



Junos[®] OS

CoS Congestion Avoidance with RED Drop Profiles Feature Guide for Routing Devices

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Table of Contents

	About the Documentation	ix
	Documentation and Release Notes	ix
	Supported Platforms	ix
	Using the Examples in This Manual	ix
	Merging a Full Example	x
	Merging a Snippet	x
	Documentation Conventions	xi
	Documentation Feedback	xiii
	Requesting Technical Support	xiii
	Self-Help Online Tools and Resources	xiii
	Opening a Case with JTAC	xiv
Part 1	Overview	
Chapter 1	RED Drop Profiles	3
	RED Drop Profiles Overview	3
	Default Drop Profile	5
	Packet Loss Priority Configuration Overview	5
Part 2	Configuration	
Chapter 2	Configuration Tasks	9
	Setting Packet Loss Priority	9
	Example: Overriding the Default PLP on M320 Routers	9
	Configuring RED Drop Profiles	10
	Configuring Weighted RED Buffer Occupancy	11
Chapter 3	Examples	13
	Example: Configuring RED Drop Profiles	13
	Example: Configuring Weighted RED Buffer Occupancy	14
Chapter 4	Configuration Statements	17
	copy-plp-all	17
	drop-probability (Interpolated Value)	18
	drop-probability (Percentage)	18
	drop-profiles (Class-of-Service)	19
	fill-level (Interpolated Value)	20
	fill-level (Drop Profiles)	21
	interpolate	22
	red-buffer-occupancy	23

Part 3	Administration	
Chapter 5	Operational Commands	27
	show class-of-service drop-profile	28
Part 4	Index	
	Index	33

List of Figures

Part 1	Overview	
Chapter 1	RED Drop Profiles	3
	Figure 1: Segmented and Interpolated Drop Profiles	4
Part 2	Configuration	
Chapter 3	Examples	13
	Figure 2: Segmented and Interpolated Drop Profiles	13

List of Tables

	About the Documentation	ix
	Table 1: Notice Icons	xi
	Table 2: Text and Syntax Conventions	xii
Part 3	Administration	
Chapter 5	Operational Commands	27
	Table 3: show class-of-service drop-profile Output Fields	28

About the Documentation

- [Documentation and Release Notes on page ix](#)
- [Supported Platforms on page ix](#)
- [Using the Examples in This Manual on page ix](#)
- [Documentation Conventions on page xi](#)
- [Documentation Feedback on page xiii](#)
- [Requesting Technical Support on page xiii](#)

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/>.

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Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at <http://www.juniper.net/books>.

Supported Platforms

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

- [T Series](#)
- [M Series](#)
- [MX 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.xml;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

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

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

Merging a Snippet

To merge a snippet, follow these steps:

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

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

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


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

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

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

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

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

Documentation Conventions

Table 1 on page xi 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 xii 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
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [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]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; 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.	<ul style="list-style-type: none"> 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 send your comments to techpubs-comments@juniper.net, or fill out the documentation feedback form at <https://www.juniper.net/cgi-bin/docbugreport/>. If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release version (if applicable)

Requesting Technical Support

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

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

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- Search for known bugs: <http://www2.juniper.net/kb/>

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

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

Opening a Case with JTAC

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

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

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

PART 1

Overview

- [RED Drop Profiles on page 3](#)

CHAPTER 1

RED Drop Profiles

- [RED Drop Profiles Overview on page 3](#)
- [Default Drop Profile on page 5](#)
- [Packet Loss Priority Configuration Overview on page 5](#)

RED Drop Profiles Overview

You can configure two parameters to control congestion at the output stage. The first parameter defines the delay-buffer bandwidth, which provides packet buffer space to absorb burst traffic up to the specified duration of delay. Once the specified delay buffer becomes full, packets with 100 percent drop probability are dropped from the head of the buffer. For more information, see *Configuring the Scheduler Buffer Size*.

The second parameter defines the drop probabilities across the range of delay-buffer occupancy, supporting the random early detection (RED) process. When the number of packets queued is greater than the ability of the router or switch to empty a queue, the queue requires a method for determining which packets to drop from the network. To address this, the Junos OS provides the option of enabling RED on individual queues.

