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CoS Re-Marking of Packets Exiting the Network Feature Guide for Routing Devices

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Table of Contents

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

Part 1 Overview

Chapter 1 **Rewriting Packet Header Information 3**

Rewriting Packet Header Information Overview 3
Header Bits Preserved, Cleared, and Rewritten 4
Setting IPv6 DSCP and MPLS EXP Values Independently 5
Classifiers and Rewrite Rules at the Global and Physical Interface Levels Overview 5

Part 2 Configuration

Chapter 2 **Configuration Tasks for Applying Rewrite Rules 9**

Applying Default Rewrite Rules 9
Configuring Rewrite Rules 11
Applying Rewrite Rules to Output Logical Interfaces 12
Configuring DSCP Values for IPv6 Packets Entering the MPLS Tunnel 13
Applying IEEE 802.1p Rewrite Rules to Dual VLAN Tags 15
Example: Applying an IEEE 802.1p Rewrite Rule to Dual VLAN Tags 16
Applying IEEE 802.1ad Rewrite Rules to Dual VLAN Tags 17
Example: Applying an IEEE 802.1ad Rewrite Rule to Dual VLAN Tags 17
Configuring Classifiers and Rewrite Rules at the Global and Physical Interface Levels 18

Chapter 3 **Configuration Tasks for Rewriting Packet Header Information 21**

Rewriting MPLS and IPv4 Packet Headers 21
Example: Rewriting MPLS and IPv4 Packet Headers 23
Example: Simultaneous DSCP and EXP Rewrite 24
Rewriting the EXP Bits of All Three Labels of an Outgoing Packet 25
Example: Rewriting the EXP Bits of All Three Labels of an Outgoing Packet 26

Rewriting IEEE 802.1p Packet Headers with an MPLS EXP Value 27
Configuring the IEEE 802.1p Field for CoS Host Outbound Traffic 29
Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic . . . 29
Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface 30
Setting Ingress DSCP Bits for Multicast Traffic over Layer 3 VPNs 31
Assigning the Default Frame Relay DE Loss Priority Map to an Interface 32
Defining a Custom Frame Relay Loss Priority Map 33

Chapter 4 Examples 35

Example: Per-Node Rewriting of EXP Bits 35
Example: Remarking Diffserv Code Points to MPLS EXPs to Carry CoS Profiles Across a Service Provider's L3VPN MPLS Network 36
Example: Remarking Diffserv Code Points to 802.1P PCPs to Carry CoS Profiles Across a Service Provider's VPLS Network 58

Chapter 5 Configuration Statements 81

code-point 82
default (CoS Host Outbound Traffic) 82
dscp (Rewrite Rules) 83
dscp (Rewrite Rules on Physical Interface) 84
dscp-ipv6 (Class-of-Service) 85
exp 86
exp-push-push-push 87
exp-swap-push-push 88
forwarding-class (BA Classifiers) 89
frame-relay-de (Defining Loss Priority Maps) 90
host-outbound-traffic (Class-of-Service) 91
ieee-802.1 (Rewrite Rules on Logical Interface) 92
ieee-802.1 (Host Outbound Traffic) 93
ieee-802.1 (Rewrite Rules on Physical Interface) 93
ieee-802.1ad 94
import (Rewrite Rules) 95
inet-precedence 95
inet-precedence (Rewrite Rules on Physical Interface) 96
interfaces 97
loss-priority (BA Classifiers) 99
loss-priority-maps 100
loss-priority-maps (Assigning to an Interface) 101
protocol (Rewrite Rules) 102
rewrite-rules (CoS Host Outbound Traffic) 103
rewrite-rules (Definition) 104
rewrite-rules (Interfaces) 105
rewrite-rules (Physical Interfaces) 106
unit 107
vlan-tag 108

Part 3 Administration

Chapter 6 Operational Commands 111

show class-of-service loss-priority-map 112

Part 4 Index

Index 117

List of Figures

Part 1 Overview

Chapter 1 **Rewriting Packet Header Information 3**

Figure 1: Packet Flow Across the Network 4

Part 2 Configuration

Chapter 4 **Examples 35**

Figure 2: MPLS Packet Structure 38

Figure 3: Rewriting CoS Information at the Network Border to Transit an MPLS Network Scenario 38

Figure 4: Typical VPLS Topology 59

Figure 5: VPLS with CoS Scenario 61

List of Tables

About the Documentation xi

Table 1: Notice Icons xiii
Table 2: Text and Syntax Conventions xiv

Part 2 Configuration

Chapter 2 Configuration Tasks for Applying Rewrite Rules 9

Table 3: Default Packet Header Rewrite Mappings 10

Chapter 3 Configuration Tasks for Rewriting Packet Header Information 21

Table 4: Default MPLS EXP Rewrite Table 21

Part 3 Administration

Chapter 6 Operational Commands 111

Table 5: show class-of-service loss-priority-map Output Fields 112

About the Documentation

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

Documentation and Release Notes

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

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

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Supported Platforms

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

- T Series
- M Series
- MX Series
- ACX Series
- PTX Series

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming

configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

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

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

Merging a Full Example

To merge a full example, follow these steps:

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

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

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

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

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

Merging a Snippet

To merge a snippet, follow these steps:

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

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

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

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

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

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

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

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

Documentation Conventions

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

Table 1: Notice Icons

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

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

Table 2: Text and Syntax Conventions

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

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

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

GUI Conventions

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

Convention	Description	Examples
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

Documentation Feedback

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

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

Requesting Technical Support

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

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf.
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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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- Search for known bugs: http://www2.juniper.net/kb/
- Find product documentation: http://www.juniper.net/techpubs/
- Find solutions and answer questions using our Knowledge Base: http://kb.juniper.net/
- Download the latest versions of software and review release notes: http://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: http://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: http://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: http://www.juniper.net/cm/

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

Opening a Case with JTAC

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

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

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

PART 1

Overview

- Rewriting Packet Header Information on page 3

CHAPTER 1

Rewriting Packet Header Information

- Rewriting Packet Header Information Overview on page 3
- Header Bits Preserved, Cleared, and Rewritten on page 4
- Setting IPv6 DSCP and MPLS EXP Values Independently on page 5
- Classifiers and Rewrite Rules at the Global and Physical Interface Levels Overview on page 5

Rewriting Packet Header Information Overview

As packets enter or exit a network, edge routers might be required to alter the class-of-service (CoS) settings of the packets. Rewrite rules set the value of the CoS bits within the packet's header. Each rewrite rule reads the current forwarding class and loss priority information associated with the packet, locates the chosen CoS value from a table, and writes this CoS value into the packet header.

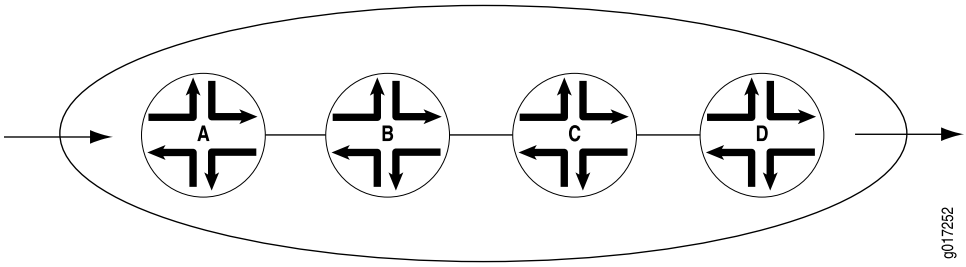
In effect, the rewrite rule performs the opposite function of the behavior aggregate (BA) classifier used when the packet enters the routing device. As the packet leaves the routing platform, the final CoS action is generally the application of a rewrite rule.

You configure rewrite rules to alter CoS values in outgoing packets on the outbound interfaces of an edge router to meet the policies of a targeted peer. This allows the downstream routing device in a neighboring network to classify each packet into the appropriate service group.

In addition, you often need to rewrite a given marker (IP precedence, Differentiated Services code point [DSCP], IEEE 802.1p, or MPLS EXP settings) at the inbound interfaces of an edge router to accommodate BA classification by core devices.

Figure 1 on page 4 shows a flow of packets through four routing devices. Router A rewrites the CoS bits in incoming packet to accommodate the BA classification performed by Routers B and C. Router D alters the CoS bits of the packets before transmitting them to the neighboring network.

Figure 1: Packet Flow Across the Network



To configure CoS rewrite rules, you define the rewrite rule and apply it to an interface. Include the following statements at the **[edit class-of-service]** hierarchy level:

```
[edit class-of-service]
interfaces {
  interface-name {
    unit logical-unit-number {
      rewrite-rules {
        dscp (rewrite-name | default)protocol protocol-types;
        dscp-ipv6 (rewrite-name | default);
        exp (rewrite-name | default)protocol protocol-types;
        exp-push-push-push default;
        exp-swap-push-push default;
        ieee-802.1 (rewrite-name | default) vlan-tag (outer | outer-and-inner);
        ieee-802.1ad (rewrite-name | default) vlan-tag (outer | outer-and-inner);
        inet-precedence (rewrite-name | default)protocol protocol-types;
      }
    }
  }
}
rewrite-rules {
  (dscp | dscp-ipv6 | exp | frame-relay-de | ieee-802.1 | inet-precedence) rewrite-name {
    import (rewrite-name | default);
    forwarding-class class-name {
      loss-priority level code-point (alias | bits);
    }
  }
}
```

Header Bits Preserved, Cleared, and Rewritten

For every incoming packet, the ingress classifier decodes the ingress CoS bits into a forwarding class and packet loss priority (PLP) combination.

The egress CoS information depends on which type of rewrite marker is active, as follows:

- For Multiprotocol Label Switching (MPLS) EXP and IEEE 802.1 rewrite markers, values are derived from the forwarding class and PLP values in rewrite rules. MPLS EXP and IEEE 802.1 markers are not preserved because they are part of the Layer 2 encapsulation.
- For IP precedence and DiffServ code point (DSCP) rewrite markers, the marker alters the first three bits on the type-of-service (ToS) byte while leaving the last three bits unchanged.

Setting IPv6 DSCP and MPLS EXP Values Independently

On the M120, M320 with Enhanced III FPCs, MX Series 3D Universal Edge Routers, and EX Series switches, you can set the DSCP and MPLS EXP bits independently on IPv6 packets. To enable this feature, include the **protocol mpls** statement at the **[edit class-of-service interfaces** *interface-name* **unit** *logical-unit-number* **rewrite-rules dscp-ipv6** *rewrite-name***]** hierarchy level.

You can set DSCP IPv6 values only at the ingress MPLS node.

The following limitations apply to this feature:

- This feature is supported only on M120, M320 with Enhanced III FPCs, MX Series Ethernet Services routers, and EX Series switches.
- MPLS packets entering another MPLS tunnel at the ingress node may mark only the EXP value if EXP rewrite rules are configured, but not the DSCP value in the IPv6 header.
- This feature does not support MPLS packets generated by the Routing Engine.
- The IP precedence field is not applicable for IPv6, and is not supported.

Related Documentation

- Configuring DSCP Values for IPv6 Packets Entering the MPLS Tunnel on page 13

Classifiers and Rewrite Rules at the Global and Physical Interface Levels Overview

On ACX Series Universal Access Routers and EX Series switches, CoS supports classification and rewrite at the global level and physical interface levels.

At a global level, you can define EXP classification.

At a physical interface level, you can define the following features:

- DSCP and inet-precedence classifiers
- DSCP and inet-precedence rewrites
- ieee-802.1 classifiers (inner and outer)
- ieee-802.1 rewrites (outer)

At a logical interface level, you can define the fixed classification and EXP rewrites.

To configure global EXP classifiers, include the **classfiers exp** *classifier-name* statement at the **[edit class-of-service] system-defaults** hierarchy level.

To configure classifiers or rewrite rules at the physical interface, include either the **classifiers** statement or the **rewrite-rules** statement at the **[edit class-of-service] interfaces** *interface-name* **]** hierarchy level.

To display classifiers configured under **system-defaults**, enter the **show class-of-service system-defaults** command.

To display classifiers and rewrite rules bound to physical interfaces, enter the **show class-of-service interfaces *interface-name*** command.

Related Documentation

- Configuring Classifiers and Rewrite Rules at the Global and Physical Interface Levels on page 18

PART 2

Configuration

- Configuration Tasks for Applying Rewrite Rules on page 9
- Configuration Tasks for Rewriting Packet Header Information on page 21
- Examples on page 35
- Configuration Statements on page 81

CHAPTER 2

Configuration Tasks for Applying Rewrite Rules

- Applying Default Rewrite Rules on page 9
- Configuring Rewrite Rules on page 11
- Applying Rewrite Rules to Output Logical Interfaces on page 12
- Configuring DSCP Values for IPv6 Packets Entering the MPLS Tunnel on page 13
- Applying IEEE 802.1p Rewrite Rules to Dual VLAN Tags on page 15
- Applying IEEE 802.1ad Rewrite Rules to Dual VLAN Tags on page 17
- Configuring Classifiers and Rewrite Rules at the Global and Physical Interface Levels on page 18

Applying Default Rewrite Rules

By default, rewrite rules are not usually applied to interfaces. The exceptions are MPLS interfaces: all MPLS-enabled interfaces use the default EXP rewrite rule, even if not configured. Except for MPLS interfaces, if you want to apply a rewrite rule, you can either design your own rule and apply it to an interface, or you can apply a default rewrite rule. To apply default rewrite rules, include one or more of the following statements at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules]
dscp default;
dscp-ipv6 default;
exp default;
ieee-802.1 default vlan-tag (outer | outer-and-inner);
inet-precedence default;
```

Table 3 on page 10 shows the default rewrite rule mappings. These are based on the default bit definitions of DSCP, DSCP IPv6, EXP, IEEE, and IP CoS values, as shown in *Default CoS Values Overview*, and the default forwarding classes shown in *Default Forwarding Classes*.

When the software detects packets whose CoS values match the forwarding class and PLP values in the first two columns in Table 3 on page 10, the software maps the header bits of those packets to the code-point aliases in the last column in Table 3 on page 10.

The code-point aliases in the last column map to the CoS bits shown in *Default CoS Values Overview*.

Table 3: Default Packet Header Rewrite Mappings

Map from Forwarding Class	PLP Value	Map to DSCP/DSCP IPv6/ EXP/IEEE/IP
expedited-forwarding	**low**	**ef**
expedited-forwarding	**high**	**ef**
assured-forwarding	**low**	**af11**
assured-forwarding	**high**	**af12** (DSCP/DSCP IPv6/EXP)
best-effort	**low**	**be**
best-effort	**high**	**be**
network-control	**low**	**nc1/cs6**
network-control	**high**	**nc2/cs7**

In the following example, the **so-1/2/3.0** interface is assigned the default DSCP rewrite rule. One result of this configuration is that each packet exiting the interface with the **expedited-forwarding** forwarding class and the **high** or **low** loss priority has its DSCP bits rewritten to the DSCP **ef** code-point alias. *Default CoS Values Overview* shows that this code-point alias maps to the **101110** bits.

Another result of this configuration is that all packets exiting the interface with the **best-effort** forwarding class and the **high** or **low** loss priority have their EXP bits rewritten to the EXP **be** code-point alias.*Default CoS Values Overview* shows that this code-point alias maps to the **000** bits.

To evaluate all the implications of this example, see *Default CoS Values Overview* and Table 3 on page 10.

```
class-of-service {
  interfaces {
    so-1/2/3 {
      unit 0 {
        rewrite-rules {
          dscp default;
        }
      }
    }
  }
}
```

Configuring Rewrite Rules

You define markers in the rewrite rules section of the CoS configuration hierarchy and reference them in the logical interface configuration. This model supports marking on the DSCP, DSCP IPv6, IP precedence, IEEE 802.1, and MPLS EXP CoS values.

To configure a rewrite-rules mapping and associate it with the appropriate forwarding class and code-point alias or bit set, include the **rewrite-rules** statement at the **[edit class-of-service]** hierarchy level:

```
[edit class-of-service]
rewrite-rules {
  (dscp | dscp-ipv6 | exp | ieee-802.1 |ieee-802.1ad | inet-precedence) rewrite-name {
    import (rewrite-name | default);
    forwarding-class class-name {
      loss-priority level code-point (alias | bits);
    }
  }
}
```

NOTE: The inet-precedence statement is not supported on PTX Series Packet Transport Routers.

The rewrite rule sets the code-point aliases and bit patterns for a specific forwarding class and PLP. The inputs for the map are the forwarding class and the PLP. The output of the map is the code-point alias or bit pattern. For more information about how CoS maps work, see *CoS Inputs and Outputs Overview*.

By default, IP precedence rewrite rules alter the first three bits on the type-of-service (ToS) byte while leaving the last three bits unchanged. This default behavior is not configurable. The default behavior applies to rules you configure by including the **inet-precedence** statement at the **[edit class-of-service rewrite-rules]** hierarchy level. The default behavior also applies to rewrite rules you configure for MPLS packets with IPv4 payloads. You configure these types of rewrite rules by including the **mpls-inet-both** or **mpls-inet-both-non-vpn** option at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules exp *rewrite-rule-name* protocol]** hierarchy level.

On the M320, T1600, and MX960 routers and EX Series switches, if you configure **vlan-vpls** encapsulation and add an IEEE 802.1 header on a Gigabit Ethernet or 10 Gigabit Ethernet interface to output traffic, but do not apply an IEEE 802.1 rewrite rule, then the default IEEE 802.1 rewrite rule is ignored and the IEEE 802.1p bits are set to match the forwarding class queue.

NOTE: The forwarding class is determined by ingress classification.

Related Documentation

- Applying Rewrite Rules to Output Logical Interfaces on page 12

- Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface on page 30

Applying Rewrite Rules to Output Logical Interfaces

To assign the rewrite-rules configuration to the output logical interface, include the **rewrite-rules** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number]
rewrite-rules {
   dscp (rewrite-name | <default>)protocol protocol-types;
   dscp-ipv6 (rewrite-name | <default>) protocol protocol-types
   exp (rewrite-name | <default>)protocol protocol-types;
   exp-push-push-push <default>;
   exp-swap-push-push <default>;
   ieee-802.1 (rewrite-name | <default>) inet-prec vlan-tag (outer | outer-and-inner);
   inet-precedence (rewrite-name | <default>)protocol protocol-types;
}
```

On M120, M320 with an Enhanced III FPC, MX Series routers and T 4000 routers with Type 5 FPCs, you can combine the **dscp** or **inet-prec** and **exp** options to set the DSCP or IP precedence bits and MPLS EXP bits independently on IP packets entering an MPLS tunnel.

For IQ PICs, you can configure only one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule. If you configure more than one IEEE 802.1 rewrite rule for the IQ PIC, the configuration check fails.

Logical interfaces do not support multiple **dscp** rewrite rules or multiple **dscp-ipv6** rewrite rules for the same protocol.

In the following example, the DSCP bits specified in **ss-dscp** are applied to packets entering the MPLS tunnel on **ge-2/1/1**, and the DSCP bits specified in ss-v6dscp are applied to IPv6 packets. The EXP bits are set to the bit configuration specified in **ss-exp**:

```
[edit class-of-service interfaces]
ge-2/1/1
   unit 10 {
      rewrite-rules {
         dscp ssf-dscp protocol mpls; # Applies to IPv4 packets entering MPLS tunnel
         dscp-ipv6 ss-v6dscp protocol mpls; # Applies to IPv6 packets entering MPLS tunnel
         exp ss-exp; # Sets label EXP bits independently
      }
   }
}
```

You can use interface wildcards for ***interface-name*** and ***logical-unit-number***. You can also include Layer 2 and Layer 3 rewrite information in the same configuration.

NOTE: On M Series routers only, if you include the **control-word** statement at the **[edit protocols l2circuit neighbor *address* interface *interface-name*]** hierarchy level, the software cannot rewrite MPLS EXP bits.

DSCP and DSCP IPv6 rewrite rules are supported on M Series and T Series routers when non-queuing PICs are installed, but are disabled when queuing PICs are installed with the following exceptions:

- On M320 routers, DSCP rewrite is supported on IQ, IQ2, IQE, and IQ2E PICs when used with the Enhanced III FPC.
- On M120 routers, DSCP rewrite is supported on IQ, IQ2, IQE, and IQ2E PICs.

DSCP and DCSP IPv6 rewrite rules are supported on MIC and MPC interfaces on MX Series routers.

DSCP rewrite rules are not supported on T Series routers when IQ, IQ2, IQE, IQ2E, SONET/SDH OC48/STM16 IQE, or PD-5-10XGE-SFPP PICs are installed.

For IQ PICs, you can configure only one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule.

On M320 and T Series routers (except for T4000 routers with Type 5 FPCs), for a single interface, you cannot enable a rewrite rule on a subset of forwarding classes. You must assign a rewrite rule to either none of the forwarding classes or all of the forwarding classes. When you assign a rewrite rule to a subset of forwarding classes, the commit does not fail, and the subset of forwarding classes works as expected. However, the forwarding classes to which the rewrite rule is not assigned are rewritten to all zeros.

For example, if you configure a Differentiated Services code point (DSCP) rewrite rule, the bits in the forwarding classes to which you do not assign the rewrite rule are rewritten to 000000; if you configure an IP precedence rewrite rule, the bits in the forwarding classes to which you do not assign the rewrite rule are rewritten to 000.

