Junos® OS

Layer 2 Bridging and Switching Configuration Guide for Security Devices

Release
12.1

Published: 2012-03-06

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Junos OS Layer 2 Bridging and Switching Configuration Guide for Security Devices
Release 12.1

Revision History
March 2012—R1 Junos OS 12.1

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

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Abbreviated Table of Contents

Table of Contents

Part 2 Index

About This Guide

This preface provides the following guidelines for using the *Junos OS Layer 2 Bridging and Switching Configuration Guide for Security Devices*:

J Series and SRX Series Documentation and Release Notes

For a list of related J Series documentation, see http://www.juniper.net/techpubs/software/junos-jseries/index-main.html .

For a list of related SRX Series documentation, see http://www.juniper.net/techpubs/hardware/srx-series-main.html .

If the information in the latest release notes differs from the information in the documentation, follow the *Junos OS 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/.

Juniper Networks supports a technical book program to publish books by Juniper Networks engineers and subject matter experts with book publishers around the world. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration using the Junos operating system (Junos OS) and Juniper Networks devices. In addition, the Juniper Networks Technical Library, published in conjunction with O'Reilly Media, explores improving network security, reliability, and availability using Junos OS configuration techniques. All the books are for sale at technical bookstores and book outlets around the world. The current list can be viewed at http://www.juniper.net/books .

Objectives

This guide contains instructions for configuring the J Series and SRX Series interfaces for basic IP routing with standard routing protocols. It also shows how to create backup ISDN interfaces, configure digital subscriber line (DSL) connections and link services, create stateless firewall filters—also known as access control lists (ACLs)—and configure class-of-service (CoS) traffic classification.

Audience

This manual is designed for anyone who installs, sets up, configures, monitors, or administers a J Series Services Router or an SRX Series Services Gateway running Junos OS. The manual is intended for the following audiences:

- Customers with technical knowledge of and experience with networks and network security, the Internet, and Internet routing protocols
- Network administrators who install, configure, and manage Internet routers

Supported Routing Platforms

This manual describes features supported on J Series Services Routers and SRX Series Services Gateways running Junos OS.

Document Conventions

Table 1 on page xii defines the 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.

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

Table 2: Text and Syntax Conventions

<table>
<tr><th>Convention</th><th>Description</th><th>Examples</th></tr>
<tr><td>Bold text like this</td><td>Represents text that you type.</td><td>To enter configuration mode, type the configure command:

user@host> configure</td></tr>
<tr><td><code>Fixed-width text like this</code></td><td>Represents output that appears on the terminal screen.</td><td><code>user@host></code> show chassis alarms

<code>No alarms currently active</code></td></tr>
<tr><td>Italic text like this</td><td>• Introduces important new terms.
• Identifies book names.
• Identifies RFC and Internet draft titles.</td><td>• A policy term is a named structure that defines match conditions and actions.
• Junos OS System Basics Configuration Guide
• RFC 1997, BGP Communities Attribute</td></tr>
<tr><td>Italic text like this</td><td>Represents variables (options for which you substitute a value) in commands or configuration statements.</td><td>Configure the machine's domain name:

[edit]
root@# set system domain-name domain-name</td></tr>
<tr><td>Text like this</td><td>Represents names of configuration statements, commands, files, and directories; interface names; configuration hierarchy levels; or labels on routing platform components.</td><td>• To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level.
• The console port is labeled CONSOLE.</td></tr>
<tr><td>< > (angle brackets)</td><td>Enclose optional keywords or variables.</td><td>stub <default-metric <i>metric</i>>;</td></tr>
<tr><td>| (pipe symbol)</td><td>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.</td><td>broadcast | multicast

(string1 | string2 | string3)</td></tr>
<tr><td># (pound sign)</td><td>Indicates a comment specified on the same line as the configuration statement to which it applies.</td><td>rsvp { # Required for dynamic MPLS only</td></tr>
<tr><td>[ ] (square brackets)</td><td>Enclose a variable for which you can substitute one or more values.</td><td>community name members [community-ids]</td></tr>
<tr><td>Indention and braces ({ })</td><td>Identify a level in the configuration hierarchy.</td><td rowspan="2">[edit]
routing-options {
  static {
    route default {
      nexthop address;
      retain;
    }
  }
}</td></tr>
<tr><td>; (semicolon)</td><td>Identifies a leaf statement at a configuration hierarchy level.</td></tr>
<tr><td colspan="3">J-Web GUI Conventions</td></tr>
</table>

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

Convention	Description	Examples
Bold text like this	Represents J-Web graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of J-Web 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 send your comments to **techpubs-comments@juniper.net**, or fill out the documentation feedback form at https://www.juniper.net/cgi-bin/docbugreport/ . If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release 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 postsales 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 .
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- 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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For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

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- 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, visit us at http://www.juniper.net/support/requesting-support.html

PART 1

Layer 2 Bridging and Switching

CHAPTER 1

Configuring Ethernet Ports for Switching

Ethernet Ports Switching Overview

Certain ports on Juniper Networks devices can function as Ethernet access switches that switch traffic at Layer 2 and route traffic at Layer 3.

You can deploy supported devices in branch offices as an access or desktop switch with integrated routing capability, thus eliminating intermediate access switch devices from your network topology. The Ethernet ports provide switching while the Routing Engine provides routing functionality, enabling you to use a single device to provide routing, access switching, and WAN interfaces.

This topic contains the following sections:

Supported Devices and Ports

Juniper Networks supports switching features on the following Ethernet ports and devices (see Table 3 on page 4):

- Multiport Gigabit Ethernet uPIMs on the J Series device
- Onboard Ethernet ports (Gigabit and Fast Ethernet built-in ports) on the SRX100, SRX210, and SRX240 devices
- Multiport Gigabit Ethernet XPIM on the SRX650 device

Table 3: Supported Devices and Ports for Switching Features

Device	Ports
J Series devices	Multiport Gigabit Ethernet uPIMs
SRX240 devices	Onboard Gigabit Ethernet ports (**ge-0/0/0** through **ge-0/0/15**)
SRX210 devices	Onboard Gigabit Ethernet ports (**ge-0/0/0** and **ge-0/0/1**) Onboard Fast Ethernet ports (**fe-0/0/2** and **fe-0/0/7**)
SRX100 devices	Onboard Fast Ethernet ports (**fe-0/0/0** and **fe-0/0/7**)
SRX650 devices	Multiport Gigabit Ethernet XPIM modules

On J Series and SRX650 devices, you can set multiport switch modules (uPIMs and XPIMs, respectively) to three modes of operation: routing (the default), switching, or enhanced switching. Routed traffic is forwarded from any port of the Gigabit Ethernet uPIM to the WAN interface. Switched traffic is forwarded from one port of the Gigabit Ethernet uPIM to another port on the same Gigabit Ethernet uPIM. Switched traffic is not forwarded from a port on one uPIM to a port on a different uPIM.

On the SRX100, SRX220, and SRX240 devices, you can set the onboard Gigabit Ethernet ports to operate as either switched ports or routed ports.

Integrated Bridging and Routing

Integrated bridging and routing (IRB) provides support for simultaneous Layer 2 bridging and Layer 3 routing within the same bridge domain. Packets arriving on an interface of the bridge domain are switched or routed based on the destination MAC address of the packet. Packets with the router's MAC address as the destination are routed to other Layer 3 interfaces.

Link Layer Discovery Protocol and LLDP-Media Endpoint Discovery

Devices use Link Layer Discovery Protocol (LLDP) and LLDP-Media Endpoint Discovery (MFD) to learn and distribute device information on network links. The information allows the device to quickly identify a variety of systems, resulting in a LAN that interoperates smoothly and efficiently.

LLDP-capable devices transmit information in Type Length Value (TLV) messages to neighbor devices. Device information can include specifics, such as chassis and port identification and system name and system capabilities. The TLVs leverage this information from parameters that have already been configured in the Junos OS.

LLDP-MED goes one step further, exchanging IP-telephony messages between the device and the IP telephone. These TLV messages provide detailed information on Power over Ethernet (PoE) policy. The PoE Management TLVs let the device ports advertise the power level and power priority needed. For example, the device can compare the power needed by an IP telephone running on a PoE interface with available resources. If the device cannot meet the resources required by the IP telephone, the device could negotiate with the telephone until a compromise on power is reached.

The following basic TLVs are supported:

- Chassis Identifier—The MAC address associated with the local system.
- Port identifier—The port identification for the specified port in the local system.
- Port Description—The user-configured port description. The port description can be a maximum of 256 characters.
- System Name—The user-configured name of the local system. The system name can be a maximum of 256 characters.
- Switching Features Overview—This information is not configurable, but taken from the software.
- System Capabilities—The primary function performed by the system. The capabilities that system supports; for example, bridge or router. This information is not configurable, but based on the model of the product.
- Management Address—The IP management address of the local system.

The following LLDP-MED TLVs are supported:

- LLDP-MED Capabilities—A TLV that advertises the primary function of the port. The values range from 0 through 15:
  - 0—Capabilities
  - 1—Network policy
  - 2—Location identification
  - 3—Extended power through medium-dependent interface power-sourcing equipment (MDI-PSE)
  - 4—Inventory
  - 5–15—Reserved
- LLDP-MED Device Class Values:
  - 0—Class not defined
  - 1—Class 1 device
  - 2—Class 2 device
  - 3—Class 3 device

- 4—Network connectivity device
- 5–255— Reserved

- Network Policy—A TLV that advertises the port VLAN configuration and associated Layer 2 and Layer 3 attributes. Attributes include the policy identifier, application types, such as voice or streaming video, 802.1Q VLAN tagging, and 802.1p priority bits and Diffserv code points.
- Endpoint Location—A TLV that advertises the physical location of the endpoint.
- Extended Power via MDI—A TLV that advertises the power type, power source, power priority, and power value of the port. It is the responsibility of the PSE device (network connectivity device) to advertise the power priority on a port.

LLDP and LLDP-MED must be explicitly configured on uPIMs (in enhanced switching mode) on J Series devices, base ports on SRX100, SRX210, and SRX240 devices, and Gigabit Backplane Physical Interface Modules (GPIMs) on SRX650 devices. To configure LLDP on all interfaces or on a specific interface, use the **lldp** statement at the [**set protocols**] hierarchy. To configure LLDP-MED on all interfaces or on a specific interface, use the **lldp-med** statement at the [**set protocols**] hierarchy.

Types of Switch Ports

The ports, or interfaces, on a switch operate in either access mode or trunk mode.

An interface in access mode connects to a network device, such as a desktop computer, an IP telephone, a printer, a file server, or a security camera. The interface itself belongs to a single VLAN. The frames transmitted over an access interface are normal Ethernet frames.

Trunk interfaces handle traffic for multiple VLANs, multiplexing the traffic for all those VLANs over the same physical connection. Trunk interfaces are generally used to interconnect switches to one another.

uPIM in a Daisy Chain

You cannot combine multiple uPIMs to act as a single integrated switch. However, you can connect uPIMs on the same chassis externally by physically connecting a port on one uPIM to a port on another uPIM in a daisy-chain fashion.

Two or more uPIMs daisy-chained together create a single switch with a higher port count than either individual uPIM. One port on each uPIM is used solely for the connection. For example, if you daisy-chain a 6-port uPIM and an 8-port uPIM, the result operates as a 12-port uPIM. Any port of a uPIM can be used for daisy chaining.

Configure the IP address for only one of the daisy-chained uPIMs, making it the primary uPIM. The secondary uPIM routes traffic to the primary uPIM, which forwards it to the Routing Engine. This results in some increase in latency and packet drops due to oversubscription of the external link.

Only one link between the two uPIMs is supported. Connecting more than one link between uPIMs creates a loop topology, which is not supported.

Q-in-Q VLAN Tagging

Q-in-Q tunneling, defined by the IEEE 802.1ad standard, allows service providers on Ethernet access networks to extend a Layer 2 Ethernet connection between two customer sites.

In Q-in-Q tunneling, as a packet travels from a customer VLAN (C-VLAN) to a service provider's VLAN, a service provider-specific 802.1Q tag is added to the packet. This additional tag is used to segregate traffic into service-provider-defined service VLANs (S-VLANs). The original customer 802.1Q tag of the packet remains and is transmitted transparently, passing through the service provider's network. As the packet leaves the S-VLAN in the downstream direction, the extra 802.1Q tag is removed.

NOTE: **When Q-in-Q tunneling is configured for a service provider's VLAN, all Routing Engine packets, including packets from the routed VLAN interface, that are transmitted from the customer-facing access port of that VLAN will always be untagged.**

There are three ways to map C-VLANs to an S-VLAN:

- All-in-one bundling—Use the **dot1q-tunneling** statement at the [**edit vlans**] hierarchy to map without specifying customer VLANs. All packets from a specific access interface are mapped to the S-VLAN.
- Many-to-one bundling—Use the **customer-vlans** statement at the [**edit vlans**] hierarchy to specify which C-VLANs are mapped to the S-VLAN.
- Mapping C-VLAN on a specific interface—Use the **mapping** statement at the [**edit vlans**] hierarchy to map a specific C-VLAN on a specified access interface to the S-VLAN.

Table 4 on page 7 lists the C-VLAN to S-VLAN mapping supported on SRX Series devices:

Table 4: Supported Mapping Methods

Mapping	SRX210	SRX240	SRX650	J Series Devices (PIM)
All-in-one bundling	Yes	Yes	Yes	Yes
Many-to-one bundling	No	No	Yes	No
Mapping C-VLAN on a specific interface	No	No	Yes	No

NOTE: On SRX650 devices, in the dot1q-tunneling configuration options, customer VLANs range and VLAN push do not work together for the same S-VLAN, even when you commit the configuration. If both are configured, then VLAN push takes priority over customer VLANs range.

IRB interfaces are supported on Q-in-Q VLANs for SRX210, SRX240, SRX650, and J Series devices. Packets arriving on an IRB interface on a Q-in-Q VLAN are routed regardless of whether the packet is single or double tagged. The outgoing routed packets contain an S-VLAN tag only when exiting a trunk interface; the packets exit the interface untagged when exiting an access interface.

In a Q-in-Q deployment, customer packets from downstream interfaces are transported without any changes to source and destination MAC addresses. You can disable MAC address learning at both the interface level and the VLAN level. Disabling MAC address learning on an interface disables learning for all the VLANs of which that interface is a member. When you disable MAC address learning on a VLAN, MAC addresses that have already been learned are flushed.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Interfaces Configuration Guide for Security Devices*
- Understanding Switching Modes on page 8

Switching Modes

Understanding Switching Modes

You can set a multiport Gigabit Ethernet uPIM on a J Series device to either switching or enhanced switching mode. The default mode of operation is routing mode.

When you set a multiport uPIM to switching mode, the uPIM appears as a single entity for monitoring purposes. The only physical port settings that you can configure are autonegotiation, speed, and duplex mode on each uPIM port, and these settings are optional.

Example: Configuring Switching Modes

This example shows how to configure a multiport Gigabit Ethernet uPIM to function in switching mode so the uPIM appears as a single entity for monitoring purposes.

- Configuration on page 9
- Verification on page 9

Requirements

Before you begin, see "Understanding Switching Modes" on page 8.

Overview

In this example, you configure **chassis** and set the uPIM mode of operation to switching. You then set the uPIM mode of operation to enhanced switching. Finally, you configure interface ge-2/0/0 and set the physical port parameter to auto-negotiation on switch port 1 on the uPIM.

Configuration

Step-by-Step Procedure

To configure a uPIM to function in switching mode:

1. Set the uPIM mode of operation to switching.

   [edit chassis fpc 0 pic 0 ethernet]
   user@host# **set pic-mode switching**

2. Set the uPIM mode of operation to enhanced switching.

   [edit chassis fpc 0 pic 0 ethernet]
   user@host# **set pic-mode enhanced-switching**

3. Set a physical port parameter on the uPIM.

   [edit]
   user@host# **set interfaces ge-2/0/0 switch-options switch-port 1 auto-negotiation**

4. If you are done configuring the device, commit the configuration.

   [edit]
   user@host# **commit**

Verification

To verify the configuration is working properly, enter the **show interfaces ge-2/0/0 switch-options** and **show chassis fpc 0** commands.

Verifying Switching Mode Configuration

Purpose

The operational mode command for checking the status and statistics for multiport uPIMs in switching mode is different from that in routing mode. For uPIMs in routing mode, the operational commands are the same as for other Gigabit Ethernet interfaces, such as the 1-port Gigabit Ethernet ePIM and built-in Gigabit Ethernet ports.

However, not all operational mode commands are supported for ports of a uPIM in switching mode. For example, the operational mode command for monitoring port statistics is not supported.

NOTE: To clear the statistics for the individual switch ports, use the **clear interfaces statistics ge-*pim*/0/0 switch-port *port-number*** command.