Depending on the drop probabilities, RED might drop many packets long before the buffer becomes full, or it might drop only a few packets even if the buffer is almost full.

A *drop profile* is a mechanism of RED that defines parameters that allow packets to be dropped from the network. Drop profiles define the meanings of the loss priorities.

When you configure drop profiles, there are two important values: the queue fullness and the drop probability. The *queue fullness* represents a percentage of the memory used to store packets in relation to the total amount that has been allocated for that specific queue. Similarly, the *drop probability* is a percentage value that correlates to the likelihood that an individual packet is dropped from the network. These two variables are combined in a graph-like format, as shown in [Figure 1 on page 4](#).

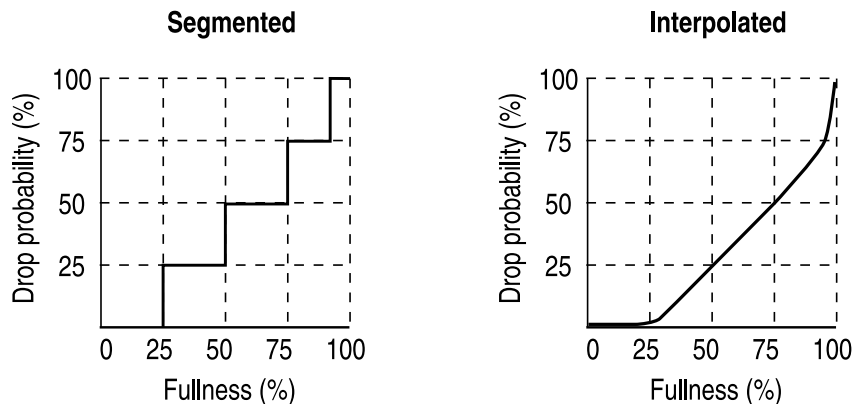
The maximum number of queue fullness levels supported per drop profile is based on the underlying line card:

- Physical or logical interfaces hosted on MICs in Queuing or Enhanced Queuing MPCs for MX Series routers support up to 64 (fill level, drop probability) pairs per segmented or interpolated drop profile.

- Physical or logical interfaces hosted on Enhanced Queuing DPCs for MX Series routers support up to 64 (fill level, drop probability) pairs per segmented drop profile or 2 pairs per interpolated drop profile. For more information, see *Configuring WRED on Enhanced Queuing DPCs*.
- Physical or logical interfaces hosted on IQ2 PICs or IQE PICs support up to two (fill level, drop probability) pairs per segmented or interpolated drop profile.

Figure 1 on page 4 shows both a segmented and an interpolated graph. Although the formation of these graph lines is different, the application of the profile is the same. When a packet reaches the head of the queue, a random number between 0 and 100 is calculated by the router or switch. This random number is plotted against the drop profile using the current queue fullness of that particular queue. When the random number falls above the graph line, the packet is transmitted onto the physical media. When the number falls below the graph line, the packet is dropped from the network.

Figure 1: Segmented and Interpolated Drop Profiles



By defining multiple fill levels and drop probabilities, you create a segmented drop profile. The line segments are defined in terms of the following graphical model: in the first quadrant, the x axis represents the fill level, and the y axis represents the drop probability. The initial line segment spans from the origin (0,0) to the point ($\langle l1 \rangle$, $\langle p1 \rangle$); a second line runs from ($\langle l1 \rangle$, $\langle p1 \rangle$) to ($\langle l2 \rangle$, $\langle p2 \rangle$) and so forth, until a final line segment connects (100,100). The software automatically constructs a drop profile containing 64 fill levels at drop probabilities that approximate the calculated line segments.



NOTE: If you configure the `interpolate` statement, you can specify more than 64 pairs, but the system generates only 64 discrete entries.

You specify drop probabilities in the drop profile section of the class-of-service (CoS) configuration hierarchy and reference them in each scheduler configuration. For each scheduler, you can configure multiple separate drop profiles, one for each combination of loss priority (low, medium-low, medium-high, or high) and protocol.

You can configure a maximum of 32 different drop profiles.