Related Documentation

- Setting IPv6 DSCP and MPLS EXP Values Independently on page 5
- Configuring DSCP Values for IPv6 Packets Entering the MPLS Tunnel on page 13

Configuring DSCP Values for IPv6 Packets Entering the MPLS Tunnel

The following configuration example explains in detail how to set the DSCP and MPLS EXP bits independently on IPv6 packets.

1. Configure the router device (ingress PE router) to classify (behavior aggregate or multifield) the incoming packets to a particular forwarding class.

[edit firewall]

```
family inet6 {
  filter ss-v6filt {
    term ss-vpn {
      from {
        destination-address {
          ::ffff:192.0.2.128/120;
        }
      }
        then {
        loss-priority low;
        forwarding-class ss-fc;
      }
    }
  }
}
```

In the preceding example, the ingress FPC classifies (MF) incoming IPv6 packets destined for address "::ffff:192.0.2.128/120" to forwarding class "ss-fc" and loss priority "low."

2. Attach the preceding firewall filter to an interface. Because you are matching on inbound traffic, this would be an input filter. This classifies all traffic on the interface "ge-2/1/0" that matches the filter "ss-v6."

```
[edit interfaces]
ge-2/1/0 {
  hierarchical-scheduler;
  vlan-tagging;
  unit 300 {
    family inet6 {
      filter {
        input ss-v6filt;
      }
      address ::ffff:192.0.2.100/120;
    }
  }
}
```

3. Configure the DSCP–IPv6 rewrite rule for the forwarding class "ss-fc." This causes the outgoing IPv6 packets belonging to the forwarding class "ss-fc" and loss priority "low" to have their DSCP value rewritten to 100000.

```
[edit class-of-service rewrite-rules]
dscp-ipv6 ss-v6dscp {
  forwarding-class ss-fc {
    loss-priority low code-point 100000;
  }
}
```

4. Configure the EXP rewrite values for the forwarding class "ss-fc." This rewrite rule stamps an EXP value of 100 on all outgoing MPLS packets assigned to the forwarding class "ss-fc" and loss priority "low."

```
[edit class-of-service rewrite-rules]
exp ss-exp {
  forwarding-class ss-fc {
    loss-priority low code-point 100;
```

```
    }
  }
```

5. Apply the preceding rewrite rule to an egress interface. On the egress FPC, all IPv6 packets in the forwarding class “ss-fc” with loss priority “low” are marked with the DSCP value “100000” and an EXP value of “100” before they enter the MPLS tunnel.

```
[edit class-of-service interfaces]
ge-2/1/1 {
  unit 10 {
    rewrite-rules {
      dscp-ipv6 ss-v6dscp protocol mpls;
      exp ss-exp;
    }
  }
}
```

6. To support IPv4 DSCP and MPLS EXP independent rewrite at the same time, you can define and apply an IPv4 DSCP rewrite rule “ss-dscp” to the same interface.

```
[edit class-of-service interfaces]
ge-2/1/1 {
  unit 10 {
    rewrite-rules {
      dscp ss-dscp protocol mpls;
      dscp-ipv6 ss-v6dscp protocol mpls;
      exp ss-exp;
    }
  }
}
```

Related Documentation

- Setting IPv6 DSCP and MPLS EXP Values Independently on page 5

Applying IEEE 802.1p Rewrite Rules to Dual VLAN Tags

By default, when you apply an IEEE 802.1p rewrite rule to an output logical interface, the software rewrites the IEEE bits in the outer VLAN tag only.

For Gigabit Ethernet IQ2 PICs, 10-port 10-Gigabit OSE PICs, and 10-Gigabit Ethernet IQ2 PICs only, you can rewrite the IEEE bits in both the outer and inner VLAN tags of the tagged Ethernet frames. When you enable class of service (CoS) rewrite for both tags, the same IEEE 802.1p rewrite table is used for the inner and outer VLAN tag.

For IQ PICs, you can only configure one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule.

To rewrite both the outer and inner VLAN tags, include the **vlan-tag outer-and-inner** statement at the **[edit class-of-service interfaces** *interface-name* **unit** *logical-unit-number* **rewrite-rules ieee-802.1 (***rewrite-name* **| default)]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules
  ieee-802.1 (rewrite-name | default)]
vlan-tag outer-and-inner;
```

To explicitly specify the default behavior, include the **vlan-tag outer** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules ieee-802.1 (*rewrite-name* | default)]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules
  ieee-802.1 (rewrite-name | default)]
vlan-tag outer;
```

For more information about VLAN tags, see the *Junos OS Network Interfaces Library for Routing Devices*.

On MX routers and EX Series switches, you can perform IEEE 802.1p and DEI rewriting based on forwarding class and PLP at the VPLS ingress PE. You rewrite (mark) the IEEE 802.1p or DEI bits on frames at the VPLS ingress PE based on the value of the forwarding class and PLP established for the traffic. You can rewrite either the outer tag only or the outer and inner tag. When both tags are rewritten, both get the same value. To configure these rewrite rules, include the **ieee-802.1** statement at the [**edit class-of-services routing-instance *routing-instance-name* rewrite-rules**] hierarchy level.

NOTE: For MX80, MX240, MX480, and MX960 routers with MPC/MICs, rewrite on LSI interfaces is not supported (the routers, with DPC, do support rewrite on LSI interfaces).

On routing devices with IQ2 or IQ2-E PICs, you can perform IEEE 802.1p and DEI rewriting based on forwarding-class and packet loss priority (PLP) at the VPLS ingress provider edge (PE) router. You rewrite (mark) the IEEE 802.1p or DEI bits on frames at the VPLS ingress PE based on the value of the forwarding-class and PLP established for the traffic. You can rewrite either the outer tag only or both the outer and inner tags. When both tags are rewritten, both get the same value.

NOTE: The 10-port 10-Gigabit OSE PIC does not support DEI rewriting based on forwarding class and PLP at the VPLS ingress PE.

To configure these rewrite rules, include the **ieee-802.1** statement at the [**edit class-of-services routing-instance *routing-instance-name* rewrite-rules**] hierarchy level.

Example: Applying an IEEE 802.1p Rewrite Rule to Dual VLAN Tags

Apply the **ieee8021p-rwrule1** rewrite rule to both inner and outer VLAN tags of Ethernet-tagged frames exiting the **ge-0/0/0.0** interface:

```
class-of-service {
  interfaces {
    ge-0/0/0 {
      unit 0 {
        rewrite-rules {
          ieee-802.1 ieee8021p-rwrule1 vlan-tag outer-and-inner;
        }
      }
    }
```

```
    }
}
```

Applying IEEE 802.1ad Rewrite Rules to Dual VLAN Tags

By default, when you apply an IEEE 802.1ad rewrite rule to an output logical interface, the software rewrites the IEEE bits in the outer VLAN tag only.

For MX Series routers and IQ2 PICs, you can rewrite the IEEE 802.1ad bits in both the outer and inner VLAN tags of the tagged Ethernet frames. When you enable the CoS rewrite for both tags, the same IEEE 802.1ad rewrite table is used for the inner and outer VLAN tag.

NOTE: When you apply IEEE 802.1ad rewrite rules for inner and outer VLAN tags, you cannot rewrite the Canonical Format Identifier (CFI) bit for the inner VLAN tag.

To rewrite both the outer and inner VLAN tags, include the **vlan-tag outer-and-inner** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules ieee-802.1ad (*rewrite-name* | default)]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules
  ieee-802.1ad (rewrite-name | default)]
vlan-tag outer-and-inner;
```

To explicitly specify the default behavior, include the **vlan-tag outer** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules ieee-802.1ad (*rewrite-name* | default)]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules
  ieee-802.1ad (rewrite-name | default)]
vlan-tag outer;
```

For more information about VLAN tags, see the *Junos OS Network Interfaces Library for Routing Devices*.

Example: Applying an IEEE 802.1ad Rewrite Rule to Dual VLAN Tags

Apply the **dot1p_dei_rw** rewrite rule to both inner and outer VLAN tags of Ethernet-tagged frames exiting the **ge-2/0/0.0** interface:

```
class-of-service {
  interfaces {
    ge-2/0/0 {
      unit 0 {
        rewrite-rules {
          ieee-802.1ad dot1p_dei_rw vlan-tag outer-and-inner;
        }
      }
    }
  }
}
```

Configuring Classifiers and Rewrite Rules at the Global and Physical Interface Levels

On ACX Series Universal Access Routers and EX Series switches, CoS supports classification and rewrite at the global and physical interface levels.

To configure the global EXP classifier, include the following statements at the **[edit class-of-service] system-defaults** hierarchy level.

```
[edit class-of-service]
{
  system-defaults
    {
    classifiers exp classifier-name
  }
}
```

CoS supports one global system default classifier of the EXP type, as shown in the following example:

```
[edit class-of-service]
{
  system-defaults {
    classifiers {
      exp exp-classf-core;
    }
  }
}
```

To configure classifiers and rewrite rules at the physical interface level, include the following statements at the **[edit class-of-service] interfaces** hierarchy level.

```
[edit class-of-service]
interfaces {
  interface-name
    classifiers dscp classifier-name
    classifiers inet-precedence classifier-name
    classifiers ieee-802.1 [vlan-tag (outer | inner)] classifier-name
    rewrite-rules dscp rewrite-name
    rewrite-rules inet-prec rewrite-name
    rewrite-rules ieee-802.1 rewrite-name
}
```

The following example shows classifiers and rewrite rules configured on physical interfaces:

```
ge-0/1/0 {
  unit 0 {
    rewrite-rules {
      exp custom-exp;
    }
  }
  classifiers {
    dscp d1;
    ieee-802.1 ci;
  }
```

```
    rewrite-rules {
      dscp default;
    }
  }
    ge-0/1/2 {
      classifiers {
        ieee-802.1 ci;
      }
      rewrite-rules {
        ieee-802.1 ri;
      }
    }
    ge-0/1/3 {
      unit 0 {
        rewrite-rules {
          exp custom-exp2;
        }
      }
    }
    ge-0/1/7 {
      classifiers {
        dscp d1;
      }
    }
    ge-0/1/8 {
      classifiers {
        dscp d1;
      }
    }
```

Related Documentation

- Classifiers and Rewrite Rules at the Global and Physical Interface Levels Overview on page 5

CHAPTER 3

Configuration Tasks for Rewriting Packet Header Information

- Rewriting MPLS and IPv4 Packet Headers on page 21
- Rewriting the EXP Bits of All Three Labels of an Outgoing Packet on page 25
- Rewriting IEEE 802.1p Packet Headers with an MPLS EXP Value on page 27
- Configuring the IEEE 802.1p Field for CoS Host Outbound Traffic on page 29
- Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic on page 29
- Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface on page 30
- Setting Ingress DSCP Bits for Multicast Traffic over Layer 3 VPNs on page 31
- Assigning the Default Frame Relay DE Loss Priority Map to an Interface on page 32
- Defining a Custom Frame Relay Loss Priority Map on page 33

Rewriting MPLS and IPv4 Packet Headers

You can apply a rewrite rule to MPLS and IPv4 packet headers simultaneously. This allows you to initialize MPLS EXP and IP precedence bits at LSP ingress. You can configure different rewrite rules depending on whether the traffic is VPN or non-VPN.

The default MPLS EXP rewrite table contents are shown in Table 4 on page 21.

Table 4: Default MPLS EXP Rewrite Table

Forwarding Class	Loss Priority	CoS Value
best-effort	**low**	000
best-effort	**high**	001
expedited-forwarding	**low**	010
expedited-forwarding	**high**	011
assured-forwarding	**low**	100

Table 4: Default MPLS EXP Rewrite Table *(continued)*

Forwarding Class	Loss Priority	CoS Value
assured-forwarding	**high**	101
network-control	**low**	110
network-control	**high**	111

By default, IP precedence rewrite rules alter the first three bits on the type-of-service (ToS) byte while leaving the last three bits unchanged. This default behavior applies to rewrite rules you configure for MPLS packets with IPv4 payloads.

To override the default MPLS EXP rewrite table and rewrite MPLS and IPv4 packet headers simultaneously, include the **protocol** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules exp *rewrite-rule-name*]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules exp
  rewrite-rule-name]
protocol protocol-types;
```

The **protocol** statement defines the types of MPLS packets and packet headers to which the specified rewrite rule is applied. The MPLS packet can be a standard MPLS packet or an MPLS packet with an IPv4 payload. Specify the type of MPLS packet using the following options:

- **mpls**—Applies the rewrite rule to MPLS packets and writes the CoS value to MPLS headers.
- **mpls-inet-both**—Applies the rewrite rule to VPN MPLS packets with IPv4 payloads. On Juniper Networks M120 Multiservice Edge Routers, M320 Multiservice Edge Routers, and T Series Core Routers (except T4000 routers), writes the CoS value to the MPLS and IPv4 headers. On other M Series Multiservice Edge Router routers, causes all ingress MPLS LSP packets with IPv4 payloads to be initialized with **000** code points for the MPLS EXP value, and the configured rewrite code point for IP precedence.
- **mpls-inet-both-non-vpn**—Applies the rewrite rule to non-VPN MPLS packets with IPv4 payloads. On Juniper Networks M120 Multiservice Edge Routers, M320 Multiservice Edge Routers, and T Series Core Routers, writes the CoS value to the MPLS and IPv4 headers. On other M Series Multiservice Edge Routers, causes all ingress MPLS LSP packets with IPv4 payloads to be initialized with **000** code points for the MPLS EXP value, and the configured rewrite code point for IP precedence.

On M120 routers, M320 routers with Enhanced-III FPCs, and MX Series routers, you can perform simultaneous DSCP and EXP rewrite by attaching independent DSCP or IPv4 precedence rewrite rules and EXP rewrite rules to the same core interface. Thus, you can rewrite both code points (DSCP and EXP) when the packet is received by the ingress provider edge (PE) router on the MPLS core.

An alternative to overwriting the default with a rewrite-rules mapping is to configure the default packet header rewrite mappings, as discussed in "Applying Default Rewrite Rules" on page 9.

By default, IP precedence rewrite rules alter the first three bits on the ToS byte while leaving the last three bits unchanged. This default behavior is not configurable. The default behavior applies to rules you configure by including the **inet-precedence** statement at the **[edit class-of-service rewrite-rules]** hierarchy level. The default behavior also applies to rewrite rules you configure for MPLS packets with IPv4 payloads. You configure these types of rewrite rules by including the **mpls-inet-both** or **mpls-inet-both-non-vpn** option at the **[edit class-of-service interfaces** ***interface-name*** **unit** ***logical-unit-number*** **rewrite-rules exp** ***rewrite-rule-name*** **protocol]** hierarchy level.

Example: Rewriting MPLS and IPv4 Packet Headers

On M320 and T Series routers, configure rewrite tables and apply them in various ways to achieve the following results:

- For interface **so-3/1/0**, the three EXP rewrite tables are applied to packets, depending on the protocol of the payload:
  - IPv4 packets (VPN) that enter the LSPs on interface **so-3/1/0** are initialized with values from rewrite table **exp-inet-table**. An identical 3-bit value is written into the IP precedence and MPLS EXP bit fields.
  - IPv4 packets (non-VPN) that enter the LSPs on interface **so-3/1/0** are initialized with values from rewrite table **rule-non-vpn**. An identical 3-bit value is written into the IP precedence and MPLS EXP bit fields.
  - Non-IPv4 packets that enter the LSPs on interface **so-3/1/0** are initialized with values from rewrite table **rule1**, and written into the MPLS EXP header field only. The statement **exp rule1** has the same result as **exp rule1 protocol mpls**.
- For interface **so-3/1/0**, IPv4 packets transmitted over a non-LSP layer are initialized with values from IP precedence rewrite table **rule2**.
- For interface **so-3/1/1**, IPv4 packets that enter the LSPs are initialized with values from EXP rewrite table **exp-inet-table**. An identical 3-bit value is written into the IP precedence and MPLS EXP bit fields.
- For interface **so-3/1/1**, MPLS packets other than IPv4 Layer 3 types are also initialized with values from table **exp-inet-table**. For VPN MPLS packets with IPv4 payloads, the CoS value is written to MPLS and IPv4 headers. For VPN MPLS packets without IPv4 payloads, the CoS value is written to MPLS headers only.

```
[edit class-of-service]
rewrite-rules {
   exp exp-inet-table {
      forwarding-class best-effort {
         loss-priority low code-point 000;
         loss-priority high code-point 001;
      }
      forwarding-class assured-forwarding {
         loss-priority low code-point 010;
```

```
        loss-priority high code-point 011;
      }
      forwarding-class expedited-forwarding {
        loss-priority low code-point 111;
        loss-priority high code-point 110;
      }
      forwarding-class network-control {
        loss-priority low code-point 100;
        loss-priority high code-point 101;
      }
    }
    exp rule1 {
      ...
    }
    inet-precedence rule2 {
      ...
    }
  }
  exp rule_non_vpn {
    ...
  }

  interfaces {
    so-3/1/0 {
      unit 0 {
        rewrite-rules {
          exp rule1;
          inet-precedence rule2;
          exp exp-inet-table protocol mpls-inet-both; # For all VPN traffic.
          exp rule_non_vpn protocol mpls-inet-both-non-vpn; # For all non-VPN
            # traffic.
        }
      }
    }
    so-3/1/1 {
      unit 0 {
        rewrite-rules {
          exp exp-inet-table protocol [mpls mpls-inet-both];
        }
      }
    }
  }
```

Example: Simultaneous DSCP and EXP Rewrite

On M120 routers, M320 routers with Enhanced-III FPCs, and MX Series routers, configure the simultaneous DSCP and EXP rewrite rules as shown below:

1. Configure CoS.

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

2. Configure the EXP rewrite rule on the interface.

   ```
   [edit class-of-service]
   ```

```
user@host# set interfaces ge-2/0/3 unit 0 rewrite-rule exp rule1
```

3. Configure the IPv4 rewrite rule on the interface.

```
[edit class-of-service]
user@host# set interfaces ge-2/0/3 unit 0 rewrite-rule inet-precedence rule2
```

4. Configure the IPv4 rewrite rule on the interface and apply it to packets entering the MPLS tunnel.

```
[edit class-of-service]
user@host# set interfaces ge-2/0/3 unit 0 rewrite-rule inet-precedence rule3 protocol
  mpls
```

5. Verify the configuration by using the **show interfaces** command.

```
[edit class-of-service]
user@host# show interfaces ge-2/0/3 unit 0
rewrite-rules {
exp rule1;
inet-precedence rule2;
inet-precedence rule3 protocol mpls;
}
```

In the example above, there are two different IPv4 precedence rewrite rules: **rule2** and **rule3**. **rule2** affects the IPv4 to IPv4 traffic and **rule3** affects the IPv4 to MPLS traffic.

Rewriting the EXP Bits of All Three Labels of an Outgoing Packet

In interprovider, carrier-of-carrier, and complex traffic engineering scenarios, it is sometimes necessary to push three labels on the next hop, using a swap-push-push or triple-push operation.

By default, on M Series routers, the top MPLS EXP label of an outgoing packet is not rewritten when you configure swap-push-push and triple-push operations. On M Series routers, you can rewrite the EXP bits of all three labels of an outgoing packet, thereby maintaining the CoS of an incoming MPLS or non-MPLS packet.

When the software performs a swap-push-push operation and no rewriting is configured, the EXP fields of all three labels are the same as in the old label. If there is EXP rewriting configured, the EXP bits of the bottom two labels are overwritten with the table entry. The EXP setting of the top label is retained even with rewriting.

To push three labels on all incoming MPLS packets, include the **exp-swap-push-push default** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules]
exp-swap-push-push default;
```

When the software performs a push-push-push operation and if no rewriting is configured, the EXP fields of the bottom two labels are zero. If EXP rewriting is configured, the EXP fields of the bottom two labels are rewritten with the table entry's rewrite value. The EXP field of the top label is inserted with the Qn+PLP value. This Qn reflects the final classification by a multifield classifier if one exists, regardless of whether rewriting is configured.

NOTE: The **exp-push-push-push** and **exp-swap-push-push** configuration on the egress interface does not rewrite the top label's EXP field with the Qn+PLP value on an IQ or IQ2 PIC.

