

# RED Drop Profiles on EX9200 Switches



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# About the Documentation

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## Documentation and Release Notes

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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

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

- EX Series

## Using the Examples in This Manual

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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 xi defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

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

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

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

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

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

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

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

- Download the latest versions of software and review release notes:  
<http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications:  
<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/>

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- 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

- [Managing Congestion Using RED Drop Profiles and Packet Loss Priorities on page 3](#)
- [Managing Congestion by Setting Packet Loss Priority for Different Traffic Flows on page 5](#)

### Managing Congestion Using RED Drop Profiles and Packet Loss Priorities

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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 *Managing Congestion on the Egress Interface by 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 packet 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](#).

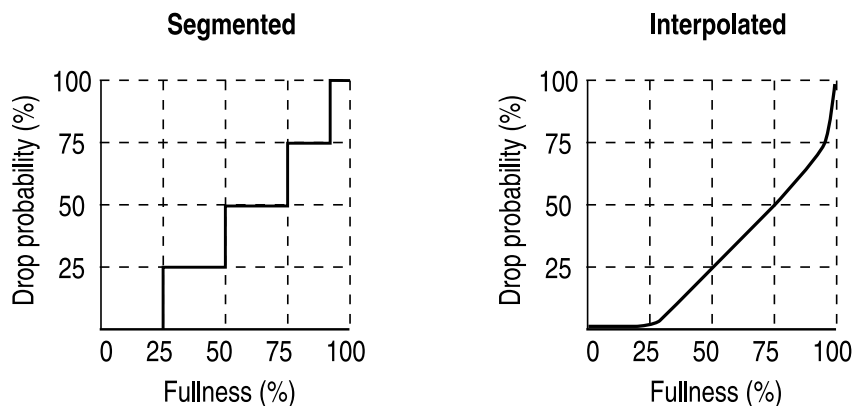
The maximum number of queue fullness levels supported per drop profile is based on the line card:

- 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**



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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.

*Loss priorities* allow you to set the priority of dropping a packet. Loss priority affects the scheduling of a packet without affecting the packet's relative ordering. You can use the packet loss priority (PLP) bit as part of a congestion control strategy. You can use the loss priority setting to identify packets that have experienced congestion. Typically you mark packets exceeding some service level with a high loss priority. You set loss priority by configuring a classifier or a policer. The loss priority is used later in the workflow to select one of the drop profiles used by RED.

You specify drop probabilities in the drop profile section of the class-of-service (CoS) configuration hierarchy and map them to corresponding loss priorities 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 ];
    }
  }
}
```

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 21](#)
  - [drop-probability \(Percentage\)](#)

## Managing Congestion by Setting Packet Loss Priority for Different Traffic Flows

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 *Understanding How Behavior Aggregate Classifiers Prioritize Trusted Traffic* and *Overview of Assigning Service Levels to Packets Based on Multiple Packet Header Fields*.

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 Packet Loss Priority*.

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;
      }
    }
  }
}
```

### Mapping PLP to RED Drop Profiles

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.

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

- [Defining Packet Drop Behavior by Configuring RED Drop Profiles on page 11](#)
- [Determining Packet Drop Behavior by Configuring Drop Profile Maps for Schedulers](#)
- [Configuring Schedulers](#)



## PART 2

# Configuration

- [Configuration Tasks on page 11](#)
- [Examples on page 15](#)
- [Configuration Statements on page 17](#)





## CHAPTER 2

# Configuration Tasks

- [Defining Packet Drop Behavior by Configuring RED Drop Profiles on page 11](#)
- [Managing Transient Traffic Bursts by Configuring Weighted RED Buffer Occupancy on page 13](#)