To configure RED drop profiles, include the following statements at the **[edit class-of-service]** hierarchy level:

```
[edit class-of-service]
drop-profiles {
  profile-name {
    fill-level percentage drop-probability percentage;
    interpolate {
      drop-probability [ values ];
      fill-level [ values ];
    }
  }
}
```

Default Drop Profile

If you configure no drop profiles on Juniper Networks M320 Multiservice Edge Routers or T Series Core Routers, random early detection (RED) is in effect by default and functions as the primary mechanism for managing congestion. In the default RED drop profile, when the fill-level is 0 percent, the drop probability is 0 percent. When the fill-level is 100 percent, the drop probability is 100 percent.

As a backup method for managing congestion, tail dropping takes effect when congestion of small packets occurs. On M320 and T Series Core Routers, the software supports *tail-RED*, which means that when tail dropping occurs, the software uses RED to execute intelligent tail drops. On other routers, the software executes tail drops unconditionally.

- Related Documentation
- [drop-probability \(Interpolated Value\) on page 18](#)
 - [drop-probability \(Percentage\) on page 18](#)

Packet Loss Priority Configuration Overview

Loss priority settings help determine which packets are dropped from the network during periods of congestion. The software supports multiple packet loss priority (PLP) designations: **low** and **high**. (In addition, **medium-low** and **medium-high** PLPs are supported when you configure tricolor marking.) You can set PLP by configuring a behavior aggregate or multifield classifier.



NOTE: On T Series routers with different Packet Forwarding Engines (non-Enhanced Scaling and Enhanced Scaling FPCs) and on M320 routers, you can configure PLP bit copying for ingress and egress unicast and multicast traffic. To configure PLP bit copying, include the **copy-plp-all** statement at the **[edit class-of-service]** hierarchy level.

A drop-profile map examines the loss priority setting of an outgoing packet: **high**, **medium-high**, **medium-low**, **low**, or **any**.

Obviously, *low*, *medium-low*, *medium-high*, and *high* are relative terms, which by themselves have no meaning. Drop profiles define the meanings of the loss priorities. In

the following example, the **low-drop** drop profile defines the meaning of **low** PLP as a 10 percent drop probability when the fill level is 75 percent and a 40 percent drop probability when the fill level is 95 percent. The **high-drop** drop profile defines the meaning of **high** PLP as a 50 percent drop probability when the fill level is 25 percent and a 90 percent drop probability when the fill level is 50 percent.

In this example, the scheduler includes two drop-profile maps, which specify that packets are evaluated by the **low-drop** drop profile if they have a **low** loss priority and are from any protocol. Packets are evaluated by the **high-drop** drop profile if they have a **high** loss priority and are from any protocol.

```
[edit class-of-service]
drop-profiles {
  low-drop {
    interpolate {
      drop-probability [ 10 40];
      fill-level [ 75 95];
    }
  }
  high-drop {
    interpolate {
      drop-probability [ 50 90];
      fill-level [ 25 50];
    }
  }
}
schedulers {
  best-effort {
    drop-profile-map loss-priority low protocol any drop-profile low-drop;
    drop-profile-map loss-priority high protocol any drop-profile high-drop;
  }
}
```

**Related
Documentation**

- [Configuring Schedulers](#)
- [Setting Packet Loss Priority on page 9](#)
- [copy-plp-all on page 17](#)
- [Configuring Tricolor Marking](#)
- [Setting Packet Loss Priority on page 9](#)
- [Configuring Multifield Classifiers](#)

PART 2

Configuration

- [Configuration Tasks on page 9](#)
- [Examples on page 13](#)
- [Configuration Statements on page 17](#)

CHAPTER 2

Configuration Tasks

- [Setting Packet Loss Priority on page 9](#)
- [Configuring RED Drop Profiles on page 10](#)
- [Configuring Weighted RED Buffer Occupancy on page 11](#)

Setting Packet Loss Priority

By default, the least significant bit of the CoS value sets the packet loss priority (PLP) value. For example, CoS value 000 is associated with PLP **low**, and CoS value 001 is associated with PLP **high**. In general, you can change the PLP by configuring a behavior aggregate (BA) or multifield classifier, as discussed in *Overview of BA Classifier Types* and *Multifield Classifier Overview*.

However, on Juniper Networks M320 Multiservice Edge Routers, MX Series 3D Universal Edge Routers, and T Series Core Routers and EX Series switches that do not have tricolor marking enabled, the loss priority can be configured by setting the PLP within a multifield classifier or by behavior aggregate (BA) classifier. This setting can then be used by the appropriate drop profile map and rewrite rule.