To push three labels on incoming non-MPLS packets, include the **exp-push-push-push default** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number rewrite-rules]
exp-push-push-push default;
```

These configurations apply the default MPLS EXP rewrite table, as described in "Rewriting MPLS and IPv4 Packet Headers" on page 21. You can configure these operations and override the default MPLS EXP rewrite table with a custom table. For more information about writing and applying a custom rewrite table, see "Configuring Rewrite Rules" on page 11 and "Applying Rewrite Rules to Output Logical Interfaces" on page 12.

NOTE: With a three-label stack, if you do not include the **exp-swap-push-push default** or **exp-push-push-push default** statement in the configuration, the top label's EXP bits are set to zero.

Example: Rewriting the EXP Bits of All Three Labels of an Outgoing Packet

Configure a swap-push-push operation, and override the default rewrite table with a custom table:

```
[edit class-of-service]
forwarding-classes {
   queue 0 be;
   queue 1 ef;
   queue 2 af;
   queue 3 nc;
}
interfaces {
   so-1/1/3 {
      unit 0 {
         rewrite-rules {
            exp exp_rew; # Apply custom rewrite table
            exp-swap-push-push default;
         }
      }
   }
}
rewrite-rules {
   exp exp_rew {
      forwarding-class be {
         loss-priority low code-point 000;
         loss-priority high code-point 100;
      }
      forwarding-class ef {
```

```
            loss-priority low code-point 001;
            loss-priority high code-point 101;
        }
        forwarding-class af {
            loss-priority low code-point 010;
            loss-priority high code-point 110;
        }
        forwarding-class nc {
            loss-priority low code-point 011;
            loss-priority high code-point 111;
        }
    }
}
```

Rewriting IEEE 802.1p Packet Headers with an MPLS EXP Value

For Ethernet interfaces on Juniper Networks M320 Multiservice Edge Routers, MX Series Ethernet Service Routers, and T Series Core Routers that have a peer connection to an M Series Multiservice Edge Router, MX Series, or T Series router, you can rewrite both MPLS EXP and IEEE 802.1p bits to a configured value. This enables you to pass the configured value to the Layer 2 VLAN path. For IQ PICs, you can only configure one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule.

To rewrite both the MPLS EXP and IEEE 802.1p bits, you must include EXP and IEEE 802.1p rewrite rules in the interface configuration. To configure EXP and IEEE 802.1p rewrite rules, include the **rewrite-rules** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]** hierarchy level, specifying the **exp** and **ieee-802.1** options:

```
[edit class-of-service interfaces interface-name unit logical-unit-number]
rewrite-rules {
    exp rewrite-rule-name;
    ieee-802.1 default;
}
```

When you combine these two rewrite rules, only the EXP rewrite table is used for rewriting packet headers. If you do not configure a VLAN on the interface, only the EXP rewriting is in effect. If you do not configure an LSP on the interface or if the MPLS EXP rewrite rule mapping is removed, the IEEE 802.1p default rewrite rules mapping takes effect.

NOTE: You can also combine other rewrite rules. IP, DSCP, DSCP IPv6, and MPLS EXP are associated with Layer 3 packet headers, and IEEE 802.1p is associated with Layer 2 packet headers.

For IQ PICs, you can only configure one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule.

If you combine IEEE 802.1p with IP rewrite rules, the Layer 3 packets and Layer 2 headers are rewritten with the IP rewrite rule.

If you combine IEEE 802.1p with DSCP or DSCP IPv6 rewrite rules, three bits of the Layer 2 header and six bits of the Layer 3 packet header are rewritten with the DSCP or DSCP IPv6 rewrite rule.

NOTE: For MPCs, default EXP rewrite rules do not exist for logical interfaces. The EXP CoS bits for MPLS labels are obtained from the IP precedence bits for IP traffic. The EXP bits for labels that are pushed or swapped are inherited from the current label of the MPLS packets. For non-IP and non-MPLS packets, the EXP bits are set to 0. If a custom EXP rewrite rule is configured on the core-facing interface, then it overrides the EXP bits.

The following example shows how to configure an EXP rewrite rule and apply it to both MPLS EXP and IEEE 802.1p bits:

```
[edit class-of-service]
rewrite-rules {
  exp exp-ieee-table {
    forwarding-class best-effort {
      loss-priority low code-point 000;
      loss-priority high code-point 001;
    }
    forwarding-class assured-forwarding {
      loss-priority low code-point 010;
      loss-priority high code-point 011;
    }
    forwarding-class expedited-forwarding {
      loss-priority low code-point 111;
      loss-priority high code-point 110;
    }
    forwarding-class network-control {
      loss-priority low code-point 100;
      loss-priority high code-point 101;
    }
  }
}
interfaces {
  so-3/1/0 {
    unit 0 {
      rewrite-rules {
```

```
            exp exp-ieee-table;
            ieee-802.1 default;
        }
    }
  }
}
```

Configuring the IEEE 802.1p Field for CoS Host Outbound Traffic

This topic provides a summary of the configuration for setting the IEEE 802.1p field in the Ethernet frame header for host outbound traffic (control plane traffic). You can set a global value for the priority code point that applies to all host outbound traffic. Additionally, or alternatively, you can specify that rewrite rules are applied to all host outbound traffic on egress logical interfaces. These are rules that have been previously configured to set the IEEE 802.1p field for data traffic on those interfaces.

Configuration of 802.1p bits is supported only on the following hardware and software components:

- EX Series switches
- MX Series 3D Universal Edge Routers
- Enhanced Queuing DPCs
- MPCs
- Junos OS Release 12.3 or later

To configure the IEEE 802.1p field settings:

1. (Optional) Specify a global default value for the IEEE 802.1p field for all host outbound traffic.

   See "Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic" on page 29.

2. (Optional) Specify that the IEEE 802.1p rewrite rules for the egress logical interfaces are applied to all host outbound traffic on those interfaces.

   See "Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface" on page 30.

Related Documentation

- Rewriting Packet Header Information Overview on page 3

Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic

This topic describes how to configure a global default value for the IEEE 802.1p field for all host outbound traffic on MX Series routers and EX Series switches.

To configure a global default value for the IEEE 802.1p field:

- Specify the value.

```
[edit class-of-service host-outbound-traffic ieee-802.1]
user@host# set default value
```

For example, specify that a value of 010 is applied to all host outbound traffic:

```
[edit class-of-service host-outbound-traffic ieee-802.1]
user@host# set default 010
```

Related Documentation

- Configuring the IEEE 802.1p Field for CoS Host Outbound Traffic on page 29
- Rewriting Packet Header Information Overview on page 3

Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface

This topic describes how to apply rewrite rules for egress logical interfaces to the IEEE 802.1p field for all host outbound traffic on those interfaces on MX Series routers and EX Series switches.

This task requires separately configured rewrite rules that map packet loss priority information to the code point value in the 802.1p field for data traffic on egress logical interfaces. See "Rewriting Packet Header Information Overview" on page 3.

To configure the rewrite rules:

1. Configure the CoS rewrite rules to map the forwarding class to the desired value for the 802.1p field.

   See "Configuring Rewrite Rules" on page 11.

2. Associate the rewrite rules to the desired egress logical interfaces.

   See "Applying Rewrite Rules to Output Logical Interfaces" on page 12.

3. (Optional) Configure the forwarding class for host outbound traffic. Do not configure this forwarding class if you want to use the default forwarding class assignment (input classification).

   See *Overriding the Input Classification*.

To configure the rewrite rules to apply to the host outbound traffic IEEE 802.1p field:

- Configure the rewrite rules.

```
[edit class-of-service host-outbound-traffic ieee-802.1]
user@host# set rewrite-rules
```

```
[edit class-of-service]
rewrite-rules {
  ieee-802.1 rewrite_foo {
    forwarding-class network-control {
      loss-priority low code-point 101;
    }
  }
}
interfaces {
```

```
    ge-1/0/0 {
      unit 100 {
        rewrite-rules {
          ieee-802.1 rewrite_foo vlan-tag outer-and-inner;
        }
      }
    }
}
host-outbound-traffic {
  forwarding-class network-control;
}
host-outbound-traffic {
  ieee-802.1 {
    rewrite-rules;
  }
}
```

Related Documentation

- Configuring the IEEE 802.1p Field for CoS Host Outbound Traffic on page 29
- Rewriting Packet Header Information Overview on page 3

Setting Ingress DSCP Bits for Multicast Traffic over Layer 3 VPNs

By default, the DSCP bits on outer IP headers arriving at an ingress PE router using generic routing encapsulation (GRE) are not set for multicast traffic sent over an Layer 3 virtual private network (VPN) provider network. However, you can configure a type-of-service (ToS) rewrite rule so the router sets the DSCP bits of GRE packets to be consistent with the service provider's overall core network CoS policy. The bits are set at the core-facing interface of the ingress provider edge (PE) router. For more information about rewriting IP header bits, see "Rewriting Packet Header Information Overview" on page 3.

This section describes this configuration from a CoS perspective. The examples are not complete multicast or VPN configurations. For more information about multicast, see the *Multicast Protocols Feature Guide for Routing Devices*. For more information about Layer 3 VPNs, see the *Junos OS VPNs Library for Routing Devices*.

To configure the rewrite rules on the core-facing interface of the ingress PE, include the **rewrite-rules** statement at the **[edit class-of-service]** hierarchy level. You apply the rule to the proper ingress interface at the **[edit class-of-service interfaces]** hierarchy level to complete the configuration. This ingress DSCP rewrite is independent of classifiers placed on ingress traffic arriving on the customer-facing interface of the PE router.

The rewrite rules are applied to all unicast packets and multicast groups. You cannot configure different rewrite rules for different multicast groups. The use of DSCPv6 bits is not supported because IPv6 multicast is not supported. You can configure another rewrite rule for the EXP bits on MPLS CE-CE unicast traffic.

This example defines a rewrite rule called **dscp-rule** that establishes a value of **000000** for best-effort traffic. The rule is applied to the outgoing, core-facing PE interface **ge-2/3/0**.

```
[edit class-of-service]
rewrite-rules {
  dscp dscp-rule {
```

```
    forwarding-class best-effort {
      loss-priority low code-point 000000;
    }
  }
}

[edit class-of-service interfaces]
ge-2/3/0 {
  unit 0 {
    rewrite-rules {
      dscp dscp-rule;
    }
  }
}
```

Assigning the Default Frame Relay DE Loss Priority Map to an Interface

For interfaces with the Frame Relay encapsulation on M120 routers, M320 routers with Enhanced III FPC, M7i and M10i routers with Enhanced Compact Forwarding Engine Board, and MX Series routers, you can set the loss priority of Frame Relay traffic based on the discard eligibility (DE) bit. For each incoming frame with the DE bit containing the class-of-service (CoS) value **0** or **1**, you can configure a Frame Relay loss priority value of low, medium-low, medium-high, or high.

The default Frame Relay loss priority map contains the following settings:

```
loss-priority low code-point 0;
loss-priority high code-point 1;
```

The default map sets the loss priority to low for each incoming frame with the DE bit containing the CoS value **0**. The map sets the loss priority to high for each incoming frame with the DE bit containing the CoS value **1**.

To assign the default Frame Relay DE loss priority map to an interface:

1. Include the **frame-relay-de default** statement at the **[edit class-of-service interfaces** *interface-name* **unit** *logical-unit-number* **loss-priority-maps]** hierarchy level.

   For example:

   ```
   [edit class-of-service interfaces so-1/0/0 unit 0 loss-priority-maps]
   user@host# set frame-relay-de default;
   ```

2. Verify the configuration in operational mode.

   ```
   user@host> show class-of-service loss-priority-map
   Loss-priority-map: frame-relay-de-default, Code point type: frame-relay-de,
   Index: 38
     Code point       Loss Priority
     0                Low
     1                High
   ```

Related Documentation

- show class-of-service loss-priority-map on page 112

Defining a Custom Frame Relay Loss Priority Map

You can apply a classifier to the same interface on which you configure a Frame Relay loss priority value. The Frame Relay loss priority map is applied first, followed by the classifier. The classifier can change the loss priority to a higher value only (for example, from low to high). If the classifier specifies a loss priority with a lower value than the current loss priority of a particular packet, the classifier does not change the loss priority of that packet.

To define a custom Frame Relay loss priority map:

1. At the **[edit class-of-service loss-priority-maps]** hierarchy level in configuration mode, specify the loss priority map for the Frame Relay DE bit.

   ```
   [edit class-of-service loss-priority-maps]
   user@host# set frame-relay-de name loss-priority level code-points [ alias | bits ];
   ```

   For example:

   ```
   [edit class-of-service loss-priority-maps]
   user@host# set frame-relay-de fr_rw loss-priority low code-points 0;
   user@host# set frame-relay-de fr_rw loss-priority high code-points 0;
   user@host# set frame-relay-de fr_rw loss-priority medium-low code-points 1;
   user@host# set frame-relay-de fr_rw loss-priority medium-high code-points 1;
   ```

   NOTE: The loss priority map does not take effect until you apply it to a logical interface.

2. Apply a rule to a logical interface.

   ```
   [edit class-of-service interfaces interface-name unit logical-unit-number
     loss-priority-maps]
   user@host# set frame-relay-de name;
   ```

   For example:

   ```
   [edit class-of-service interfaces so-1/0/0 unit 0 loss-priority-maps]
   user@host# set frame-relay-de fr_rw;
   ```

3. Verify the configuration in operational mode.

   ```
   user@host> show class-of-service loss-priority-map
   Loss-priority-map: frame-relay-de-fr_rw, Code point type: frame-relay-de,
   Index: 38
     Code point      Loss priority
     0                low
     0                high
     1                medium-low
     1                medium-high
   ```

Related Documentation

- show class-of-service loss-priority-map on page 112
- frame-relay-de on page 90

CHAPTER 4

Examples

- Example: Per-Node Rewriting of EXP Bits on page 35
- Example: Remarking Diffserv Code Points to MPLS EXPs to Carry CoS Profiles Across a Service Provider's L3VPN MPLS Network on page 36
- Example: Remarking Diffserv Code Points to 802.1P PCPs to Carry CoS Profiles Across a Service Provider's VPLS Network on page 58

Example: Per-Node Rewriting of EXP Bits

To configure a custom table to rewrite the EXP bits, also known as CoS bits, on a particular node, the classifier table and the rewrite table must specify exactly the same CoS values.

In addition, the least significant bit of the CoS value itself must represent the PLP value. For example, CoS value **000** must be associated with PLP **low**, **001** must be associated with PLP **high**, and so forth.

This example configures a custom table to rewrite the EXP bits on a particular node:

```
[edit class-of-service]
classifiers {
   exp exp-class {
      forwarding-class be {
         loss-priority low code-points 000;
         loss-priority high code-points 001;
      }
      forwarding-class af {
         loss-priority low code-points 010;
         loss-priority high code-points 011;
      }
      forwarding-class ef {
         loss-priority low code-points 100;
         loss-priority high code-points 101;
      }
      forwarding-class nc {
         loss-priority low code-points 110;
         loss-priority high code-points 111;
      }
   }
}
rewrite-rules {
   exp exp-rw {
```

```
        forwarding-class be {
          loss-priority low code-point 000;
          loss-priority high code-point 001;
        }
        forwarding-class af {
          loss-priority low code-point 010;
          loss-priority high code-point 011;
        }
        forwarding-class ef {
          loss-priority low code-point 100;
          loss-priority high code-point 101;
        }
        forwarding-class nc {
          loss-priority low code-point 110;
          loss-priority high code-point 111;
        }
      }
    }
```

Example: Remarking Diffserv Code Points to MPLS EXPs to Carry CoS Profiles Across a Service Provider's L3VPN MPLS Network

This example is an introduction in how to rewrite (remark) DSCP class-of-service (CoS) code point values at the network border of a customer network and a service provider's MPLS network while maintaining the original CoS profile of the traffic so that the traffic can be remarked with the original DSCP code points when it exits the MPLS network.

- Requirements on page 36
- Overview on page 36
- Configuration on page 39
- Verification on page 57

Requirements

To verify this procedure, this example uses a traffic generator. The traffic generator can be hardware-based or it can be software running on a server or host machine.

The functionality in this procedure is widely supported on devices that run Junos OS. The example shown here was tested and verified on MX Series routers running Junos OS Release 10.4.

Overview

The purpose of rewriting the IP DSCP code point values to MPLS EXP code point values is to carry the packet's CoS profile across the service provider's MPLS network. The rewriting is performed by the provider edge (PE) routers at the borders of the service provider's network. See Figure 3 on page 38.

Junos OS contains several DSCP default rewrite rules that might meet your requirements. You display them with the **show class-of-service rewrite-rule** command. A partial set of the default rewrite DSCP code point rule mappings is shown in the following table.

You can also define your own custom rewrite-rules table, or use a mixture of the default rewrite-rules and a custom table that you create. This example uses default rewrite-rules.

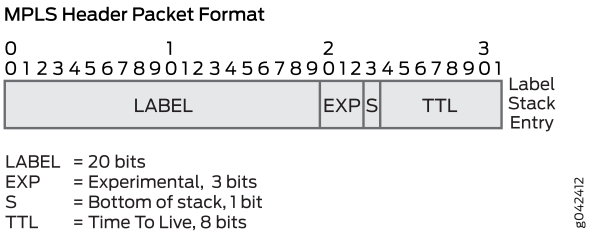
Map from Forwarding Class	PLP Value	MAP to DSCP/DSCP IPv6/EXP/IP Code Point Aliases
expedited-forwarding	low	ef
expedited-forwarding	high	ef
assured-forwarding	low	af11
assured-forwarding	high	af12 (DSCP/DSCP IPv6/EXP)
best-effort	low	be
best-effort	high	be
network-control	low	nc1/cs6
network-control	high	nc2/cs7

Junos OS uses the values shown in the following table for MPLS CoS in the EXP fields of the MPLS header.

Forwarding Class	Loss Priority	EXP Code Point
best-effort	low	000
best-effort	high	001
expedited-forwarding	low	010
expedited-forwarding	high	011
assured-forwarding	low	100
assured-forwarding	high	101
network-control	low	110
network-control	high	111

Figure 2 on page 38 shows the MPLS packet structure.

Figure 2: MPLS Packet Structure



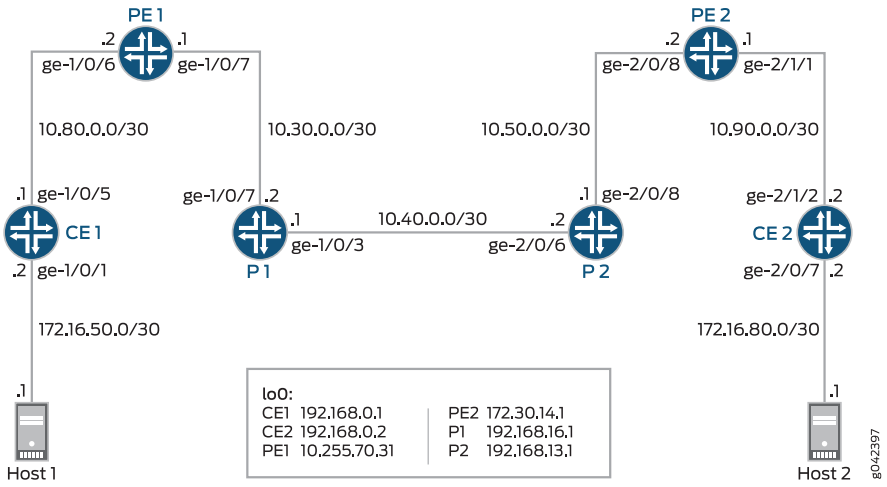
NOTE: In addition to providing the necessary information to complete the purpose of this example, this example also includes all of the commands required to re-create the Layer 3 VPN (L3VPN) network as shown in Figure 3 on page 38. A full explanation of the tasks required to configure an L3VPN network is not included in this example. If you require more information regarding configuring an L3VPN network, refer to the *Layer 3 VPNs Feature Guide for Routing Devices* available at http://juniper.net/techpubs .

A thorough explanation of the required CoS rewriting and the underlying algorithms used in this example is beyond the scope of this document. For more information, refer to *QOS-Enabled Networks—Tools and Foundations* by Miguel Barreiros and Peter Lundqvist. This book is available at many online booksellers and at www.juniper.net/books .

Topology

This example uses the topology in Figure 3 on page 38.

Figure 3: Rewriting CoS Information at the Network Border to Transit an MPLS Network Scenario



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.

Device CE1

```
set interfaces ge-1/0/1 unit 0 description to-host
set interfaces ge-1/0/1 unit 0 family inet address 172.16.50.2/30
set interfaces ge-1/0/1 unit 0 family inet filter input ip-v4
set interfaces ge-1/0/5 unit 0 description to_Provider
set interfaces ge-1/0/5 unit 0 family inet address 10.80.0.1/30
set interfaces lo0 unit 1 description loopback-interface
set interfaces lo0 unit 1 family inet address 192.168.0.1/32
set protocols bgp group to_Provider type external
set protocols bgp group to_Provider export send-direct
set protocols bgp group to_Provider peer-as 64511
set protocols bgp group to_Provider neighbor 10.80.0.2
set policy-options policy-statement send-direct from protocol direct
set policy-options policy-statement send-direct then accept
set routing-options router-id 192.168.0.1
set routing-options autonomous-system 64510
set firewall family inet filter ip-v4 term tcp80 from port 80
set firewall family inet filter ip-v4 term tcp80 then dscp ef
set firewall family inet filter ip-v4 term 12345 from port 12345
set firewall family inet filter ip-v4 term 12345 then dscp be
set firewall family inet filter ip-v4 term accept then accept
```

Device PE1