To verify the status and view statistics for a port on a uPIM in switching mode:

user@host# **show interfaces ge-*slot*/0/0 switch-port *port-number***

```
Port 0, Physical link is Up
        Speed: 100mbps, Auto-negotiation: Enabled
   Statistics:                          Receive         Transmit
          Total bytes                   28437086        21792250
          Total packets                   409145           88008
          Unicast packets                   9987           83817
          Multicast packets               145002               0
          Broadcast packets               254156            4191
          Multiple collisions                 23              10
          FIFO/CRC/Align errors                0               0
          MAC pause frames                     0               0
          Oversized frames                     0
          Runt frames                          0
          Jabber frames                        0
          Fragment frames                      0
          Discarded frames                     0
        Autonegotiation information:
          Negotiation status: Complete
          Link partner:
              Link mode: Full-duplex, Flow control: None, Remote fault: OK, Link
 partner Speed: 100 Mbps
          Local resolution:
              Flow control: None, Remote fault: Link OK
```

VLANs

Understanding VLANs

Each VLAN is a collection of network nodes that are grouped together to form separate broadcast domains. On an Ethernet network that is a single LAN, all traffic is forwarded to all nodes on the LAN. On VLANs, frames whose origin and destination are in the same VLAN are forwarded only within the local VLAN. Frames that are not destined for the local VLAN are the only ones forwarded to other broadcast domains. VLANs thus limit the amount of traffic flowing across the entire LAN, reducing the possible number of collisions and packet retransmissions within a VLAN and on the LAN as a whole.

On an Ethernet LAN, all network nodes must be physically connected to the same network. On VLANs, the physical location of the nodes is not important, so you can group network devices in any way that makes sense for your organization, such as by department or business function, by types of network nodes, or even by physical location. Each VLAN is identified by a single IP subnetwork and by standardized IEEE 802.1Q encapsulation.

To identify which VLAN the traffic belongs to, all frames on an Ethernet VLAN are identified by a tag, as defined in the IEEE 802.1Q standard. These frames are tagged and are encapsulated with 802.1Q tags.

For a simple network that has only a single VLAN, all traffic has the same 802.1Q tag. When an Ethernet LAN is divided into VLANs, each VLAN is identified by a unique 802.1Q tag. The tag is applied to all frames so that the network nodes receiving the frames know to which VLAN a frame belongs. Trunk ports, which multiplex traffic among a number of VLANs, use the tag to determine the origin of frames and where to forward them.

Fore VLAN configuration details, see Table 5 on page 11.

Table 5: VLAN Configuration Details

Field	Function	Action
General		
VLAN Name	Specifies a unique name for the VLAN.	Enter a name. NOTE: VLAN text field is disabled when vlan-tagging is not enabled.
VLAN ID/Range	Specifies the identifier or range for the VLAN.	Select one: • **VLAN ID**—Type a unique identification number from **1** through **4094**. If no value is specified, it defaults to 1. • **VLAN Range**—Type a number range to create VLANs with IDs corresponding to the range. For example, the range 2–3 will create two VLANs with the ID 2 and 3.
Description	Describes the VLAN.	Enter a brief description for the VLAN.
Input Filter	Specifies the VLAN firewall filter that is applied to incoming packets.	To apply an input firewall filter, select the firewall filter from the list.
Output Filter	Specifies the VLAN firewall filter that is applied to outgoing packets.	To apply an output firewall filter, select the firewall filter from the list.
Ports		
Ports	Specifies the ports to be associated with this VLAN for data traffic. You can also remove the port association.	Click one: • **Add**—Select the ports from the available list. • **Remove**—Select the port that you do not want associated with the VLAN.
IP Address		
Layer 3 Information	Specifies IP address options for the VLAN.	Select to enable the IP address options.
IP Address	Specifies the IP address of the VLAN.	Enter the IP address.
Subnet Mask	Specifies the range of logical addresses within the address space that is assigned to an organization.	Enter the address, for example, **255.255.255.0**. You can also specify the address prefix.

Table 5: VLAN Configuration Details *(continued)*

Field	Function	Action
Input Filter	Specifies the VLAN interface firewall filter that is applied to incoming packets.	To apply an input firewall filter to an interface, select the firewall filter from the list.
Output Filter	Specifies the VLAN interface firewall filter that is applied to outgoing packets.	To apply an output firewall filter to an interface, select the firewall filter from the list.
ARP/MAC Details	Specifies the details for configuring the static IP address and MAC.	Click the **ARP/MAC Details** button. Enter the static IP address and MAC address in the window that is displayed.
VoIP		
Ports	Specifies the ports to be associated with this VLAN for voice traffic. You can also remove the port association.	Click one: • **Add**—Select the ports from the available list. • **Remove**—Select the port that you do not want associated with the VLAN.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Example: Configuring VLANs on page 12
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Configuring VLANs

This example shows you how to configure a VLAN.

Requirements

Before you begin:

- Determine which interfaces to use and verify that they are in switch mode. See "Example: Configuring Switching Modes" on page 8.
- Determine what ports to use on the device and how to segment your network. See "Understanding Switching Modes" on page 8.

Overview

In this example, you create a new VLAN and then configure attributes.

Configuration

GUI Step-by-Step Procedure

To access the VLAN:

1. In the J-Web user interface, select **Configure>Switching>VLAN**.

   The VLAN configuration page displays a list of existing VLANs. If you select a specific VLAN, the specific VLAN details are displayed in the details section.

2. Click one:
   - **Add**—Creates a VLAN.
   - **Edit**—Edits an existing VLAN configuration.
   - **Delete**—Deletes an existing VLAN.

   NOTE: If you delete a VLAN, the VLAN configuration for all the associated interfaces is also deleted.

   Add or edit VLAN information.
3. Click one:
   - **OK**—Saves the configuration and returns to the main configuration page, then click **Commit Options**>**Commit**.
   - **Cancel**—Cancels your entries and returns to the main configuration page.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding VLANs on page 10
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Spanning Tree Protocol

Understanding the Spanning Tree Protocol

Spanning Tree Protocol (STP), defined in IEEE 802.1D, creates a tree of links in the Ethernet switched network. Links that cause loops in the network are disabled, thereby providing a single active link between any two switches.

Rapid Spanning Tree Protocol (RSTP), originally defined in IEEE 802.1w and later merged into IEEE 802.1D, facilitates faster spanning tree convergence after a topology change.

Multiple Spanning Tree Protocol (MSTP), initially defined in IEEE 802.1s and later included in IEEE 802.1Q, supports mapping of multiple VLANs onto a single spanning tree instance. This reduces the number of spanning tree instances required in a switched network with many VLANs.

Juniper Networks devices provide Layer 2 loop prevention through STP, RSTP, and MSTP. You can configure bridge protocols data unit (BPDU) protection on interfaces to prevent them from receiving BPDUs that could result in STP misconfigurations, which could lead to network outages.

For STP configuration parameters, see Table 6 on page 14.

Table 6: STP Configuration Parameters

Field	Function	Action
Protocol Name	Displays the spanning-tree protocol.	View only.
Disable	Disables STP on the interface.	To enable this option, select the check box.
BPDU Protect	Specifies that BPDU blocks are to be processed.	To enable this option, select the check box.
Bridge Priority	Specifies the bridge priority. The bridge priority determines which bridge is elected as the root bridge. If two bridges have the same path cost to the root bridge, the bridge priority determines which bridge becomes the designated bridge for a LAN segment.	Select a value.
Forward Delay	Specifies the number of seconds an interface waits before changing from spanning-tree learning and listening states to the forwarding state.	Enter a value from 4 through 30 seconds.
Hello Time	Specifies time interval in seconds at which the root bridge transmits configuration BPDUs.	Enter a value from 1 through 10 seconds.
Max Age	Specifies the maximum aging time in seconds for all MST instances. The maximum aging time is the number of seconds a switch waits without receiving spanning-tree configuration messages before attempting a reconfiguration.	Enter a value from 6 through 40 seconds.

For RSTP configuration parameters, see Table 7 on page 14.

Table 7: RSTP Configuration Parameters

Field	Function	Action
Protocol Name	Displays the spanning-tree protocol.	View only.
Disable	Specifies whether RSTP must be disabled on the interface.	To enable this option, select the check box.
BPDU Protect	Specifies that BPDU blocks are to be processed.	To enable this option, select the check box.
Bridge Priority	Specifies the bridge priority. The bridge priority determines which bridge is elected as the root bridge. If two bridges have the same path cost to the root bridge, the bridge priority determines which bridge becomes the designated bridge for a LAN segment.	Select a value.
Forward Delay	Specifies the number of seconds a port waits before changing from its spanning-tree learning and listening states to the forwarding state.	Enter a value from 4 through 30 seconds.

Table 7: RSTP Configuration Parameters *(continued)*

Field	Function	Action
Hello Time	Specifies the hello time in seconds for all MST instances.	Enter a value from 1 through 10 seconds.
Max Age	Specifies the maximum aging time in seconds for all MST instances. The maximum aging time is the number of seconds a switch waits without receiving spanning-tree configuration messages before attempting a reconfiguration.	Enter a value from 6 through 40 seconds.

For MSTP configuration parameters, see Table 8 on page 15.

Table 8: MSTP Configuration Parameters

Field	Function	Action
Protocol Name	Displays the spanning-tree protocol.	View only.
Disable	Specifies whether MSTP must be disabled on the interface.	To enable this option, select the check box.
BPDU Protect	Specifies that BPDU blocks are to be processed.	To enable this option, select the check box.
Bridge Priority	Specifies the bridge priority. The bridge priority determines which bridge is elected as the root bridge. If two bridges have the same path cost to the root bridge, the bridge priority determines which bridge becomes the designated bridge for a LAN segment.	Select a value.
Forward Delay	Specifies the number of seconds a port waits before changing from its spanning-tree learning and listening states to the forwarding state.	Enter a value from 4 through 30 seconds.
Hello Time	Specifies the hello time in seconds for all MST instances.	Enter a value from 1 through 10 seconds.
Max Age	Specifies the maximum aging time for all MST instances. The maximum aging time is the number of seconds a switch waits without receiving spanning-tree configuration messages before attempting a reconfiguration.	Enter a value from 6 through 40 seconds.
Configuration Name	MSTP region name carried in the MSTP bridge protocol data units (BPDUs).	Enter a name.
Max Hops	Maximum number of hops a BPDU can be forwarded in the MSTP region.	Enter a value from 1 through 255.
Revision Level	Revision number of the MSTP region configuration.	Enter a value from 0 through 65,535.
MSTI tab		

Table 8: MSTP Configuration Parameters *(continued)*

Field	Function	Action
MSTI Id	Specifies the multiple spanning-tree instance (MSTI) identifier. MSTI IDs are local to each region, so you can reuse the same MSTI ID in different regions.	Click one: • **Add**—Creates a MSTI. • **Edit**—Edits an existing MSTI. • **Delete**—Deletes an existing MSTI.
Bridge Priority	Specifies the bridge priority. The bridge priority determines which bridge is elected as the root bridge. If two bridges have the same path cost to the root bridge, the bridge priority determines which bridge becomes the designated bridge for a LAN segment.	Select a value.
VLAN	Specifies the VLANs for the MSTI.	Click one: • **Add**—Selects VLANs from the list. • **Remove**—Deletes the selected VLAN.
Interfaces	Specifies the interface for the MSTP protocol.	Click one: • **Add**—Selects interfaces from the list. • **Edit**—Edits the selected interface. • **Remove**—Deletes the selected interface.

For spanning-tree port configuration details, see Table 9 on page 16.

Table 9: Spanning-Tree Ports Configuration Details

Field	Function	Action
Interface Name	Specifies the interface for the spanning-tree protocol type.	Select an interface.
Cost	Specifies the link cost to control which bridge is the designated bridge and which interface is the designated interface.	Enter a value from 1 through 200,000,000.
Priority	Specifies the interface priority to control which interface is elected as the root port.	Select a value.
Edge	Configures the interface as an edge interface. Edge interfaces immediately transition to a forwarding state.	Select to configure the interface as an edge interface.
Mode	Specifies the link mode.	Select one: • **Point to Point**—For full-duplex links, select this mode. • **Shared**—For half-duplex links, select this mode.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Configuring the Spanning Tree Protocol on page 17
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Configuring the Spanning Tree Protocol

This example shows you how to configure the Spanning Tree Protocol on a Ethernet switched network.

Requirements

Before you begin:

- Determine which interfaces to use and verify that they are in switch mode. See "Example: Configuring Switching Modes" on page 8.
- Review information about switching modes. See "Understanding Switching Modes" on page 8.

Overview

In this example, you enable the Spanning Tree Protocol on switched Ethernet ports.

Configuration

GUI Step-by-Step Procedure

To access the Spanning Tree Quick Configuration:

1. In the J-Web user interface, select **Configure>Switching>Spanning Tree**.

   The Spanning Tree Configuration page displays a list of existing spanning-trees. If you select a specific spanning tree, the specific spanning tree details are displayed in the General and Interfaces tabs.

2. Click one of the following:

   - **Add**—Creates a spanning tree.
   - **Edit**—Edits an existing spanning-tree configuration.
   - **Delete**—Deletes an existing spanning tree.

   When you are adding a spanning tree, select a protocol name: STP, RSTP, or MSTP.

   Select the **Ports** tab to configure the ports associated with this spanning tree. Click one of the following:

   - **Add**—Creates a new spanning-tree interface configuration.
   - **Edit**—Modifies an existing spanning-tree interface configuration.
   - **Delete**—Deletes an existing spanning-tree interface configuration.

When you are adding or editing a spanning-tree port, enter information describing the port.

3. Click one:
   - Click **OK** to check your configuration and save it as a candidate configuration, then click **Commit Options**>**Commit**.
   - Click **Cancel** to cancel the configuration without saving changes.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding the Spanning Tree Protocol on page 13
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Link Aggregation Control Protocol

Understanding Link Aggregation Control Protocol

LACP, a subcomponent of IEEE 802.3ad, provides additional functionality for link aggregation groups (LAGs). Use the link aggregation feature to aggregate one or more Ethernet interfaces to form to form a logical point-to-point link, known as a LAG, virtual link, or bundle. The MAC client can treat this virtual link like a single link.

This topic contains the following sections:

Link Aggregation Benefits

Link aggregation increases bandwidth, provides graceful degradation as failure occurs, and increases availability. It provides network redundancy by load-balancing traffic across all available links. If one of the links should fail, the system automatically load-balances traffic across all remaining links.

When LACP is not enabled, a local LAG might attempt to transmit packets to a remote single interface, which causes the communication to fail. When LACP is enabled, a local LAG cannot transmit packets unless a LAG with LACP is also configured on the remote end of the link.

A typical LAG deployment includes aggregate trunk links between an access switch and a distribution switch or customer edge (CE) device.

Link Aggregation Configuration Guidelines

When configuring link aggregation, note the following guidelines and restrictions:

- Link aggregation is supported only for Ethernet interfaces that are configured in switching mode (**family ethernet-switching**). Aggregating interfaces that are configured in routed mode (**family inet**) is not supported.
- You can configure a LAG by specifying the link number as a physical device and then associating a set of ports with the link. All the ports must have the same speed and be in full-duplex mode. Junos OS assigns a unique ID and port priority to each port. The ID and priority are not configurable.
- You must enable LACP when you configure a LAG.
- You can create up to eight Ethernet ports in each bundle.
- Each LAG must be configured on both sides of the link. The ports on either side of the link must be set to the same speed. At least one end of the LAG should be configured as active.
- LAGs are not supported on virtual chassis port links.
- By default, Ethernet links do not exchange protocol data units (PDUs), which contain information about the state of the link. You can configure Ethernet links to actively transmit PDUs, or you can configure the links to passively transmit them, sending out LACP PDUs only when they receive them from another link. The transmitting link is known as the actor and the receiving link is known as the partner.
- LAGs can only be used for a point-to-point connection.

For LACP configuration details, see Table 10 on page 19 and Table 11 on page 19.

Table 10: LACP (Link Aggregation Control Protocol) Configuration

Field	Function
Aggregated Interface	Indicates the name of the aggregated interface.
Link Status	Indicates whether the interface is linked (Up) or not linked (Down).
VLAN (VLAN ID)	Virtual LAN identifier value for IEEE 802.1Q VLAN tags (0.4094).
Description	The description for the LAG.

Table 11: Details of Aggregation

Field	Function
Administrative Status	Displays if the interface is enabled (Up) or disabled (Down).
Logical Interfaces	Shows the logical interface of the aggregated interface.

Table 11: Details of Aggregation *(continued)*

Field	Function
Member Interfaces	Member interfaces hold all the aggregated interfaces of the selected interfaces.
Port Mode	Specifies the mode of operation for the port: trunk or access.
Native VLAN (VLAN ID)	VLAN identifier to associate with untagged packets received on the interface.
IP Address/Subnet Mask	Specifies the address of the aggregated interfaces.
IPV6 Address/Subnet Mask	Specifies the IPV6 address of the aggregated interfaces.

For aggregated Ethernet interface options, see Table 12 on page 20.