## Defining Packet Drop Behavior by 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.

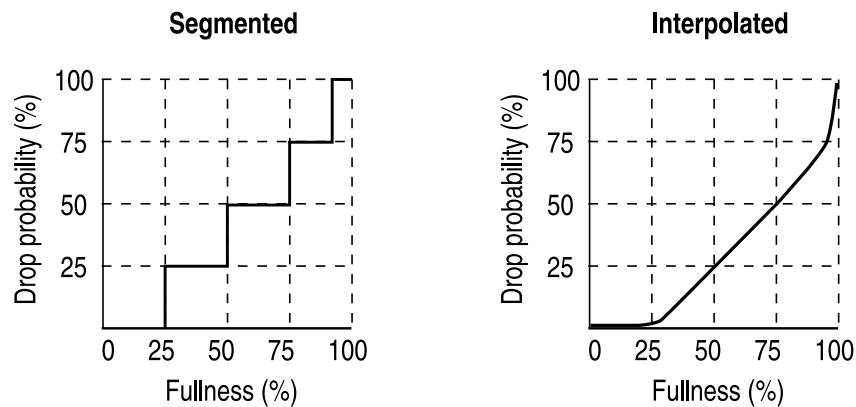
To configure a drop profile, include the **drop-profiles** statement at the **[edit class-of-service]** hierarchy level:

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

To configure a drop profile, 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 [“Managing Congestion Using RED Drop Profiles and Packet Loss Priorities” on page 3](#).

For example, the following shows a segmented configuration and an interpolated configuration that correspond to the graphs in [Figure 2 on page 12](#). The values defined in the configuration are matched to represent the data points in the graph line.

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 this profile's segmented 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.

You can 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

```
class-of-service {
  drop-profiles {
    interpolated-style-profile {
      interpolate {
        fill-level [ 50 75 ];
        drop-probability [ 25 50 ];
      }
    }
  }
}
```

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 *Determining Packet Drop Behavior by Configuring Drop Profile Maps for Schedulers*.

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**Related Documentation** • [Managing Congestion Using RED Drop Profiles and Packet Loss Priorities on page 3](#)

## Managing Transient Traffic Bursts by 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: Managing Transient Traffic Bursts by Configuring Weighted RED Buffer Occupancy on page 15](#)
- *red-buffer-occupancy*

## CHAPTER 3

# Examples

- [Example: Managing Transient Traffic Bursts by Configuring Weighted RED Buffer Occupancy on page 15](#)

### Example: Managing Transient Traffic Bursts by 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

- [Managing Transient Traffic Bursts by Configuring Weighted RED Buffer Occupancy on page 13](#)

- *red-buffer-occupancy*

## CHAPTER 4

# Configuration Statements

- [\[edit class-of-service\] Hierarchy Level on page 17](#)
- [drop-probability \(Interpolated Value\) on page 21](#)
- [drop-profiles on page 22](#)
- [fill-level \(Interpolated Value\) on page 23](#)
- [fill-level \(Drop Profiles\) on page 24](#)
- [interpolate on page 24](#)

### [edit class-of-service] Hierarchy Level

```
class-of-service {
  classifiers {
    type classifier-name {
      forwarding-class class-name {
        loss-priority (high | low | medium-high | medium-low) code-points [ aliases bits ];
      }
      import (classifier-name | default);
    }
  }
  code-point-aliases {
    (dscp | dscp-ipv6 | exp | ieee-802.1 | ieee-802.1ad | inet-precedence) {
      alias-name bits;
    }
  }
  drop-profiles {
    profile-name {
      fill-level percentage drop-probability percentage;
      interpolate {
        drop-probability value;
        fill-level value;
      }
    }
  }
  fabric {
    scheduler-map {
      priority (high | low) scheduler scheduler-name;
    }
  }
  forwarding-class-map {
    map-name {
```

```

        class class-name queue-num queue-number <restricted-queue queue-number>;
    }
}
forwarding-classes {
    class class-name policing-priority (normal | premium) queue-num queue-number
        priority (high | low);
    queue queue-number class-name policing-priority (normal | premium) priority (high |
        low);
}
forwarding-policy {
    class class-name {
        classification-override {
            forwarding-class class-name;
        }
    }
    next-hop-map map-name {
        forwarding-class class-name {
            discard;
            lsp-next-hop [ lsp-regular-expressions ];
            next-hop [ next-hop-names ];
            non-lsp-next-hop;
        }
    }
}
fragmentation-maps {
    map-name {
        forwarding-class class-name {
            drop-timeout milliseconds;
            fragment-threshold bytes;
            multilink-class number;
            no-fragmentation;
        }
    }
}
host-outbound-traffic {
    dscp-code-point value;
    forwarding-class class-name;
    ieee-802.1 {
        default value;
        rewrite-rules;
    }
    tcp {
        raise-internet-control-priority;
    }
}
interfaces {
    ... the interfaces subhierarchy appears after the main [edit class-of-service] hierarchy
    ...
}
}
restricted-queues {
    forwarding-class class-name queue-number;
}
rewrite-rules {
    (dscp | dscp-ipv6 | exp | frame-relay-de | ieee-802.1 | ieee-802.1ad | inet-precedence)
    rewrite-rule {