```
set interfaces ge-1/0/6 description to_vpna
set interfaces ge-1/0/6 unit 0 family inet address 10.80.0.2/30
set interfaces ge-1/0/7 description to_P1
set interfaces ge-1/0/7 unit 0 family inet address 10.30.0.1/30
set interfaces ge-1/0/7 unit 0 family mpls
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 10.255.70.31/32
set routing-options router-id 10.255.70.31
set routing-options autonomous-system 64511
set protocols mpls interface ge-1/0/7.0
set protocols bgp group to_PE2 type internal
set protocols bgp group to_PE2 local-address 10.255.70.31
set protocols bgp group to_PE2 family inet-vpn unicast
set protocols bgp group to_PE2 neighbor 172.30.14.1
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ospf area 0.0.0.0 interface ge-1/0/7.0
set protocols ldp interface ge-1/0/7.0
set protocols ldp interface lo0.0
set routing-instances vpna instance-type vrf
set routing-instances vpna interface ge-1/0/6.0
set routing-instances vpna route-distinguisher 64511:1
set routing-instances vpna vrf-target target:64511:1
set routing-instances vpna protocols bgp group to_vpna type external
set routing-instances vpna protocols bgp group to_vpna peer-as 64510
set routing-instances vpna protocols bgp group to_vpna neighbor 10.80.0.1
```

```
set class-of-service classifiers dscp dscpv4 forwarding-class expedited-forwarding
  loss-priority low code-points ef
set class-of-service classifiers dscp dscpv4 forwarding-class best-effort loss-priority low
  code-points be
set class-of-service classifiers exp exp-in forwarding-class expedited-forwarding
  loss-priority low code-points 010
set class-of-service classifiers exp exp-in forwarding-class best-effort loss-priority low
  code-points 000
set class-of-service interfaces ge-1/0/6 unit 0 classifiers dscp dscpv4
set class-of-service interfaces ge-1/0/6 unit 0 rewrite-rules dscp dscpv4-rw
set class-of-service interfaces ge-1/0/7 unit 0 classifiers exp exp-in
set class-of-service interfaces ge-1/0/7 unit 0 rewrite-rules exp exp-out
set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class expedited-forwarding
  loss-priority low code-point ef
set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class best-effort loss-priority
  low code-point be
set class-of-service rewrite-rules exp exp-out forwarding-class expedited-forwarding
  loss-priority low code-point 010
set class-of-service rewrite-rules exp exp-out forwarding-class best-effort loss-priority
  low code-point 000
```

Device P1

```
set interfaces ge-1/0/3 description to_P2
set interfaces ge-1/0/3 unit 0 family inet address 10.40.0.1/30
set interfaces ge-1/0/3 unit 0 family mpls
set interfaces ge-1/0/7 description to_PE1
set interfaces ge-1/0/7 unit 0 family inet address 10.30.0.2/30
set interfaces ge-1/0/7 unit 0 family mpls
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 192.168.16.1/32
set routing-options router-id 10.255.187.32
set protocols mpls interface ge-1/0/7.0
set protocols mpls interface ge-1/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/7.0
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-1/0/3.0
set protocols ldp interface ge-1/0/7.0
set protocols ldp interface lo0.0
```

Device P2

```
set interfaces ge-2/0/6 description to_P1
set interfaces ge-2/0/6 unit 0 family inet address 10.40.0.2/30
set interfaces ge-2/0/6 unit 0 family mpls
set interfaces ge-2/0/8 description to_PE2
set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.1/30
set interfaces ge-2/0/8 unit 0 family mpls
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 192.168.13.1/32
set routing-options router-id 192.168.187.3
set protocols mpls interface ge-2/0/6.0
set protocols mpls interface ge-2/0/8.0
set protocols ospf area 0.0.0.0 interface ge-2/0/6.0
set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-2/0/6.0
set protocols ldp interface ge-2/0/8.0
set protocols ldp interface lo0.0
```

Device PE2

```
set interfaces ge-2/0/8 description to-R1
set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.2/30
set interfaces ge-2/0/8 unit 0 family mpls
set interfaces ge-2/1/1 unit 0 description to-vpna
set interfaces ge-2/1/1 unit 0 family inet address 10.90.0.1/30
set interfaces ge-2/1/7 unit 0 family inet address 10.0.31.2/30
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 172.30.14.1
set routing-options router-id 172.30.14.1
set routing-options autonomous-system 64511
set protocols mpls interface ge-2/0/8.0
set protocols bgp group to_PE2 type internal
set protocols bgp group to_PE2 local-address 172.30.14.1
set protocols bgp group to_PE2 family inet-vpn unicast
set protocols bgp group to_PE2 neighbor 10.255.70.31
set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-2/0/8.0
set protocols ldp interface lo0.0
set routing-instances vpna instance-type vrf
set routing-instances vpna interface ge-2/1/1.0
set routing-instances vpna route-distinguisher 64511:1
set routing-instances vpna vrf-target target:64511:1
set routing-instances vpna protocols bgp group to_vpna type external
set routing-instances vpna protocols bgp group to_vpna peer-as 64512
set routing-instances vpna protocols bgp group to_vpna neighbor 10.90.0.2
set class-of-service classifiers dscp dscpv4 forwarding-class expedited-forwarding
  loss-priority low code-points ef
set class-of-service classifiers dscp dscpv4 forwarding-class best-effort loss-priority low
  code-points be
set class-of-service classifiers exp exp-in forwarding-class expedited-forwarding
  loss-priority low code-points 010
set class-of-service classifiers exp exp-in forwarding-class best-effort loss-priority low
  code-points 000
set class-of-service interfaces ge-2/0/8 unit 0 classifiers exp exp-in
set class-of-service interfaces ge-2/0/8 unit 0 rewrite-rules exp exp-out
set class-of-service interfaces ge-2/1/1 unit 0 classifiers dscp dscpv4
set class-of-service interfaces ge-2/1/1 unit 0 rewrite-rules dscp dscpv4-rw
set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class expedited-forwarding
  loss-priority low code-point ef
set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class best-effort loss-priority
  low code-point be
set class-of-service rewrite-rules exp exp-out forwarding-class expedited-forwarding
  loss-priority low code-point 010
set class-of-service rewrite-rules exp exp-out forwarding-class best-effort loss-priority
  low code-point 000
```

Device CE2

```
set interfaces ge-2/0/7 unit 0 description to-host
set interfaces ge-2/0/7 unit 0 family inet address 172.16.80.2/30
set interfaces ge-2/0/7 unit 0 family inet filter input ip-v4
set interfaces ge-2/1/2 unit 0 description to-Provider
set interfaces ge-2/1/2 unit 0 family inet address 10.90.0.2/30
set interfaces lo0 unit 1 description loopback-interface
set interfaces lo0 unit 1 family inet address 192.168.0.2/32
set protocols bgp group to_Provider type external
```

```
set protocols bgp group to_Provider export send-direct
set protocols bgp group to_Provider peer-as 64511
set protocols bgp group to_Provider neighbor 10.90.0.1
set policy-options policy-statement send-direct from protocol direct
set policy-options policy-statement send-direct then accept
set routing-options router-id 192.168.0.2
set routing-options autonomous-system 64512
set firewall family inet filter ip-v4 term tcp80 from port 80
set firewall family inet filter ip-v4 term tcp80 then dscp ef
set firewall family inet filter ip-v4 term 12345 from port 12345
set firewall family inet filter ip-v4 term 12345 then dscp be
set firewall family inet filter ip-v4 term accept then accept
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device CE1:

1. Configure the device interfaces.

```
[edit ]
user@CE1# set interfaces ge-1/0/1 unit 0 description to-host
user@CE1# set interfaces ge-1/0/1 unit 0 family inet address 172.16.50.2/30
user@CE1# set interfaces ge-1/0/1 unit 0 family inet filter input ip-v4

user@CE1# set interfaces ge-1/0/5 unit 0 description to_Provider
user@CE1# set interfaces ge-1/0/5 unit 0 family inet address 10.80.0.1/30

user@CE1# set interfaces lo0 unit 1 description loopback-interface
user@CE1# set interfaces lo0 unit 1 family inet address 192.168.0.1/32
```

2. Configure the BGP parameters

```
[edit ]
user@CE1# set protocols bgp group to_Provider type external
user@CE1# set protocols bgp group to_Provider export send-direct
user@CE1# set protocols bgp group to_Provider peer-as 64511
user@CE1# set protocols bgp group to_Provider neighbor 10.80.0.2
```

3. Configure the policy option parameters.

```
[edit ]
user@CE1# set policy-options policy-statement send-direct from protocol direct
user@CE1# set policy-options policy-statement send-direct then accept
```

4. Configure the routing option parameters.

```
[edit ]
user@CE1# set routing-options router-id 192.168.0.1
user@CE1# set routing-options autonomous-system 64510
```

5. Configure the DSCP code point rewrite parameters.

```
[edit ]
user@CE1# set firewall family inet filter ip-v4 term tcp80 from port 80
user@CE1# set firewall family inet filter ip-v4 term tcp80 then dscp ef
user@CE1# set firewall family inet filter ip-v4 term 12345 from port 12345
```

```
user@CE1# set firewall family inet filter ip-v4 term 12345 then dscp be
user@CE1# set firewall family inet filter ip-v4 term accept then accept
```

Step-by-Step Procedure

To configure Device PE1:

1. Configure the device interfaces.

```
[edit ]
user@PE1# set interfaces ge-1/0/6 description to_vpna
user@PE1# set interfaces ge-1/0/6 unit 0 family inet address 10.80.0.2/30

user@PE1# set interfaces ge-1/0/7 description to_P1
user@PE1# set interfaces ge-1/0/7 unit 0 family inet address 10.30.0.1/30
user@PE1# set interfaces ge-1/0/7 unit 0 family mpls

user@PE1# set interfaces lo0 unit 0 description loopback-interface
user@PE1# set interfaces lo0 unit 0 family inet address 10.255.70.31/32
```

2. Configure the routing option parameters.

```
[edit ]
user@PE1# set routing-options router-id 10.255.70.31
user@PE1# set routing-options autonomous-system 64511
```

3. Configure the protocol parameters.

```
user@PE1# set protocols mpls interface ge-1/0/7.0

user@PE1# set protocols bgp group to_PE2 type internal
user@PE1# set protocols bgp group to_PE2 local-address 10.255.70.31
user@PE1# set protocols bgp group to_PE2 family inet-vpn unicast
user@PE1# set protocols bgp group to_PE2 neighbor 172.30.14.1

user@PE1# set protocols ospf area 0.0.0.0 interface lo0.0 passive
user@PE1# set protocols ospf area 0.0.0.0 interface ge-1/0/7.0

user@PE1# set protocols ldp interface ge-1/0/7.0
user@PE1# set protocols ldp interface lo0.0
```

4. Configure the routing instance parameters.

```
[edit ]
user@PE1# set routing-instances vpna instance-type vrf
user@PE1# set routing-instances vpna interface ge-1/0/6.0
user@PE1# set routing-instances vpna route-distinguisher 64511:1
user@PE1# set routing-instances vpna vrf-target target:64511:1
user@PE1# set routing-instances vpna protocols bgp group to_vpna type external
user@PE1# set routing-instances vpna protocols bgp group to_vpna peer-as 64510
user@PE1# set routing-instances vpna protocols bgp group to_vpna neighbor
  10.80.0.1
```

5. Configure the class-of-service parameters that perform the DSCP code point to MPLS EXP rewriting.

```
user@PE1# set class-of-service classifiers dscp dscpv4 forwarding-class
  expedited-forwarding loss-priority low code-points ef
```

```
user@PE1# set class-of-service classifiers dscp dscpv4 forwarding-class best-effort
  loss-priority low code-points be
user@PE1# set class-of-service classifiers exp exp-in forwarding-class
  expedited-forwarding loss-priority low code-points 010
user@PE1# set class-of-service classifiers exp exp-in forwarding-class best-effort
  loss-priority low code-points 000
user@PE1# set class-of-service interfaces ge-1/0/6 unit 0 classifiers dscp dscpv4
user@PE1# set class-of-service interfaces ge-1/0/6 unit 0 rewrite-rules dscp
  dscpv4-rw
user@PE1# set class-of-service interfaces ge-1/0/7 unit 0 classifiers exp exp-in
user@PE1# set class-of-service interfaces ge-1/0/7 unit 0 rewrite-rules exp exp-out
user@PE1# set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class
  expedited-forwarding loss-priority low code-point ef
user@PE1# set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class
  best-effort loss-priority low code-point be
user@PE1# set class-of-service rewrite-rules exp exp-out forwarding-class
  expedited-forwarding loss-priority low code-point 010
user@PE1# set class-of-service rewrite-rules exp exp-out forwarding-class
  best-effort loss-priority low code-point 000
```

Step-by-Step Procedure

To configure Device P1:

1. Configure the device interfaces.

```
[edit ]
user@P1# set interfaces ge-1/0/3 description to_P2
user@P1# set interfaces ge-1/0/3 unit 0 family inet address 10.40.0.1/30
user@P1# set interfaces ge-1/0/3 unit 0 family mpls

user@P1# set interfaces ge-1/0/7 description to_PE1
user@P1# set interfaces ge-1/0/7 unit 0 family inet address 10.30.0.2/30
user@P1# set interfaces ge-1/0/7 unit 0 family mpls

user@P1# set interfaces lo0 unit 0 description loopback-interface
user@P1# set interfaces lo0 unit 0 family inet address 192.168.16.1/32
```

2. Configure the routing option parameters.

```
[edit ]
user@P1# set routing-options router-id 10.255.187.32
```

3. Configure the protocol parameters.

```
[edit ]
user@P1# set protocols mpls interface ge-1/0/7.0
user@P1# set protocols mpls interface ge-1/0/3.0

user@P1# set protocols ospf area 0.0.0.0 interface ge-1/0/3.0
user@P1# set protocols ospf area 0.0.0.0 interface ge-1/0/7.0
user@P1# set protocols ospf area 0.0.0.0 interface lo0.0 passive

user@P1# set protocols ldp interface ge-1/0/3.0
user@P1# set protocols ldp interface ge-1/0/7.0
user@P1# set protocols ldp interface lo0.0
```

Step-by-Step Procedure

To configure Device P2:

1. Configure the device interfaces.

```
[edit ]
user@P2# set interfaces ge-2/0/6 description to_P1
user@P2# set interfaces ge-2/0/6 unit 0 family inet address 10.40.0.2/30
user@P2# set interfaces ge-2/0/6 unit 0 family mpls

user@P2# set interfaces ge-2/0/8 description to_PE2
user@P2# set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.1/30
user@P2# set interfaces ge-2/0/8 unit 0 family mpls

user@P2# set interfaces lo0 unit 0 description loopback-interface
user@P2# set interfaces lo0 unit 0 family inet address 192.168.13.1/32
```

2. Configure the routing option parameters.

```
[edit ]
user@P2# set routing-options router-id 192.168.187.3
```

3. Configure the protocol parameters.

```
[edit ]
user@P2# set protocols mpls interface ge-2/0/6.0
user@P2# set protocols mpls interface ge-2/0/8.0

user@P2# set protocols ospf area 0.0.0.0 interface ge-2/0/6.0
user@P2# set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
user@P2# set protocols ospf area 0.0.0.0 interface lo0.0 passive

user@P2# set protocols ldp interface ge-2/0/6.0
user@P2# set protocols ldp interface ge-2/0/8.0
user@P2# set protocols ldp interface lo0.0
```

Step-by-Step Procedure

To configure Device PE2:

1. Configure the device interfaces.

```
[edit ]
user@PE2# set interfaces ge-2/0/8 description to-R1
user@PE2# set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.2/30
user@PE2# set interfaces ge-2/0/8 unit 0 family mpls

user@PE2# set interfaces ge-2/1/1 unit 0 description to-vpna
user@PE2# set interfaces ge-2/1/1 unit 0 family inet address 10.90.0.1/30

user@PE2# set interfaces lo0 unit 0 description loopback-interface
user@PE2# set interfaces lo0 unit 0 family inet address 172.30.14.1/32
```

2. Configure the routing option parameters.

```
[edit ]
user@PE2# set routing-options router-id 172.30.14.1
user@PE2# set routing-options autonomous-system 64511
```

3. Configure the protocol parameters.

```
[edit ]
user@PE2# set protocols mpls interface ge-2/0/8.0

user@PE2# set protocols bgp group to_PE2 type internal
user@PE2# set protocols bgp group to_PE2 local-address 172.30.14.1
user@PE2# set protocols bgp group to_PE2 family inet-vpn unicast
user@PE2# set protocols bgp group to_PE2 neighbor 10.255.70.31

user@PE2# set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
user@PE2# set protocols ospf area 0.0.0.0 interface lo0.0 passive
user@PE2# set protocols ldp interface ge-2/0/8.0
user@PE2# set protocols ldp interface lo0.0
```

4. Configure the routing instance parameters.

```
[edit ]
user@PE2# set routing-instances vpna instance-type vrf
user@PE2# set routing-instances vpna interface ge-2/1/1.0
user@PE2# set routing-instances vpna route-distinguisher 64511:1
user@PE2# set routing-instances vpna vrf-target target:64511:1
user@PE2# set routing-instances vpna protocols bgp group to_vpna type external
user@PE2# set routing-instances vpna protocols bgp group to_vpna peer-as 64512
user@PE2# set routing-instances vpna protocols bgp group to_vpna neighbor
  10.90.0.2
```

5. Configure the class-of-service parameters that perform the DSCP code point to MPLS EXP rewriting.

```
[edit ]
user@PE2# set class-of-service classifiers dscp dscpv4 forwarding-class
  expedited-forwarding loss-priority low code-points ef
user@PE2# set class-of-service classifiers dscp dscpv4 forwarding-class best-effort
  loss-priority low code-points be
user@PE2# set class-of-service classifiers exp exp-in forwarding-class
  expedited-forwarding loss-priority low code-points 010
user@PE2# set class-of-service classifiers exp exp-in forwarding-class best-effort
  loss-priority low code-points 000
user@PE2# set class-of-service interfaces ge-2/0/8 unit 0 classifiers exp exp-in
user@PE2# set class-of-service interfaces ge-2/0/8 unit 0 rewrite-rules exp exp-out
user@PE2# set class-of-service interfaces ge-2/1/1 unit 0 classifiers dscp dscpv4
user@PE2# set class-of-service interfaces ge-2/1/1 unit 0 rewrite-rules dscp
  dscpv4-rw
user@PE2# set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class
  expedited-forwarding loss-priority low code-point ef
user@PE2# set class-of-service rewrite-rules dscp dscpv4-rw forwarding-class
  best-effort loss-priority low code-point be
user@PE2# set class-of-service rewrite-rules exp exp-out forwarding-class
  expedited-forwarding loss-priority low code-point 010
user@PE2# set class-of-service rewrite-rules exp exp-out forwarding-class
  best-effort loss-priority low code-point 000
```

Step-by-Step Procedure

To configure Device CE2:

1. Configure the device interfaces.

```
[edit ]
user@CE2# set interfaces ge-2/0/7 unit 0 description to-host
user@CE2# set interfaces ge-2/0/7 unit 0 family inet address 172.16.80.2/30
user@CE2# set interfaces ge-2/0/7 unit 0 family inet filter input ip-v4

user@CE2# set interfaces ge-2/1/2 unit 0 description to-Provider
user@CE2# set interfaces ge-2/1/2 unit 0 family inet address 10.90.0.2/30

set interfaces lo0 unit 1 description loopback-interface
set interfaces lo0 unit 1 family inet address 192.168.0.2/32
```

2. Configure the protocol parameters.

```
[edit ]
user@CE2# set protocols bgp group to_Provider type external
user@CE2# set protocols bgp group to_Provider export send-direct
user@CE2# set protocols bgp group to_Provider peer-as 64511
user@CE2# set protocols bgp group to_Provider neighbor 10.90.0.1
```

3. Configure the policy option parameters.

```
[edit ]
user@CE2# set policy-options policy-statement send-direct from protocol direct
user@CE2# set policy-options policy-statement send-direct then accept
```

4. Configure the routing option parameters.

```
[edit ]
user@CE2# set routing-options router-id 192.168.0.2
user@CE2# set routing-options autonomous-system 64512
```

5. Configure the DSCP code point rewrite parameters.

```
[edit ]
user@CE2# set firewall family inet filter ip-v4 term tcp80 from port 80
user@CE2# set firewall family inet filter ip-v4 term tcp80 then dscp ef
user@CE2# set firewall family inet filter ip-v4 term 12345 from port 12345
user@CE2# set firewall family inet filter ip-v4 term 12345 then dscp be
user@CE2# set firewall family inet filter ip-v4 term accept then accept
```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, **show policy-options**, **show routing-options**, **show routing-instances**, **show firewall**, and **show class-of-service** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@CE1# show interfaces
ge-1/0/1 {
   unit 0 {
      description to-host;
      family inet {
         filter {
            input ip-v4;
         }
         address 172.16.50.2/30;
      }
   }
```

```
}
ge-1/0/5 {
   unit 0 {
      description to_Provider;
      family inet {
         address 10.80.0.1/30;
      }
   }
}
lo0 {
   unit 1 {
      description loopback-interface;
      family inet {
         address 192.168.0.1/32;
      }
   }
}
```

```
user@CE1# show protocols
bgp {
   group to_Provider {
      type external;
      export send-direct;
      peer-as 64511;
      neighbor 10.80.0.2;
   }
}
```

```
user@CE1# show policy-options
policy-statement send-direct {
   from protocol direct;
   then accept;
}
```

```
user@CE1# show routing-options
router-id 192.168.0.1;
autonomous-system 64510;
```

```
user@CE1# show firewall
family inet {
   filter ip-v4 {
      term tcp80 {
         from {
            port 80;
         }
         then dscp ef;
      }
      term 12345 {
         from {
            port 12345;
         }
         then dscp be;
      }
      term accept {
         then accept;
      }
   }
```

```
}
```

If you are done configuring Device CE1, enter **commit** from configuration mode.