On M320 routers and T Series routers with Enhanced II Flexible PIC Concentrators (FPCs) and tricolor marking enabled, you can set the PLP with a BA or multifield classifier, as described in *Using BA Classifiers to Set PLP* and *Using Multifield Classifiers to Set PLP*.

On T Series routers with different Packet Forwarding Engines (non-Enhanced Scaling and Enhanced Scaling FPCs), you can configure PLP bit copying for ingress and egress unicast and multicast traffic. To configure, include the **copy-plp-all** statement at the **[edit class-of-service]** hierarchy level.

Example: Overriding the Default PLP on M320 Routers

The following example shows a two-step procedure to override the default PLP settings on M320 routers:

1. The following example specifies that while the DSCP code points are 110, the loss priority is set to **high**; however, on M320 routers, overriding the default PLP this way has no effect.

```
class-of-service {
  classifiers {
    dscp ba-classifier {
```



```
        forwarding-class expedited-forwarding {  
            loss-priority high code-points 110;  
        }  
    }  
}
```

2. For M320 routers, this multifield classifier sets the PLP.

```
firewall {  
    filter ef-filter {  
        term ef-multifield {  
            from {  
                precedence 6;  
            }  
            then {  
                loss-priority high;  
                forwarding-class expedited-forwarding;  
            }  
        }  
    }  
}
```

- Related Documentation**
- [Packet Loss Priority Configuration Overview on page 5](#)
 - [Configuring Schedulers](#)

Configuring RED Drop Profiles

You enable RED by applying a drop profile to a scheduler. When RED is operational on an interface, the queue no longer drops packets from the tail of the queue. Rather, packets are dropped after they reach the head of the queue.

To configure a drop profile, include the **drop-profiles** statement at the **[edit class-of-service]** hierarchy level:

```
[edit class-of-service]  
drop-profiles {  
    profile-name {  
        fill-level percentage drop-probability percentage;  
        interpolate {  
            drop-probability [ values ];  
            fill-level [ values ];  
        }  
    }  
}
```

In this configuration, include either the **interpolate** statement and its options, or the fill-level and drop-probability **percentage** values. These two alternatives enable you to configure either each drop probability at up to 64 fill-level/drop-probability paired values, or a profile represented as a series of line segments, as discussed in [“RED Drop Profiles Overview” on page 3](#).

After you configure a drop profile, you must assign the drop profile to a drop-profile map, and assign the drop-profile map to a scheduler, as discussed in *Configuring Drop Profile Maps for Schedulers*.

Configuring Weighted RED Buffer Occupancy

By default, RED is performed based on instantaneous buffer occupancy information. However, IQ-PICs can be configured to use *weighted average* buffer occupancy information. This option is configured on a per-PIC basis and applies to the following IQ-PICs:

- Channelized T1/T3
- Channelized E1/E3
- Channelized OC3/STM1
- Channelized OC12

If you configure this feature on an unsupported PIC, you see an error message.

If you configure this feature on a channelized OC12 intelligent queuing (IQ) interface, the PIC reboots.

When weighted average buffer occupancy is configured, you configure a weight value for averaged buffer occupancy calculations. This weight value is expressed as a negative exponential value of 2 in a fractional expression. For example, a configured weight value of 2 would be expressed as $1/(2^2) = 1/4$. If a configured weight value was configured as 1 (the default), the value would be expressed as $1/(2^1) = 1/2$.

This calculated weight value is applied to the instantaneous buffer occupancy value to determine the new value of the weighted average buffer occupancy. The formula to derive the new weighted average buffer occupancy is:

new average buffer occupancy = weight value * instantaneous buffer occupancy + (1 – weight value) * current average buffer occupancy

For example, if the weight exponent value is configured as 3 (giving a weight value of $1/2^3 = 1/8$), the formula used to determine the new average buffer occupancy based on the instant buffer usage is:

new average buffer occupancy = $1/8$ * instantaneous buffer occupancy + $(7/8)$ * current average buffer occupancy

The valid operational range for the weight value on IQ-PICs is 0 through 31. A value of 0 results in the average buffer occupancy being the same as the instantaneous buffer occupancy calculations. Values higher than 31 can be configured, but in these cases the current maximum *operational* value of 31 is used for buffer occupancy calculations.