Table 12: Aggregated Ethernet Interface Options

Field	Function	Action
Aggregated Interface	Indicates the name of the aggregated interface.	Enter the aggregated interface name. If an aggregated interface already exists, then the field is displayed as read-only.
LACP Mode	Specifies the mode in which LACP packets are exchanged between the interfaces. The modes are: • None—Indicates that no mode is applicable. • Active—Indicates that the interface initiates transmission of LACP packets • Passive—Indicates that the interface only responds to LACP packets.	Select from the list.
Description	The description for the LAG.	Enter the description.
Interface	Indicates that the interfaces available for aggregation.	Click **Add** to select the interfaces. NOTE: Only interfaces that are configured with the same speeds can be selected together for a LAG.
Speed	Indicates the speed of the interface.	
Enable Log	Specifies whether to enable generation of log entries for LAG.	Select to enable log generation.

NOTE: On SRX100, SRX110, SRX120, SRX210, SRX220, SRX240, SRX650, and J Series devices, the speed mode and link mode configuration are available for member interfaces of ae.

For VLAN options, see Table 13 on page 21.

Table 13: Edit VLAN Options

Field	Function	Action
Port Mode	Specifies the mode of operation for the port: trunk or access.	If you select Trunk, you can: 1. Click **Add** to add a VLAN member. 2. Select the VLAN and click **OK**. 3. (Optional) Associate a native VLAN ID with the port. If you select Access, you can: 1. Select the VLAN member to be associated with the port. 2. (Optional) Associate a VoIP VLAN with the interface. Only a VLAN with a VLAN ID can be associated as a VoIP VLAN. 3. Click **OK**.
VLAN Options	For trunk interfaces, the VLANs for which the interface can carry traffic.	Click **Add** to select VLAN members.
Native VLAN	VLAN identifier to associate with untagged packets received on the interface.	Select the VLAN identifier.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Example: Configuring Link Aggregation Control Protocol on page 21
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Configuring Link Aggregation Control Protocol

This example shows how to configure LACP.

Requirements

Before you begin:

- Verify that the Ethernet interfaces are in switch mode. See “Example: Configuring Switching Modes” on page 8.

- Link aggregation of one or more interfaces must be set up to form a virtual link or link aggregation group (LAG) before you can apply LACP. See "Understanding Switching Modes" on page 8.

Overview

In this example, you configure link aggregation for switched Ethernet interfaces then apply LACP.

Configuration

GUI Step-by-Step Procedure

To access the LACP Configuration:

1. In the J-Web user interface, select **Configure>Interfaces>Link Aggregation**.

   The Aggregated Interfaces list is displayed.

2. Click one of the following:

   - **Device Count**—Creates an aggregated Ethernet interface, or LAG. You can choose the number of device that you want to create.
   - **Add**—Adds a new aggregated Ethernet Interface, or LAG.
   - **Edit**— Modifies a selected LAG
     - **Aggregation**—Modifies an selected LAG.
     - **VLAN**—Specifies VLAN options for the selected LAG.
     - **IP Option**—Configuring IP address to LAG is not supported and when you try to configure the IP address an error message is displayed.
   - **Delete**—Deletes the selected LAG.
   - **Disable Port** or **Enable Port**—Disables or enables the administrative status on the selected interface.

3. Click one:

   - Click **OK** to check your configuration and save it as a candidate configuration, then click **Commit Options**>**Commit**.
   - Click **Cancel** to cancel the configuration without saving changes.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding Link Aggregation Control Protocol on page 18
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

802.1X Port-Based Network Authentication

Understanding 802.1X Port-Based Network Authentication

IEEE 802.1X and MAC RADIUS authentication both provide network edge security, protecting Ethernet LANs from unauthorized user access by blocking all traffic to and from devices at the interface until the supplicant's credential or MAC address is presented and matched on the *authentication server* (a RADIUS server). When the supplicant is authenticated, the switch stops blocking access and opens the interface to the supplicant.

A LAN network configured for 802.1X authentication contains three basic components:

- *Supplicant*—The IEEE term for a host that requests to join the network. The host can be responsive or nonresponsive. A responsive host is one on which 802.1X authentication is enabled and that provides authentication credentials (such as a user name and password). A nonresponsive host is one on which 802.1X authentication is not enabled.
- *Authenticator Port Access Entity*—The IEEE term for the authenticator. The SRX Series or J Series device is the authenticator and controls access by blocking all traffic to and from supplicants until they are authenticated.
- *Authentication server*—The server containing the back-end database that makes authentication decisions. (Junos OS supports RADIUS authentication servers.) The authentication server contains credential information for each supplicant that can connect to the network. The authenticator forwards credentials supplied by the supplicant to the authentication server. If the credentials forwarded by the authenticator match the credentials in the authentication server database, access is granted. If the credentials forwarded do not match, access is denied.

NOTE: **Change of authorization (CoA) is not supported on SRX100, SRX210, SRX240, SRX650, and J Series devices.**

The implementation of 802.1X authentication provides the following features for the specified devices. See Table 14 on page 23. The 802.1X implementation provides the following supplicant capacities. See Table 15 on page 24.

Table 14: 802.1x Authentication Features

Feature	SRX100	SRX210	SRX240	SRX650	J Series
Dynamic VLAN assignment	No	Yes	Yes	Yes	No

Table 14: 802.1x Authentication Features *(continued)*

MAC RADIUS authentication	Yes	Yes	Yes	Yes	No
Static MAC bypass	Yes (without VLAN option)	Yes	Yes	Yes	Yes (without VLAN option)
Guest VLAN	No	Yes	Yes	Yes	No
RADIUS server failure fallback	No	Yes	Yes	Yes	No
VoIP VLAN support	No	Yes	Yes	Yes	No
RADIUS accounting	Yes	Yes	Yes	Yes	No

Table 15: 802.1x Supplicant Capacities

	SRX100	SRX210	SRX240	SRX650	J Series
Supplicants per port	64	64	64	64	64
Supplicants per system	2K	2K	2K	2K	2K
Supplicants with dynamic VLAN assignments	Not supported	64	300	2K	Not supported

This topic contains the following sections:

Dynamic VLAN Assignment

When a supplicant first connects to an SRX Series or J Series device, the authenticator sends a request to the supplicant to begin 802.1X authentication. If the supplicant is an 802.1X-enabled device, it responds, and the authenticator relays an authentication request to the RADIUS server.

As part of the reply to the authentication request, the RADIUS server returns information about the VLAN to which the port belongs. By configuring the VLAN information at the RADIUS server, you can control the VLAN assignment on the port.

MAC RADIUS Authentication

If the authenticator sends three requests to a supplicant to begin 802.1X authentication and receives no response, the supplicant is considered nonresponsive. For a nonresponsive supplicant, the authenticator sends a request to the RADIUS server for authentication of the supplicant's MAC address. If the MAC address matches an entry in a predefined list of MAC addresses on the RADIUS server, authentication is granted and the authenticator opens LAN access on the interface where the supplicant is connected.

You can configure the number of times the authenticator attempts to receive a response and the time period between attempts.

Static MAC Bypass

The authenticator can allow particular supplicants direct access to the LAN and bypass the authentication server by including the supplicants' MAC addresses in the static MAC bypass list configured on the SRX Series or J Series device. This list is checked first. If a match is found, the supplicant is considered successfully authenticated and the interface is opened up for it. No further authentication is done for that supplicant. If a match is not found and 802.1X authentication is enabled for the supplicant, the device continues with MAC RADIUS authentication on the authentication server.

For each MAC address in the list, you can configure the VLAN to which the supplicant is moved or the interfaces on which the supplicant can connect.

Guest VLAN

You can specify a guest VLAN that provides limited network access for nonresponsive supplicants. If a guest-vlan is configured, the authenticator connects all nonresponsive supplicants to the predetermined VLAN, providing limited network access, often only to the Internet. This type of configuration can be used to provide Internet access to visitors without compromising company security.

NOTE: **In 802.1x, mac-radius and guest-vlan should not be configured together, because guest-vlan does not work when mac-radius is configured.**

IEEE 802.1X provides LAN access to nonresponsive hosts, which are hosts where 802.1X is not enabled. These hosts, referred to as guests, typically are provided access only to the Internet.

RADIUS Server Failure Fallback

You can define one of four actions to be taken if no RADIUS authentication server is reachable (if, for example, a server failure or a timeout has occurred on the authentication server).

- **deny**—(default) Prevent traffic from flowing from the supplicant through the interface.
- **permit**—Allow traffic to flow from the supplicant through the interface as if the supplicant were successfully authenticated by the RADIUS server.

- **use-cache**—Force successful authentication if authentication was granted before the failure or timeout. This ensures that authenticated users are not adversely affected by a failure or timeout.
- **vlan *vlan-name* | *vlan-id*** —Move the supplicant to a different VLAN specified by name or ID. This applies only to the first supplicant connecting to the interface.

NOTE: **For permit, use-cache, and vlan fallback actions to work, 802.1X supplicants need to accept an out of sequence SUCCESS packet.**

For RADIUS server settings, see Table 16 on page 26.

Table 16: RADIUS Server Settings

Field	Function	Your Action
IP Address	Specifies the IP address of the server.	Enter the IP address in dotted decimal notation.
Password	Specifies the login password.	Enter the password.
Confirm Password	Verifies the login password for the server.	Reenter the password.
Server Port Number	Specifies the port with which the server is associated.	Type the port number.
Source Address	Specifies the source address of the SRX Series device for communicating with the server.	Type the IP address in dotted decimal notation.
Retry Attempts	Specifies the number of login retries allowed after a login failure.	Type the number.
Timeout	Specifies the time interval to wait before the connection to the server is closed.	Type the interval in seconds.

For 802.1X exclusion list details, see Table 17 on page 26.

Table 17: 802.1X Exclusion List

Field	Function	Your Action
MAC Address	Specifies the MAC address to be excluded from 802.1X authentication.	Enter the MAC address.
Exclude if connected through the port	Specifies that a supplicant can bypass authentication if it is connected through a particular interface.	Select to enable the option. Select the port through which the supplicant is connected.
Move the host to the VLAN	Moves the host to a specific VLAN once the host is authenticated.	Select to enable the option. Select the VLAN from the list.

For 802.1X port settings, see Table 18 on page 27.

Table 18: 802.1X Port Settings

Field	Function	Your Action
Supplicant Mode		
Supplicant Mode	Specifies the mode to be adopted for supplicants: • Single—allows only one host for authentication. • Multiple—allows multiple hosts for authentication. Each host is checked before being admitted to the network. • Single authentication for multiple hosts—allows multiple hosts but only the first is authenticated.	Select the required mode.
Authentication		
Enable re-authentication	Specifies enabling reauthentication on the selected interface.	Select to enable reauthentication. Enter the timeout for reauthentication in seconds.
Action for nonresponsive hosts	Specifies the action to be taken in case a supplicant is nonresponsive: • Move to the Guest VLAN—moves the supplicant to the specified Guest VLAN. • Deny—does not permit access to the supplicant.	Select the desired action.
Timeouts	Specifies timeout values for: • Port waiting time after an authentication failure • EAPOL retransmitting interval • Maximum EAPOL requests • Maximum number of retries • Port timeout value for a response from the supplicant • Port timeout value for a response from the RADIUS server	Enter timeout values in seconds for the appropriate options.

VoIP VLAN Support

When VoIP is used with 802.1X, the RADIUS server authenticates the phone, and Link Layer Discovery Protocol–Media Endpoint Discovery (LLDP-MED) provides the class-of-service (CoS) parameters for the phone.

You can configure 802.1X authentication to work with VoIP in multiple-supplicant or single-supplicant mode:

- **Multiple-supplicant mode**—Allows multiple supplicants to connect to the interface. Each supplicant is authenticated individually.
- **Single-supplicant mode**—Authenticates only the first supplicant. All other supplicants who connect later to the interface are allowed to “piggyback” on the first supplicant’s authentication and gain full access.

RADIUS Accounting

Configuring RADIUS accounting on a SRX Series or J Series device lets you collect statistical data about users logging on and off a LAN, and sends it to a RADIUS accounting server. The collected data can be used for general network monitoring, to analyze and track usage patterns, or to bill a user based on the amount of time or type of services accessed.

To configure RADIUS accounting, specify one or more RADIUS accounting servers to receive the statistical data from the device, and select the type of accounting data to be collected. To view the collected statistics, you can access the log file configured to receive them.

Server Reject VLAN

By default, when authentication fails, the supplicant is denied access to the network. However, you can specify a VLAN to which the supplicant is moved if authentication fails. The server reject VLAN is similar to a guest VLAN. With a server reject VLAN, however, authentication is first attempted by credential, then by MAC address. If both authentication methods fail, the supplicant is given access to a predetermined VLAN with limited network access.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Example: Configuring 802.1x Authentication on page 28
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Configuring 802.1x Authentication

This example shows how to configure 802.1X authentication, configure RADIUS, and configure a guest VLAN.

Requirements

Before you begin:

- Verify that the interfaces to use are in switch mode. See “Example: Configuring Switching Modes” on page 8.
- Review switching mode and VLAN information. See “Understanding Switching Modes” on page 8 and “Understanding VLANs” on page 10.

Overview

In this example, you configure 802.1X authentication.

Configuration

GUI Step-by-Step Procedure

1. From the **Configure** menu, select **Security > 802.1X**.

   The 802.1X screen displays a list of interfaces, whether 802.1X security has been enabled, and the assigned port role.

   When you select a particular interface, the Details section displays 802.1X details for the selected interface.

   NOTE: **After you make changes to the configuration, click OK to check your configuration and save it as a candidate configuration, then click Commit Options>Commit.**

2. Click one: RADIUS Servers or Exclusion List. Click **Add** or **Edit** to add or modify the settings.

   - Edit—specifies 802.1X settings for the selected interface.
     - Apply 802.1X Profile—applies a predefined 802.1X profile based on the port role. If a message appears asking if you want to configure a RADIUS server, click **Yes** and enter information.
     - 802.1X Configuration—configures custom 802.1X settings for the selected interface. If a message appears asking if you want to configure a RADIUS server, click **Yes** and enter information.
   - Delete—deletes the existing 802.1X authentication configuration on the selected interface.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding 802.1X Port-Based Network Authentication on page 23
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Specifying RADIUS Server Connections on the Device

This example shows how to specify a RADIUS server for 802.1X authentication to provide network edge security.

- Requirements on page 30
- Overview on page 30
- Configuration on page 30
- Verification on page 32

Requirements

Before you begin, verify that the interfaces that will be used are in switch mode. See "Example: Configuring Switching Modes" on page 8.

- To use 802.1X or MAC RADIUS authentication, you must specify the connections on the SRX Series or J Series device for each RADIUS server to which you will connect.

Overview

In this example, you set the RADIUS server IP address to 10.0.0.100 and the secret password to abc. The secret password on the device must match the secret password on the server. To define more than one RADIUS server, you need to enter separate radius-server commands.

You then specify the source address as 10.93.14.100. By default, the RADIUS server uses the address of the interface sending the RADIUS request to determine the source of the request. If the request has been diverted on an alternate route to the RADIUS server, the interface relaying the request might not be an interface on the device. To ensure that the source is identified correctly, specify its IP address explicitly.

Then you create a profile called profile1 and set the authentication order to radius. You can specify one or more RADIUS servers to be associated with profile1. Finally, you define profile1 as the authentication profile for 802.1X or MAC RADIUS authenticator.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set access radius-server 10.0.0.100 port 1812 secret abc
set access radius-server 10.0.0.100 source-address 10.93.14.100
set access profile profile1 authentication-order radius
set access profile profile1 radius authentication-server 10.0.0.100
set protocols dot1x authenticator authentication-profile-name profile1
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To specify a RADIUS server for 802.1X authentication:

1. Configure access.

```
[edit]
user@host# edit access
```

NOTE: For 802.1X authentication, the RADIUS server must be configured at the access hierarchy level.

2. Define the IP address and the secret password for the RADIUS server.

   [edit access]
   user@host# **set radius-server 10.0.0.100 port 1812 secret abc**

3. Specify the IP address and the source address.

   [edit access]
   user@host# **set radius-server 10.0.0.100 source-address 10.93.14.100**

4. Create the profile.

   [edit access]
   user@host# **edit profile profile1**

5. Configure the authentication order.

   [edit access profile profile1]
   user@host# **set authentication-order radius**

6. Specify one or more RADIUS servers to be associated with profile1.

   [edit access profile profile1]
   user@host# **set radius authentication-server 10.0.0.100**

7. Define authentication profile.

   [edit]
   user@host# **set protocols dot1x authenticator authentication-profile-name profile1**

Results From configuration mode, confirm your configuration by entering the **show access** and **show protocols dot1x** commands. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
[edit]
  user@host# show access
  radius-server {
  10.0.0.100 {
  port 1812;
    secret "$9$mf5F6/tOBE"; ## SECRET-DATA
    source-address 10.93.14.100;
  }
  }
  profile profile1 {
    authentication-order radius;
    radius {
    authentication-server 10.0.0.100;
  }
}
[edit]
  user@host# show protocols dot1x
  authenticator {
  authentication-profile-name profile1;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

To confirm that the configuration is working properly, perform this task:

- Verifying a RADIUS Server on page 32

Verifying a RADIUS Server

Purpose Verify that the RADIUS server is configured properly.

