



Configuring Layer 3 Subinterface Queuing

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Restrictions for Layer 3 Subinterface Queuing

- Subinterface Queuing is supported only on Cisco Catalyst 9500X Series Switches.
- Subinterface queuing is supported only on Layer 3 subinterfaces.
- Queuing policy is not supported on port channels or subinterfaces of port channels.
- Subinterface queuing supports a maximum of two queues—priority traffic class (class 7) and nonpriority traffic class (class default).
- Subinterface queuing is not supported for multicast traffic.
- Queued traffic on subinterfaces cannot be re-marked on the main interface using the re-mark policy.
- Hierarchical queuing is supported on the subinterface with this restriction—the parent policy can contain only class-default, which can have shape or bandwidth remaining ratio or both shape and bandwidth remaining ratio.
- Shaping is only supported in:
 - Priority traffic class for child or non-HQoS queuing policy.
 - Class-default for parent policy in HQoS policy.
- Bandwidth remaining ratio is not supported for queue policies with priority level defined.
- Bandwidth remaining ratio is only supported in the parent class of the HQoS queuing policy on subinterfaces.
- Traffic on all the subinterfaces without queuing policy applied, flows through the main interface queues, while traffic for the subinterfaces with queuing policy applied, flows through their respective queues.

- For direct, connected interfaces with defined IP addresses, traffic does not flow through subinterface queues but through the main interface queue. For indirect connected interfaces, traffic flows through subinterface queues.
- The **no switchport** command should be run to configure layer 3 subinterfaces.
- If a policy is applied on any of the subinterfaces, you cannot apply or remove a policy on the main interface without removing the policy on the subinterface. You can only modify the policy on the main interface.
- Queuing policy maps can be applied to a maximum of 400 Layer 3 subinterfaces.
- When HQoS is enabled on a subinterface, and the parent is configured with shape rate value (in percent), then the parent shape rate value is calculated using the main interface physical bandwidth as the reference bandwidth.
- When queuing policy is enabled on a subinterface, the subinterface queuing packet drop statistics are not reflected in the total packet drop statistics at the main interface level.

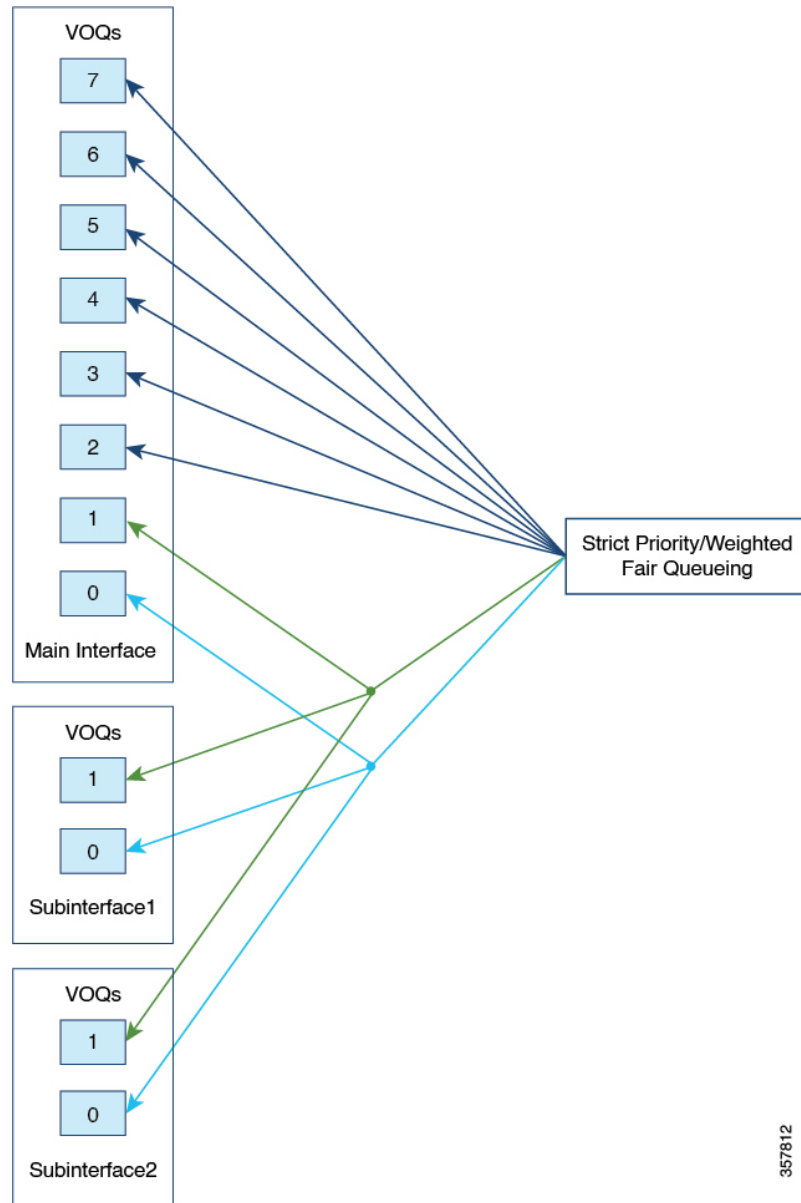
Information About Layer 3 Subinterface Queuing