```
user@PE1# show interfaces
ge-1/0/6 {
    description to_vpna;
    unit 0 {
        family inet {
            address 10.80.0.2/30;
        }
    }
}
ge-1/0/7 {
    description to_P1;
    unit 0 {
        family inet {
            address 10.30.0.1/30;
        }
        family mpls;
    }
}
lo0 {
    unit 0 {
        description loopback-interface;
        family inet {
            address 10.255.70.31/32;
        }
    }
}
```

```
user@PE1# show protocols
mpls {
    interface ge-1/0/7.0;
}
bgp {
    group to_PE2 {
        type internal;
        local-address 10.255.70.31;
        family inet-vpn {
            unicast;
        }
        neighbor 172.30.14.1;
    }
}
ospf {
    area 0.0.0.0 {
        interface lo0.0 {
            passive;
        }
        interface ge-1/0/7.0;
    }
}
ldp {
    interface ge-1/0/7.0;
    interface lo0.0;
}
```

```
user@PE1# show routing-options
router-id 10.255.70.31;
autonomous-system 64511;

user@PE1# show routing-instances
vpna {
   instance-type vrf;
   interface ge-1/0/6.0;
   route-distinguisher 64511:1;
   vrf-target target:64511:1;
   protocols {
      bgp {
         group to_vpna {
            type external;
            peer-as 64510;
            neighbor 10.80.0.1;
         }
      }
   }
}

user@PE1# show class-of-service
classifiers {
   dscp dscpv4 {
      forwarding-class expedited-forwarding {
         loss-priority low code-points ef;
      }
      forwarding-class best-effort {
         loss-priority low code-points be;
      }
   }
   exp exp-in {
      forwarding-class expedited-forwarding {
         loss-priority low code-points 010;
      }
      forwarding-class best-effort {
         loss-priority low code-points 000;
      }
   }
}
interfaces {
   ge-1/0/6 {
      unit 0 {
         classifiers {
            dscp dscpv4;
         }
         rewrite-rules {
            dscp dscpv4-rw;
         }
      }
   }
   ge-1/0/7 {
      unit 0 {
         classifiers {
            exp exp-in;
         }
         rewrite-rules {
```



```
            exp exp-out;
          }
        }
      }
    }
    rewrite-rules {
      dscp dscpv4-rw {
        forwarding-class expedited-forwarding {
          loss-priority low code-point ef;
        }
        forwarding-class best-effort {
          loss-priority low code-point be;
        }
      }
      exp exp-out {
        forwarding-class expedited-forwarding {
          loss-priority low code-point 010;
        }
        forwarding-class best-effort {
          loss-priority low code-point 000;
        }
      }
    }
```

If you are done configuring Device PE1, enter **commit** from configuration mode.

```
user@P1# show interfaces
ge-1/0/3 {
  description to_P2;
  unit 0 {
    family inet {
      address 10.40.0.1/30;
    }
    family mpls;
  }
}
ge-1/0/7 {
  description to_PE1;
  unit 0 {
    family inet {
      address 10.30.0.2/30;
    }
    family mpls;
  }
}
lo0 {
  unit 0 {
    description loopback-interface;
    family inet {
      address 192.168.16.1/32;
    }
  }
}
```

```
user@P1# show protocols
mpls {
  interface ge-1/0/7.0;
```

```
    interface ge-1/0/3.0;
}
ospf {
    area 0.0.0.0 {
        interface ge-1/0/3.0;
        interface ge-1/0/7.0;
        interface lo0.0 {
            passive;
        }
    }
}
ldp {
    interface ge-1/0/3.0;
    interface ge-1/0/7.0;
    interface lo0.0;
}
```

```
user@P1# show routing-options
router-id 10.255.187.32;
```

If you are done configuring Device P1, enter **commit** from configuration mode.

```
user@P2# show interfaces
ge-2/0/6 {
    description to_P1;
    unit 0 {
        family inet {
            address 10.40.0.2/30;
        }
        family mpls;
    }
}
ge-2/0/8 {
    description to_PE2;
    unit 0 {
        family inet {
            address 10.50.0.1/30;
        }
        family mpls;
    }
}
lo0 {
    unit 0 {
        description loopback-interface;
        family inet {
            address 192.168.13.1/32;
        }
    }
}
```

```
user@P2# show protocols
mpls {
    interface ge-2/0/6.0;
    interface ge-2/0/8.0;
}
ospf {
    area 0.0.0.0 {
```

```
        interface ge-2/0/6.0;
        interface ge-2/0/8.0;
        interface lo0.0 {
          passive;
        }
      }
    }
    ldp {
      interface ge-2/0/6.0;
      interface ge-2/0/8.0;
      interface lo0.0;
    }
```

```
user@P2# show routing-options
router-id 192.168.187.3;
```

If you are done configuring Device P2, enter **commit** from configuration mode.

```
user@PE2# show interfaces
```

```
ge-2/0/8 {
  description to-R1;
  unit 0 {
    family inet {
      address 10.50.0.2/30;
    }
    family mpls;
  }
}
ge-2/1/1 {
  unit 0 {
    description to-vpna;
    family inet {
      address 10.90.0.1/30;
    }
  }
}
lo0 {
  unit 0 {
    description loopback-interface;
    family inet {
      address 172.30.14.1/32;
    }
  }
}
```

```
user@PE2# show protocols
mpls {
  interface ge-2/0/8.0;
}
bgp {
  group to_PE1 {
    type internal;
    local-address 172.30.14.1;
    family inet-vpn {
      unicast;
    }
```

```
      neighbor 10.255.70.31;
    }
  }
  ospf {
    area 0.0.0.0 {
      interface ge-2/0/8.0;
      interface lo0.0 {
        passive;
      }
    }
  }
  ldp {
    interface ge-2/0/8.0;
    interface lo0.0;
  }
```

```
user@PE2# show routing-options
router-id 172.30.14.1;
autonomous-system 64511;
```

```
user@PE2# show routing-instances
vpna {
  instance-type vrf;
  interface ge-2/1/1.0;
  route-distinguisher 64511:1;
  vrf-target target:64511:1;
  protocols {
    bgp {
      group to_vpna {
        type external;
        peer-as 64512;
        neighbor 10.90.0.2;
      }
    }
  }
}
```

```
user@PE2# show class-of-service
classifiers {
  dscp dscpv4 {
    forwarding-class expedited-forwarding {
      loss-priority low code-points ef;
    }
    forwarding-class best-effort {
      loss-priority low code-points be;
    }
  }
  exp exp-in {
    forwarding-class expedited-forwarding {
      loss-priority low code-points 010;
    }
    forwarding-class best-effort {
      loss-priority low code-points 000;
    }
  }
}
interfaces {
```

```
    ge-2/0/8 {
        unit 0 {
            classifiers {
                exp exp-in;
            }
            rewrite-rules {
                exp exp-out;
            }
        }
    }
    ge-2/1/1 {
        unit 0 {
            classifiers {
                dscp dscpv4;
            }
            rewrite-rules {
                dscp dscpv4-rw;
            }
        }
    }
}
rewrite-rules {
    dscp dscpv4-rw {
        forwarding-class expedited-forwarding {
            loss-priority low code-point ef;
        }
        forwarding-class best-effort {
            loss-priority low code-point be;
        }
    }
    exp exp-out {
        forwarding-class expedited-forwarding {
            loss-priority low code-point 010;
        }
        forwarding-class best-effort {
            loss-priority low code-point 000;
        }
    }
}
```

If you are done configuring Device PE2, enter **commit** from configuration mode.

```
user@CE2# show interfaces
ge-2/0/7 {
    unit 0 {
        description to-host;
        family inet {
            filter {
                input ip-v4;
            }
            address 172.16.80.2/30;
        }
    }
}
ge-2/1/2 {
    unit 0 {
```

```
      description to-Provider;
      family inet {
        address 10.90.0.2/30;
      }
    }
  }
  lo0 {
    unit 1 {
      description loopback-interface;
      family inet {
        address 192.168.0.2/32;
      }
    }
  }

user@CE2# show protocols
bgp {
  group to_Provider {
    type external;
    export send-direct;
    peer-as 64511;
    neighbor 10.90.0.1;
  }
}

user@CE2# show policy-options
policy-statement send-direct {
  from protocol direct;
  then accept;
}

user@CE2# show routing-options
router-id 192.168.0.2;
autonomous-system 64512;

user@CE2# show firewall
family inet {
  filter ip-v4 {
    term tcp80 {
      from {
        port 80;
      }
      then dscp ef;
    }
    term 12345 {
      from {
        port 12345;
      }
      then dscp be;
    }
    term accept {
      then accept;
    }
  }
}
```

If you are done configuring Device CE2, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly by verifying that the DSCP code points are maintained from CE1 to CE2.

- Clearing the Firewall Counters on page 57
- Sending Traffic into the Network from TCP HTTP Ports 80 and 12345 and Monitoring the Results on page 57

Clearing the Firewall Counters

Purpose Confirm that the firewall counters are cleared.

Action On Device CE2, run the **clear firewall all** command to reset the firewall counters to 0.

```
user@CE2> clear firewall all
```

Sending Traffic into the Network from TCP HTTP Ports 80 and 12345 and Monitoring the Results

Purpose Send traffic into the network from the host connected to Device CE1 so that it that can be monitored at Device CE2.

Action A different firewall is required on interface ge-2/0/7 to count the traffic that is being transmitted outbound to the destination. The following commands apply the firewall filter that counts the marked traffic as it is transmitted to the destination.

NOTE: To capture traffic at Device CE1, apply this command **set interfaces ge-1/0/1 unit 0 family inet filter output count**, followed by the commands below.

NOTE: To capture traffic at Device CE2, apply this command **set interfaces ge-2/0/7 unit 0 family inet filter output count**, followed by the commands below.

```
set firewall family inet filter count term be from dscp be
set firewall family inet filter count term be then count be
set firewall family inet filter count term ef from dscp ef
set firewall family inet filter count term ef then count ef
set firewall family inet filter count term accept then accept
set interfaces ge-2/0/7 unit 0 family inet filter output count
```

When you are done testing, you can leave the counting filter in place, or remove it.

1. On host 1 use a traffic generator to send 20 TCP packets with a source port of 80 into the network, and repeat the task using a source port of 12345.

```
[user@host]# hping 172.16.80.1 -s 80 -k -c 20
[user@host]# hping 172.16.80.1 -s 12345 -k -c 20
```

2. On Device CE2, check the firewall counters by using the **show firewall** command.

```
user@CE2> show firewall

Filter: __CE2/ip-v4

Filter: __CE2/count
Counters:
Name                                                Bytes              Packets
be                                                    800                   20
ef                                                    800                   20
```

Meaning The code point for TCP packets to port 12345 is maintained as be. The code point for TCP packets to port 80 is maintained as ef.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Example: Configuring CoS Queuing and Scheduling Across Your Network Domain*

Example: Remarking Diffserv Code Points to 802.1P PCPs to Carry CoS Profiles Across a Service Provider's VPLS Network

This configuration example explains how to implement class-of-service (CoS) capabilities over a Virtual Private LAN Service (VPLS) network.

- Requirements on page 58
- Overview on page 58
- Configuration on page 61
- Verification on page 78

Requirements

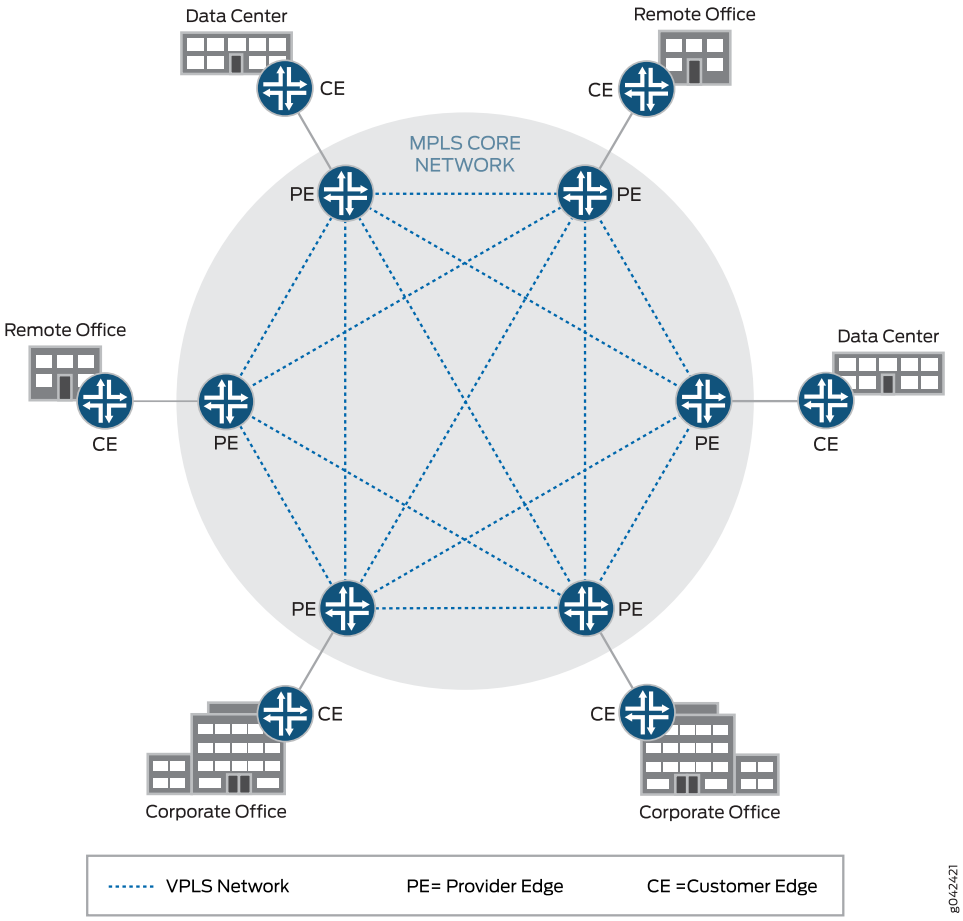
To verify this procedure, this example uses a traffic generator. The traffic generator can be hardware-based or it can be software running on a server or host machine.

The functionality in this procedure is widely supported on devices that run Junos OS. The example shown here was tested and verified on MX Series routers running Junos OS Release 10.4.

Overview

VPLS networks create a Virtual Private LAN that provides a very close approximation of an Ethernet LAN to customers of a service provider. In a VPLS network, it is not necessary for all customers to be connected to a single LAN. Instead, the customers can be spread across two or more LANs. In the simplest sense, a VPLS network connects individual LANs across a packet-switched network so that they appear as a single LAN. See Figure 4 on page 59 for an example of a typical VPLS topology.

Figure 4: Typical VPLS Topology



Junos OS contains several DiffServ code point (DSCP) default rewrite rules that might meet your requirements. You display them with the **show class-of-service rewrite-rule** command. A partial set of the default rewrite DSCP rule mappings is shown in the following table.

You can also define your own custom rewrite-rules table, or use a mixture of the default rewrite-rules and a custom table that you create. This example uses default rewrite-rules.

Map from Forwarding Class	PLP Value	MAP to DSCP/DSCP IPv6/EXP/IP Code Point Aliases
expedited-forwarding	low	ef
expedited-forwarding	high	ef
assured-forwarding	low	af11
assured-forwarding	high	af12 (DSCP/DSCP IPv6/EXP)

Map from Forwarding Class	PLP Value	MAP to DSCP/DSCP IPv6/EXP/IP Code Point Aliases
best-effort	low	be
best-effort	high	be
network-control	low	nc1/cs6
network-control	high	nc2/cs7

Junos OS uses the values shown in the following table for MPLS CoS in the EXP fields of the MPLS header.

Forwarding Class	Loss Priority	EXP Code Point
best-effort	low	000
best-effort	high	001
expedited-forwarding	low	010
expedited-forwarding	high	011
assured-forwarding	low	100
assured-forwarding	high	101
network-control	low	110
network-control	high	111

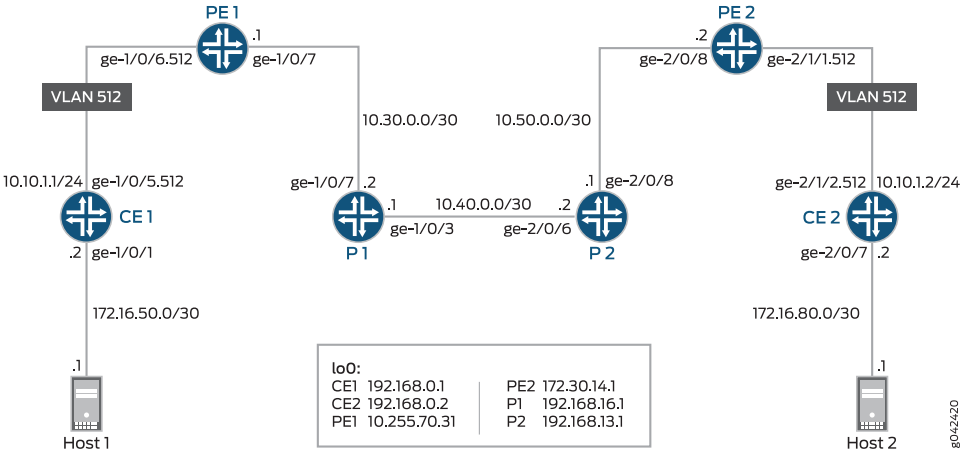
NOTE: In addition to providing the necessary information to complete the purpose of this example, this example also includes all of the commands required to recreate the VPLS network as shown in Figure 5 on page 61. A full explanation of the tasks required to configure a VPLS network is not included in this example. If you need more information regarding configuring a VPLS network, see the *VPLS Feature Guide for Routing Devices* at http://juniper.net/techpubs and RFC 4761 at http://tools.ietf.org/html/rfc4761 .

A thorough explanation of the required CoS tasks and the underlying algorithms used in this example is beyond the scope of this document. For more information, refer to *QOS-Enabled Networks—Tools and Foundations* by Miguel Barreiros and Peter Lundqvist. This book is available at many online booksellers and at www.juniper.net/books .

Topology

This example uses the topology in Figure 5 on page 61.

Figure 5: VPLS with CoS Scenario



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.

Device CE1

```
set interfaces ge-1/0/1 unit 0 description to-Host1
set interfaces ge-1/0/1 unit 0 family inet address 172.16.50.2/30
set interfaces ge-1/0/1 unit 0 family inet filter input ip-v4
set interfaces ge-1/0/5 vlan-tagging
set interfaces ge-1/0/5 unit 512 description to_PE1
set interfaces ge-1/0/5 unit 512 vlan-id 512
set interfaces ge-1/0/5 unit 512 family inet address 10.10.1.1/24
set interfaces lo0 unit 1 description loopback-interface
set interfaces lo0 unit 1 family inet address 192.168.0.1/32
set protocols ospf area 0.0.0.0 interface ge-1/0/5.512
set protocols ospf area 0.0.0.0 interface ge-1/0/1.0 passive
set protocols ospf area 0.0.0.0 interface lo0.1 passive
set firewall family inet filter ip-v4 term tcp80 from port 80
set firewall family inet filter ip-v4 term tcp80 then dscp ef
set firewall family inet filter ip-v4 term 12345 from port 12345
set firewall family inet filter ip-v4 term 12345 then dscp be
set firewall family inet filter ip-v4 term accept then accept
set class-of-service classifiers ieee-802.1 dscp1 forwarding-class expedited-forwarding
    loss-priority low code-points ef
set class-of-service classifiers ieee-802.1 dscp1 forwarding-class best-effort loss-priority
    low code-points be
set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class
    expedited-forwarding loss-priority low code-point 010
```

```
set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class best-effort
  loss-priority low code-point 000
set class-of-service interfaces ge-1/0/5 unit 512 classifiers ieee-802.1 dscp1
set class-of-service interfaces ge-1/0/5 unit 512 rewrite-rules ieee-802.1 ieee1-c2
```

Device PE1

```
set interfaces ge-1/0/6 vlan-tagging
set interfaces ge-1/0/6 encapsulation vlan-vpls
set interfaces ge-1/0/6 unit 512 description to_vpls
set interfaces ge-1/0/6 unit 512 encapsulation vlan-vpls
set interfaces ge-1/0/6 unit 512 vlan-id 512
set interfaces ge-1/0/9 description to_P1
set interfaces ge-1/0/9 unit 0 family inet address 10.30.0.1/30
set interfaces ge-1/0/9 unit 0 family mpls
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 10.255.70.31/32
set protocols mpls interface ge-1/0/9.0
set protocols bgp group to_PE2 type internal
set protocols bgp group to_PE2 local-address 10.255.70.31
set protocols bgp group to_PE2 family l2vpn signaling
set protocols bgp group to_PE2 neighbor 172.30.14.1
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ospf area 0.0.0.0 interface ge-1/0/9.0
set protocols ldp interface ge-1/0/9.0
set protocols ldp interface lo0.0
set routing-options router-id 10.255.70.31
set routing-options autonomous-system 64511
set routing-instances vpls_a instance-type vpls
set routing-instances vpls_a interface ge-1/0/6.512
set routing-instances vpls_a route-distinguisher 64511:1
set routing-instances vpls_a vrf-target target:64511:1
set routing-instances vpls_a protocols vpls no-tunnel-services
set routing-instances vpls_a protocols vpls site 1 site-identifier 1
set routing-instances vpls_a protocols vpls site 1 interface ge-1/0/6.512
```

Device P1

