



Low Latency Queueing with Priority Percentage Support

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This feature allows you to configure bandwidth as a percentage within low latency queueing (LLQ). Specifically, you can designate a percentage of the bandwidth to be allocated to an entity (such as a physical interface, a shaped ATM permanent virtual circuit [PVC], or a shaped Frame Relay PVC to which a policy map is attached). Traffic associated with the policy map will then be given priority treatment.

This feature also allows you to specify the percentage of bandwidth to be allocated to nonpriority traffic classes. It modifies two existing commands--**bandwidth** and **priority**--and provides additional functionality to the way that bandwidth can be allocated using these two commands.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for LLQ with Priority Percentage Support



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Dropping Excess Traffic

If the incoming high priority traffic exceeds the bandwidth percentage calculated by the **priority percent** command, and there is congestion in the network, the excess traffic is dropped. This is identical to the behavior demonstrated when the **priority** command uses bandwidth in kbps. In both cases, if the high priority traffic exceeds the bandwidth, and there is congestion in the network, excess traffic is dropped.

Exceeding the Configured Bandwidth Percentage Calculated by the **bandwidth percent** and **priority percent** Commands

By default, when the **bandwidth percent** and **priority percent** commands are used to allocate bandwidth, the sum of the bandwidth percentage allocated to the high priority traffic and the bandwidth percentage allocated to the nonpriority traffic cannot exceed 99 percent of the total bandwidth available on the interface.

The remaining 1 percent of the total bandwidth available on the interface is kept in reserve for the unclassified traffic and routing traffic, if any, and is proportionally divided among the defined traffic classes.

Information About LLQ with Priority Percentage Support

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Benefits of LLQ with Priority Percentage Support

This feature allows the Cisco IOS XE Software to accommodate networks with a large number of interfaces, all with differing bandwidths. This feature is useful when all of those interfaces with differing bandwidths need to be associated with a policy map that allocates proportional bandwidths to multiple classes.

Additionally, configuring bandwidth in percentages is most useful when the underlying link bandwidth is unknown or the relative class bandwidth distributions are known. For interfaces that have adaptive shaping rates (such as available bit rate [ABR] virtual circuits), CBWFQ can be configured by configuring class bandwidths in percentages.

Changes to the **bandwidth** Command for LLQ with Priority Percentage Support

This feature adds a new keyword to the **bandwidth** command--**remaining percent**. The feature also changes the functionality of the existing **percent** keyword. These changes result in the following commands for bandwidth: **bandwidth percent** and **bandwidth remaining percent**.

The **bandwidth percent** command configures bandwidth as an absolute percentage of the total bandwidth on the interface.

The **bandwidth remaining percent** command allows you to allocate bandwidth as a relative percentage of the total bandwidth available on the interface. This command allows you to specify the relative percentage of the bandwidth to be allocated to the classes of traffic. For instance, you can specify that 30 percent of the

available bandwidth be allocated to class1, and 60 percent of the bandwidth be allocated to class2. Essentially, you are specifying the ratio of the bandwidth to be allocated to the traffic class. In this case, the ratio is 1 to 2 (30 percent allocated to class1 and 60 percent allocated to class2). The sum of the numbers used to indicate this ratio cannot exceed 100 percent. This way, you need not know the total amount of bandwidth available, just the relative percentage you want to allocate for each traffic class.

Each traffic class gets a minimum bandwidth as a relative percentage of the remaining bandwidth. The remaining bandwidth is the bandwidth available after the priority queue, if present, is given its required bandwidth, and after any Resource Reservation Protocol (RSVP) flows are given their requested bandwidth.

Because this is a relative bandwidth allocation, the packets for the traffic classes are given a proportionate weight only, and no admission control is performed to determine whether any bandwidth (in kbps) is actually available. The only error checking that is performed is to ensure that the total bandwidth percentages for the classes do not exceed 100 percent.

For more information about how this feature defines and calculates bandwidth, see the [Bandwidth Calculations in LLQ with Priority Percentage Support, page 3](#) section of this document. For the `bandwidth` command syntax description and usage guidelines, see the Cisco IOS Quality of Service Solutions Command Reference.

Changes to the `priority` Command for LLQ with Priority Percentage Support

This feature also adds the `percent` keyword to the `priority` command. The `priority percent` command indicates that the bandwidth will be allocated as a percentage of the total bandwidth of the interface. You can then specify the percentage (that is, a number from 1 to 100) to be allocated by using the *percentage* argument with the `priority percent` command.

Unlike the `bandwidth` command, the `priority` command provides a strict priority to the traffic class, which ensures low latency to high priority traffic classes.