The following sections describe different queuing modes of layer 3 subinterface.

Default Queuing Mode

In default queuing mode, the main interface queue configuration has absolute priority control over and above the subinterface queues. The main interface has 8 queues (7 to 0 in order) by default, which can be configured in any of [pP(8-p)Q, where p=1 to 7, P=priority, and Q=queue] combination. The subinterface has 2 queues (Q1 and Q0) that map to or share the priority level with queues (Q1 and Q0) of the main interface. Therefore, these subinterface queues are lower in priority when compared to the main interface queues based on the policy applied on the main interface.

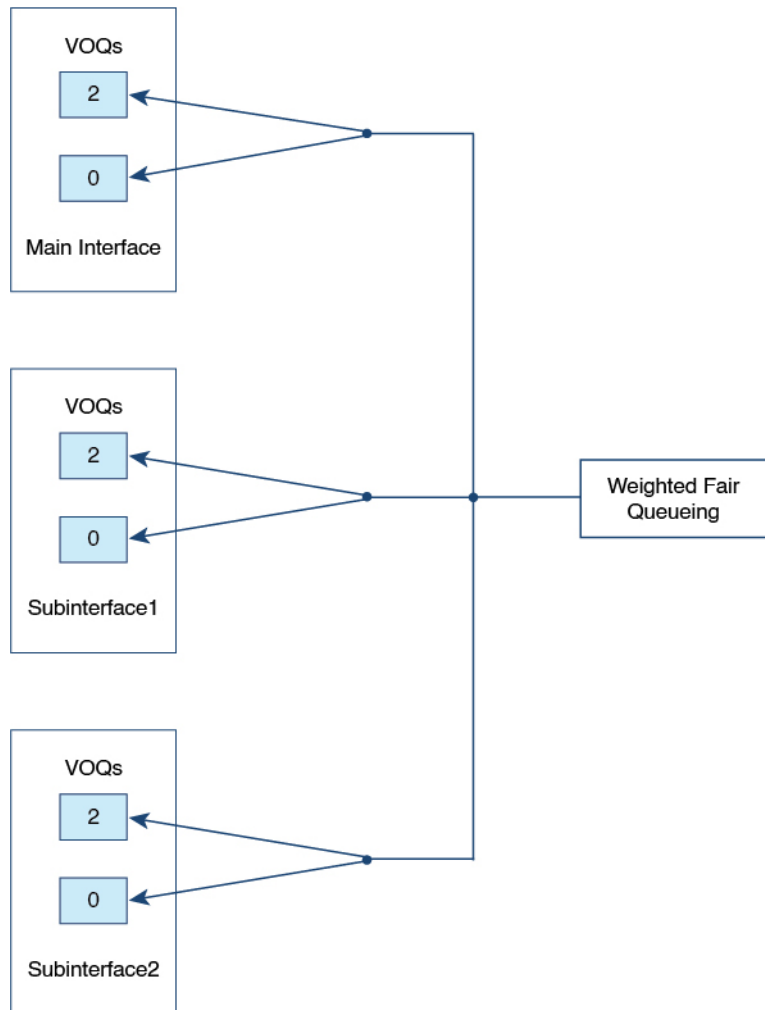
Figure 1: Default Queuing Mode



Subinterface Propagation Queuing Mode

In this mode, the main interface queues are treated and configured just as any other subinterface queue, and all behavior and restriction of the subinterface queues are applicable to the main interface queue as well. A queue of same priority level across the main interface and subinterface(s) contend for bandwidth or priority at the same level. Further, in this mode the user can configure bandwidth distribution ratio between the main interface and subinterface(s). The user cannot change the mode of the main interface while queuing policy is applied on the main interface.

Figure 2: Subinterface Propagation Queuing Mode



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Hierarchical QoS

The following HQoS configuration options are supported.

- Port shaper: Port shaper is used to limit or shape the overall transmission rate for a given port (main or subinterface). Port shaper is supported via HQoS queuing policy on the main interface and subinterface(s) with shaper configured on the parent policy.
 - Main interface: Port shaper applied on the main interface is applicable to all subinterfaces.



Note This is applicable only if the main interface is not in priority propagation mode. If the main interface is in priority propagation mode, then it is treated as a subinterface and its shaper value will not be applicable to the subinterfaces.

- Subinterface: Port shaper is applied only to the subinterface on which port shaper policy is applied.

- Port bandwidth distribution ratio among subinterfaces: Port bandwidth remaining ratio is used to govern or configure bandwidth distribution ratio between subinterfaces. Port bandwidth remaining ratio is supported using the **bandwidth remaining ratio** command which is configured on the parent policy applied on the subinterface.