```
set interfaces ge-1/0/3 description to_P2
set interfaces ge-1/0/3 unit 0 family inet address 10.40.0.1/30
set interfaces ge-1/0/3 unit 0 family mpls
set interfaces ge-1/0/9 description to_PE1
set interfaces ge-1/0/9 unit 0 family inet address 10.30.0.2/30
set interfaces ge-1/0/9 unit 0 family mpls
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 192.168.16.1/32
set protocols mpls interface ge-1/0/9.0
set protocols mpls interface ge-1/0/3.0
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface ge-1/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/9.0
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-1/0/3.0
set protocols ldp interface ge-1/0/9.0
set protocols ldp interface lo0.0
set routing-options router-id 192.168.16.1
```

Device P2

```
set interfaces ge-2/0/6 description to_P1
```

```
set interfaces ge-2/0/6 unit 0 family inet address 10.40.0.2/30
set interfaces ge-2/0/6 unit 0 family mpls
set interfaces ge-2/0/8 description to_PE2
set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.1/30
set interfaces ge-2/0/8 unit 0 family mpls
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 192.168.13.1/32
set protocols mpls interface ge-2/0/6.0
set protocols mpls interface ge-2/0/8.0
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface ge-2/0/6.0
set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-2/0/6.0
set protocols ldp interface ge-2/0/8.0
set protocols ldp interface lo0.0
set routing-options router-id 192.168.13.1
```

Device PE2

```
set interfaces ge-2/0/8 description to-R1
set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.2/30
set interfaces ge-2/0/8 unit 0 family mpls
set interfaces ge-2/1/1 vlan-tagging
set interfaces ge-2/1/1 encapsulation vlan-vpls
set interfaces ge-2/1/1 unit 512 description to_vpls
set interfaces ge-2/1/1 unit 512 encapsulation vlan-vpls
set interfaces ge-2/1/1 unit 512 vlan-id 512
set interfaces lo0 unit 0 description loopback-interface
set interfaces lo0 unit 0 family inet address 172.30.14.1/32
set protocols mpls interface ge-2/0/8.0
set protocols bgp group to_PE1 type internal
set protocols bgp group to_PE1 local-address 172.30.14.1
set protocols bgp group to_PE1 family l2vpn signaling
set protocols bgp group to_PE1 neighbor 10.255.70.31
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ldp interface ge-2/0/8.0
set protocols ldp interface lo0.0
set routing-options router-id 172.30.14.1
set routing-options autonomous-system 64511
set routing-instances vpls_a instance-type vpls
set routing-instances vpls_a interface ge-2/1/1.512
set routing-instances vpls_a route-distinguisher 64511:1
set routing-instances vpls_a vrf-target target:64511:1
set routing-instances vpls_a protocols vpls no-tunnel-services
set routing-instances vpls_a protocols vpls site 2 site-identifier 2
set routing-instances vpls_a protocols vpls site 2 interface ge-2/1/1.512
```

Device CE2

```
set interfaces ge-2/0/7 unit 0 description to-Host2
set interfaces ge-2/0/7 unit 0 family inet address 172.16.80.2/30
set interfaces ge-2/0/7 unit 0 family inet filter input ip-v4
set interfaces ge-2/1/2 vlan-tagging
set interfaces ge-2/1/2 unit 512 description to-PE2
set interfaces ge-2/1/2 unit 512 vlan-id 512
set interfaces ge-2/1/2 unit 512 family inet address 10.10.1.2/24
```

```
set interfaces lo0 unit 1 description loopback-interface
set interfaces lo0 unit 1 family inet address 192.168.0.2/32
set protocols ospf area 0.0.0.0 interface lo0.1 passive
set protocols ospf area 0.0.0.0 interface ge-2/0/7.0 passive
set protocols ospf area 0.0.0.0 interface ge-2/1/2.512
set firewall family inet filter ip-v4 term tcp80 from port 80
set firewall family inet filter ip-v4 term tcp80 then dscp ef
set firewall family inet filter ip-v4 term 12345 from port 12345
set firewall family inet filter ip-v4 term 12345 then dscp be
set firewall family inet filter ip-v4 term accept then accept
set class-of-service classifiers ieee-802.1 dscp1 forwarding-class expedited-forwarding
  loss-priority low code-points ef
set class-of-service classifiers ieee-802.1 dscp1 forwarding-class best-effort loss-priority
  low code-points be
set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class
  expedited-forwarding loss-priority low code-point 010
set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class best-effort
  loss-priority low code-point 000
set class-of-service interfaces ge-2/1/2 unit 512 rewrite-rules ieee-802.1 ieee1-c2
set class-of-service interfaces ge-2/1/2 unit 512 classifiers ieee-802.1 dscp1
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure Device CE1:

1. Configure the device interfaces.

```
[edit ]
user@CE1# set interfaces ge-1/0/1 unit 0 description to-Host1
user@CE1# set interfaces ge-1/0/1 unit 0 family inet address 172.16.50.2/30
user@CE1#set interfaces ge-1/0/1 unit 0 family inet filter input ip-v4


user@CE1#set interfaces lo0 unit 1 description loopback-interface
user@CE1# set interfaces lo0 unit 1 family inet address 192.168.0.1/32
```

2. Configure the VLAN parameters.

```
[edit ]
user@CE1# set interfaces ge-1/0/5 vlan-tagging
user@CE1# set interfaces ge-1/0/5 unit 512 description to_PE1
user@CE1# set interfaces ge-1/0/5 unit 512 vlan-id 512
user@CE1# set interfaces ge-1/0/5 unit 512 family inet address 10.10.1.1/24
```

3. Configure the class-of-service parameters.

```
[edit ]
user@CE1# set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class
  expedited-forwarding loss-priority low code-point 010
user@CE1# set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class
  best-effort loss-priority low code-point 000
user@CE1# set class-of-service classifiers ieee-802.1 dscp1 forwarding-class
  expedited-forwarding loss-priority low code-points ef
user@CE1# set class-of-service classifiers ieee-802.1 dscp1 forwarding-class
  best-effort loss-priority low code-points be
```

```
user@CE1# set class-of-service interfaces ge-1/0/5 unit 512 rewrite-rules ieee-802.1
  ieee1-c2
user@CE1# set class-of-service interfaces ge-1/0/5 unit 512 classifiers ieee-802.1
  dscp1
```

4. Configure the protocol parameters.

```
[edit ]
user@CE1# set protocols ospf area 0.0.0.0 interface ge-1/0/5.512
user@CE1# set protocols ospf area 0.0.0.0 interface ge-1/0/1.0 passive
user@CE1# set protocols ospf area 0.0.0.0 interface lo0.0 passive
```

5. Configure the firewall DSCP rewrite parameters.

```
[edit ]
user@CE1# set firewall family inet filter ip-v4 term tcp80 from port 80
user@CE1# set firewall family inet filter ip-v4 term tcp80 then dscp ef
user@CE1# set firewall family inet filter ip-v4 term 12345 from port 12345
user@CE1# set firewall family inet filter ip-v4 term 12345 then dscp be
user@CE1# set firewall family inet filter ip-v4 term accept then accept
```

Step-by-Step Procedure

To configure Device PE1:

1. Configure the device interfaces.

```
[edit ]
user@PE1# set interfaces ge-1/0/9 description to_P1
user@PE1# set interfaces ge-1/0/9 unit 0 family inet address 10.30.0.1/30
user@PE1# set interfaces ge-1/0/9 unit 0 family mpls


user@PE1# set interfaces lo0 unit 0 description loopback-interface
user@PE1# set interfaces lo0 unit 0 family inet address 10.255.70.31/32
```

2. Configure the VLAN parameters.

```
[edit ]
user@PE1# set interfaces ge-1/0/6 vlan-tagging
user@PE1# set interfaces ge-1/0/6 encapsulation vlan-vpls
user@PE1# set interfaces ge-1/0/6 unit 512 description to_vpls
user@PE1# set interfaces ge-1/0/6 unit 512 encapsulation vlan-vpls
user@PE1# set interfaces ge-1/0/6 unit 512 vlan-id 512
```

3. Configure the protocol parameters.

```
[edit ]
user@PE1# set protocols mpls interface ge-1/0/9.0


user@PE1# set protocols bgp group to_PE2 type internal
user@PE1# set protocols bgp group to_PE2 local-address 10.255.70.31
user@PE1# set protocols bgp group to_PE2 family l2vpn signaling
user@PE1# set protocols bgp group to_PE2 neighbor 172.30.14.1


user@PE1# set protocols ospf traffic-engineering
user@PE1# set protocols ospf area 0.0.0.0 interface lo0.0 passive
user@PE1# set protocols ospf area 0.0.0.0 interface ge-1/0/9.0


user@PE1# set protocols ldp interface ge-1/0/9.0
```

```
user@PE1# set protocols ldp interface lo0.0
```

4. Configure the routing option parameters.

```
[edit ]
user@PE1# set routing-options router-id 10.255.70.31
user@PE1# set routing-options autonomous-system 64511
```

5. Configure the routing instance parameters.

```
[edit ]
user@PE1# set routing-instances vpls_a instance-type vpls
user@PE1# set routing-instances vpls_a interface ge-1/0/6.512
user@PE1# set routing-instances vpls_a route-distinguisher 64511:1
user@PE1# set routing-instances vpls_a vrf-target target:64511:1
user@PE1# set routing-instances vpls_a protocols vpls no-tunnel-services
user@PE1# set routing-instances vpls_a protocols vpls site 1 site-identifier 1
user@PE1# set routing-instances vpls_a protocols vpls site 1 interface ge-1/0/6.512
```

Step-by-Step Procedure

To configure Device P1:

1. Configure the device interfaces.

```
[edit ]
user@P1# set interfaces ge-1/0/3 description to_P2
user@P1# set interfaces ge-1/0/3 unit 0 family inet address 10.40.0.1/30
user@P1# set interfaces ge-1/0/3 unit 0 family mpls

user@P1# set interfaces ge-1/0/9 description to_PE1
user@P1# set interfaces ge-1/0/9 unit 0 family inet address 10.30.0.2/30
user@P1# set interfaces ge-1/0/9 unit 0 family mpls

user@P1# set interfaces lo0 unit 0 description loopback-interface
user@P1# set interfaces lo0 unit 0 family inet address 192.168.16.1/32
```

2. Configure the protocol parameters.

```
[edit ]
user@P1# set protocols mpls interface ge-1/0/9.0
user@P1# set protocols mpls interface ge-1/0/3.0

user@P1# set protocols ospf traffic-engineering
user@P1# set protocols ospf area 0.0.0.0 interface ge-1/0/3.0
user@P1# set protocols ospf area 0.0.0.0 interface ge-1/0/9.0
user@P1# set protocols ospf area 0.0.0.0 interface lo0.0 passive

user@P1# set protocols ldp interface ge-1/0/3.0
user@P1# set protocols ldp interface ge-1/0/9.0
user@P1# set protocols ldp interface lo0.0
```

3. Configure the routing options parameter.

```
[edit ]
user@P1# set routing-options router-id 192.168.16.1
```

Step-by-Step Procedure

To configure Device P2:

1. Configure the device interfaces.

```
[edit ]
user@P2# set interfaces ge-2/0/6 description to_P1
user@P2#set interfaces ge-2/0/6 unit 0 family inet address 10.40.0.2/30
user@P2# set interfaces ge-2/0/6 unit 0 family mpls

user@P2# set interfaces ge-2/0/8 description to_PE2
user@P2# set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.1/30
user@P2# set interfaces ge-2/0/8 unit 0 family mpls

user@P2# set interfaces lo0 unit 0 description loopback-interface
user@P2# set interfaces lo0 unit 0 family inet address 192.168.13.1/32
```

2. Configure the protocol parameters.

```
[edit ]
user@P2# set protocols mpls interface ge-2/0/6.0
user@P2# set protocols mpls interface ge-2/0/8.0

user@P2# set protocols ospf traffic-engineering
user@P2#  set protocols ospf area 0.0.0.0 interface ge-2/0/6.0
user@P2# set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
user@P2# set protocols ospf area 0.0.0.0 interface lo0.0 passive

user@P2# set protocols ldp interface ge-2/0/6.0
user@P2# set protocols ldp interface ge-2/0/8.0
user@P2# set protocols ldp interface lo0.0
```

3. Configure the routing option parameter.

```
[edit ]
user@P2# set routing-options router-id 192.168.13.1
```

Step-by-Step Procedure

To configure Device PE2:

1. Configure the device interfaces.

```
[edit ]
user@PE2# set interfaces ge-2/0/8 description to-R1
user@PE2# set interfaces ge-2/0/8 unit 0 family inet address 10.50.0.2/30
user@PE2# set interfaces ge-2/0/8 unit 0 family mpls

user@PE2# set interfaces lo0 unit 0 description loopback-interface
user@PE2# set interfaces lo0 unit 0 family inet address 172.30.14.1/32
```

2. Configure the VLAN parameters.

```
[edit ]
user@PE2# set interfaces ge-2/1/1 vlan-tagging
user@PE2# set interfaces ge-2/1/1 encapsulation vlan-vpls
user@PE2# set interfaces ge-2/1/1 unit 512 description to_vpls
user@PE2# set interfaces ge-2/1/1 unit 512 encapsulation vlan-vpls
user@PE2# set interfaces ge-2/1/1 unit 512 vlan-id 512
```

3. Configure the protocol parameters.

```
[edit ]
user@PE2# set protocols mpls interface ge-2/0/8.0

user@PE2# set protocols bgp group to_PE1 type internal
user@PE2# set protocols bgp group to_PE1 local-address 172.30.14.1
user@P2# set protocols bgp group to_PE1 family l2vpn signaling
user@PE2# set protocols bgp group to_PE1 neighbor 10.255.70.31

user@PE2# set protocols ospf traffic-engineering
user@PE2# set protocols ospf area 0.0.0.0 interface ge-2/0/8.0
user@PE2# set protocols ospf area 0.0.0.0 interface lo0.0 passive

user@PE2# set protocols ldp interface ge-2/0/8.0
user@PE2# set protocols ldp interface lo0.0
```

4. Configure the routing option parameters.

```
[edit ]
user@PE2# set routing-options router-id 172.30.14.1
user@PE2# set routing-options autonomous-system 64511
```

5. Configure the routing instance parameters.

```
[edit ]
user@P2# set routing-instances vpls_a instance-type vpls
user@PE2# set routing-instances vpls_a interface ge-2/1/1.512
user@PE2# set routing-instances vpls_a route-distinguisher 64511:1
user@PE2# set routing-instances vpls_a vrf-target target:64511:1
user@PE2# set routing-instances vpls_a protocols vpls no-tunnel-services
user@PE2# set routing-instances vpls_a protocols vpls site 2 site-identifier 2
user@PE2# set routing-instances vpls_a protocols vpls site 2 interface ge-2/1/1.512
```

Step-by-Step Procedure

To configure Device CE2:

1. Configure the device interfaces.

```
[edit ]
user@CE2# set interfaces ge-2/0/7 unit 0 description to-Host2
user@CE2# set interfaces ge-2/0/7 unit 0 family inet address 172.16.80.2/30
user@CE2# set interfaces ge-2/0/7 unit 0 family inet filter input ip-v4

user@CE2# set interfaces lo0 unit 1 description loopback-interface
user@CE2# set interfaces lo0 unit 1 family inet address 192.168.0.2/32
```

2. Configure the VLAN parameters

```
[edit ]
user@CE2# set interfaces ge-2/1/2 vlan-tagging
user@CE2# set interfaces ge-2/1/2 unit 512 description to-PE2
user@CE2# set interfaces ge-2/1/2 unit 512 vlan-id 512
user@CE2# set interfaces ge-2/1/2 unit 512 family inet address 10.10.1.2/24
```

3. Configure the class-of-service parameters.

```
[edit ]
```

```
user@CE2# set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class
  expedited-forwarding loss-priority low code-point 010
user@CE2# set class-of-service rewrite-rules ieee-802.1 ieee1-c2 forwarding-class
  best-effort loss-priority low code-point 000
user@CE2# set class-of-service classifiers ieee-802.1 dscp1 forwarding-class
  expedited-forwarding loss-priority low code-points ef
user@CE2# set class-of-service classifiers ieee-802.1 dscp1 forwarding-class
  best-effort loss-priority low code-points be
user@CE2# set class-of-service interfaces ge-2/1/2 unit 512 rewrite-rules ieee-802.1
  ieee1-c2
user@CE2# set class-of-service interfaces ge-2/1/2 unit 512 classifiers ieee-802.1
  dscp1
```

4. Configure the protocol parameters.

```
[edit ]
user@CE2# set protocols ospf area 0.0.0.0 interface lo0.0 passive
user@CE2# set protocols ospf area 0.0.0.0 interface ge-2/0/7.0 passive
user@CE2# set protocols ospf area 0.0.0.0 interface ge-2/1/2.512
```

5. Configure the firewall DSCP rewrite parameters.

```
[edit ]
user@CE2# set firewall family inet filter ip-v4 term tcp80 from port 80
user@CE2# set firewall family inet filter ip-v4 term tcp80 then dscp ef
user@CE2# set firewall family inet filter ip-v4 term 12345 from port 12345
user@CE2# set firewall family inet filter ip-v4 term 12345 then dscp be
user@CE2# set firewall family inet filter ip-v4 term accept then accept
```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show class-of-service**, **show protocols**, **show routing-options, show routing-instances,** and **show firewall**, commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@CE1# show interfaces
ge-1/0/1 {
    unit 0 {
        description to-Host1;
        family inet {
            filter {
                input ip-v4;
            }
            address 172.16.50.2/30;
        }
    }
}
ge-1/0/5 {
    vlan-tagging;
    unit 512 {
        description to_PE1;
        vlan-id 512;
        family inet {
            address 10.10.1.1/24;
        }
    }
}
```

```
lo0 {
  unit 1 {
    description loopback-interface;
    family inet {
      address 192.168.0.1/32;
    }
  }
}
```

```
user@CE1# show class-of-service
classifiers {
  ieee-802.1 dscp1 {
    forwarding-class expedited-forwarding {
      loss-priority low code-points ef;
    }
    forwarding-class best-effort {
      loss-priority low code-points be;
    }
  }
}
interfaces {
  ge-1/0/5 {
    unit 512 {
      classifiers {
        ieee-802.1 dscp1;
      }
      rewrite-rules {
        ieee-802.1 ieee1-c2;
      }
    }
  }
}
rewrite-rules {
  ieee-802.1 ieee1-c2 {
    forwarding-class expedited-forwarding {
      loss-priority low code-point 010;
    }
    forwarding-class best-effort {
      loss-priority low code-point 000;
    }
  }
}
```

```
user@CE1# show protocols
ospf {
  area 0.0.0.0 {
    interface ge-1/0/5.512;
    interface ge-1/0/1.0 {
      passive;
    }
    interface lo0.1 {
      passive;
    }
  }
}
```

```
user@CE1# show firewall
```

```
family inet {
  filter ip-v4 {
    term tcp80 {
      from {
        port 80;
      }
      then dscp ef;
    }
    term 12345 {
      from {
        port 12345;
      }
      then dscp be;
    }
    term accept {
      then accept;
    }
  }
}
```

If you are done configuring Device CE1, enter **commit** from configuration mode.

```
user@PE1# show interfaces
ge-1/0/6 {
  vlan-tagging;
  encapsulation vlan-vpls;
  unit 512 {
    description to_vpls;
    encapsulation vlan-vpls;
    vlan-id 512;
  }
}
ge-1/0/9 {
  description to_P1;
  unit 0 {
    family inet {
      address 10.30.0.1/30;
    }
    family mpls;
  }
}
lo0 {
  unit 0 {
    description loopback-interface;
    family inet {
      address 10.255.70.31/32;
    }
  }
}
```

```
user@PE1# show protocols
mpls {
  interface ge-1/0/9.0;
}
bgp {
  group to_PE2 {
    type internal;
```

```
      local-address 10.255.70.31;
      family l2vpn {
        signaling;
      }
      neighbor 172.30.14.1;
    }
  }
  ospf {
    traffic-engineering;
    area 0.0.0.0 {
      interface lo0.0 {
        passive;
      }
      interface ge-1/0/9.0;
    }
  }
  ldp {
    interface ge-1/0/9.0;
    interface lo0.0;
  }
```

```
user@PE1# show routing-options
router-id 10.255.70.31;
autonomous-system 64511;
```

```
user@PE1# show routing-instances
vpls_a {
  instance-type vpls;
  interface ge-1/0/6.512;
  route-distinguisher 64511:1;
  vrf-target target:64511:1;
  protocols {
    vpls {
      no-tunnel-services;
      site 1 {
        site-identifier 1;
        interface ge-1/0/6.512;
      }
    }
  }
}
```

If you are done configuring Device PE1, enter **commit** from configuration mode.