```



```

        forwarding-class class-name {
            loss-priority level code-point (alias | bits);
        }
        import (rewrite-rule | default);
    }
}
routing-instances routing-instance-name {
    classifiers {
        dscp (classifier-name | default);
        dscp-ipv6 (classifier-name | default);
        exp (classifier-name | default);
        ieee-208.1 (classifier-name | default | encapsulated | vlan-tag (inner | outer));
    }
}
scheduler-maps {
    map-name {
        forwarding-class class-name scheduler scheduler-name;
    }
}
schedulers {
    scheduler-name {
        adjust-minimum value;
        adjust-percent value;
        buffer-size (exact | percent percentage | remainder);
        drop-profile-map loss-priority (any | high | low | medium-high | medium-low)
            protocol any;
        excess-priority (high | low | medium-high | medium-low);
        excess-rate (percent percentage | proportion proportion);
        priority (high | low | medium-high | medium-low | strict-high);
        shaping-rate (bps | percent percentage | burst-size size);
        transmit-rate (bps | percent percentage | remainder) <exact | rate-limit>;
    }
}
traceoptions {
    file <files number> <match regular-expression> <size maximum-file-size>
        <world-readable | no-world-readable>;
    flag flag;
    no-remote-trace;
}
traffic-control-profiles {
    profile-name {
        adjust-minimum rate;
        delay-buffer-rate (bps | cps cps | percent percentage);
        excess-rate (percent percentage | proportion value);
        guaranteed-rate (bps | percent percentage) <burst-size bytes>;
        overhead-accounting (frame-mode | cell-mode) <bytes byte-value>;
        scheduler-map map-name;
        shaping-rate (bps | percent percentage) <burst-size bytes>;
    }
}
tri-color;
}

class-of-service {
    interfaces {
        interface-name {

```

```

excess-bandwidth-share (equal | proportional value);
input-excess-bandwidth-share (equal | proportional value);
input-scheduler-map map-name;
input-shaping-rate bps;
input-traffic-control-profile profile-name;
output-forwarding-class-map map-name;
output-traffic-control-profile profile-name;
scheduler-map map-name;
scheduler-map-chassis (map-name | derived);
shaping-rate bps;
unit (logical-unit-number | *){
  classifiers {
    dscp (classifier-name | default) {
      family [ inet mpls ];
    }
    dscp-ipv6 (classifier-name | default) {
      family [ inet mpls ];
    }
    exp (classifier-name | default);
    ieee-208.1 (classifier-name | default) <vlan-tag (inner | outer)>;
    ieee-208.1ad (classifier-name | default);
    inet-precedence (classifier-name | default);
  }
  forwarding-class class-name;
  input-scheduler-map map-name;
  input-shaping-rate bps;
  input-traffic-control-profile profile-name shared-instance instance-name;
  loss-priority-maps {
    (map-name | default);
  }
  loss-priority-rewrites {
    (map-name | default);
  }
  output-forwarding-class-map map-name;
  output-traffic-control-profile profile-name shared-instance instance-name;
  rewrite-rules {
    dscp (rule-name | default) <protocol mpls>;
    dscp-ipv6 (rule-name | default);
    exp (rule-name | default) <protocol [ mpls-any | mpls-inet-both |
      mpls-inet-both-non-vpn ]>;
    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>;
  }
  scheduler-map map-name;
  shaping-rate bps;
  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 (equal | proportional value);
  input-excess-bandwidth-share (equal | proportional value);
  input-traffic-control-profile profile-name;

