detail  
(Reflective Relay Is  
Configured)**

user@switch1> show ethernet-switching interfaces ge-7/0/2 detail

Interface: ge-7/0/2, Index: 66, State: down, Port mode: Tagged-access  
Ether type for the interface: 0X8100  
Reflective Relay Status: Enabled  
Ether type for the interface: 0x8100  
VLAN membership:  
    VLAN\_Purple VLAN\_Orange VLAN\_Blue, 802.1Q Tag: 450, tagged, unblocked  
Number of MACs learned on IFL: 0

## show ethernet-switching table

---

|                                 |  |
|---------------------------------|--|
| <b>Syntax</b>                   | <pre>show ethernet-switching table &lt;brief   detail   extensive   summary&gt; &lt;interface <i>interface-name</i>&gt; &lt;management-vlan&gt; &lt;persistent-mac &lt;interface <i>interface-name</i>&gt;&gt; &lt;sort-by (<i>name</i>   <i>tag</i>)&gt; &lt;vlan <i>vlan-name</i>&gt;</pre>  |
| <b>Release Information</b>      | <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Options <b>summary</b>, <b>management-vlan</b>, and <b>vlan <i>vlan-name</i></b> introduced in Junos OS Release 9.6 for EX Series switches.</p> <p>Option <b>sort-by</b> and field name <b>tag</b> introduced in Junos OS Release 10.1 for EX Series switches.</p> <p>Option <b>persistent-mac</b> introduced in Junos OS Release 11.4 for EX Series switches.</p>  |
| <b>Description</b>              | Display the Ethernet switching table.  |
| <b>Options</b>                  | <p><b>none</b>—(Optional) Display brief information about the Ethernet switching table.</p> <p><b>brief   detail   extensive   summary</b>—(Optional) Display the specified level of output.</p> <p><b>interface <i>interface-name</i></b>—(Optional) Display the Ethernet switching table for a specific interface.</p> <p><b>management-vlan</b>—(Optional) Display the Ethernet switching table for a management VLAN.</p> <p><b>persistent-mac &lt;interface <i>interface-name</i>&gt;</b>—(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><b>sort-by (<i>name</i>   <i>tag</i>)</b>—(Optional) Display VLANs in ascending order of VLAN IDs or VLAN names.</p> <p><b>vlan <i>vlan-name</i></b>—(Optional) Display the Ethernet switching table for a specific VLAN.</p> |
| <b>Required Privilege Level</b> | view   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• clear ethernet-switching table</li><li>• Example: Setting Up Basic Bridging and a VLAN for an EX Series Switch</li><li>• Example: Setting Up Bridging with Multiple VLANs for EX Series Switches</li><li>• Example: Setting Up Q-in-Q Tunneling on EX Series Switches</li></ul>  |
| <b>List of Sample Output</b>    | <p><a href="#">show ethernet-switching table on page 40</a></p> <p><a href="#">show ethernet-switching table brief on page 40</a></p>  |



[show ethernet-switching table detail on page 41](#)  
[show ethernet-switching table extensive on page 41](#)  
[show ethernet-switching table persistent-mac on page 42](#)  
[show ethernet-switching table persistent-mac interface ge-0/0/16.0 on page 42](#)

**Output Fields** [Table 2 on page 39](#) lists the output fields for the **show ethernet-switching table** command. Output fields are listed in the approximate order in which they appear.

**Table 2: show ethernet-switching table Output Fields**

| Field Name                | Field Description  | Level of Output                         |
|---------------------------|--|---|
| <b>VLAN</b>               | The name of a VLAN.  | All levels                              |
| <b>Tag</b>                | The VLAN ID tag name or number.  | <b>extensive</b>                        |
| <b>MAC or MAC address</b> | The MAC address associated with the VLAN.  | All levels                              |
| <b>Type</b>               | The type of MAC address. Values are: <ul style="list-style-type: none"> <li>• <b>static</b>—The MAC address is manually created.</li> <li>• <b>learn</b>—The MAC address is learned dynamically from a packet's source MAC address.</li> <li>• <b>flood</b>—The MAC address is unknown and flooded to all members.</li> <li>• <b>persistent</b>—The learned MAC addresses that will persist across restarts of the switch or interface-down events.</li> </ul> | All levels except <b>persistent-mac</b> |
| <b>Type</b>               | The type of MAC address. Values are: <ul style="list-style-type: none"> <li>• <b>installed</b>—addresses that are in the Ethernet switching table.</li> <li>• <b>uninstalled</b>—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.</li> </ul>   | <b>persistent-mac</b>                   |
| <b>Age</b>                | The time remaining before the entry ages out and is removed from the Ethernet switching table.   | All levels                              |
| <b>Interfaces</b>         | Interface associated with learned MAC addresses or <b>All-members</b> (flood entry).   | All levels                              |
| <b>Learned</b>            | For learned entries, the time which the entry was added to the Ethernet switching table.   | <b>detail, extensive</b>                |
| <b>Nexthop index</b>      | The next-hop index number.   | <b>detail, extensive</b>                |
| <b>persistent-mac</b>     | <b>installed</b> indicates MAC addresses that are in the Ethernet switching table and <b>uninstalled</b> 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 user@switch> show ethernet-switching table
ethernet-switching Ethernet-switching table: 57 entries, 15 learned, 2 persistent
table
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 user@switch> show ethernet-switching table brief
ethernet-switching Ethernet-switching table: 57 entries, 15 learned, 2 persistent entries
table brief
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
Nextthop 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
Nextthop index: 1315

VLAN: v1, Tag: 101, MAC: *, Interface: All-members
Interfaces:
  ge-0/0/31.0
Type: Flood
Nextthop 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
Nextthop index: 1312

VLAN: v2, Tag: 102, MAC: *, Interface: All-members
Interfaces:
  ae0.0
Type: Flood
Nextthop 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
Nextthop index: 567

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

```