```
user@P1# show interfaces
ge-1/0/3 {
  description to_P2;
  unit 0 {
    family inet {
      address 10.40.0.1/30;
    }
    family mpls;
  }
}
ge-1/0/9 {
  description to_PE1;
  unit 0 {
```

```
      family inet {
        address 10.30.0.2/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      description loopback-interface;
      family inet {
        address 192.168.16.1/32;
      }
    }
  }
  lo0 {
    unit 0 {
      description loopback-interface;
      family inet {
        address 192.168.16.1/32;
      }
    }
  }
```

```
user@P1# show protocols
mpls {
  interface ge-1/0/9.0;
  interface ge-1/0/3.0;
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface ge-1/0/3.0;
    interface ge-1/0/9.0;
    interface lo0.0 {
      passive;
    }
  }
}
ldp {
  interface ge-1/0/3.0;
  interface ge-1/0/9.0;
  interface lo0.0;
}
```

```
user@P1# show routing-options
router-id 192.168.16.1;
```

If you are done configuring Device P1, enter **commit** from configuration mode.

```
user@P2# show interfaces
ge-2/0/6 {
  description to_P1;
  unit 0 {
    family inet {
      address 10.40.0.2/30;
    }
    family mpls;
```

```
    }
  }
  ge-2/0/8 {
    description to_PE2;
    unit 0 {
      family inet {
        address 10.50.0.1/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      description loopback-interface;
      family inet {
        address 192.168.13.1/32;
      }
    }
  }
```

```
user@P2# show protocols
mpls {
  interface ge-2/0/6.0;
  interface ge-2/0/8.0;
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface ge-2/0/6.0;
    interface ge-2/0/8.0;
    interface lo0.0 {
      passive;
    }
  }
}
ldp {
  interface ge-2/0/6.0;
  interface ge-2/0/8.0;
  interface lo0.0;
}
```

```
user@P2# show routing-options
router-id 192.168.13.1;
```

If you are done configuring Device P2, enter **commit** from configuration mode.

```
user@PE2# show interfaces
ge-2/0/8 {
  description to-R1;
  unit 0 {
    family inet {
      address 10.50.0.2/30;
    }
    family mpls;
  }
}
ge-2/1/1 {
```

```
    vlan-tagging;
    encapsulation vlan-vpls;
    unit 512 {
      description to_vpls;
      encapsulation vlan-vpls;
      vlan-id 512;
    }
  }
  lo0 {
    unit 0 {
      description loopback-interface;
      family inet {
        address 172.30.14.1/32;
      }
    }
  }
```

```
user@PE2# show protocols
mpls {
  interface ge-2/0/8.0;
}
bgp {
  group to_PE1 {
    type internal;
    local-address 172.30.14.1;
    family l2vpn {
      signaling;
    }
    neighbor 10.255.70.31;
  }
}
ospf {
  traffic-engineering;
  area 0.0.0.0 {
    interface ge-2/0/8.0;
    interface lo0.0 {
      passive;
    }
  }
}
ldp {
  interface ge-2/0/8.0;
  interface lo0.0;
}
```

```
user@PE2# show routing-options
router-id 172.30.14.1;
autonomous-system 64511;
```

```
user@PE2# show routing-instances
vpls_a {
  instance-type vpls;
  interface ge-2/1/1.512;
  route-distinguisher 64511:1;
  vrf-target target:64511:1;
  protocols {
    vpls {
```

```
        no-tunnel-services;
        site 2 {
          site-identifier 2;
          interface ge-2/1/1.512;
        }
      }
    }
}
```

If you are done configuring Device PE2, enter **commit** from configuration mode.

```
user@CE2# show interfaces
ge-2/0/7 {
  unit 0 {
    description to-Host2;
    family inet {
      filter {
        input ip-v4;
      }
      address 172.16.80.2/30;
    }
  }
}
ge-2/1/2 {
  vlan-tagging;
  unit 512 {
    description to-PE2;
    vlan-id 512;
    family inet {
      address 10.10.1.2/24;
    }
  }
}
lo0 {
  unit 1 {
    description loopback-interface;
    family inet {
      address 192.168.0.2/32;
    }
  }
}
user@CE2# show class-of-service
classifiers {
  ieee-802.1 dscp1 {
    forwarding-class expedited-forwarding {
      loss-priority low code-points ef;
    }
    forwarding-class best-effort {
      loss-priority low code-points be;
    }
  }
}
interfaces {
  ge-2/1/2 {
    unit 512 {
      classifiers {
```

```
            ieee-802.1 dscp1;
          }
          rewrite-rules {
            ieee-802.1 ieee1-c2;
          }
        }
      }
    }
    rewrite-rules {
      ieee-802.1 ieee1-c2 {
        forwarding-class expedited-forwarding {
          loss-priority low code-point 010;
        }
        forwarding-class best-effort {
          loss-priority low code-point 000;
        }
      }
    }
    user@CE2# show protocols
    ospf {
      area 0.0.0.0 {
        interface lo0.1 {
          passive;
        }
        interface ge-2/0/7.0 {
          passive;
        }
        interface ge-2/1/2.512;
      }
    }
    user@CE2# show firewall
    family inet {
      filter ip-v4 {
        term tcp80 {
          from {
            port 80;
          }
          then dscp ef;
        }
        term 12345 {
          from {
            port 12345;
          }
          then dscp be;
        }
        term accept {
          then accept;
        }
      }
    }
```

If you are done configuring Device CE2, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly by verifying that the DSCP aliases are maintained from Device CE1 to Device CE2.

- Clearing the Firewall Counters on page 78
- Sending Traffic into the Network from TCP HTTP Ports 80 and 12345 and Verifying the Results on page 78

Clearing the Firewall Counters

Purpose Confirm that the firewall counters are cleared.

Action On Device CE2, run the **clear firewall all** command to reset the firewall counters to 0.

```
user@CE2> clear firewall all
```

Sending Traffic into the Network from TCP HTTP Ports 80 and 12345 and Verifying the Results

Purpose Send traffic into the network that can be verified at Device CE2.

Action Configure a new firewall on Device CE2 if you want to verify that the traffic that is being transmitted to Device Host2 from Device Host1 still has the correct DSCP aliases. The following commands create and apply the firewall filter that displays the traffic counts for each code point alias:

```
user@CE2# set firewall family inet filter count term be from dscp be
user@CE2# set firewall family inet filter count term be then count be
user@CE2# set firewall family inet filter count term ef from dscp ef
user@CE2# set firewall family inet filter count term ef then count ef
user@CE2# set firewall family inet filter count term accept then accept
user@CE2# set interfaces ge-2/0/7 unit 0 family inet filter output count
```

When you are done configuring Device CE2, enter **commit** from configuration mode.

When you are done testing, you can leave the counting filter in place, or remove it.

1. On Device Host1 use a traffic generator to send 20 TCP packets with a source port of 80 into the network.

   The -s flag sets the source port. The -k flag causes the source port to remain steady instead of incrementing. The -c flag sets the number of packets to 20.

   Repeat the task using a source port of 12345.

   ```
   [user@host1]# hping 172.16.80.1 -s 80 -k -c 20
   [user@host1]# hping 172.16.80.1 -s 12345 -k -c 20
   ```

2. On Device CE2, display the firewall counters by using the **show firewall** command.

   ```
   user@CE2> show firewall
   show firewall

   Filter: __CE2/count
   Counters:
   Name                                                Bytes              Packets
   ```

```
be                                  800
20
ef                                  800
20
```

Meaning The code point aliases set by Device CE1 are maintained across the VPLS backbone and appear intact at Device CE2.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- *Example: Configuring CoS Queuing and Scheduling Across Your Network Domain*

CHAPTER 5

Configuration Statements

- code-point on page 82
- default (CoS Host Outbound Traffic) on page 82
- dscp (Rewrite Rules) on page 83
- dscp (Rewrite Rules on Physical Interface) on page 84
- dscp-ipv6 (Class-of-Service) on page 85
- exp on page 86
- exp-push-push-push on page 87
- exp-swap-push-push on page 88
- forwarding-class (BA Classifiers) on page 89
- frame-relay-de (Defining Loss Priority Maps) on page 90
- host-outbound-traffic (Class-of-Service) on page 91
- ieee-802.1 (Rewrite Rules on Logical Interface) on page 92
- ieee-802.1 (Host Outbound Traffic) on page 93
- ieee-802.1 (Rewrite Rules on Physical Interface) on page 93
- ieee-802.1ad on page 94
- import (Rewrite Rules) on page 95
- inet-precedence on page 95
- inet-precedence (Rewrite Rules on Physical Interface) on page 96
- interfaces on page 97
- loss-priority (BA Classifiers) on page 99
- loss-priority-maps on page 100
- loss-priority-maps (Assigning to an Interface) on page 101
- protocol (Rewrite Rules) on page 102
- rewrite-rules (CoS Host Outbound Traffic) on page 103
- rewrite-rules (Definition) on page 104
- rewrite-rules (Interfaces) on page 105
- rewrite-rules (Physical Interfaces) on page 106

- unit on page 107
- vlan-tag on page 108

code-point

Syntax code-point [*aliases*] [*bit-patterns*];

Hierarchy Level [edit class-of-service rewrite-rules *type rewrite-name* forwarding-class *class-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify one or more code-point aliases or bit sets for association with a forwarding class.

Options ***aliases***—Name of each alias.

bit-patterns—Value of the code-point bits, in decimal form.

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

Related Documentation
- Configuring Rewrite Rules on page 11

default (CoS Host Outbound Traffic)

Syntax default *value*;

Hierarchy Level [edit class-of-service host-outbound-traffic ieee-802.1]

Release Information Statement introduced in Junos OS Release 12.3.

Description Apply a global default value to the IEEE 802.1p—priority code point (PCP)—field in the Ethernet frame header for all host outbound traffic.

Options ***value***—Three-bit binary number.
Range: 000 through 111

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

Related Documentation
- Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic on page 29
- Rewriting Packet Header Information Overview on page 3

dscp (Rewrite Rules)

Syntax dscp (*rewrite-name* | default) protocol mpls;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.

Description For IPv4 traffic, apply a Differentiated Services (DiffServ) code point (DSCP) rewrite rule.

Logical interfaces do not support multiple **dscp** rewrite rules for the same protocol.

DSCP and DSCP IPv6 rewrite rules are supported on M Series and T Series routers when non-queuing PICs are installed, but are disabled when queuing PICs are installed with the following exceptions:

- On M320 routers, DSCP rewrite is supported on IQ, IQ2, IQE, and IQ2E PICs when used with the Enhanced III FPC.
- On M120 routers, DSCP rewrite is supported on IQ, IQ2, IQE, and IQ2E PICs.

DSCP and DCSP IPv6 rewrite rules are supported on MIC and MPC interfaces on MX Series routers.

DSCP rewrite rules are not supported on T Series routers when IQ, IQ2, IQE, IQ2E, SONET/SDH OC48/STM16 IQE, or PD-5-10XGE-SFPP PICs are installed.

Options *rewrite-name*—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules dscp]** hierarchy level.

default—The default mapping.

protocol mpls—(Optional for ingress MPLS tunnel nodes) For interfaces on MX Series routers or hosted on Enhanced III FPCs in M120 or M320 routers only, rewrite the MPLS EXP bits in the MPLS header independently of the IPv4 DSCP value for IPv4 packets entering an MPLS tunnel.

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

Related Documentation

- Configuring Rewrite Rules on page 11
- Applying Rewrite Rules to Output Logical Interfaces on page 12
- **protocol (Rewrite Rules) on page 102**
- Rewriting MPLS and IPv4 Packet Headers on page 21
- **rewrite-rules (Definition) on page 104**

dscp (Rewrite Rules on Physical Interface)

Syntax dscp (*rewrite-name* | default);

Hierarchy Level [edit class-of-service interfaces *interface-name* rewrite-rules

Release Information Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access routers.

Description Associate a rewrite-rules configuration or default mapping with a specific interface.

Options ***rewrite-name***—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules]** hierarchy level.

default—The default mapping.

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

dscp-ipv6 (Class-of-Service)

Syntax dscp-ipv6 (*rewrite-name* | <default>) protocol mpls;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.
Support for **protocol mpls** option introduced in Junos OS Release 10.4R2.

Description For IPv6 traffic, apply a DSCP rewrite rule.

Logical interfaces do not support multiple **dscp-ipv6** rewrite rules for the same protocol.

DSCP and DSCP IPv6 rewrite rules are supported on M Series and T Series routers when non-queuing PICs are installed, but are disabled when queuing PICs are installed with the following exceptions:

- On M320 routers, DSCP rewrite is supported on IQ, IQ2, IQE, and IQ2E PICs when used with the Enhanced III FPC.
- On M120 routers, DSCP rewrite is supported on IQ, IQ2, IQE, and IQ2E PICs.

DSCP and DCSP IPv6 rewrite rules are supported on MIC and MPC interfaces on MX Series routers.

DSCP rewrite rules are not supported on T Series routers when IQ, IQ2, IQE, IQ2E, SONET/SDH OC48/STM16 IQE, or PD-5-10XGE-SFPP PICs are installed.

Options *rewrite-name*—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules dscp-ipv6]** hierarchy level.

default—Default mapping.

protocol mpls—(Optional for ingress MPLS tunnel nodes) For interfaces on MX Series routers or hosted on Enhanced III FPCs in M120 or M320 routers only, rewrite the MPLS EXP bits in the MPLS header independently of the IPv6 DSCP value for IPv6 packets entering an MPLS tunnel.

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

Related Documentation

- Configuring Rewrite Rules on page 11
- **protocol on page 102**
- Setting IPv6 DSCP and MPLS EXP Values Independently on page 5
- Configuring DSCP Values for IPv6 Packets Entering the MPLS Tunnel on page 13
- Applying Rewrite Rules to Output Logical Interfaces on page 12
- **rewrite-rules (Definition) on page 104**

exp

Syntax exp (*rewrite-name* | default) protocol *protocol-types*;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced before Junos OS Release 12.2. for ACX series

Description Apply an MPLS experimental (EXP) rewrite rule.

Options ***rewrite-name***—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules exp]** hierarchy level.

default—The default mapping.

By default, IP precedence rewrite rules alter the first three bits on the type-of-service (ToS) byte while leaving the last three bits unchanged. This default behavior applies to rewrite rules you configure for MPLS packets with IPv4 payloads. You configure these types of rewrite rules by including the **mpls-inet-both** or **mpls-inet-both-non-vpn** option at the **[edit class-of-service interfaces interface *interface-name* unit *logical-unit-number* rewrite-rules exp *rewrite-rule-name* protocol]** hierarchy level. The IP precedence rewrite rules explanation does not apply to ACX Series Universal Access routers.

On interfaces configured on Modular Port Concentrators (MPCs) and Modular Interface Cards (MICs) on MX Series 3D Universal Edge Routers and EX Series switches, we highly recommend that you configure the **default** option when you configure a behavior aggregate (BA) classifier that does not include a specific rewrite rule for MPLS packets. Doing so ensures that MPLS exp value is rewritten according to the BA classifier rules configured for forwarding or packet loss priority. This does not apply to ACX Series Universal Access routers.

protocol-types—Specify one or more protocol matching criteria:

- **mpls-any**—Apply to MPLS packets, write MPLS header only.
- **mpls-inet-both**—Apply to IPv4 MPLS packets, write MPLS and IPv4 header.
- **mpls-inet-both-non-vpn**—Apply to IPv4 MPLS packets, write MPLS and IPv4 header for only non VPN traffic.

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

Related Documentation

- Configuring Rewrite Rules on page 11
- Rewriting the EXP Bits of All Three Labels of an Outgoing Packet on page 25
- Applying Rewrite Rules to Output Logical Interfaces on page 12
- **protocol (Rewrite Rules) on page 102**

- rewrite-rules (Definition) on page 104

exp-push-push-push

Syntax exp-push-push-push default;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.

Description For M Series routers and EX Series switches, rewrite the EXP bits of all three labels of an outgoing packet, thereby maintaining CoS of an incoming non-MPLS packet.

Options **default**—Apply the default MPLS EXP rewrite table.

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

Related Documentation

- Rewriting the EXP Bits of All Three Labels of an Outgoing Packet on page 25
- dscp (Rewrite Rules) on page 83
- dscp-ipv6 (Class-of-Service) on page 85
- exp on page 86
- exp-swap-push-push on page 88
- ieee-802.1 (Rewrite Rules on Logical Interface) on page 92
- ieee-802.1ad on page 94
- inet-precedence on page 95
- rewrite-rules (Definition) on page 104

exp-swap-push-push

Syntax exp-swap-push-push default;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.

Description For M Series routers and EX Series switches, rewrite the EXP bits of all three labels of an outgoing packet, thereby maintaining CoS of an incoming MPLS packet.

Options **default**—Apply the default MPLS EXP rewrite table.

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

Related Documentation

- Rewriting the EXP Bits of All Three Labels of an Outgoing Packet on page 25
- dscp (Rewrite Rules) on page 83
- dscp-ipv6 (Class-of-Service) on page 85
- exp on page 86
- exp-push-push-push on page 87
- ieee-802.1 (Rewrite Rules on Logical Interface) on page 92
- ieee-802.1ad on page 94
- inet-precedence on page 95
- rewrite-rules (Definition) on page 104

forwarding-class (BA Classifiers)

Syntax

```
forwarding-class class-name {
    loss-priority level code-points [ aliases ] [ bit-patterns ];
}
```

Hierarchy Level [edit class-of-service classifiers *type classifier-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Define forwarding class name and option values.

Options ***class-name***—Name of the forwarding class.

The remaining statements are explained separately.

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

Related Documentation

- *Defining Classifiers*

frame-relay-de (Defining Loss Priority Maps)

Syntax

```
frame-relay-de name {
  loss-priority level code-points [ alias | bits ];
}
```

Hierarchy Level [edit class-of-service loss-priority-maps]

Release Information Statement introduced in Junos OS Release 11.4.

Description Define a Frame Relay discard eligibility (DE) bit loss priority map.

Options *name*—Name of the loss priority map.

loss-priority *level*—Level of the loss priority to be applied based on the specified CoS values. The loss priority level can be one of the following:

- **high**—Packet has high loss priority.
- **low**—Packet has low loss priority.
- **medium-high**—Packet has medium-high loss priority.
- **medium-low**—Packet has medium-low loss priority.

The remaining statements are explained separately.

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

Related Documentation

- Defining a Custom Frame Relay Loss Priority Map on page 33

host-outbound-traffic (Class-of-Service)

Syntax

```
host-outbound-traffic {
  forwarding-class class-name;
  dscp-code-point value;
  ieee-802.1 {
    default value;
    rewrite-rules;
  }
}
```

Hierarchy Level [edit class-of-service]

Release Information

Statement introduced in Junos OS Release 8.4.
Statement introduced in Junos OS 8.5 for SRX1400, SRX3400, SRX3600, SRX5600, and SRX5800 firewalls.
Statement introduced before Junos OS 11.4 for EX Series switches.
Support for **ieee-802.1** statement introduced in Junos OS Release 12.3.
Support for distributed protocol handler traffic introduced in Junos OS Release 13.2.

Description Classify and mark host outbound traffic. This statement does not affect transit traffic or incoming traffic.

Default If you do not specify a forwarding class or DSCP value, the router uses the default queue and DSCP bit assignments for host outbound traffic.

Options The remaining statements are explained separately.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- *Default Queue Assignments for Routing Engine Sourced Traffic*
- *Default DSCP and DSCP IPv6 Classifier*
- *Changing the Default Queuing and Marking of Host Outbound Traffic*.
- Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic on page 29
- Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface on page 30
- *Understanding Junos OS CoS Components for EX Series Switches*

ieee-802.1 (Rewrite Rules on Logical Interface)

Syntax ieee-802.1 (*rewrite-name* | default) vlan-tag (outer | outer-and-inner);

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.
vlan-tag statement introduced in Junos OS Release 8.1.

Description Apply an IEEE-802.1 rewrite rule. For IQ PICs, you can only configure one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule.

Options *rewrite-name*—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules ieee-802.1]** hierarchy level.

default—The default mapping.

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

Related Documentation

- Configuring Rewrite Rules on page 11
- dscp (Rewrite Rules) on page 83
- dscp-ipv6 (Class-of-Service) on page 85
- exp on page 86
- exp-push-push-push on page 87
- exp-swap-push-push on page 88
- ieee-802.1ad on page 94
- inet-precedence on page 95
- rewrite-rules (Definition) on page 104

ieee-802.1 (Host Outbound Traffic)

Syntax