Bandwidth Calculations in LLQ with Priority Percentage Support

When the `bandwidth` and `priority` commands calculate the total amount of bandwidth available on an entity, the following guidelines are invoked:

- If the entity is a physical interface, the total bandwidth is the bandwidth on the physical interface.
- If the entity is a shaped ATM PVC, the total bandwidth is calculated as follows:
 - For a variable bit rate (VBR) VC, the average shaping rate is used in the calculation.
 - For an available bit rate (ABR) VC, the minimum shaping rate is used in the calculation.

How to Configure LLQ with Priority Percentage Support

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Specifying the Bandwidth Percentage

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map*
4. **class** {*class-name***class-default**}
5. **priority** {*bandwidth-kbps* | **percent** *percentage*} [*burst*]
6. **bandwidth** {*bandwidth-kbps* | **percent** *percentage* | **remaining percent** *percentage*}
7. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2 configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3 policy-map <i>policy-map</i> Example: Router(config)# policy-map policy1	Specifies the name of the policy map to be created or modified. Enters policy-map configuration mode. <ul style="list-style-type: none"> • Enter the policy map name.
Step 4 class { <i>class-name</i> class-default }	Specifies the class so that you can configure or modify its policy. Enters policy-map class configuration mode. <ul style="list-style-type: none"> • Enter the class name.
Step 5 priority { <i>bandwidth-kbps</i> percent <i>percentage</i> } [<i>burst</i>] Example: Router(config-pmap-c)# priority percent 10	Gives priority to a class of traffic belonging to the policy map. <ul style="list-style-type: none"> • Enter the priority percentage.

Command or Action	Purpose
<p>Step 6 bandwidth { <i>bandwidth-kbps</i> percent <i>percentage</i> remaining percent <i>percentage</i> }</p> <p>Example:</p> <pre>Router(config-pmap-c)# bandwidth percent 30</pre>	<p>Specifies the bandwidth for a class of traffic belonging to the policy map.</p> <ul style="list-style-type: none"> Enter the bandwidth percentage.
<p>Step 7 end</p> <p>Example:</p> <p>Example:</p> <pre>Router(config-pmap-c)# end</pre>	<p>(Optional) Exits policy-map class configuration mode and returns to privileged EXEC mode.</p>

Verifying the Bandwidth Percentage

SUMMARY STEPS

- enable
- show policy-map *policy-map*
- show policy-map *policy-map* class *class-name*
- show policy-map interface *type number*
- exit

DETAILED STEPS

Command or Action	Purpose
<p>Step 1 enable</p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> Enter your password if prompted.
<p>Step 2 show policy-map <i>policy-map</i></p> <p>Example:</p> <pre>Router# show policy-map policy1</pre>	<p>(Optional) Displays the configuration of all classes for a specified service policy map or the configuration of all classes for all existing policy maps</p> <ul style="list-style-type: none"> Enter the name of the policy map whose complete configuration is to be displayed.

Command or Action	Purpose
<p>Step 3 <code>show policy-map <i>policy-map</i> class <i>class-name</i></code></p> <p>Example:</p> <pre>Router# show policy-map policy1 class class1</pre>	<p>(Optional) Displays the configuration for the specified class of the specified policy map.</p> <ul style="list-style-type: none"> Enter the policy map name and the class name.
<p>Step 4 <code>show policy-map interface <i>type number</i></code></p> <p>Example:</p> <pre>Router# show policy-map interface serial4/0/0</pre>	<p>(Optional) Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.</p> <ul style="list-style-type: none"> Enter the interface type and number.
<p>Step 5 <code>exit</code></p> <p>Example:</p> <pre>Router# exit</pre>	<p>(Optional) Exits privileged EXEC mode.</p>

Configuration Examples for LLQ with Priority Percentage Support

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Example Specifying the Bandwidth Percentage

The following example uses the **priority percent** command to specify a bandwidth percentage of 10 percent for the class called voice-percent. Then the **bandwidth remaining percent** command is used to specify a bandwidth percentage of 30 percent for the class called data1 and a bandwidth percentage of 20 percent for the class called data2.

```
Router> enable
Router# configure terminal
Router(config)# policy-map policy1
Router(config-pmap)# class voice-percent
Router(config-pmap-c)# priority percent 10
Router(config-pmap-c)# exit
Router(config-pmap)# class data1
Router(config-pmap-c)# bandwidth remaining percent 30
Router(config-pmap-c)# exit
Router(config-pmap)# class data2
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# end
```

As a result of this configuration, 10 percent of the interface bandwidth is guaranteed for the class called voice-percent. The classes called data1 and data2 get 30 percent and 20 percent of the remaining bandwidth, respectively.