NOTE: The `show interfaces` command with the `extensive` option displays the *configured* value for the RED buffer occupancy weight exponent. However, in all such cases, the current *operational* maximum value of 31 is used internally.

To configure a Q-PIC for RED weighted average buffer occupancy calculations, include the **red-buffer-occupancy** statement with the **weighted-averaged** option at the **[edit chassis fpc slot-number pic pic-number]** hierarchy level:

```
[edit chassis]
fpc slot-number {
  pic pic-number {
    red-buffer-occupancy {
      weighted-averaged [ instant-usage-weight-exponent exponent-number ];
    }
  }
}
```

**Related
Documentation**

- [Example: Configuring Weighted RED Buffer Occupancy on page 14](#)
- [red-buffer-occupancy on page 23](#)

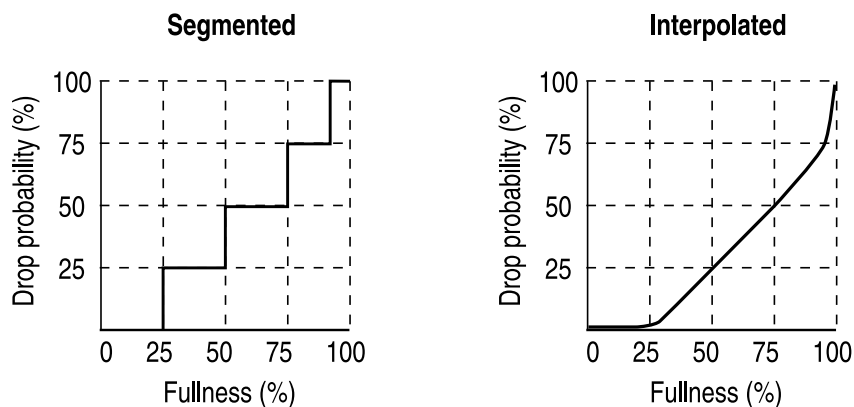
Examples

- [Example: Configuring RED Drop Profiles on page 13](#)
- [Example: Configuring Weighted RED Buffer Occupancy on page 14](#)

Example: Configuring RED Drop Profiles

Create a segmented configuration and an interpolated configuration that correspond to the graphs in [Figure 2 on page 13](#). The values defined in the configuration are matched to represent the data points in the graph line. In this example, the drop probability is 25 percent when the queue is 50 percent full. The drop probability increases to 50 percent when the queue is 75 percent full.

Figure 2: Segmented and Interpolated Drop Profiles



Creating a Segmented Configuration

```
class-of-service {
  drop-profiles {
    segmented-style-profile {
      fill-level 25 drop-probability 25;
      fill-level 50 drop-probability 50;
      fill-level 75 drop-probability 75;
      fill-level 95 drop-probability 100;
    }
  }
}
```

To create the profile's graph line, the software begins at the bottom-left corner, representing a 0 percent fill level and a 0 percent drop probability. This configuration

draws a line directly to the right until it reaches the first defined fill level, 25 percent for this configuration. The software then continues the line vertically until the first drop probability is reached. This process is repeated for all of the defined levels and probabilities until the top-right corner of the graph is reached.

Create a smoother graph line by configuring the profile with the **interpolate** statement. This allows the software to automatically generate 64 data points on the graph beginning at (0, 0) and ending at (100, 100). Along the way, the graph line intersects specific data points, which you define as follows:

Creating an Interpolated Configuration	<pre>class-of-service { drop-profiles { interpolated-style-profile { interpolate { fill-level [50 75]; drop-probability [25 50]; } } } }</pre>
---	--

Example: Configuring Weighted RED Buffer Occupancy

Configure the Q-PIC to use a weight value of 1/2 in average buffer occupancy calculations.

```
[edit chassis]
fpc 0 {
  pic 1 {
    red-buffer-occupancy {
      weighted-averaged instant-usage-weight-exponent 1;
    }
  }
}
```

or

```
[edit chassis]
fpc 0 {
  pic 1 {
    red-buffer-occupancy {
      weighted-averaged; # the default value is 1 if not specified
    }
  }
}
```