```
ieee-802.1 {
  default value;
  rewrite-rules;
}
```

Hierarchy Level [edit class-of-service host-outbound-traffic]

Release Information Statement introduced in Junos OS Release 12.3.

Description Apply the IEEE 802.1p rewrite rules associated with the egress logical interface to the IEEE 802.1p PCP field for all host outbound traffic on that interface.

The remaining statements are explained separately.

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

Related Documentation

- Configuring a Global Default IEEE 802.1p Value for All Host Outbound Traffic on page 29
- Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface on page 30
- Rewriting Packet Header Information Overview on page 3
- Configuring Rewrite Rules on page 11

ieee-802.1 (Rewrite Rules on Physical Interface)

Syntax ieee-802.1 (*rewrite-name* | default) ;

Hierarchy Level [edit class-of-service interfaces *interface-name*]rewrite-rules

Release Information Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access routers.

Description Apply an IEEE-802.1 rewrite rule.

Options ***rewrite-name***—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules ieee-802.1]** hierarchy level.

default—The default mapping.

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

ieee-802.1ad

Syntax ieee-802.1ad (*rewrite-name* | default) vlan-tag (outer | outer-and-inner);

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced in Junos OS Release 9.2.

Description Apply a IEEE-802.1ad rewrite rule.

Options *rewrite-name*—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules ieee-802.1ad]** hierarchy level.

default—The default rewrite bit mapping.

vlan-tag—The rewrite rule is applied to the **outer** or **outer-and-inner** VLAN tag.

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

Related Documentation

- Configuring Rewrite Rules on page 11
- dscp (Rewrite Rules) on page 83
- dscp-ipv6 (Class-of-Service) on page 85
- exp on page 86
- exp-push-push-push on page 87
- exp-swap-push-push on page 88
- ieee-802.1 (Rewrite Rules on Logical Interface) on page 92
- inet-precedence on page 95
- rewrite-rules (Definition) on page 104

import (Rewrite Rules)

Syntax import (*rewrite-name* | default);

Hierarchy Level [edit class-of-service rewrite-rules *type rewrite-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify a default or previously defined **rewrite-rules** mapping to import.

Options ***rewrite-name***—Name of a rewrite-rules mapping configured at the **[edit class-of-service rewrite-rules]** hierarchy level.

default—The default **rewrite-rules** mapping.

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

Related Documentation
- Configuring Rewrite Rules on page 11

inet-precedence

Syntax inet-precedence (*rewrite-name* | default);

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules]

Release Information Statement introduced before Junos OS Release 7.4.

Description Apply a IPv4 precedence rewrite rule.

Options ***rewrite-name***—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules inet-precedence]** hierarchy level.

default—The default mapping. By default, IP precedence rewrite rules alter the first three bits on the type of service (ToS) byte while leaving the last three bits unchanged.

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

Related Documentation
- Configuring Rewrite Rules on page 11
- Applying Rewrite Rules to Output Logical Interfaces on page 12
- **protocol (Rewrite Rules) on page 102**
- **rewrite-rules (Definition) on page 104**

inet-precedence (Rewrite Rules on Physical Interface)

Syntax inet-precedence (*rewrite-name* | default);

Hierarchy Level [edit class-of-service interfaces *interface-name*rewrite-rules]

Release Information Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access routers.

Description Apply a IPv4 precedence rewrite rule.

Options ***rewrite-name***—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules inet-precedence]** hierarchy level.

default—The default mapping. By default, IP precedence rewrite rules alter the first three bits on the type of service (ToS) byte while leaving the last three bits unchanged.

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

interfaces

Syntax

```
interfaces {
  interface-name {
    classifiers{
      dscp(classifier-name | default) {
    }
      ieee-802.1 (classifier-name | default)  vlan-tag (inner | outer | classifier-name);
      inet-precedence (rewrite-name | default);
    }
    input-scheduler-map map-name;
    input-shaping-rate rate;
    irb {
      unit logical-unit-number {
        classifiers {
          type (classifier-name | default);
        }
        rewrite-rules {
          dscp (rewrite-name | default);
          dscp-ipv6 (rewrite-name | default);
          exp (rewrite-name | default)protocol protocol-types;
          ieee-802.1 (rewrite-name | default) vlan-tag (outer | outer-and-inner);
          inet-precedence (rewrite-name | default);
        }
      }
    }
    member-link-scheduler (replicate | scale);
    rewrite-rules {
      dscp (rewrite-name | default);
      ieee-802.1 (rewrite-name | default) vlan-tag (outer);
      inet-precedence (rewrite-name | default);
      }
    }
    scheduler-map map-name;
    scheduler-map-chassis map-name;
    shaping-rate rate;
    unit logical-unit-number {
      classifiers {
        type (classifier-name | default) family (mpls | inet);
      }
      forwarding-class class-name;
      fragmentation-map map-name;
      input-shaping-rate (percent percentage | rate);
      input-traffic-control-profile profile-name shared-instance instance-name;
      output-traffic-control-profile profile-name shared-instance instance-name;
      per-session-scheduler;
      rewrite-rules {
        dscp (rewrite-name | default);
        dscp-ipv6 (rewrite-name | default);
        exp (rewrite-name | default) protocol protocol-types;
        exp-push-push-push default;
        exp-swap-push-push default;
        ieee-802.1 (rewrite-name | default) vlan-tag (outer | outer-and-inner);
        inet-precedence (rewrite-name | default);
```

```
        }
        scheduler-map map-name;
        shaping-rate rate;
        translation-table (to-dscp-from-dscp | to-dscp-ipv6-from-dscp-ipv6 | to-exp-from-exp
          | to-inet-precedence-from-inet-precedence) table-name;
      }
    }
    interface-set interface-set-name {
      excess-bandwidth-share;
      internal-node;
      output-traffic-control-profile profile-name;
      output-traffic-control-profile-remaining profile-name;
    }
}
```

Hierarchy Level [edit class-of-service]

Release Information Statement introduced before Junos OS Release 7.4.
Interface-set level added in Junos OS Release 8.5.

Description Configure interface-specific CoS properties for incoming packets.

Options The remaining statements are explained separately.

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

Related Documentation

- *Overview of BA Classifier Types*
- Configuring Rewrite Rules on page 11

loss-priority (BA Classifiers)

Syntax loss-priority *level*;

Hierarchy Level [edit class-of-service classifiers *type classifier-name* forwarding-class *class-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify packet loss priority value for a specific set of code-point aliases and bit patterns.

Options ***level*** can be one of the following:

- **high**—Packet has high loss priority.
- **medium-high**—Packet has medium-high loss priority.
- **medium-low**—Packet has medium-low loss priority.
- **low**—Packet has low loss priority.

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

Related Documentation

- *Overview of BA Classifier Types*
- *Configuring Tricolor Marking*

loss-priority-maps

Syntax

```
loss-priority-maps {
  frame-relay-de rewrite-name {
    loss-priority level {
    code-points [ aliases] [ bit-patterns ];
    }
  }
}
```

Hierarchy Level [edit class-of-service]

Release Information Statement introduced in JUNOS Release 11.4.

Description Map the loss priority of incoming packets based on the CoS values.

Options **frame-relay-de *rewrite-name***—Name of the Frame Relay DE bit loss priority map.

loss-priority *level*—The loss priority level can be one of the following:

- **high**—Packet has high loss priority.
- **low**—Packet has low loss priority.
- **medium-high**—Packet has medium-high loss priority.
- **medium-low**—Packet has medium-low loss priority.

The remaining statements are explained separately.

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

Related Documentation

- Assigning the Default Frame Relay DE Loss Priority Map to an Interface on page 32

loss-priority-maps (Assigning to an Interface)

Syntax

```
loss-priority-maps {
  frame-relay-de (loss-priority-rewrite-name | default);
}
```

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number*]

Release Information Statement introduced in JUNOS Release 11.4.

Description Assign the loss priority map to a logical interface.

Options

default—Apply the default loss priority map. The default map includes the following configuration:

```
loss-priority low code-point 0;
loss-priority high code-point 1;
```

map-name—Name of loss priority map to be applied.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Assigning the Default Frame Relay DE Loss Priority Map to an Interface on page 32
- unit on page 107

protocol (Rewrite Rules)

Syntax protocol *protocol-types*;

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules exp *rewrite-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules dscp *rewrite-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules dscp-ipv6 *rewrite-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules inet-prec *rewrite-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Option for **dscp** and **inet-prec** introduced in Junos OS Release 8.4.
Option for **dscp-ipv6** introduced in Junos OS Release 10.4R2.

Description Apply a rewrite rule to MPLS packets only, and write the CoS value to MPLS headers only; or apply a rewrite rule to MPLS and IPv4 packets, and write the CoS value to MPLS and IPv4 headers.

Options ***protocol-types*** can be one of the following:

- **mpls**—Apply a rewrite rule to MPLS packets and write the CoS value to MPLS headers.
- **mpls-inet-both**—Apply a rewrite rule to VPN MPLS packets with IPv4 payloads. On M120, M320, MX Series, and T Series routers (except T4000 routers), and EX Series switches, write the CoS value to the MPLS and IPv4 headers. On M Series routers, initialize all ingress MPLS LSP packets with IPv4 payloads with 000 code points for the MPLS EXP value, and the configured rewrite code point for IP precedence.
- **mpls-inet-both-non-vpn**—Apply a rewrite rule to non-VPN MPLS packets with IPv4 payloads. On M120, M320, MX Series, T Series routers, and EX Series switches write the CoS value to the MPLS and IPv4 headers. On M Series routers, initialize all ingress MPLS LSP packets with IPv4 payloads with 000 code points for the MPLS EXP value, and the configured rewrite code point for IP precedence.

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

Related Documentation
- Rewriting MPLS and IPv4 Packet Headers on page 21

rewrite-rules (CoS Host Outbound Traffic)

Syntax rewrite-rules;

Hierarchy Level [edit class-of-service host-outbound-traffic ieee-802.1]

Release Information Statement introduced in Junos OS Release 12.3.

Description Apply the IEEE 802.1p rewrite rules associated with the egress logical interface to the IEEE 802.1p PCP field for all host outbound traffic on that interface.

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

Related Documentation

- Applying Egress Interface Rewrite Rules to the IEEE 802.1p Field for All Host Outbound Traffic on the Interface on page 30
- Rewriting Packet Header Information Overview on page 3
- Configuring Rewrite Rules on page 11

rewrite-rules (Definition)

Syntax

```
rewrite-rules {
  type rewrite-name{
    import (rewrite-name | default);
    forwarding-class class-name {
      loss-priority level code-point [ aliases ] [ bit-patterns ];
    }
  }
}
```

Hierarchy Level [edit class-of-service]

Release Information Statement introduced before Junos OS Release 7.4.
ieee-802.1ad option introduced in Junos OS Release 9.2.

Description Specify a rewrite-rules mapping for the traffic that passes through all queues on the interface.

Options *rewrite-name*—Name of a **rewrite-rules** mapping.

type—Traffic type.

Values: **dscp**, **dscp-ipv6**, **exp**, **frame-relay-de** (J Series routers only), **ieee-802.1**, **ieee-802.1ad**, **inet-precedence**

The remaining statements are explained separately.

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

Related Documentation

- Configuring Rewrite Rules on page 11
- J Series router documentation

rewrite-rules (Interfaces)

Syntax

```
rewrite-rules {
  dscp (rewrite-name | default) protocol mpls;
  dscp-ipv6 (rewrite-name | default) protocol mpls;
  exp (rewrite-name | default) protocol protocol-types;
  exp-push-push-push default;
  exp-swap-push-push default;
  ieee-802.1 (rewrite-name | default) vlan-tag (outer | outer-and-inner);
  ieee-802.1ad (rewrite-name | default) vlan-tag (outer | outer-and-inner);
  inet-precedence (rewrite-name | default) protocol mpls;
}
```

Hierarchy Level

[edit class-of-service interfaces *interface-name*],
[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Associate a rewrite-rules configuration or default mapping with a specific interface.

The **[edit class-of-service interfaces *interface-name*]** hierarchy level is not supported on M Series routers.

The **[edit class-of-service interfaces *interface-name* unit *logical-unit-number*]** hierarchy level is not supported on ACX Series routers.

On an MX Series router and on an EX Series switch, **exp-push-push-push**, **exp-swap-push-push**, and **frame-relay-de** are not supported on an integrated routing and bridging (IRB) interface.

On an ACX Series router, only the outer tag is supported for **dscp**, **inet-precedence**, and **ieee802.1**.

On M Series routers only, if you include the **control-word** statement at the **[edit protocols l2circuit neighbor *address* interface *interface-name*]** hierarchy level, the software cannot rewrite MPLS EXP bits.

For IQ PICs, you can configure only one IEEE 802.1 rewrite rule on a physical port. All logical ports (units) on that physical port should apply the same IEEE 802.1 rewrite rule.

On M320 and T Series routers (except for T4000 routers with Type 5 FPCs), for a single interface, you cannot enable a rewrite rule on a subset of forwarding classes. You must assign a rewrite rule to either none of the forwarding classes or all of the forwarding classes. When you assign a rewrite rule to a subset of forwarding classes, the commit does not fail, and the subset of forwarding classes works as expected. However, the forwarding classes to which the rewrite rule is not assigned are rewritten to all zeros.

For example, if you configure a Differentiated Services code point (DSCP) rewrite rule, the bits in the forwarding classes to which you do not assign the rewrite rule are rewritten to 000000. If you configure an IP precedence rewrite rule, the bits in the forwarding classes to which you do not assign the rewrite rule are rewritten to 000.

Options

rewrite-name—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules]** hierarchy level.

default—The default mapping.

The remaining statements are explained separately.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Rewrite Rules on page 11
- rewrite-rules (Definition) on page 104
- Applying Rewrite Rules to Output Logical Interfaces on page 12

rewrite-rules (Physical Interfaces)

Syntax

```
rewrite-rules {
  dscp (rewrite-name | default);
  ieee-802.1 (rewrite-name | default);
  inet-precedence (rewrite-name | default);
}
```

Hierarchy Level

[edit class-of-service interfaces *interface-name*]

Release Information

Statement introduced in Junos OS Release 12.2 for the ACX Series Universal Access routers.

Description

Associate a rewrite-rules configuration or default mapping with a specific interface.

Options

rewrite-name—Name of a **rewrite-rules** mapping configured at the **[edit class-of-service rewrite-rules]** hierarchy level.

default—The default mapping.

The remaining statements are explained separately.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

unit

Syntax

```
unit logical-unit-number {
  classifiers {
    type (classifier-name | default) family (mpls | all);
  }
  forwarding-class class-name;
  fragmentation-map map-name;
  input-traffic-control-profile profile-name shared-instance instance-name;
  output-traffic-control-profile profile-name shared-instance instance-name;
  per-session-scheduler;
  rewrite-rules {
    dscp (rewrite-name | default);
    dscp-ipv6 (rewrite-name | default);
    exp (rewrite-name | default)protocol protocol-types;
    exp-push-push-push default;
    exp-swap-push-push default;
    ieee-802.1 (rewrite-name | default) vlan-tag (outer | outer-and-inner);
    inet-precedence (rewrite-name | default);
  }
  scheduler-map map-name;
  shaping-rate rate;
}
```

Hierarchy Level [edit class-of-service interfaces *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure a logical interface on the physical device. You must configure a logical interface to be able to use the physical device.

Options ***logical-unit-number***—Number of the logical unit.

Range: 0 through 16,384

The remaining statements are explained separately.

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

Related Documentation

- *Overview of BA Classifier Types*
- Configuring Rewrite Rules on page 11

vlan-tag

Syntax vlan-tag (outer | outer-and-inner);

Hierarchy Level [edit class-of-service interfaces *interface-name* unit *logical-unit-number* rewrite-rules ieee-802.1 (*rewrite-name* | default)]

Release Information Statement introduced in Junos OS Release 8.1.

Description For Gigabit Ethernet IQ2 PICs only, apply this IEEE-802.1 rewrite rule to the outer or outer and inner VLAN tags.

Default If you do not include this statement, the rewrite rule applies to the outer VLAN tag only.

Options **outer**—Apply the rewrite rule to the outer VLAN tag only.

outer-and-inner—Apply the rewrite rule to both the outer and inner VLAN tags.

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

Related Documentation

- Applying IEEE 802.1p Rewrite Rules to Dual VLAN Tags on page 15

PART 3

Administration

- Operational Commands on page 111

CHAPTER 6

Operational Commands

- show class-of-service loss-priority-map

show class-of-service loss-priority-map

Syntax show class-of-service loss-priority-map
<name *name*>
<type frame-relay-de>

Release Information Command introduced before Junos OS Release 7.4.

Description (J Series Services Router only) Display mapping of code point value to loss priority.

Options **none**—Display all loss priority maps.

name *name*—(Optional) Display the specified loss priority map.

type frame-relay-de—(Optional) Display Frame Relay discard eligible code point.

Required Privilege Level view

List of Sample Output show class-of-service loss-priority-map on page 112

Output Fields Table 5 on page 112 describes the output fields for the **show class-of-service loss-priority-map** command. Output fields are listed in the approximate order in which they appear.

Table 5: show class-of-service loss-priority-map Output Fields

Field Name	Field Description
Loss-priority-map	Name of the loss priority map.
Code point type	Type: **frame-relay-de**.
Index	Internal index.
Code point	Code point value.
Loss priority	Loss priority of **low**, **medium-low**, **medium-high**, or **high**.

Sample Output

show class-of-service loss-priority-map

```
user@host> show class-of-service loss-priority-map
Loss-priority-map: frame-relay-de-default, Code point type: frame-relay-de, Index:
 9
  Code point         Loss priority
  0                  low
  1                  high

Loss-priority-map: bar, Code point type: frame-relay-de, Index: 2212
  Code point         Loss priority
  0                  medium-low
```

```
  1                 medium-high

Loss-priority-map: abc, Code point type: frame-relay-de, Index: 11038
  Code point        Loss priority
  0                 medium-high
  1                 high
```

PART 4

Index

- Index on page 117

Index

Symbols

#, comments in configuration statements....xiv
( ), in syntax descriptions....xiv
< >, in syntax descriptions....xiv
[ ], in configuration statements....xiv
{ }, in configuration statements....xiv
| (pipe), in syntax descriptions....xiv

A

assigning frame relay de loss priority
  CoS....32

B

braces, in configuration statements....xiv
brackets
  angle, in syntax descriptions....xiv
  square, in configuration statements....xiv

C

classification and rewrite
  at global and physical interface levels, example configuration....18
  at global and physical interface levels, overview....5
code-point statement....82
  usage guidelines....9
comments, in configuration statements....xiv
conventions
  text and syntax....xiii
CoS
  assigning frame relay de loss priority....32
  defining frame relay de loss priority map....33
  host outbound traffic
    configuring IEEE 802.1p field....29
  mapping, displaying
    code point value to loss priority, J Series....112
  rewrite rules....3
    applying a default....9
    applying to VLAN tags....15, 16, 17
    assigning to interface....12
    defining custom....11
    EXP bits, rewriting three labels....25
    IEEE bits, rewriting with MPLS value....27
    MPLS EXP and IEEE 802.1p....27
    MPLS EXP and IPv4....21, 23
CoS IEEE 802.1p statements
  default....82
  host-outbound-traffic, CoS....91
  ieee-802.1....93
  rewrite-rules....103
curly braces, in configuration statements....xiv
customer support....xv
  contacting JTAC....xv

D

default traffic statement....82
defining frame relay de loss priority map
  CoS....33
documentation
  comments on....xv
DSCP
  over Layer 3 VPNs....31
dscp statement....83
  usage guidelines....9, 11
dscp-ipv6 statement....85
  usage guidelines....9, 11

E

EXP bits
  rewriting....3
exp statement....86
  usage guidelines....9, 11
exp-push-push-push statement....87
  usage guidelines....25
exp-swap-push-push statement....88
  usage guidelines....25

F

font conventions....xiii
frame-relay-de statement
  defining loss priority maps....90

H

host outbound traffic
  configuring IEEE 802.1p field....29
  egress rewrite rules for IEEE 802.1p field....30
  global default IEEE 802.1p value....29
host-outbound traffic statement
  CoS....91

I

IEEE 802p.1 field
- configuring host outbound traffic....29
- egress rewrite rules....30
- global default value....29

ieee-802.1 statement....93
- rewrite rules on logical interface....92
- rewrite rules on physical interface....93
- usage guidelines....9

ieee-802.1ad statement....94

inet-precedence statement....95
- usage guidelines....9, 11

interfaces statement
- CoS....97
  - usage guidelines....9

L

loss-priority-maps statement....100
- assigning to Interface....101

M

manuals
- comments on....xv

P

packet header bits
- rewritten....4

parentheses, in syntax descriptions....xiv

protocol statement
- usage guidelines....21

R

rewrite rules
- applying a default....9
- applying to VLAN tags....15, 17
  - example configuration....16, 17
- assigning to interface....12
- CoS....3
- defining custom....11
- EXP bits....35
  - rewriting three labels....25
- IEEE bits
  - applying to VLAN tags....15, 17
  - example configuration....16, 17
  - rewriting with MPLS value....27
- IPv6 packets....9
- MPLS EXP and IPv4....21
  - example configuration....23

rewrite-rules statement....103
- usage guidelines....9

rewriting
- packet header bits....3, 4

S

show class-of-service loss-priority-map command....112

support, technical *See* technical support

syntax conventions....xiii

T

technical support
- contacting JTAC....xv

U

unit statement
- CoS....107
  - usage guidelines....9

V

VLAN tags
- application of rewrite rules to....15, 17
  - example configuration....16, 17

vlan-tag statement....108
- usage guidelines....15, 17