



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.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the “[Feature Information for LLQ with Priority Percentage Support](#)” section on [page 11](#).

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Contents

- [Restrictions for LLQ with Priority Percentage Support, page 2](#)
- [Information About LLQ with Priority Percentage Support, page 2](#)
- [How to Configure LLQ with Priority Percentage Support, page 4](#)



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- [Configuration Examples for LLQ with Priority Percentage Support, page 6](#)
- [Additional References, page 9](#)
- [Command Reference, page 10](#)
- [Feature Information for LLQ with Priority Percentage Support, page 11](#)

Restrictions for LLQ with Priority Percentage Support

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 75 percent of the total bandwidth available on the interface.

The remaining 25 percent of the total bandwidth available on the interface is kept in reserve for the unclassified traffic and routing traffic, if any, and proportionally divided among the defined traffic classes. To override the 75 percent limitation, use the **max-reserved bandwidth** command in interface configuration mode.



Note

The **max-reserved bandwidth** command is intended for use on main interfaces only; it has no effect on virtual circuits (VCs) or ATM permanent virtual circuits (PVCs).

Information About LLQ with Priority Percentage Support

To configure the Low Latency Queueing with Priority Percentage Support feature, you should understand the following concepts:

- [Benefits of LLQ with Priority Percentage Support, page 3](#)
- [Changes to the bandwidth Command for LLQ with Priority Percentage Support, page 3](#)
- [Changes to the priority Command for LLQ with Priority Percentage Support, page 3](#)
- [Bandwidth Calculations in LLQ with Priority Percentage Support, page 4](#)

Benefits of LLQ with Priority Percentage Support

This feature allows the Cisco IOS 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](#)” 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.

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

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.
- If the entity is a shaped Frame Relay PVC, the total bandwidth is calculated as follows:
 - If a minimum acceptable committed information rate (minCIR) is not configured, the CIR divided by two is used in the calculation.
 - If a minimum acceptable CIR is configured, the minCIR setting is used in the calculation.

For more information on bandwidth allocation, see the “[Congestion Management Overview](#)” module.

How to Configure LLQ with Priority Percentage Support

This section contains the following procedures.

- [Specifying the Bandwidth Percentage](#) (required)
- [Verifying the Bandwidth Percentage](#) (optional)

Specifying the Bandwidth Percentage

To specify the bandwidth percentage, perform the following steps.

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. Names can be a maximum of 40 alphanumeric characters.
Step 4	class { <i>class-name</i> class-default } Example: Router(config-pmap)# class class1	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.
Step 6	bandwidth { <i>bandwidth-kbps</i> percent <i>percentage</i> remaining percent <i>percentage</i> } Example: Router(config-pmap-c)# bandwidth percent 30	Specifies the bandwidth for a class of traffic belonging to the policy map. <ul style="list-style-type: none"> Enter the bandwidth percentage.
Step 7	end Router(config-pmap-c)# end	(Optional) Exits policy-map class configuration mode and returns to privileged EXEC mode.

Verifying the Bandwidth Percentage

To verify the bandwidth percentage, use one or more of the **show** commands listed in the following steps.

SUMMARY STEPS

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

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	show policy-map <i>policy-map</i> Example: Router# show policy-map policy1	(Optional) Displays the configuration of all classes for a specified service policy map or the configuration of all classes for all existing policy maps <ul style="list-style-type: none">• Enter the name of the policy map whose complete configuration is to be displayed. The name can be a maximum of 40 alphanumeric characters.
Step 3	show policy-map <i>policy-map</i> class <i>class-name</i> Example: Router# show policy-map policy1 class class1	(Optional) Displays the configuration for the specified class of the specified policy map. <ul style="list-style-type: none">• Enter the policy map name and the class name.
Step 4	show policy-map interface <i>type number</i> Example: Router# show policy-map interface serial4/0	(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. <ul style="list-style-type: none">• Enter the interface type and number.
Step 5	exit Example: Router# exit	(Optional) Exits privileged EXEC mode.

Configuration Examples for LLQ with Priority Percentage Support

This section provides the following configuration examples:

- [Specifying the Bandwidth Percentage: Example, page 6](#)
- [Mixing the Units of Bandwidth for Nonpriority Traffic: Example, page 7](#)
- [Verifying the Bandwidth Percentage, page 5](#)

Specifying the Bandwidth Percentage: Example

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.

Mixing the Units of Bandwidth for Nonpriority Traffic: Example

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
```

Verifying the Bandwidth Percentage: Example

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 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

Serial3/2

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, interface s3/2 has a total bandwidth of 1544 kbps. During periods of congestion, 50 percent (or 772 kbps) of the 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.



Note

The counters displayed for classes configured with **bandwidth** or **priority** after using the **show policy-map interface** command are updated only if congestion is present on the interface.

Additional References

The following sections provide references related to the Low Latency Queueing with Priority Percentage Support feature.

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	Cisco IOS Quality of Service Solutions Command Reference
Congestion management concepts and related topics	“Congestion Management Overview” module
LLQ, bandwidth allocation	“Configuring Weighted Fair Queueing” 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 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
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/techsupport</p>

Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS Quality of Service Solutions Command Reference* at http://www.cisco.com/en/US/docs/ios/qos/command/reference/qos_book.html. For information about all Cisco IOS commands, use the Command Lookup Tool at <http://tools.cisco.com/Support/CLILookup> or the *Cisco IOS Master Command List, All Releases*, at http://www.cisco.com/en/US/docs/ios/mcl/allreleasemcl/all_book.html.

- **bandwidth** (policy-map class)
- **priority**

Feature Information for LLQ with Priority Percentage Support

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

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Note

Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

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

Feature Name	Releases	Feature Information
Low Latency Queueing with Priority Percentage Support	12.2(2)T 12.0(28)S 12.2(28)SB	<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>In 12.2(2)T, this feature was introduced.</p> <p>In 12.0(28)S, this feature was integrated into Cisco IOS Release 12.0(28)S.</p> <p>In 12.2(28)SB, this feature was integrated into Cisco IOS Release 12.2(28)SB.</p> <p>The following commands were introduced or modified: bandwidth (policy-map class), priority.</p>

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