Example Mixing the Units of Bandwidth for Nonpriority Traffic

If a particular unit (that is, kbps or percentages) is used when specifying the bandwidth for a specific class of nonpriority traffic, the same bandwidth unit must be used when specifying the bandwidth for the other nonpriority classes in that policy map. The bandwidth units within the same policy map must be identical. However, the unit for the **priority** command in the priority class can be different from the bandwidth unit of the nonpriority class. The same configuration can contain multiple policy maps, however, which in turn can use different bandwidth units.

The following sample configuration contains three policy maps--policy1, policy2, and policy3. In the policy map called policy1 and the policy map called policy2, the bandwidth is specified by percentage. However, in the policy map called policy3, bandwidth is specified in kbps.

```
Router> enable
Router# configure terminal
Router(config)# policy-map policy1
Router(config-pmap)# class voice-percent
Router(config-pmap-c)# priority percent 10
Router(config-pmap-c)# exit
Router(config-pmap)# class data1
Router(config-pmap-c)# bandwidth percent 30
Router(config-pmap-c)# exit
Router(config-pmap)# class data2
Router(config-pmap-c)# bandwidth percent 20
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map policy2
Router(config-pmap)# class voice-percent
Router(config-pmap-c)# priority percent 10
Router(config-pmap-c)# exit
Router(config-pmap)# class data1
Router(config-pmap-c)# bandwidth remaining percent 30
Router(config-pmap-c)# exit
Router(config-pmap)# class data2
Router(config-pmap-c)# bandwidth remaining percent 20
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map policy3
Router(config-pmap)# class voice-percent
Router(config-pmap-c)# priority 500
Router(config-pmap-c)# exit
Router(config-pmap)# class data1
Router(config-pmap-c)# bandwidth 30
Router(config-pmap-c)# exit
Router(config-pmap)# class data2
Router(config-pmap-c)# bandwidth 20
Router(config-pmap-c)# end
```

Example Verifying the Bandwidth Percentage

The following sample output from the **show policy-map interface** command shows that 50 percent of the interface bandwidth is guaranteed for the class called class1 and that 25 percent is guaranteed for the class called class2. The output displays the amount of bandwidth as both a percentage and a number of kbps.

```
Router# show policy-map interface
serial3/2/0
Serial3/2/0
Service-policy output:policy1
Class-map:class1 (match-all)
```

```

0 packets, 0 bytes
5 minute offered rate 0 bps, drop rate 0 bps
Match:none
Weighted Fair Queueing
  Output Queue:Conversation 265
  Bandwidth 50 (%)
  Bandwidth 772 (kbps) Max Threshold 64 (packets)
  (pkts matched/bytes matched) 0/0
  (depth/total drops/no-buffer drops) 0/0/0
Class-map:class2 (match-all)
0 packets, 0 bytes
5 minute offered rate 0 bps, drop rate 0 bps
Match:none
Weighted Fair Queueing
  Output Queue:Conversation 266
  Bandwidth 25 (%)
  Bandwidth 386 (kbps) Max Threshold 64 (packets)
  (pkts matched/bytes matched) 0/0
  (depth/total drops/no-buffer drops) 0/0/0
Class-map:class-default (match-any)
0 packets, 0 bytes
5 minute offered rate 0 bps, drop rate 0 bps
Match:any

```

In this example, serial interface s3/2/0 has a total bandwidth of 1544 kbps. During periods of congestion, 50 percent (or 772 kbps) of the link bandwidth is guaranteed to the class called class1, and 25 percent (or 386 kbps) of the link bandwidth is guaranteed to the class called class2.

Additional References

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Quality of Service Solutions Command Reference</i>
LLQ	"Applying QoS Features Using the MQC" module

Standards

Standards	Title
No new or modified standards are supported, and support for existing standards has not been modified.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE Software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported, and support for existing RFCs has not been modified.	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for LLQ with Priority Percentage Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 **Feature Information for Low Latency Queueing with Priority Percentage Support**

Feature Name	Releases	Feature Information
Low Latency Queueing with Priority Percentage Support	Cisco IOS XE Release 2.1	<p>This feature allows you to configure bandwidth as a percentage within low latency queueing (LLQ). Specifically, you can designate a percentage of the bandwidth to be allocated to an entity (such as a physical interface, a shaped ATM permanent virtual circuit [PVC], or a shaped Frame Relay PVC to which a policy map is attached). Traffic associated with the policy map will then be given priority treatment.</p> <p>This feature was implemented on the Cisco ASR 1000 Series Routers.</p> <p>The following commands were introduced or modified: bandwidth(policy-map class), priority.</p>

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