Action From configuration mode, enter the **show access** and **show protocols dot1x** commands.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding 802.1X Port-Based Network Authentication on page 23
- Understanding Switching Modes on page 8
- Understanding VLANs on page 10
- Ethernet Ports Switching Overview on page 3
- Example: Configuring 802.1x Authentication on page 28

Example: Configuring 802.1x Interface Settings

This example shows how to configure 802.1X interface settings for network edge security.

- Requirements on page 32
- Overview on page 32
- Configuration on page 33
- Verification on page 34

Requirements

Before you begin:

- Verify that the interfaces that will be used are in switch mode. See "Example: Configuring Switching Modes" on page 8.
- Ensure that the interfaces are defined in the interfaces hierarchy with family ethernet-switching.

Overview

In this example, you set the supplicant mode to multiple after configuring protocol dot1x and authenticator interface ge-0/0/5. You then enable reauthentication and set the reauthentication interval to 120. You configure the interface timeout value for the response from the supplicant as 5. You then configure the timeout for the interface before it resends an authentication request to the RADIUS server as 5. You specify the time, in seconds, the interface waits before retransmitting the initial EAPoL PDUs to the supplicant as 60. Finally, you configure the maximum number of times an EAPoL request packet is retransmitted to the supplicant before the authentication session times out as 5.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set protocols dot1x authenticator interface ge-0/0/5 supplicant multiple reauthentication
  120
set protocols dot1x authenticator interface ge-0/0/5 supplicant-timeout 5 server-timeout
  5 transmit-period 60
set protocols dot1x authenticator interface ge-0/0/5 maximum-requests 5
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure 802.1x interface settings:

1. Configure the protocol.

   ```
   [edit]
   user@host# edit protocols dot1x
   ```

2. Configure an interface.

   ```
   [edit protocols dot1x]
   user@host# edit authenticator interface ge-0/0/5
   ```

3. Configure the supplicant mode.

   ```
   [edit protocols dot1x authenticator interface ge-0/0/5.0]
   user@host# set supplicant multiple
   ```

4. Enable reauthentication and specify the reauthentication interval.

   ```
   [edit protocols dot1x authenticator interface ge-0/0/5.0]
   user@host# set reauthentication 120
   ```

5. Configure the interface timeout value for the response from the supplicant.

   ```
   [edit protocols dot1x authenticator interface ge-0/0/5.0]
   user@host# set supplicant-timeout 5
   ```

6. Set the server timeout value.

   ```
   [edit protocols dot1x authenticator interface ge-0/0/5.0]
   user@host# set server-timeout 5
   ```

7. Configure transmit period.

   ```
   [edit protocols dot1x authenticator interface ge-0/0/5.0]
   user@host# set transmit-period 60
   ```

8. Specify the maximum request value.

   ```
   [edit protocols dot1x authenticator interface ge-0/0/5.0]
   user@host# set maximum-requests 5
   ```

Results From configuration mode, confirm your configuration by entering the **show protocols dot1x** command. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
[edit]
  user@host# show protocols dot1x
  authenticator {
  interface {
  ge-0/0/5.0 {
    supplicant multiple;
    transmit-period 60;
    reauthentication 120;
    supplicant-timeout 5;
    server-timeout 5;
    maximum-requests 5;
    }
  }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

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

- Verifying 802.1X Interface Settings on page 34

Verifying 802.1X Interface Settings

Purpose Verify that the 802.1X interface settings are working properly.

Action From configuration mode, enter the **show protocols dot1x** command.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding 802.1X Port-Based Network Authentication on page 23
- Example: Configuring 802.1x Authentication on page 28
- Ethernet Ports Switching Overview on page 3
- Understanding Switching Modes on page 8
- Understanding VLANs on page 10

Example: Configuring a Guest VLAN

This example shows how to configure a guest VLAN for limited network access or for Internet-only access to avoid compromising a company's security.

- Requirements on page 35
- Overview on page 35
- Configuration on page 35
- Verification on page 35

Requirements

Before you begin, verify that the interfaces that will be used are in switch mode. See "Example: Configuring Switching Modes" on page 8 and "Understanding Switching Modes" on page 8.

Overview

In this example, you configure a VLAN called visitor-vlan with a VLAN ID of 300. Then you set protocols and configure visitor-vlan as the guest VLAN.

Configuration

Step-by-Step Procedure

To configure a guest VLAN:

1. Configure a VLAN.

```
[edit]
user@host# set vlans visitor-vlan vlan-id 300
```

2. Specify the guest VLAN.

```
[edit]
user@host# set protocols dot1x authenticator interface all guest-vlan visitor-vlan
```

3. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Verification

To verify the configuration is working properly, enter the **show vlans** and **show protocols dot1x** commands.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding VLANs on page 10
- Understanding 802.1X Port-Based Network Authentication on page 23
- Example: Configuring 802.1x Authentication on page 28
- Ethernet Ports Switching Overview on page 3

Port Security

Port Security Overview

Ethernet LANs are vulnerable to attacks such as address spoofing (forging) and Layer 2 denial of service (DoS) attacks on network devices. Port security features help protect the access ports on your services gateway against the losses of information and productivity that can result from such attacks.

Junos OS on SRX Series devices provides features to help secure ports on a switching port on the services gateway. The ports can be categorized as either trusted or untrusted. You apply policies appropriate to those categories to protect against various types of attacks.

The MAC limit port security feature can be turned on to obtain the most robust port security level. Basic port security features are enabled in the services gateway's default configuration. You can configure additional features with minimal configuration steps.

Related Documentation

- Ethernet Ports Switching Overview on page 3
- Understanding MAC Limiting on page 36
- Verifying Switching Mode Configuration on page 9

Understanding MAC Limiting

MAC limiting protects against flooding of the Ethernet switching table (also known as the MAC forwarding table or Layer 2 forwarding table). You enable this feature on interfaces (ports). MAC move limiting detects MAC movement and MAC spoofing on access interfaces. You enable this feature on VLANs.

MAC limiting sets a limit on the number of MAC addresses that can be learned dynamically on a single Layer 2 access interface or on all the Layer 2 access interfaces on the services gateway.

You configure the maximum number of dynamic MAC addresses allowed per interface. When the limit is exceeded, incoming packets with new MAC addresses are treated as specified by the configuration.

You can choose to have one of the following actions performed when the MAC addresses limit is exceeded:

- **drop**—Drop the packet and generate an alarm, an SNMP trap, or a system log entry. This is the default.
- **log**—Do not drop the packet but generate an alarm, an SNMP trap, or a system log entry.
- **none**—Take no action.
- **shutdown**—Disable the interface and generate an alarm. If you have configured the services gateway with the **port-error-disable** statement, the disabled interface recovers automatically upon expiration of the specified disable timeout. If you have not configured the services gateway for autorecovery from port error disabled conditions, you can bring up the disabled interfaces with running the **clear ethernet-switching port-error** command.

NOTE: MAC limit is only applied to new MAC learning requests. If you already have 10 learned MAC addresses and you configure the limit as 5, all the MACs will remain in the forwarding database (FDB) table. Once the learned MAC addresses age out (or are cleared by the user with the clear ethernet-switching command), they are not relearned.

MAC limiting does not apply to static MAC addresses. Users can configure any number of static MAC addresses independent of MAC limiting and all of them are added to FDB.

Related Documentation

- Example: Configuring MAC Limiting on page 37
- Port Security Overview on page 35
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Configuring MAC Limiting

Requirements

Before you begin, verify that the interfaces that will be used are in switch mode. See “Example: Configuring Switching Modes” on page 8 and “Understanding Switching Modes” on page 8.

Overview

MAC limiting protects against flooding of the Ethernet switching table on the SRX Series Services Gateways. MAC limiting sets a limit on the number of MAC addresses that can be learned on a single Layer 2 access interface (port).

This example shows how to configure port security features by setting a MAC limit of 5.

Configuration

Step-by-Step Procedure

The action is not specified, so the switch performs the default action drop if the limit is exceeded:

1. On a single interface (here, the interface is ge-0/0/1):

```
[edit ethernet-switching-options secure-access-port]
user@host# set interface ge–0/0/1 mac-limit 5
```

2. On all interfaces:

```
[edit ethernet-switching-options secure-access-port]
```

user@host# set interface all mac–limit 5

NOTE: Do not set the mac-limit to 1. The first learned MAC address is often inserted into the FDB automatically (for example, for routed VLAN interfaces the first MAC address inserted into the forwarding database is the MAC address of the RVI; for Aggregated Ethernet bundles using LACP, the first MAC address inserted into the FDB in the forwarding table is the source address of the protocol packet). The services gateway will therefore not learn MAC addresses other than the automatic addresses when the mac-limit is set to 1, and this will cause problems with MAC learning and forwarding.

3. For specifying specific allowed MAC addresses:

   - On a single interface (here, the interface is ge-0/0/2):

     [edit ethernet-switching-options secure-access-port]
     user@host# set interface ge–0/0/2 allowed-mac 00:05:85:3A:82:80
     user@host# set interface ge–0/0/2 allowed-mac 00:05:85:3A:82:81
     user@host# set interface ge–0/0/2 allowed-mac 00:05:85:3A:82:83

   - On all interfaces:

     [edit ethernet-switching-options secure-access-port]
     user@host# set interface all allowed-mac 00:05:85:3A:82:80
     user@host# set interface all allowed-mac 00:05:85:3A:82:81
     user@host# set interface all allowed-mac 00:05:85:3A:82:83

Verification

Verifying That MAC Limiting Is Working Correctly on the Services Gateway

Purpose Verify that MAC limiting is working on the services gateway.

Action Display the learned MAC addresses. The following sample output shows the results when two packets were sent from hosts on ge-0/0/1 and five packets requests were sent from hosts on ge-0/0/2, with both interfaces set to a MAC limit of 4 with the action drop:

```
user@host> show ethernet-switching table
Ethernet-switching table: 7 entries, 6 learned
VLAN MAC address Type Age Interfaces
employee-vlan * Flood - ge-0/0/2.0
employee-vlan 00:05:85:3A:82:77 Learn 0 ge-0/0/1.0
employee-vlan 00:05:85:3A:82:79 Learn 0 ge-0/0/1.0
employee-vlan 00:05:85:3A:82:80 Learn 0 ge-0/0/2.0
employee-vlan 00:05:85:3A:82:81 Learn 0 ge-0/0/2.0
employee-vlan 00:05:85:3A:82:83 Learn 0 ge-0/0/2.0
employee-vlan 00:05:85:3A:82:85 Learn 0 ge-0/0/2.0
```

Meaning The sample output shows that with a MAC limit of 4 for each interface, the packet for a fifth MAC address on ge-0/0/2 was dropped because it exceeded the MAC limit. The address was not learned, and thus an asterisk (*) rather than an address appears in the MAC address column in the first line of the sample output.

Related Documentation

- Understanding MAC Limiting on page 36
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

IGMP Snooping

Understanding IGMP Snooping

Internet Group Management Protocol (IGMP) snooping regulates multicast traffic in a switched network. With IGMP snooping enabled, the Juniper Networks device monitors the IGMP transmissions between a host (a network device) and a multicast router, keeping track of the multicast groups and associated member interfaces. The Juniper Networks device uses that information to make intelligent multicast-forwarding decisions and to forward traffic to its intended destination interfaces.

This topic contains the following sections:

How IGMP Snooping Works

A J Series device usually learns *unicast* MAC addresses by checking the source address field of the frames it receives. However, a *multicast* MAC address can never be the source address for a packet. As a result, the switch floods multicast traffic on the VLAN, consuming significant amounts of bandwidth.

IGMP snooping regulates multicast traffic on a VLAN to avoid flooding. When IGMP snooping is enabled, the switch intercepts IGMP packets and uses the content of the packets to build a multicast cache table. The cache table is a database of multicast groups and their corresponding member ports. The cache table is then used to regulate multicast traffic on the VLAN.

When the router receives multicast packets, it uses the cache table to selectively forward the packets only to the ports that are members of the destination multicast group.

For IGMP snooping configuration details, see Table 19 on page 39.

Table 19: IGMP Snooping Configuration Fields

Field	Function	Action
VLAN Name	Specifies the VLAN on which to enable IGMP snooping.	Select the VLAN from the list.

Table 19: IGMP Snooping Configuration Fields *(continued)*

Field	Function	Action
Immediate Leave	Immediately removes a multicast group membership from an interface when it receives a leave message from that interface and suppresses the sending of any group-specific queries for the multicast group	To enable the option, select the check box. To disable the option, clear the check box.
Query Interval	Configures how frequently the switch sends host-query timeout messages to a multicast group.	Enter a value from 1 through 1024 seconds.
Query Last Member Interval	Configures the interval between group-specific query timeout messages sent by the switch.	Enter a value from 1 through 1024 seconds.
Query Response Interval	Configures the length of time the switch waits to receive a response to a specific query message from a host.	Enter a value from 1 through 25 seconds.
Robust Count	Specifies the number of timeout intervals the switch waits before timing out a multicast group.	Enter a value from 2 through 10.
Interfaces List	Statically configures an interface as a switching interface toward a multicast router (the interface to receive multicast traffic).	1. Click **Add**. 2. Select an interface from the list. 3. Select **Multicast Router Interface**. 4. Enter the maximum number of groups an interface can join in **Group Limit**. 5. In **Static**, choose one: • Click **Add**, type a group IP address, and click **OK**. • Select a group and click **Remove** to remove the group membership.

How Hosts Join and Leave Multicast Groups

Hosts can join multicast groups in either of two ways:

- By sending an unsolicited IGMP join message to a multicast router that specifies the IP multicast that the host is attempting to join.
- By sending an IGMP join message in response to a general query from a multicast router.

A multicast router continues to forward multicast traffic to a VLAN provided that at least one host on that VLAN responds to the periodic general IGMP queries. For a host to remain a member of a multicast group, therefore, it must continue to respond to the periodic general IGMP queries.

To leave a multicast group, a host can either not respond to the periodic general IGMP queries, which results in a “silent leave” (the only leave option for hosts connected to switches running IGMPv1), or send a group-specific IGMPv2 leave message.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Example: Configuring IGMP Snooping on page 41
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Configuring IGMP Snooping

This example shows you how to configure IGMP snooping

Requirements

Before you begin:

- Ensure that the interfaces that will be used are in switch mode. See “Example: Configuring Switching Modes” on page 8.
- You should have a switched multicast network environment with VLANs configured. See “Example: Configuring VLANs” on page 12.

Overview

In this example, you configure IGMP snooping.

Configuration

GUI Step-by-Step Procedure

To access the IGMP Snooping Quick Configuration:

1. In the J-Web user interface, select **Configure>Switching>IGMP Snooping**.

   The VLAN Configuration page displays a list of existing IGMP snooping configurations.

2. Click one:

   - **Add**—Creates an IGMP snooping configuration for the VLAN.
   - **Edit**—Edits an existing IGMP snooping configuration for the VLAN.
   - **Delete**—Deletes member settings for the interface.

     NOTE: **If you delete a configuration, the VLAN configuration for all the associated interfaces is also deleted.**

   - **Disable Vlan**—Disables IGMP snooping on the selected VLAN.

   When you are adding or editing a VLAN, enter information.

3. Click one:

- Click **OK** to check your configuration and save it as a candidate configuration, then click **Commit Options**>**Commit**.
- Click **Cancel** to cancel the configuration without saving changes.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding IGMP Snooping on page 39
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

GARP VLAN Registration Protocol

Understanding GARP VLAN Registration Protocol

As a network expands and the number of clients and VLANs increases, VLAN administration becomes complex, and the task of efficiently configuring VLANs becomes increasingly difficult. To automate VLAN administration, you can enable GARP VLAN Registration Protocol (GVRP) on the network.

The Generic VLAN Registration Protocol (GVRP) is an application protocol of the Generic Attribute Registration Protocol (GARP) and is defined in the IEEE 802.1Q standard. GVRP learns VLANs on a particular 802.1Q trunk port and adds the corresponding trunk port to the VLAN if the advertised VLAN is preconfigured on the switch.

The VLAN registration information sent by GVRP includes the current VLAN membership—that is, which switches are members of which VLANs—and which switch ports are in which VLAN. GVRP shares all VLAN information configured manually on a local switch.

As part of ensuring that VLAN membership information is current, GVRP removes switches and ports from the VLAN information when they become unavailable. Pruning VLAN information limits the network VLAN configuration to active participants only, reducing network overhead, and targets the scope of broadcast, unknown unicast, and multicast (BUM) traffic to interested devices only.

For GVRP global settings, see Table 20 on page 42.

Table 20: GVRP Global Settings

Field	Function	Action
Disable GVRP	Disables GVRP on all the interfaces.	Click to select.
Join Timer	Specifies the number of milliseconds an interface must wait before sending VLAN advertisements.	Enter a value from 0 through 4,294,967,295 milliseconds.