Configure the Q-PIC to use a weight value of 1/4 in average buffer occupancy calculations.

```
[edit chassis]
fpc 0 {
  pic 1 {
    red-buffer-occupancy {
      weighted-averaged instant-usage-weight-exponent 2;
    }
  }
}
```


- Related Documentation**
- [Configuring Weighted RED Buffer Occupancy on page 11](#)
 - [red-buffer-occupancy on page 23](#)

CHAPTER 4

Configuration Statements

- [copy-plp-all](#) on page 17
- [drop-probability \(Interpolated Value\)](#) on page 18
- [drop-probability \(Percentage\)](#) on page 18
- [drop-profiles \(Class-of-Service\)](#) on page 19
- [fill-level \(Interpolated Value\)](#) on page 20
- [fill-level \(Drop Profiles\)](#) on page 21
- [interpolate](#) on page 22
- [red-buffer-occupancy](#) on page 23

[copy-plp-all](#)

Syntax	<code>copy-plp-all;</code>
Hierarchy Level	<code>[edit class-of-service]</code>
Release Information	Statement introduced in Junos OS Release 10.3.
Description	Enable PLP bit copying for ingress and egress for unicast and multicast traffic when traffic is ingressing one FPC and egressing the other (from E3-FPC to non-E3 FPC on M320 routers, or from ES-FPC to non-ES FPC on T Series routers).
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Packet Loss Priority Configuration Overview on page 5• Setting Packet Loss Priority on page 9

drop-probability (Interpolated Value)

Syntax	<code>drop-probability [values];</code>
Hierarchy Level	[edit class-of-service drop-profiles <i>profile-name</i> interpolate]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
Description	Define up to 64 values for interpolating drop probabilities on Juniper Networks M320 Multiservice Edge Routers and T Series Core Routers. On EX Series switches, this statement is supported only on the EX9200 switch, EX8200 standalone switches, and EX8200 Virtual Chassis.
Options	percentage —The probability (expressed in percentage) for a packet to be dropped from the queue. Range: 0 through 100
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Default Drop Profile on page 5

drop-probability (Percentage)

Syntax	<code>drop-probability <i>percentage</i>;</code>
Hierarchy Level	[edit class-of-service drop-profiles <i>profile-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Define drop probability percentage on Juniper Networks M320 Multiservice Edge Routers and T Series Core Routers.
Options	percentage —Probability that a packet is dropped, expressed as a percentage. A value of 0 means that a packet is never dropped, and a value of 100 means that all packets are dropped. Range: 0 through 100 percent
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Default Drop Profile on page 5

drop-profiles (Class-of-Service)

Syntax	<pre> drop-profiles { profile-name { fill-level percentage drop-probability percentage; interpolate { drop-probability [values]; fill-level [values] } } } </pre>
Hierarchy Level	[edit class-of-service]
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced before Junos OS 11.4 for EX Series switches.</p>
Description	<p>Define drop profiles for RED.</p> <p>For a packet to be dropped, it must match the drop profile. When a packet arrives, RED checks the queue fill level. If the fill level corresponds to a nonzero drop probability, the RED algorithm determines whether to drop the packet.</p>
Options	<p>profile-name—Name of the drop profile.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring RED Drop Profiles on page 10 • Understanding CoS Tail Drop Profiles • Example: Configuring CoS on EX Series Switches • Configuring CoS Tail Drop Profiles (CLI Procedure)

fill-level (Interpolated Value)

Syntax	fill-level [<i>values</i>];
Hierarchy Level	[edit class-of-service drop-profiles <i>profile-name</i> interpolate]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
Description	Define up to 64 values for interpolating queue fill level. On EX Series switches, this statement is supported only on EX8200 standalone switches and EX8200 Virtual Chassis.
Options	values —Data points for mapping queue fill percentage. Range: 0 through 100 Default: In the default tail drop profile, when the fill level is 0 percent, the drop probability is 0 percent. When the fill level is 100 percent, the drop probability is 100 percent.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• RED Drop Profiles Overview on page 3• Configuring RED Drop Profiles on page 10.• Understanding CoS Tail Drop Profiles• Configuring CoS Tail Drop Profiles (CLI Procedure)


fill-level (Drop Profiles)