```

```

        input-traffic-control-profile-remaining profile-name;
        internal-node;
        output-traffic-control-profile profile-name;
        output-traffic-control-profile-remaining profile-name;
    }
}

```

**Related Documentation** • [Notational Conventions Used in Junos OS Configuration Hierarchies](#)

## drop-probability (Interpolated Value)

<b>Syntax</b>	<code>drop-probability [<i>values</i>];</code>
<b>Hierarchy Level</b>	[edit class-of-service <a href="#">drop-profiles</a> <i>profile-name</i> <a href="#">interpolate</a> ]
<b>Release Information</b>	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
<b>Description</b>	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.
<b>Options</b>	<b><i>percentage</i></b> —The probability (expressed in percentage) for a packet to be dropped from the queue. <b>Range:</b> 0 through 100
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	• <a href="#">Managing Congestion Using RED Drop Profiles and Packet Loss Priorities on page 3</a>

## drop-profiles

---

<b>Syntax</b>	<pre>drop-profiles {   profile-name {     fill-level percentage drop-probability percentage;     interpolate {       drop-probability [values];       fill-level [values]     }   } }</pre>
<b>Hierarchy Level</b>	[edit class-of-service]
<b>Release Information</b>	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
<b>Description</b>	<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>
<b>Options</b>	<p><i>profile-name</i>—Name of the drop profile.</p> <p>The remaining statements are explained separately.</p>
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Defining Packet Drop Behavior by Configuring RED Drop Profiles on page 11</a></li></ul>

## fill-level (Interpolated Value)

---

<b>Syntax</b>	fill-level [ <i>values</i> ];
<b>Hierarchy Level</b>	[edit class-of-service <b>drop-profiles</b> <i>profile-name</i> interpolate]
<b>Release Information</b>	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
<b>Description</b>	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.
<b>Options</b>	<b>values</b> —Data points for mapping queue fill percentage. <b>Range:</b> 0 through 100 <b>Default:</b> 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.
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Managing Congestion Using RED Drop Profiles and Packet Loss Priorities on page 3</a></li> <li>• <a href="#">Defining Packet Drop Behavior by Configuring RED Drop Profiles on page 11.</a></li> </ul>

## fill-level (Drop Profiles)

---

<b>Syntax</b>	<code>fill-level <i>percentage</i>;</code>
<b>Hierarchy Level</b>	[edit class-of-service <a href="#">drop-profiles</a> <i>profile-name</i> ]
<b>Release Information</b>	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
<b>Description</b>	When configuring RED, map the fullness of a queue to a drop probability.
<b>Options</b>	<b><i>percentage</i></b> —How full the queue is, expressed as a percentage. You configure the <b>fill-level</b> and <b>drop-probability</b> statements in pairs. To specify multiple fill levels, include multiple <b>fill-level</b> and <b>drop-probability</b> 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 " <a href="#">Managing Congestion Using RED Drop Profiles and Packet Loss Priorities</a> " on page 3. <b>Range:</b> 0 through 100 percent
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Managing Congestion Using RED Drop Profiles and Packet Loss Priorities on page 3</a></li><li>• <a href="#">Defining Packet Drop Behavior by Configuring RED Drop Profiles on page 11</a></li></ul>

## interpolate

---

<b>Syntax</b>	<pre>interpolate {   <a href="#">drop-probability</a> [<i>values</i>];   <a href="#">fill-level</a> [<i>values</i>]; }</pre>
<b>Hierarchy Level</b>	[edit class-of-service <a href="#">drop-profiles</a> <i>profile-name</i> ]
<b>Release Information</b>	Statement introduced before Junos OS Release 7.4. Statement introduced before Junos OS 11.4 for EX Series switches.
<b>Description</b>	Specify values for interpolating relationship between queue fill level and drop probability.  On EX Series switches, this statement is supported only on EX8200 standalone switches and EX8200 Virtual Chassis.  The remaining statements are explained separately.
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• See <a href="#">Defining Packet Drop Behavior by Configuring RED Drop Profiles on page 11</a>.</li></ul>