Table 20: GVRP Global Settings *(continued)*

Field	Function	Action
Leave Timer	Specifies the number of milliseconds an interface must wait after receiving a leave message to remove itself from the VLAN specified in the message.	Enter a value from 0 through 4,294,967,295 milliseconds.
Leave All Timer	Specifies the interval in milliseconds at which Leave All messages are sent on interfaces. Leave All messages help to maintain current GVRP VLAN membership information in the network.	Enter a value from 0 through 4,294,967,295 milliseconds.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Example: Configuring GARP VLAN Registration Protocol on page 43
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

Example: Configuring GARP VLAN Registration Protocol

This example shows you how to enable GVRP.

Requirements

Before you begin:

- Ensure that the interfaces that will be used are in switch mode. See "Example: Configuring Switching Modes" on page 8.
- You should have a switched multicast network environment with VLANs configured. See "Example: Configuring VLANs" on page 12.

Overview

In this example, you configure GVRP on an interface.

Configuration

GUI Step-by-Step Procedure

To access the GVRP Quick Configuration:

1. In the J-Web user interface, select **Configure>Switching>GVRP**.

   The GVRP Configuration page displays a list of interfaces on which GVRP is enabled.

2. Click one:

   - **Global Settings**—Modifies GVRP timers. Enter the information.
   - **Add**—Enables GVRP on an interface.
   - **Disable Port**—Disables an interface.
   - **Delete**—Deletes an interface.

3. Click one:

    - Click **OK** to check your configuration and save it as a candidate configuration, then click **Commit Options**>**Commit**.
    - Click **Cancel** to cancel the configuration without saving changes.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding GARP VLAN Registration Protocol on page 42
- Ethernet Ports Switching Overview on page 3
- Verifying Switching Mode Configuration on page 9

CHAPTER 2

Configuring Layer 2 Bridging and Transparent Mode

Layer 2 Bridging and Transparent Mode Overview

For SRX Series devices, transparent mode provides full security services for Layer 2 bridging capabilities. On these SRX Series devices, you can configure one or more bridge domains to perform Layer 2 bridging. A bridge domain is a set of logical interfaces that share the same flooding or broadcast characteristics. Like a virtual LAN (VLAN), a bridge domain spans one or more ports of multiple devices. Thus, the SRX Series device can function as a Layer 2 switch with multiple bridge domains that participate in the same Layer 2 network.

In transparent mode, the SRX Series device filters packets that traverse the device without modifying any of the source or destination information in the IP packet headers. Transparent mode is useful for protecting servers that mainly receive traffic from untrusted sources because there is no need to reconfigure the IP settings of routers or protected servers.

NOTE: Transparent mode is supported only for IPv4 traffic.

In transparent mode, all physical ports on the device are assigned to Layer 2 interfaces. Do not route Layer 3 traffic through the device. Layer 2 zones can be configured to host Layer 2 interfaces, and security policies can be defined between Layer 2 zones. When packets travel between Layer 2 zones, security policies can be enforced on these packets.

NOTE: Not all security features are supported in transparent mode:

- NAT is not supported.
- IPsec VPN is not supported.
- For ALGs, only DNS, FTP, RTSP, and TFTP ALGs are supported. Other ALGs are not supported.

Layer 2 Bridging Exceptions on SRX Series Devices

The bridging functions on the SRX Series devices are similar to the bridging features on Juniper Networks MX Series routers. However, the following Layer 2 networking features on MX Series routers are not supported on SRX Series devices:

- Layer 2 control protocols—These protocols are used on MX Series routers for Rapid Spanning Tree Protocol (RSTP) or Multiple Spanning Tree Protocol (MSTP) in customer edge interfaces of a VPLS routing instance.
- Virtual switch routing instance—The virtual switching routing instance is used on MX Series routers to group one or more bridge domains.
- Virtual private LAN services (VPLS) routing instance—The VPLS routing instance is used on MX Series routers for point-to-multipoint LAN implementations between a set of sites in a VPN.

In addition, the SRX Series devices do not support the following Layer 2 features:

- Spanning Tree Protocol (STP), RSTP, or MSTP—It is the user's responsibility to ensure that no flooding loops exist in the network topology.
- Internet Group Management Protocol (IGMP) snooping—Host-to-router signaling protocol for IPv4 used to report their multicast group memberships to neighboring routers and determine whether group members are present during IP multicasting.
- Double-tagged VLANs or IEEE 802.1Q VLAN identifiers encapsulated within 802.1Q packets (also called "Q in Q" VLAN tagging)—Only untagged or single-tagged VLAN identifiers are supported on SRX Series devices.
- Nonqualified VLAN learning, where only the MAC address is used for learning within the bridge domain—VLAN learning on SRX Series devices is qualified; that is, both the VLAN identifier and MAC address are used.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding Bridge Domains on page 47
- Understanding Transparent Mode Conditions on page 49

Bridge Domains

This topic includes the following sections:

Understanding Bridge Domains

The packets that are forwarded within a bridge domain are determined by the VLAN ID of the packets and the VLAN ID of the bridge domain. Only the packets with VLAN IDs that match the VLAN ID configured for a bridge domain are forwarded within the bridge domain.

When configuring bridge domains, you can specify either a single VLAN ID or a list of specific VLAN IDs. If you specify a list of VLAN IDs, a bridge domain is created for each VLAN ID in the list. Certain bridge domain properties, such as the integrated routing and bridging interface (IRB), are not configurable if bridge domains are created in this manner.

Each Layer 2 logical interface configured on the device is implicitly assigned to a bridge domain based on the VLAN ID of the packets accepted by the interface. You do not need to explicitly define the logical interfaces when configuring a bridge domain.

You can configure one or more static MAC addresses for a logical interface in a bridge domain; this is only applicable if you specified a single VLAN ID when creating the bridge domain.

NOTE: If a static MAC address you configure for a logical interface appears on a different logical interface, packets sent to that interface are dropped.

You can configure the following properties that apply to all bridge domains on the SRX Series device:

- Layer 2 address learning—Layer 2 address learning is enabled by default. A bridge domain learns unicast media access control (MAC) addresses to avoid flooding packets to all interfaces in the bridge domain. Each bridge domain creates a source MAC entry in its forwarding tables for each source MAC address learned from packets received on interfaces that belong to the bridge domain. When you disable MAC learning, source MAC addresses are not dynamically learned, and any packets sent to these source addresses are flooded into a bridge domain.
- Maximum number of MAC addresses learned from all logical interfaces on the SRX Series device—After the MAC address limit is reached, the default is for any incoming packets with a new source MAC address to be forwarded. You can specify that the

packets be dropped instead. The default limits of MAC addresses for the SRX Series devices are shown in Table 21 on page 48.

Table 21: MAC Addresses Default Limits

SRX Series Devices	Default Limit for MAC Addresses
SRX100 SRX210	1024
SRX220	2048
SRX240	4096
SRX650	16,384
SRX3400 SRX3600 SRX5600 SRX5800	131,071

- Timeout interval for MAC table entries. By default, the timeout interval for MAC table entries is 300 seconds. The minimum you can configure is 10 seconds and the maximum is 64,000 seconds. The timeout interval applies only to dynamically learned MAC addresses. This value does not apply to configured static MAC addresses, which never time out.

NOTE: SRX100, SRX210, SRX220, SRX240, and SRX650 devices support only 16,000 MAC entries.

Example: Configuring Bridge Domains

This example shows how to configure bridge domains.

Requirements

Before you begin, determine the properties you want to configure for the bridge domain. See "Understanding Bridge Domains" on page 47.

Overview

In this example, you configure bridge domain bd1 for VLANs 1 and 10, and bridge domain bd2 for VLAN 2. You then limit the number of MAC addresses learned on all logical interfaces on the device to 64,000. When this limit is reached, incoming packets with a new source MAC address will be dropped.

Configuration

Step-by-Step Procedure

To configure bridge domains:

1. Configure the domain type and VLANs.

```
[edit]
user@host# set bridge-domains bd1 vlan-id-list 1-10
user@host# set bridge-domains bd2 vlan-id 2
```

2. Limit the number of MAC addresses.

```
[edit]
user@host# set protocols l2-learning global-mac-limit 64000 packet-action drop
```

3. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Verification

To verify the configuration is working properly, enter the **show bridge-domains** and **show protocols l2-learning** commands.

Layer 2 Interfaces

This topic includes the following sections:

Understanding Transparent Mode Conditions

A device operates in Layer 2 transparent mode when all physical interfaces on the device are configured as Layer 2 interfaces. A physical interface is a Layer 2 interface if its logical interface is configured with the **bridge** family.

There is no command to define or enable transparent mode on the device. The device operates in transparent mode when there are interfaces defined as Layer 2 interfaces.

The device operates in route mode (the default mode) if there are no physical interfaces configured as Layer 2 interfaces.

NOTE: The SRX Series device can operate at either route mode or transparent mode, but not both modes at the same time. Changing the mode requires a reboot of the device.

You can configure the **fxp0** out-of-band management interface on the SRX Series device as a Layer 3 interface, even if Layer 2 interfaces are defined on the device. With the exception of the **fxp0** interface, you must not define Layer 2 and Layer 3 interfaces on the device's network ports.

NOTE: There is no fxp0 out-of-band management interface on the SRX100, SRX210, SRX220, SRX240, and SRX650 devices.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Example: Configuring Layer 2 Logical Interfaces on page 51
- Understanding Layer 2 Interfaces on page 50

Understanding Layer 2 Interfaces

Layer 2 logical interfaces are created by defining one or more logical units on a physical interface with the family address type **bridge**. If a physical interface has a **bridge** family logical interface, it cannot have any other family type in its logical interfaces. A logical interface can be configured in one of the following modes:

- Access mode—Interface accepts untagged packets, assigns the specified VLAN identifier to the packet, and forwards the packet within the bridge domain that is configured with the matching VLAN identifier.
- Trunk mode—Interface accepts any packet tagged with a VLAN identifier that matches a specified list of VLAN identifiers. Trunk mode interfaces are generally used to interconnect switches. To configure a VLAN identifier for untagged packets received on the physical interface, use the **native-vlan-id** option. If the **native-vlan-id** option is not configured, untagged packets are dropped.

  Tagged packets arriving on a trunk mode interface can be rewritten or "retagged" with a different VLAN identifier. This allows incoming packets to be selectively redirected to a firewall or other security device.

NOTE: Multiple trunk mode logical interfaces can be defined, as long as the VLAN identifiers of a trunk interface do not overlap with those of another trunk interface. The **native-vlan-id** must belong to a VLAN identifier list configured for a trunk interface.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Example: Configuring Layer 2 Logical Interfaces on page 51
- Understanding Transparent Mode Conditions on page 49

Example: Configuring Layer 2 Logical Interfaces

This example shows how to configure a Layer 2 logical interface as a trunk port so that the incoming packets can be selectively redirected to a firewall or other security device.

Requirements

Before you begin, configure the bridge domains. See "Example: Configuring Bridge Domains" on page 48.

Overview

In this example, you configure logical interface ge-3/0/0.0 as a trunk port that carries traffic for packets tagged with VLAN identifiers 1 through 10; this interface is implicitly assigned to the previously configured bridge domains bd1 and bd2. Then you assign a VLAN ID of 10 to any untagged packets received on physical interface ge-3/0/0.

Configuration

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure a Layer 2 logical interface as a trunk port:

1. Configure the logical interface.

```
[edit interfaces ge-3/0/0]
user@host# set unit 0 family bridge interface-mode trunk vlan-id-list 1–10
```

2. Specify a VLAN ID for untagged packets.

```
[edit interfaces ge-3/0/0]
user@host# set vlan-tagging native-vlan-id 10
```

3. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Verification

To verify the configuration is working properly, enter the **show interfaces ge-3/0/0** and **show interfaces ge-3/0/0.0** commands.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Layer 2 Interfaces on page 50
- Understanding Transparent Mode Conditions on page 49
- Example: Configuring Layer 2 Security Zones on page 57

Understanding VLAN Retagging

The VLAN identifier in packets arriving on a Layer 2 trunk port can be rewritten or "retagged" with a different internal VLAN identifier. VLAN retagging is a symmetric operation; upon exiting the same trunk port, the retagged VLAN identifier is replaced with the original VLAN identifier. VLAN retagging provides a way to selectively screen incoming packets and redirect them to a firewall or other security device without affecting other VLAN traffic.

VLAN retagging can be applied only to interfaces configured as Layer 2 trunk interfaces. These interfaces can include redundant Ethernet interfaces in a Layer 2 transparent mode chassis cluster configuration.

NOTE: **If a trunk port is configured for VLAN retagging, untagged packets received on the port cannot be assigned a VLAN identifier with the VLAN retagging configuration. To configure a VLAN identifier for untagged packets received on the physical interface, use the native-vlan-id statement.**

To configure VLAN retagging for a Layer 2 trunk interface, specify a one-to-one mapping of the following:

- Incoming VLAN identifier—VLAN identifier of the incoming packet that is to be retagged. This VLAN identifier must not be the same VLAN identifier configured with the **native-vlan-id** statement for the trunk port.
- Internal VLAN identifier—VLAN identifier for the retagged packet. This VLAN identifier must be in the VLAN identifier list for the trunk port and must not be the same VLAN identifier configured with the **native-vlan-id** statement for the trunk port.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45

- Example: Configuring VLAN Retagging on page 53
- Example: Configuring Layer 2 Logical Interfaces on page 51

Example: Configuring VLAN Retagging

This example shows how to configure VLAN retagging on a Layer 2 trunk interface to selectively screen incoming packets and redirect them to a security device without affecting other VLAN traffic.

Requirements

Before you begin, determine the mapping you want to include for the VLAN retagging. See “Understanding VLAN Retagging” on page 52.

Overview

In this example, you create a Layer 2 trunk interface called ge-3/0/0 and configure it to receive packets with VLAN identifiers 1 through 10. Packets that arrive on the interface with VLAN identifier 11 are retagged with VLAN identifier 2. Before exiting the trunk interface, VLAN identifier 2 in the retagged packets is replaced with VLAN identifier 11. All VLAN identifiers in the retagged packets change back when you exit the trunk interface.

Configuration

Step-by-Step Procedure

To configure VLAN retagging on a Layer 2 trunk interface:

1. Create a Layer 2 trunk interface.

   ```
   [edit]
   user@host# set interfaces ge-3/0/0 unit 0 family bridge interface-mode trunk
     vlan-id-list 1–10
   ```

2. Configure VLAN retagging.

   ```
   [edit]
   user@host# set interfaces ge-3/0/0 unit 0 family bridge vlan-rewrite translate 11 2
   ```

3. If you are done configuring the device, commit the configuration.

   ```
   [edit]
   user@host# commit
   ```

Verification

To verify the configuration is working properly, enter the **show interfaces ge-3/0/0** command.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Example: Configuring Layer 2 Logical Interfaces on page 51

Understanding Integrated Routing and Bridging Interfaces

For bridge domains configured with a single VLAN identifier, you can optionally configure an integrated routing and bridging (IRB) interface for management traffic in the bridge domain. An IRB interface acts as a Layer 3 routing interface for a bridge domain.

NOTE: If you specify a VLAN identifier list in the bridge domain configuration, you cannot configure an IRB interface for the bridge domain.

Currently the IRB interface on the SRX Series device does not support traffic forwarding or routing. In transparent mode, packets arriving on a Layer 2 interface that are destined for the device's MAC address are classified as Layer 3 traffic while packets that are not destined for the device's MAC address are classified as Layer 2 traffic. Packets destined for the device's MAC address are sent to the IRB interface. Packets from the device's routing engine are sent out the IRB interface.

You create an IRB logical interface in a similar manner as a Layer 3 interface, but the IRB interface does not support traffic forwarding or routing. The IRB interface cannot be assigned to a security zone; however, you can configure certain services on a per-zone basis to allow host-inbound traffic for management of the device. This allows you to control the type of traffic that can reach the device from interfaces bound to a specific zone.

NOTE: You can configure only one IRB logical interface for each bridge domain.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Example: Configuring an IRB Interface on page 54
- Understanding Bridge Domains on page 47
- Example: Configuring Bridge Domains on page 48

Example: Configuring an IRB Interface

This example shows how to configure an IRB interface so it can act as a Layer 3 routing interface for a bridge domain.

- Requirements on page 55
- Overview on page 55

Requirements

Before you begin, configure a bridge domain with a single VLAN identifier. See "Example: Configuring Bridge Domains" on page 48.

Overview

In this example, you configure the IRB logical interface unit 0 with the family type inet and IP address 10.1.1.1/24, and then reference the IRB interface irb.0 in the bd2 bridge domain configuration. Then you enable Web authentication on the IRB interface and activate the webserver on the device.

NOTE: To complete the Web authentication configuration, you must perform the following tasks:

- Define the access profile and password for a Web authentication client.
- Define the security policy that enables Web authentication for the client.

Either a local database or an external authentication server can be used as the Web authentication server.