Syntax	<code>fill-level <i>percentage</i>;</code>
Hierarchy Level	[edit class-of-service drop-profiles <i>profile-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
Description	When configuring RED, map the fullness of a queue to a drop probability.
Options	<p><i>percentage</i>—How full the queue is, expressed as a percentage. You configure the fill-level and drop-probability statements in pairs. To specify multiple fill levels, include multiple fill-level and drop-probability statements. The values you assign to each statement pair must increase relative to the previous pair's values. This is shown in the segmented graph in "RED Drop Profiles Overview" on page 3.</p> <p>Range: 0 through 100 percent</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • RED Drop Profiles Overview on page 3 • Configuring RED Drop Profiles on page 10 • Understanding CoS Tail Drop Profiles • Configuring CoS Tail Drop Profiles (CLI Procedure)

interpolate

Syntax	<pre>interpolate { drop-probability [values]; fill-level [values]; }</pre>
Hierarchy Level	[edit class-of-service drop-profiles <i>profile-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
Description	<p>Specify values for interpolating relationship between queue fill level and drop probability.</p> <p>On EX Series switches, this statement is supported only on EX8200 standalone switches and EX8200 Virtual Chassis.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• See Configuring RED Drop Profiles on page 10.• <i>Understanding Junos OS CoS Components for EX Series Switches</i>

red-buffer-occupancy

Syntax	<pre>red-buffer-occupancy { weighted-averaged [instant-usage-weight-exponent <i>exponent-value</i>]; }</pre>
Hierarchy Level	<pre>[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>], [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i>]</pre>
Release Information	Statement introduced in Junos OS Release 8.3.
Description	<p>Configure the IQ PIC to base random early detection (RED) queue management on a <i>simple moving average</i> buffer occupancy calculation. If you do not include this statement, the IQ PIC bases RED on an <i>instantaneous</i> buffer occupancy value. As an option, you can specify that the IQ PIC bases RED on a <i>weighted moving average</i> of buffer occupancy values.</p> <p>If you configure this feature on a channelized OC12 intelligent queuing (IQ) PIC, the PIC reboots.</p>
Options	<p>weighted-averaged—Configure the IQ PIC to base RED processing on a simple moving average of instantaneous buffer occupancy values instead of an instantaneous buffer occupancy.</p> <p>instant-usage-weight-exponent <i>exponent-value</i>—(Optional) Specify the integer to be used as the negative exponent of 2 to express a weight value. The PIC performs weighted RED (WRED) by based on a calculation of average buffer occupancy that applies the specified weight value to the instantaneous buffer occupancy and then factors the weighted value into the calculation of average buffer occupancy. Valid exponent range is from 1 through 31 (weight values from 2^{-1} through 2^{-31}). If you do not specify this option, the default exponent value is 0, which results in a weight value of $2^0 = 1$. With a weight value of 1, the calculation of weighted average buffer occupancy yields the same value as the simple average buffer occupancy.</p>
<div style="display: flex; align-items: center;">  <div> <p>NOTE: You can specify an exponent value greater than 31, and the value displays in the output of show commands. However, the PIC replaces the out-of-range value with the <i>operational</i> value of 31, which results in a weight value of $2^{-31} = 1 / 2^{31} = 0.0000000004656612873077392578125$.</p> </div> </div>	
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Weighted RED Buffer Occupancy on page 11 • Example: Configuring Weighted RED Buffer Occupancy on page 14

PART 3

Administration

- [Operational Commands on page 27](#)

CHAPTER 5

Operational Commands

- `show class-of-service drop-profile`

show class-of-service drop-profile

Syntax	<code>show class-of-service drop-profile</code> <code><profile-name <i>profile-name</i>></code>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display data points for each class-of-service (CoS) random early detection (RED) drop profile.
Options	none —Display all drop profiles. profile-name <i>profile-name</i> —(Optional) Display the specified profile only.
Required Privilege Level	view
List of Sample Output	show class-of-service drop-profile on page 29 show class-of-service drop-profile (EX4200 Switch) on page 29 show class-of-service drop-profile (EX8200 Switch) on page 29
Output Fields	Table 3 on page 28 describes the output fields for the show class-of-service drop-profile command. Output fields are listed in the approximate order in which they appear.