Configuration

Step-by-Step Procedure

To configure an IRB interface:

1. Create an IRB logical interface.

   ```
   [edit]
   user@host# set interface irb unit 0 family inet address 10.1.1.1/24 web-authentication
     http
   ```

2. Reference the IRB interface in a bridge domain.

   ```
   [edit]
   user@host# set bridge-domains bd2 routing-interface irb.0
   ```

3. Activate the webserver.

   ```
   [edit]
   user@host# set system services web-management http
   ```

4. If you are done configuring the device, commit the configuration.

   ```
   [edit]
   user@host# commit
   ```

Verification

To verify the configuration is working properly, enter the **show interface irb** , **show bridge-domains**, and **show system services** commands.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Security Configuration Guide*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Integrated Routing and Bridging Interfaces on page 54
- Example: Configuring Layer 2 Security Zones on page 57
- Understanding Bridge Domains on page 47

Layer 2 Security Zones and Security Policies

This topic includes the following sections:

- Understanding Layer 2 Security Zones on page 56
- Example: Configuring Layer 2 Security Zones on page 57
- Understanding Security Policies in Transparent Mode on page 58
- Example: Configuring Security Policies in Transparent Mode on page 59

Understanding Layer 2 Security Zones

A Layer 2 security zone is a zone that hosts Layer 2 interfaces. A security zone can be either a Layer 2 or Layer 3 zone; it can host either all Layer 2 interfaces or all Layer 3 interfaces, but it cannot contain a mix of Layer 2 and Layer 3 interfaces.

The security zone type—Layer 2 or Layer 3—is implicitly set from the first interface configured for the security zone. Subsequent interfaces configured for the same security zone must be the same type as the first interface.

NOTE: You cannot configure a device with both Layer 2 and Layer 3 security zones.

You can configure the following properties for Layer 2 security zones:

- Interfaces—List of interfaces in the zone.
- Policies—Active security policies that enforce rules for the transit traffic, in terms of what traffic can pass through the firewall, and the actions that need to take place on the traffic as it passes through the firewall.
- Screens—A Juniper Networks stateful firewall secures a network by inspecting, and then allowing or denying, all connection attempts that require passage from one security zone to another. For every security zone, and the MGT zone, you can enable a set of predefined screen options that detect and block various kinds of traffic that the device determines as potentially harmful.

NOTE: You can configure the same screen options for a Layer 2 security zone as for a Layer 3 security zone, with the exception of IP spoofing. Detection of IP spoofing is not supported on Layer 2 security zones.

- Address books—IP addresses and address sets that make up an address book to identify its members so that you can apply policies to them.
- TCP-RST—When this feature is enabled, the system sends a TCP segment with the reset flag set when traffic arrives that does not match an existing session and does not have the synchronize flag set.

In addition, you can configure a Layer 2 zone for host-inbound traffic. This allows you to specify the kinds of traffic that can reach the device from systems that are directly connected to the interfaces in the zone. You must specify all expected host-inbound traffic because inbound traffic from devices directly connected to the device's interfaces is dropped by default.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Security Configuration Guide*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Layer 2 Interfaces on page 50
- Understanding Transparent Mode Conditions on page 49
- Example: Configuring Layer 2 Security Zones on page 57
- Example: Configuring Layer 2 Logical Interfaces on page 51

Example: Configuring Layer 2 Security Zones

This example shows how to configure Layer 2 security zones.

Requirements

Before you begin, determine the properties you want to configure for the Layer 2 security zone. See “Understanding Layer 2 Security Zones” on page 56.

Overview

In this example, you configure security zone l2-zone1 to include a Layer 2 logical interface called ge-3/0/0.0 and security zone l2-zone2 to include a Layer 2 logical interface called ge-3/0/1.0. Then you configure l2-zone2 to allow all supported application services (such as SSH, Telnet, and SNMP) as host-inbound traffic.

Configuration

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure Layer 2 security zones:

1. Create a Layer 2 security zone and assign interfaces to it.

   ```
   [edit security zones]
   user@host# set security-zone l2-zone1 interfaces ge-3/0/0.0
   user@host# set security-zone l2-zone2 interfaces ge-3/0/1.0
   ```

2. Configure one of the Layer 2 security zones.

   ```
   [edit security zones]
   user@host# set security-zone l2–zone2 host-inbound-traffic system-services all
   ```

3. If you are done configuring the device, commit the configuration.

   ```
   [edit]
   user@host# commit
   ```

Verification

To verify the configuration is working properly, enter the **show security zones** command.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Example: Configuring Security Policies in Transparent Mode on page 59
- Example: Configuring Layer 2 Logical Interfaces on page 51

Understanding Security Policies in Transparent Mode

In transparent mode, security policies can be configured only between Layer 2 zones. When packets are forwarded through the bridge domain, the security policies are applied between security zones. A security policy for transparent mode is similar to a policy configured for Layer 3 zones, with the following exceptions:

- NAT is not supported.
- IPsec VPN is not supported.
- Junos OS-H323 ALGs is not supported.
- Application ANY is used.

Layer 2 forwarding does not permit any interzone traffic unless there is a policy explicitly configured on the device. By default, Layer 2 forwarding performs the following actions:

- Allows or denies traffic specified by the configured policy.

- Allows Address Resolution Protocol (ARP) and Layer 2 non-IP multicast and broadcast traffic. The device can receive and pass Layer 2 broadcast traffic for STP.
- Continues to block all non-IP and non-ARP unicast traffic.

This default behavior can be changed for bridge packet flow by using either J-Web or the CLI configuration editor:

- Configure the **block-non-ip-all** option to block all Layer 2 non-IP and non-ARP traffic, including multicast and broadcast traffic.
- Configure the **bypass-non-ip-unicast** option to allow all Layer 2 non-IP traffic to pass through the device.

NOTE: You cannot configure both options at the same time.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Security Configuration Guide*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Transparent Mode Conditions on page 49
- Example: Configuring Security Policies in Transparent Mode on page 59
- Example: Configuring Layer 2 Security Zones on page 57

Example: Configuring Security Policies in Transparent Mode

This example shows how to configure security policies in transparent mode between Layer 2 zones.

Requirements

Before you begin, determine the policy behavior you want to include in the Layer 2 security zone. See "Understanding Security Policies in Transparent Mode" on page 58.

Overview

In this example, you configure a security policy to allow HTTP traffic from the 10.1.1.1/24 subnetwork in the l2–zone1 security zone to the server at 20.1.1.1/32 in the l2–zone2 security zone.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set security policies from-zone l2-zone1 to-zone l2-zone2 policy p1 match source-address
  10.1.1.1/24
set security policies from-zone l2-zone1 to-zone l2-zone2 policy p1 match
  destination-address 20.1.1.1/32
set security policies from-zone l2-zone1 to-zone l2-zone2 policy p1 match application http
set security policies from-zone l2-zone1 to-zone l2-zone2 policy p1 then permit
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure security policies in transparent mode:

1. Create policies and assign addresses to the interfaces for the zones.

```
[edit security policies]
user@host# set from-zone l2-zone1 to-zone l2-zone2 policy p1 match source-address
  10.1.1.1/24
user@host# set from-zone l2-zone1 to-zone l2-zone2 policy p1 match
  destination-address 20.1.1.1/32
```

2. Set policies for the application.

```
[edit security policies]
user@host# set from-zone l2-zone1 to-zone l2-zone2 policy p1 match application
  http
user@host# set from-zone l2-zone1 to-zone l2-zone2 policy p1 then permit
```

Results

From configuration mode, confirm your configuration by entering the **show security policies** command. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
[edit]
  user@host#show security policies
  from-zone l2-zone1 to-zone l2-zone2
{
  policy p1 {
    match {
    source-address 10.1.1.1/24;
    destination-address 20.1.1.1/32;
    application junos-http;
  }
  then {
    permit;
  }
}
}
```


If you are done configuring the device, enter **commit** from configuration mode.

Verification

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

- Verifying Layer 2 Security Policies on page 61

Verifying Layer 2 Security Policies

Purpose Verify that the Layer 2 security policies are configured properly.

Action From configuration mode, enter the **show security policies** command.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Transparent Mode Conditions on page 49
- Example: Configuring Layer 2 Security Zones on page 57

Understanding Firewall User Authentication in Transparent Mode

A firewall user is a network user who must provide a username and password for authentication when initiating a connection across the firewall. Firewall user authentication enables administrators to restrict and permit users accessing protected resources behind a firewall based on their source IP address and other credentials. Junos OS supports the following types of firewall user authentication for transparent mode on the SRX Series device:

- Pass-through authentication—A host or a user from one zone tries to access resources on another zone. You must use an FTP, Telnet, or HTTP client to access the IP address of the protected resource and be authenticated by the firewall. The device uses FTP, Telnet, or HTTP to collect username and password information, and subsequent traffic from the user or host is allowed or denied based on the result of this authentication.
- Web authentication—Users try to connect, by using HTTP, to an IP address on the IRB interface that is enabled for Web authentication. You are prompted for the username and password that are verified by the device. Subsequent traffic from the user or host to the protected resource is allowed or denied based on the result of this authentication.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Security Configuration Guide*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Integrated Routing and Bridging Interfaces on page 54
- Example: Configuring an IRB Interface on page 54

Understanding Layer 2 Forwarding Tables

The SRX Series device maintains forwarding tables that contain MAC addresses and associated interfaces for each Layer 2 bridge domain. When a packet arrives with a new source MAC address in its frame header, the device adds the MAC address to its forwarding table and tracks the interface at which the packet arrived. The table also contains the corresponding interface through which the device can forward traffic for a particular MAC address.

If the destination MAC address of a packet is unknown to the device (that is, the destination MAC address in the packet does not have an entry in the forwarding table), the device duplicates the packet and floods it on all interfaces in the bridge domain other than the interface on which the packet arrived. This is known as *packet flooding* and is the default behavior for the device to determine the outgoing interface for an unknown destination MAC address. Packet flooding is performed at two levels: packets are flooded to different zones as permitted by configured Layer 2 security policies, and packets are also flooded to different interfaces with the same VLAN identifier within the same zone. The device learns the forwarding interface for the MAC address when a reply with that MAC address arrives at one of its interfaces.

You can specify that the SRX Series device use ARP queries and trace-route requests (which are ICMP echo requests with the time-to-live values set to 1) instead of packet flooding to locate an unknown destination MAC address. This method is considered more secure than packet flooding because the device floods ARP queries and trace-route packets—not the initial packet—on all interfaces. When ARP or trace-route flooding is used, the original packet is dropped. The device broadcasts an ARP or ICMP query to all other devices on the same subnetwork, requesting the device at the specified destination IP address to send back a reply. Only the device with the specified IP address replies, which provides the requestor with the MAC address of the responder.

ARP allows the device to discover the destination MAC address for a unicast packet if the destination IP address is in the same subnetwork as the ingress IP address. (The ingress IP address refers to the IP address of the last device to send the packet to the device. The device might be the source that sent the packet or a router forwarding the packet.) Trace-route allows the device to discover the destination MAC address even if the destination IP address belongs to a device in a subnetwork beyond that of the ingress IP address.

When you enable ARP queries to locate an unknown destination MAC address, trace-route requests are also enabled. You can also optionally specify that trace-route requests not be used; however, the device can then discover destination MAC addresses for unicast packets only if the destination IP address is in the same subnetwork as the ingress IP address.

Whether you enable ARP queries and trace-route requests or ARP-only queries to locate unknown destination MAC addresses, the SRX Series device performs the following series of actions:

1. The device notes the destination MAC address in the initial packet. The device adds the source MAC address and its corresponding interface to its forwarding table, if they are not already there.
2. The device drops the initial packet.
3. The device generates an ARP query packet and optionally a trace-route packet and floods those packets out all interfaces except the interface on which the initial packet arrived.

   ARP packets are sent out with the following field values:

   - Source IP address set to the IP address of the IRB
   - Destination IP address set to the destination IP address of the original packet
   - Source MAC address set to the MAC address of the IRB
   - Destination MAC address set to the broadcast MAC address (all `0xf`)

   Trace-route (ICMP echo request or ping) packets are sent out with the following field values:

   - Source IP address set to the IP address of the original packet
   - Destination IP address set to the destination IP address of the original packet
   - Source MAC address set to the source MAC address of the original packet
   - Destination MAC address set to the destination MAC address of the original packet
   - Time-to-live (TTL) set to **1**
4. Combining the destination MAC address from the initial packet with the interface leading to that MAC address, the device adds a new entry to its forwarding table.
5. The device forwards all subsequent packets it receives for the destination MAC address out the correct interface to the destination.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Integrated Routing and Bridging Interfaces on page 54
- Example: Configuring an IRB Interface on page 54
- Example: Configuring the Default Learning for Unknown MAC Addresses on page 63

Example: Configuring the Default Learning for Unknown MAC Addresses

This example shows how to configure the device to use only ARP requests to learn the outgoing interfaces for unknown destination MAC addresses.

- Requirements on page 64
- Overview on page 64

- Configuration on page 64
- Verification on page 64

Requirements

Before you begin, determine the MAC addresses and associated interfaces of the forwarding table. See "Understanding Layer 2 Forwarding Tables" on page 62.

Overview

In this example, you configure the device to use only ARP queries without trace-route requests.

Configuration

Step-by-Step Procedure

To configure the device to use only ARP requests to learn unknown destination MAC addresses:

1. Enable the device.

   ```
   [edit]
   user@host# set security flow bridge no-packet-flooding no-trace-route
   ```

2. If you are done configuring the device, commit the configuration.

   ```
   [edit]
   user@host# commit
   ```

Verification

To verify the configuration is working properly, enter the **show security flow** command.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Integrated Routing and Bridging Interfaces on page 54
- Example: Configuring an IRB Interface on page 54

Understanding Layer 2 Transparent Mode Chassis Clusters

A pair of SRX Series devices in Layer 2 transparent mode can be connected in a chassis cluster to provide network node redundancy. When configured in a chassis cluster, one node acts as the primary device and the other as the secondary device, ensuring stateful failover of processes and services in the event of system or hardware failure. If the primary device fails, the secondary device takes over processing of traffic.

NOTE: If the primary device fails in a Layer 2 transparent mode chassis cluster, the physical ports in the failed device become inactive (go down) for a few seconds before they become active (come up) again.

To form a chassis cluster, a pair of the same kind of supported SRX Series devices combines to act as a single system that enforces the same overall security.

Devices in Layer 2 transparent mode can be deployed in active/backup and active/active chassis cluster configurations.

The following chassis cluster features are not supported for devices in Layer 2 transparent mode:

- Gratuitous ARP—The newly elected master in a redundancy group cannot send gratuitous ARP requests to notify network devices of a change in mastership on the redundant Ethernet interface links.
- IP address monitoring—Failure of an upstream device cannot be detected.

A redundancy group is a construct that includes a collection of objects on both nodes. A redundancy group is primary on one node and backup on the other. When a redundancy group is primary on a node, its objects on that node are active. When a redundancy group fails over, all its objects fail over together.

You can create one or more redundancy groups numbered 1 through 128 for an active/active chassis cluster configuration. Each redundancy group contains one or more redundant Ethernet interfaces. A redundant Ethernet interface is a pseudointerface that contains physical interfaces from each node of the cluster. The physical interfaces in a redundant Ethernet interface must be the same kind—either Fast Ethernet or Gigabit Ethernet. If a redundancy group is active on node 0, then the child links of all associated redundant Ethernet interfaces on node 0 are active. If the redundancy group fails over to the node 1, then the child links of all redundant Ethernet interfaces on node 1 become active.

NOTE: **In the active/active chassis cluster configuration, the maximum number of redundancy groups is equal to the number of redundant Ethernet interfaces that you configure. In the active/backup chassis cluster configuration, the maximum number of redundancy groups supported is two.**

Configuring redundant Ethernet interfaces on a device in Layer 2 transparent mode is similar to configuring redundant Ethernet interfaces on a device in Layer 3 route mode, with the following difference: the redundant Ethernet interface on a device in Layer 2 transparent mode is configured as a Layer 2 logical interface.

The redundant Ethernet interface may be configured as either an access interface (with a single VLAN ID assigned to untagged packets received on the interface) or as a trunk interface (with a list of VLAN IDs accepted on the interface and, optionally, a native-vlan-id for untagged packets received on the interface). Physical interfaces (one from each node in the chassis cluster) are bound as child interfaces to the parent redundant Ethernet interface.

In Layer 2 transparent mode, MAC learning is based on the redundant Ethernet interface. The MAC table is synchronized across redundant Ethernet interfaces and Services Processing Units (SPUs) between the pair of chassis cluster devices.

The IRB interface is used only for management traffic, and it cannot be assigned to any redundant Ethernet interface or redundancy group.

All Junos OS screen options that are available for a single, nonclustered device are available for devices in Layer 2 transparent mode chassis clusters.

NOTE: Spanning-tree protocols are not supported for Layer 2 transparent mode. You should ensure that there are no loop connections in the deployment topology.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Security Configuration Guide*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Layer 2 Interfaces on page 50
- Example: Configuring Layer 2 Logical Interfaces on page 51
- Understanding Transparent Mode Conditions on page 49
- Example: Configuring Redundant Ethernet Interfaces for Layer 2 Transparent Mode Chassis Clusters on page 66
- Understanding Layer 2 Forwarding Tables on page 62

Example: Configuring Redundant Ethernet Interfaces for Layer 2 Transparent Mode Chassis Clusters

This example shows how to configure a redundant Ethernet interface on a device as a Layer 2 logical interface for a Layer 2 transparent mode chassis cluster.

Requirements

Before you begin, determine the devices you want to connect in a chassis cluster. See "Understanding Layer 2 Transparent Mode Chassis Clusters" on page 64.

Overview

This example shows you how to configure the redundant Ethernet interface as a Layer 2 logical interface and how to bind the physical interfaces (one from each node in the chassis cluster) to the redundant Ethernet interface. In this example, you create redundant Ethernet interface reth0 for redundancy group 1 and configure reth0 as an access interface with the VLAN identifier 1. Then you assign physical interface ge-2/0/2 on a chassis cluster node to the redundant Ethernet interface reth0.

Configuration

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure a redundant Ethernet interface as a Layer 2 logical interface:

1. Configure the interfaces and redundancy group.

   [edit interfaces]
   user@host# **set reth0 redundant-ether-options redundancy-group 1**
   user@host# **set reth0 unit 0 family bridge interface-mode access vlan-id 1**

2. Assign a physical interface on a chassis cluster node.

   [edit interfaces]
   user@host# **set ge-2/0/2 gigether-options redundant-parent reth0**

3. If you are done configuring the device, commit the configuration.

   [edit]
   user@host# **commit**

Verification

To verify the configuration is working properly, enter the **show interfaces reth0** and **show interfaces ge-2/0/2** commands.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Junos OS Security Configuration Guide*
- Layer 2 Bridging and Transparent Mode Overview on page 45
- Understanding Transparent Mode Conditions on page 49
- Understanding Layer 2 Transparent Mode Chassis Clusters on page 64
- Understanding Layer 2 Forwarding Tables on page 62

Transparent Mode Devices

This topic includes the following sections:

Class of Service Functions in Transparent Mode Overview

Devices operating in Layer 2 transparent mode support the following class-of-service (CoS) functions:

- IEEE 802.1p behavior aggregate (BA) classifiers to determine the forwarding treatment for packets entering the device

NOTE: **Only IEEE 802.1p BA classifier types are supported on devices operating in transparent mode.**

- Rewrite rules to redefine IEEE 802.1 CoS values in outgoing packets

NOTE: **Rewrite rules that redefine IP precedence CoS values and Differentiated Services Code Point (DSCP) CoS values are not supported on devices operating in transparent mode.**

- Shapers to apply rate limiting to an interface
- Schedulers that define the properties of an output queue

You configure BA classifiers and rewrite rules on transparent mode devices in the same way as on devices operating in Layer 3 mode. For transparent mode devices, however, you apply BA classifiers and rewrite rules only to logical interfaces configured with the **family bridge** configuration statement.

Understanding BA Traffic Classification on Transparent Mode Devices

A BA classifier checks the header information of an ingress packet. The resulting traffic classification consists of a forwarding class (FC) and packet loss priority (PLP). The FC and PLP associated with a packet specify the CoS behavior of a hop within the system. For example, a hop can place a packet into a priority queue according to its FC, and manage queues by checking the packet's PLP. Junos OS supports up to eight FCs and four PLPs.

NOTE: **MPLS EXP bit-based traffic classification is not supported.**

BA classification can be applied within one DiffServ domain. BA classification can also be applied between two domains, where each domain honors the CoS results generated by the other domain. Junos OS performs BA classification for a packet by examining its Layer 2 and Layer 3 CoS-related parameters. Those parameters include the following:

- Layer 2—IEEE 802.1p: User Priority
- Layer 3—IPv4 Precedence, IPv4 DSCP, IPv6 DSCP

On SRX Series devices in transparent mode, a BA classifier evaluates only Layer 2 parameters. On SRX Series devices in Layer 3 mode, a BA classifier can evaluate Layer

2 and Layer 3 parameters; in that case, classification resulting from Layer 3 parameters overrides that of Layer 2 parameters.

On SRX Series devices in transparent mode, you specify one of four PLP levels—high, medium-high, medium-low, or low—when configuring a BA classifier.

Example: Configuring BA Classifiers on Transparent Mode Devices

This example shows how to configure BA classifiers on transparent mode devices to determine the forwarding treatment of packets entering the devices.

Requirements

Before you begin, configure a Layer 2 logical interface. See “Example: Configuring Layer 2 Logical Interfaces” on page 51.

Overview

In this example, you configure logical interface ge-0/0/4.0 as a trunk port that carries traffic for packets tagged with VLAN identifiers 200 through 390. You then configure forwarding classes and create BA classifier c1 for IEEE 802.1 traffic where incoming packets with IEEE 802.1p priority bits 110 are assigned to the forwarding class fc1 with a low loss priority. Finally, you apply the BA classifier c1 to interface ge-0/0/4.0.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set interfaces ge-0/0/4 vlan-tagging unit 0 family bridge interface-mode trunk vlan-id-list
  200-390
set class-of-service forwarding-classes queue 0 fc1
set class-of-service forwarding-classes queue 1 fc2
set class-of-service forwarding-classes queue 3 fc4
set class-of-service forwarding-classes queue 4 fc5
set class-of-service forwarding-classes queue 5 fc6
set class-of-service forwarding-classes queue 6 fc7
set class-of-service forwarding-classes queue 7 fc8
set class-of-service forwarding-classes queue 2 fc3
set class-of-service classifiers ieee-802.1 c1 forwarding-class fc1 loss-priority low
  code-point 110
set class-of-service interfaces ge-0/0/4 unit 0 classifiers ieee-802.1 c1
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure BA classifiers on transparent mode devices:

1. Configure the logical interface as a Layer 2 trunk port.

   ```
   [edit]
   user@host# set interfaces ge-0/0/4 vlan-tagging unit 0 family bridge interface-mode
     trunk vlan-id-list 200–390
   ```

2. Configure the class of service.

   ```
   [edit]
   user@host# edit class-of-service
   ```

3. Configure the forwarding classes.

   ```
   [edit class-of-service]
   user@host# set forwarding-classes queue 0 fc1
   user@host# set forwarding-classes queue 1 fc2
   user@host# set forwarding-classes queue 3 fc4
   user@host# set forwarding-classes queue 4 fc5
   user@host# set forwarding-classes queue 5 fc6
   user@host# set forwarding-classes queue 6 fc7
   user@host# set forwarding-classes queue 7 fc8
   user@host# set forwarding-classes queue 2 fc3
   ```

4. Configure a BA classifier.

   ```
   [edit class-of-service]
   user@host# set classifiers ieee-802.1 c1 forwarding-class fc1 loss-priority low
     code-points 110
   ```

5. Apply the BA classifier to the interface.

   ```
   [edit class-of-service]
   user@host# set interfaces ge-0/0/4 unit 0 classifiers ieee-802.1 c1
   ```

Results

From configuration mode, confirm your configuration by entering the **show interfaces ge-0/0/4** and **show class-of-service** commands. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
[edit]
  user@host# show interfaces ge-0/0/4
  vlan-tagging;
  unit 0 {
    family bridge {
    interface-mode trunk;
    vlan-id-list 200-390;
  }
}
[edit]
  user@host# show class-of-service
  classifiers {
  ieee-802.1 c1 {
```

```
        forwarding-class fc1 {
        loss-priority low code-points 110;
        }
      }
      }
      forwarding-classes {
        queue 0 fc1;
        queue 1 fc2;
        queue 3 fc4;
        queue 4 fc5;
        queue 5 fc6;
        queue 6 fc7;
        queue 7 fc8;
        queue 2 fc3;
        }
        interfaces {
          ge-0/0/4 {
        unit 0 {
        classifiers {
          ieee-802.1 c1;
        }
        }
      }
    }
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

To confirm that the configuration is working properly, perform this task:

- Verifying BA Classifiers on Transparent Mode Devices on page 71

Verifying BA Classifiers on Transparent Mode Devices

Purpose Verify that the BA classifier was configured on the transparent mode devices properly.

Action From configuration mode, enter the **show interfaces ge-0/0/4** and **show class-of-service** commands.

Understanding Rewrite of Packet Headers on Transparent Mode Devices

Before a packet is transmitted from an interface, the CoS fields in the packet's header can be rewritten for the forwarding class (FC) and packet loss priority (PLP) of the packet. The rewriting function converts a packet's FC and PLP into corresponding CoS fields in the packet header. In Layer 2 transparent mode, the CoS fields are the IEEE 802.1p priority bits.

Example: Configuring Rewrite Rules on Transparent Mode Devices

This example shows how to configure rewrite rules on transparent mode devices to redefine IEEE 802.1 CoS values in outgoing packets.

Requirements

Before you begin, configure a Layer 2 logical interface. See "Example: Configuring Layer 2 Logical Interfaces" on page 51.

Overview

In this example, you configure logical interface ge-1/0/3.0 as a trunk port that carries traffic for packets tagged with VLAN identifiers 200 through 390. You then configure the forwarding classes and create rewrite rule rw1 for IEEE 802.1 traffic. For outgoing packets in the forwarding class fc1 with low loss priority, the IEEE 802.1p priority bits are rewritten as 011. Finally, you apply the rewrite rule rw1 to interface ge-1/0/3.0.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set interfaces ge-1/0/3 vlan-tagging unit 0 family bridge interface-mode trunk vlan-id-list
  200-390
set class-of-service forwarding-classes queue 0 fc1
set class-of-service forwarding-classes queue 1 fc2
set class-of-service forwarding-classes queue 3 fc4
set class-of-service forwarding-classes queue 4 fc5
set class-of-service forwarding-classes queue 5 fc6
set class-of-service forwarding-classes queue 6 fc7
set class-of-service forwarding-classes queue 7 fc8
set class-of-service forwarding-classes queue 2 fc3
set class-of-service rewrite-rules ieee-802.1 rw1 forwarding-class fc1 loss-priority low
  code-point 011
set class-of-service interfaces ge-1/0/3 unit 0 rewrite-rules ieee-802.1 rw1
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode in the *Junos OS CLI User Guide*.

To configure rewrite rules on transparent mode devices:

1. Configure the logical interface as a Layer 2 trunk port.

```
[edit]
```



```
user@host# set interfaces ge-1/0/3 vlan-tagging unit 0 family bridge interface-mode
  trunk vlan-id-list 200-390
```

2. Configure the class of service.

```
[edit]
user@host# edit class-of-service
```

3. Configure the forwarding classes.

```
[edit class-of-service]
user@host# set forwarding-classes queue 0 fc1
user@host# set forwarding-classes queue 1 fc2
user@host# set forwarding-classes queue 3 fc4
user@host# set forwarding-classes queue 4 fc5
user@host# set forwarding-classes queue 5 fc6
user@host# set forwarding-classes queue 6 fc7
user@host# set forwarding-classes queue 7 fc8
user@host# set forwarding-classes queue 2 fc3
```

4. Configure a rewrite rule.

```
[edit class-of-service]
user@host# set rewrite-rules ieee-802.1 rw1 forwarding-class fc1 loss-priority low
  code-point 011
```

5. Apply the rewrite rule to the interface.

```
[edit class-of-service]
user@host# set interfaces ge-1/0/3 unit 0 rewrite-rules ieee-802.1 rw1
```

Results From configuration mode, confirm your configuration by entering the **show interfaces ge-1/0/3** and **show class-of-service** commands. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
[edit]
  user@host# show interfaces ge-1/0/3
  vlan-tagging;
  unit 0 {
    family bridge {
    interface-mode trunk;
    vlan-id-list 200-390;
  }
}
[edit]
  user@host# show class-of-service
  forwarding-classes {
  queue 0 fc1;
    queue 1 fc2;
    queue 3 fc4;
    queue 4 fc5;
    queue 5 fc6;
    queue 6 fc7;
    queue 7 fc8;
  queue 2 fc3;
  }
  interfaces {
    ge-1/0/3 {
```



```
            unit 0 {
            rewrite-rules {
               ieee-802.1 rw1;
               }
            }
         }
         }
         rewrite-rules {
            ieee-802.1 rw1 {
            forwarding-class fc1 {
            loss-priority low code-point 011;
            }
         }
      }
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

To confirm that the configuration is working properly, perform this task:

- Verifying Rewrite Rules on Transparent Mode Devices on page 74

Verifying Rewrite Rules on Transparent Mode Devices

Purpose Verify that the rewrite rule was configured on the transparent mode devices properly.

Action From configuration mode, enter the **show interfaces ge-1/0/3** and **show class-of-service** commands.

Example: Configuring Layer 2 Trunk Interfaces with Multiple Units

This example shows you how to configure trunk interfaces with multiple units, VLANs, and security zones to allow segmentation across Layer 2 or Layer 3 switches.

- Requirements on page 74
- Overview on page 75
- Configuration on page 76
- Verification on page 85

Requirements

Before you begin:

- See information on Layer 2 interfaces in "Understanding Layer 2 Interfaces" on page 50.
- See information on security zones and policies for Layer 2 interfaces in "Understanding Layer 2 Security Zones" on page 56 and "Understanding Security Policies in Transparent Mode" on page 58.
- In this example, you will be putting the device in transparent mode. We recommend that you use a console connection so you do not lose management access.

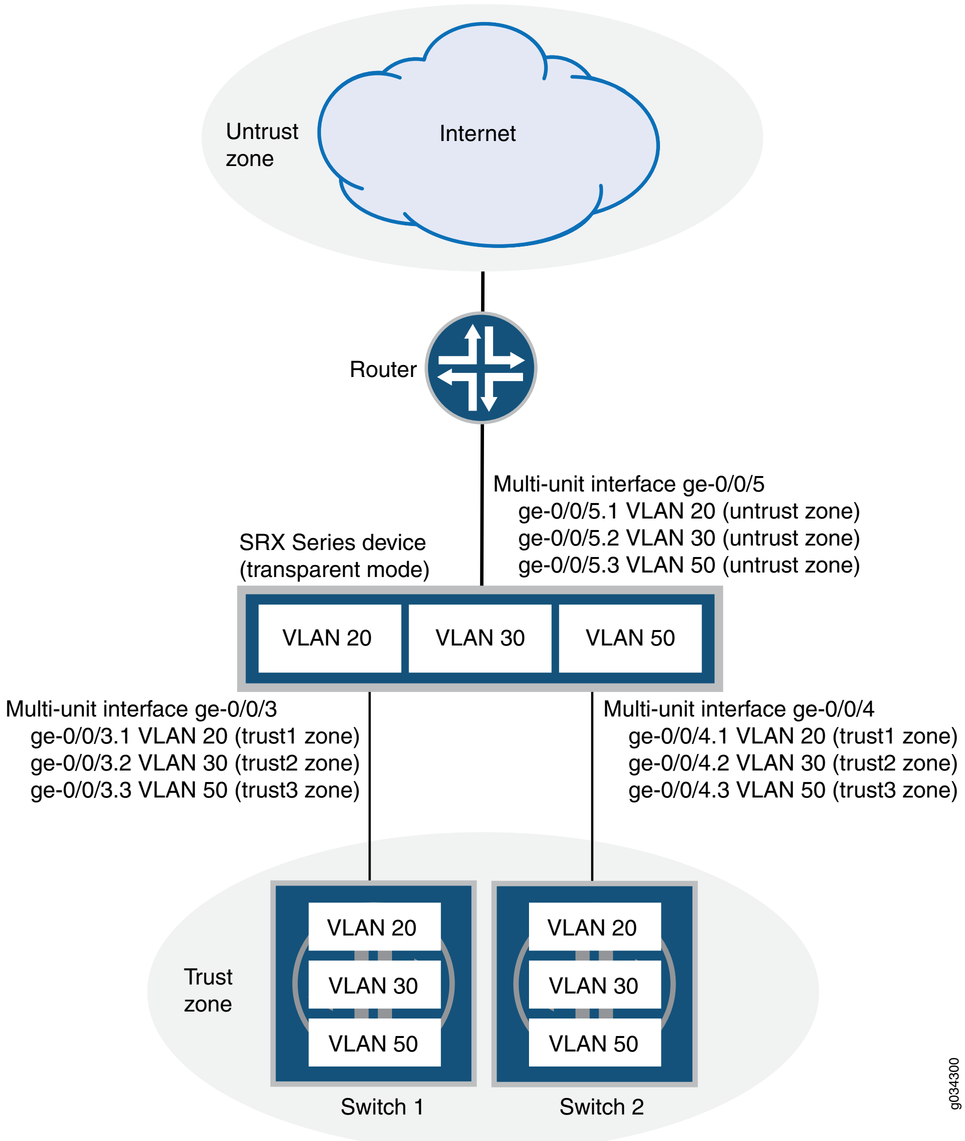
Overview

In this example, you configure an SRX Series Services Gateway in transparent mode that sits between two EX Series Switches. Each switch is connected to the services gateway using Gigabit Ethernet interfaces in trunk mode, while a third trunk port on the services gateway connects to a router that is configured as the gateway to the Internet or to an untrust zone. The trunk interfaces are also configured with multiple units, which are then broken up into multiple VLANs and zones to provide proper segmentation between VLANs.

You will first configure the interfaces, bridge domains, trunk interfaces, VLANs, and security zones as shown in Figure 1 on page 76. You then apply a policy between the trust and untrust zones. Although this example does not cover redundancy, you should configure an HA scenario if high availability is required. For more information, see the Chassis Cluster chapter in the *Junos OS Security Configuration Guide*.

NOTE: You can use this configuration with Layer 2 or Layer 3 switches. The main difference would be that with Layer 2 switches you would run STP to avoid loops; for Layer 3, you might want to run OSPF.

Figure 1: SRX Series Services Gateway, in Transparent Mode, Connected to Switches and Router Using Trunk Interfaces



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them in a text file, remove any line breaks, and then copy and paste the commands into the CLI.