Table 3: show class-of-service drop-profile Output Fields

Field Name	Field Description
Drop profile	Name of a drop profile.
Type	Type of drop profile: <ul style="list-style-type: none"> discrete (default) interpolated (EX8200 switches only)
Index	Internal index of this drop profile.
Fill Level	Percentage fullness of a queue.
Drop probability	Drop probability at this fill level.

Sample Output

show class-of-service drop-profile

```

user@host> show class-of-service drop-profile
Drop profile: <default-drop-profile>, Type: discrete, Index: 1
  Fill level    Drop probability
    100         100
Drop profile: user-drop-profile, Type: interpolated, Index: 2989
  Fill level    Drop probability
     0           0
     1           1
     2           2
     4           4
     5           5
     6           6
     8           8
    10          10
    12          15
    14          20
    15          23
... 64 entries total
    90          96
    92          96
    94          97
    95          98
    96          98
    98          99
    99          99
   100         100

```

show class-of-service drop-profile (EX4200 Switch)

```

user@switch> show class-of-service drop-profile
Drop profile: <default-drop-profile>, Type: discrete, Index: 1
  Fill level
    100
Drop profile: dp1, Type: discrete, Index: 40496
  Fill level
    10

```

show class-of-service drop-profile (EX8200 Switch)

```

user@switch> show class-of-service drop-profile
Drop profile: <default-drop-profile>, Type: discrete, Index: 1
  Fill level    Drop probability
    100         100
Drop profile: dp1, Type: interpolated, Index: 40496
  Fill level    Drop probability
     0           0
     1          80
     2          90
     4          90
     5          90
     6          90
     8          90
    10          90
    12          91
    14          91
    15          91
    16          91

```


18	91
20	91
22	92
24	92
25	92
26	92
28	92
30	92
32	93
34	93
35	93
36	93
38	93
40	93
42	94
44	94
45	94
46	94
48	94
49	94
51	95
52	95
54	95
55	95
56	95
58	95
60	95
62	96
64	96
65	96
66	96
68	96
70	96
72	97
74	97
75	97
76	97
78	97
80	97
82	98
84	98
85	98
86	98
88	98
90	98
92	99
94	99
95	99
96	99
98	99
99	99
100	100
Drop profile: dp2, Type: discrete, Index: 40499	
Fill level	Drop probability
10	5
50	50

PART 4

Index

- [Index on page 33](#)

Index

Symbols

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

B

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

C

classification	
behavior aggregate	
example configuration.....	9
overriding the default PLP.....	9
multifield	
example configuration.....	9
comments, in configuration statements.....	xii
conventions	
text and syntax.....	xi
copy-plp-all statement.....	17
CoS	
drop profile.....	3
RED.....	3
RED profile information, displaying.....	28
curly braces, in configuration statements.....	xii
customer support.....	xiii
contacting JTAC.....	xiii

D

default	
drop profiles.....	5
documentation	
comments on.....	xiii
drop profiles	
default.....	5
example.....	13

drop profiles, displaying data points.....	28
drop-probability statement	
usage guidelines.....	10
drop-profiles statement.....	19
usage guidelines.....	10

E

example	
drop profiles.....	13
weighted RED.....	14

F

fill-level statement	
usage guidelines.....	10
font conventions.....	xi

I

interpolate statement.....	22
usage guidelines.....	10

M

manuals	
comments on.....	xiii

O

overview	
packet loss priority.....	5

P

packet loss priority	
overview.....	5
parentheses, in syntax descriptions.....	xii
PLP See packet loss priority	

R

random early detection.....	28
random early detection mechanism See RED	
RED	
drop-probability statement	
usage guidelines.....	10
drop-profiles statement	
usage guidelines.....	10
weighted	
configuring.....	11
RED buffer occupancy weight	
configuring.....	11
RED drop profiles, displaying.....	28
RED, weighted	
example.....	14

red-buffer-occupancy statement.....	23
usage guidelines.....	11

S

show class-of-service drop-profile command.....	28
support, technical See technical support	
syntax conventions.....	xi

T

technical support	
contacting JTAC.....	xiii

W

weighted RED	
configuring.....	11
example.....	14