```
[edit]
set interfaces ge-0/0/3 vlan-tagging
set interfaces ge-0/0/4 vlan-tagging
set interfaces ge-0/0/5 vlan-tagging
set interfaces ge-0/0/3 native-vlan-id 50
set interfaces ge-0/0/4 native-vlan-id 50
set interfaces ge-0/0/5 native-vlan-id 50
set interfaces ge-0/0/3 unit 1 family bridge interface-mode trunk vlan-id-list 20
```

```
set interfaces ge-0/0/3 unit 2 family bridge interface-mode trunk vlan-id-list 30
set interfaces ge-0/0/3 unit 3 family bridge interface-mode trunk vlan-id-list 50
set interfaces ge-0/0/4 unit 1 family bridge interface-mode trunk vlan-id-list 20
set interfaces ge-0/0/4 unit 2 family bridge interface-mode trunk vlan-id-list 30
set interfaces ge-0/0/4 unit 3 family bridge interface-mode trunk vlan-id-list 50
set interfaces ge-0/0/5 unit 1 family bridge interface-mode trunk vlan-id-list 20
set interfaces ge-0/0/5 unit 2 family bridge interface-mode trunk vlan-id-list 30
set interfaces ge-0/0/5 unit 3 family bridge interface-mode trunk vlan-id-list 50
set bridge-domains bd1 vlan-id 20
set bridge-domains bd2 vlan-id 30
set bridge-domains bd3 vlan-id 50
set security flow bridge bypass-non-ip-unicast
set security flow bridge bpdu-vlan-flooding
set security zones security-zone trust1 interfaces ge-0/0/3.1 host-inbound-traffic
  system-services all
set security zones security-zone trust2 interfaces ge-0/0/3.2 host-inbound-traffic
  system-services all
set security zones security-zone trust3 interfaces ge-0/0/3.3 host-inbound-traffic
  system-services all
set security zones security-zone trust1 interfaces ge-0/0/4.1 host-inbound-traffic
  system-services all
set security zones security-zone trust2 interfaces ge-0/0/4.2 host-inbound-traffic
  system-services all
set security zones security-zone trust3 interfaces ge-0/0/4.3 host-inbound-traffic
  system-services all
set security zones security-zone untrust interfaces ge-0/0/5.1 host-inbound-traffic
  system-services all
set security policies from-zone trust1 to-zone untrust policy policy1 match source-address
  any
set security policies from-zone trust1 to-zone untrust policy policy1 match
  destination-address any
set security policies from-zone trust1 to-zone untrust policy policy1 match application
  any
set security policies from-zone trust1 to-zone untrust policy policy1 then permit
set security policies from-zone untrust to-zone trust1 policy policy2 match source-address
  any
set security policies from-zone untrust to-zone trust1 policy policy2 match
  destination-address any
set security policies from-zone untrust to-zone trust1 policy policy2 match application
  any
set security policies from-zone untrust to-zone trust1 policy policy2 then deny
set security policies from-zone trust2 to-zone untrust policy policy3 match source-address
  any
set security policies from-zone trust2 to-zone untrust policy policy3 match
  destination-address any
set security policies from-zone trust2 to-zone untrust policy policy3 match application
  any
set security policies from-zone trust2 to-zone untrust policy policy3 then permit
set security policies from-zone untrust to-zone trust2 policy policy4 match source-address
  any
set security policies from-zone untrust to-zone trust2 policy policy4 match
  destination-address any
set security policies from-zone untrust to-zone trust2 policy policy4 match application
  junos-http
set security policies from-zone untrust to-zone trust2 policy policy4 match application
  junos-https
```

set security policies from-zone untrust to-zone trust2 policy policy4 then permit

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see Using the CLI Editor in Configuration Mode.

To configure the three trunk interfaces, bridge domains, zones, and security policies:

1. Connect to the console port of the services gateway and delete or deactivate any interfaces that are in route mode. This step is necessary because the configuration cannot contain both route and transparent mode interfaces at the same time. After you put interfaces in transparent bridge mode, you will need to reboot the device for the new interface mode to take effect.
2. Enable VLAN tagging on the interfaces. Interfaces ge-0/0/3 and ge-0/0/4 are connected to switches 1 and 2, respectively, and interface ge-0/0/5 is connected to the router. The router can connect to the services gateway trunk port through a gigabit interface that is configured with the gateway IP address that will be used by the services gateway and switches to reach the Internet or untrust zone.

   NOTE: The example does not include the steps for configuring the router. The router identifies the services gateway and the switches as a single switch, and the services gateway uses an IP address to connect to an interface on the router that the switches use as a gateway. The services gateway controls traffic from the switch VLANs and zones through policies that determine what traffic can flow between the switches and the Internet or the untrust zone.

   ```
   [edit interfaces]
   user@host# set ge-0/0/3 vlan-tagging
   user@host# set ge-0/0/4 vlan-tagging
   user@host# set ge-0/0/5 vlan-tagging
   ```
3. (Optional) Configure the native VLAN tag as ID 50 for the interfaces to ensure that untagged packets will still flow through the device. You can also define a policy to control untagged traffic.

   ```
   [edit interfaces]
   user@host# set ge-0/0/3 native-vlan-id 50
   user@host# set ge-0/0/4 native-vlan-id 50
   user@host# set ge-0/0/5 native-vlan-id 50
   ```
4. Configure the logical units on each of the three trunk interfaces. Interfaces ge-0/0/3, ge-0/0/4, and ge-0/0/5 will each have 3 units, each with its own VLAN ID. All logical interfaces will have a VLAN ID and will use a family type bridge, interface mode trunk, and a vlan-id-list number. Unit 3 will be assigned a native VLAN tag and will be used to handle untagged packets that enter the services gateway device. If this last step was not done, untagged packets would be dropped. However, the native VLAN feature is optional.

First, configure ge-0/0/3, which is physically connected to switch1 and will be in zone trust1.

NOTE: In this case, **vlan-id-list** is used because you are using trunk mode for the interfaces. For an access mode interface, you would use **vlan-id**.

```
[edit interfaces ge-0/0/3]
user@host# set unit 1 family bridge interface-mode trunk vlan-id-list 20
user@host# set unit 2 family bridge interface-mode trunk vlan-id-list 30
user@host# set unit 3 family bridge interface-mode trunk vlan-id-list 50
```

5. Configure interface ge-0/0/4, which is physically connected to switch 2 and will be in zone trust2.

```
[edit interfaces ge-0/0/4]
user@host# set unit 1 family bridge interface-mode trunk vlan-id-list 20
user@host# set unit 2 family bridge interface-mode trunk vlan-id-list 30
user@host# set unit 3 family bridge interface-mode trunk vlan-id-list 50
```

6. Configure interface ge-0/0/5, which is connected to a router to route traffic between the services gateway and the two switches to other networks and will be in zone untrust.

NOTE: The example does not include the steps for configuring the router. The router identifies the services gateway and the switches as a single switch, and the services gateway uses an IP address to connect to an interface on the router that the switches use as a gateway. The services gateway controls traffic from the switch VLANs and zones through policies that determine what traffic can flow between the switches and the Internet or the untrust zone.

```
[edit interfaces ge-0/0/5]
user@host# set unit 1 family bridge interface-mode trunk vlan-id-list 20
user@host# set unit 2 family bridge interface-mode trunk vlan-id-list 30
user@host# set unit 3 family bridge interface-mode trunk vlan-id-list 50
```

7. Configure a bridge domains for each VLAN.

```
[edit bridge-domains]
user@host# set bd1 vlan-id 20
user@host# set bd2 vlan-id 30
user@host# set bd3 vlan-id 50
```

8. If you are using Layer 2 switches, you will need to set BPDU options to help prevent STP misconfigurations that can lead to network outages. First, enable **bypass-non-ip-unicast** to allow BPDUs. Next, set the **bpdu-vlan-flooding** option to limit flooding of BPDUs to each VLAN; otherwise BPDUs received on one port will be sent to all other ports even if ports are in different VLANs.

```
[edit security flow bridge]
user@host# set bypass-non-ip-unicast
```

```
user@host# set bpdu-vlan-flooding
```

9. Configure security zones for the logical units on ge-0/0/3, ge-0/0/4, and ge-0/0/5.

```
[edit security zones]
user@host# set security-zone trust1 interfaces ge-0/0/3.1 host-inbound-traffic
  system-services all
user@host# set security-zone trust2 interfaces ge-0/0/3.2 host-inbound-traffic
  system-services all
user@host# set security-zone trust3 interfaces ge-0/0/3.3 host-inbound-traffic
  system-services all
user@host# set security-zone trust1 interfaces ge-0/0/4.1 host-inbound-traffic
  system-services all
user@host# set security-zone trust2 interfaces ge-0/0/4.2 host-inbound-traffic
  system-services all
user@host# set security-zone trust3 interfaces ge-0/0/4.3 host-inbound-traffic
  system-services all
user@host# set security-zone untrust interfaces ge-0/0/5.1 host-inbound-traffic
  system-services all
```

10. Configure a security policy named policy1 to permit all traffic from the trust1 zone to the untrust zone.

```
[edit security policies from-zone trust1 to-zone untrust]
user@host# set policy policy1 match source-address any
user@host# set policy policy1 match destination-address any
user@host# set policy policy1 match application any
user@host# set policy policy1 then permit
```

11. Configure a security policy named policy2 to deny all traffic from the untrust zone to the trust1 zone.

```
[edit security policies from-zone untrust to-zone trust1]
user@host# set policy policy2 match source-address any
user@host# set policy policy2 match destination-address any
user@host# set policy policy2 match application any
user@host# set policy policy2 then deny
```

12. Configure a security policy named policy3 to permit all traffic from the trust2 zone to the untrust zone.

```
[edit security policies from-zone trust2 to-zone untrust]
user@host# set policy policy3 match source-address any
user@host# set policy policy3 match destination-address any
user@host# set policy policy3 match application any
user@host# set policy policy3 then permit
```

13. Create a security policy named policy4 to allow only HTTP and HTTPS traffic from the untrust zone to the trust2 zone.

```
[edit security policies from-zone untrust to-zone trust2]
user@host# set policy policy4 match source-address any
user@host# set policy policy4 match destination-address any
user@host# set policy policy4 match application junos-http
user@host# set policy policy4 match application junos-https
user@host# set policy policy4 then permit
```


Results From configuration mode, confirm your configuration by entering the **show** command. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it. The following config output only shows items configured in this example.

Interfaces configuration:

```
interfaces {
    ge-0/0/3 {
        vlan-tagging;
        native-vlan-id 50;
        unit 1 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 20;
            }
        }
        unit 2 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 30;
            }
        }
        unit 3 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 50;
            }
        }
    }
    ge-0/0/4 {
        vlan-tagging;
        native-vlan-id 50;
        unit 1 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 20;
            }
        }
        unit 2 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 30;
            }
        }
        unit 3 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 50;
            }
        }
    }
    ge-0/0/5 {
        vlan-tagging;
        native-vlan-id 50;
```

```
        unit 1 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 20;
            }
        }
        unit 2 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 30;
            }
        }
        unit 3 {
            family bridge {
                interface-mode trunk;
                vlan-id-list 50;
            }
        }
    }
}
```

Bridge domains configuration:

```
bridge-domains {
    bd1 {
        vlan-id 20;
    }
    bd2 {
        vlan-id 30;
    }
    bd3 {
        vlan-id 50;
    }
}
```

Zones and policies configuration:

```
security {
    flow {
        bridge {
            bypass-non-ip-unicast;
            bpdu-vlan-flooding;
        }
    }
    policies {
        from-zone trust1 to-zone untrust {
            policy policy1 {
                match {
                    source-address any;
                    destination-address any;
                    application any;
                }
                then {
                    permit;
                }
            }
        }
```



```
    from-zone untrust to-zone trust1 {
        policy policy2 {
            match {
                source-address any;
                destination-address any;
                application any;
            }
            then {
                deny;
            }
        }
    }
    from-zone trust2 to-zone untrust {
        policy policy3 {
            match {
                source-address any;
                destination-address any;
                application any;
            }
            then {
                permit;
            }
        }
    }
    from-zone untrust to-zone trust2 {
        policy policy4 {
            match {
                source-address any;
                destination-address any;
                application [ junos-http junos-https ];
            }
            then {
                permit;
            }
        }
    }
}
zones {
    security-zone trust1 {
        interfaces {
            ge-0/0/3.1 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
            ge-0/0/4.1 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
        }
    }
```



```
    security-zone trust2 {
        interfaces {
            ge-0/0/3.2 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
            ge-0/0/4.2 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
        }
    }
    security-zone trust3 {
        interfaces {
            ge-0/0/3.3 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
            ge-0/0/4.3 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
        }
    }
    security-zone untrust {
        interfaces {
            ge-0/0/5.1 {
                host-inbound-traffic {
                    system-services {
                        all;
                    }
                }
            }
        }
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Verifying the Interfaces Configuration on page 85
- Verifying Policies and Traffic Flow on page 85

Verifying the Interfaces Configuration

Purpose Verify that ge-0/0/3 is in the correct security zone and is in trunk mode.

Action From operational mode, enter the **show interfaces ge-0/0/3** command.

Meaning You will see information about each logical interface for ge-0/0/3. In this case, you should see the three logical interfaces. Verify that the Security:Zone field shows trust1 for ge-0/0/3.1, trust2 for ge-0/0/3.2, and trust3 for ge-0/0/3.3. Also verify that the Flags: field under Protocols bridge shows Trunk-mode for each logical interface. You can then do the same for the other interfaces (ge-0/0/4, ge-0/0/5).

The following output shows the ge-0/0.3.1 logical interface:

```
Logical interface ge-0/0/3.1 (Index 68) (SNMP ifIndex 523)
  Flags: Device-Down SNMP-Traps 0x0 Encapsulation: Ethernet-Bridge
  Input packets : 0
  Output packets: 0
  Security: Zone: trust1
  Allowed host-inbound traffic : bootp dns dhcp finger ftp tftp ident-reset
  http https ike netconf ping reverse-telnet reverse-ssh rlogin rpm rsh snmp
  snmp-trap ssh telnet traceroute xnm-clear-text xnm-ssl lsping ntp sip
  dhcpv6 r2cp
  Protocol bridge, MTU: 1518
    Flags: Is-Primary, Trunk-Mode
```

Verifying Policies and Traffic Flow

Purpose Verify that each policy is working properly and that traffic is being allowed or denied based on the policies that have been implemented.

Action From operational mode, enter the **show security zones** command.

Meaning The following output shows each security zone and the interfaces that are in those zones.

```
Security zone: trust1
  Send reset for non-SYN session TCP packets: Off
  Policy configurable: Yes
  Interfaces bound: 2
  Interfaces:
    ge-0/0/3.1
    ge-0/0/4.1

Security zone: trust2
  Send reset for non-SYN session TCP packets: Off
  Policy configurable: Yes
  Interfaces bound: 2
  Interfaces:
```



```
    ge-0/0/3.2
    ge-0/0/4.2

Security zone: trust3
  Send reset for non-SYN session TCP packets: Off
  Policy configurable: Yes
  Interfaces bound: 2
  Interfaces:
    ge-0/0/3.3
    ge-0/0/4.3

Security zone: untrust
  Send reset for non-SYN session TCP packets: Off
  Policy configurable: Yes
  Interfaces bound: 1
  Interfaces:
    ge-0/0/5.1

Security zone: junos-host
  Send reset for non-SYN session TCP packets: Off
  Policy configurable: Yes
  Interfaces bound: 0
  Interfaces:
```

After you verify the zones, you can test hosts in those zones to ensure that traffic is flowing correctly. For example, policy1 allows all traffic from trust1 to untrust and policy 2 denies all traffic for untrust to trust1. You can also test policy4, which only permits HTTP and HTTPS traffic from untrust to trust2, while trust2 should be able to pass all traffic to untrust.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding Layer 2 Interfaces on page 50
- Understanding Bridge Domains on page 47
- Understanding Layer 2 Security Zones on page 56
- Understanding Security Policies in Transparent Mode on page 58

PART 2

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