Port bandwidth remaining ratio is also supported between the main interface and subinterface, when subinterface priority propagation mode is enabled.

A maximum of 7 ratio values are supported, and so even if there are several subinterfaces under a main interface, there can be at-most 7 absolute bandwidth distribution ratio value between them.



Note The value of port shaper set on the main interface will be the maximum allowed value on subinterfaces even if a higher port shaper value is defined on the subinterfaces.

How to Configure Layer 3 Subinterface Queuing

The following sections provide configuration information about layer 3 subinterface queuing.

Enabling Subinterface Queuing Policy

This procedure provides the steps of how to enable subinterface queuing policy.

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	class-map {match-any match-all} {class name} Example: Device(config)# class-map match-all traffic-class7	Enters class map configuration mode. <ul style="list-style-type: none"> • Creates a class map to be used for matching packets to the class whose name you specify. • match-any: Any one of the match criteria must be met for traffic entering the traffic class to be classified as part of it.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • match-all: All of the match criteria must be met for traffic entering the traffic class to be classified as part of the traffic class. <p>Note match-all is the default. If match-any or match-all is not explicitly defined, match-all is chosen by default.</p>
Step 4	<p>match traffic-class <i>traffic class value</i></p> <p>Example:</p> <pre>Device(config-cmap)# match traffic-class 7</pre>	<p>Matches QoS traffic class value (from 1 to 7).</p> <p>Note Only traffic-class 7 is supported for queueing on subinterfaces. If it is not a subinterface queue, you can perform steps 3 and 4 to create class maps for all traffic classes (7 to 1), and attach these to queue policy-maps.</p>
Step 5	<p>exit</p> <p>Example:</p> <pre>Device(config-cmap)# exit</pre>	Exits class map configuration mode and enters global configuration mode.
Step 6	<p>policy-map type queueing <i>policy name</i></p> <p>Example:</p> <pre>Device(config)# policy-map type queueing subif_q_policy</pre>	Specifies the name of the main interface queueing profile policy and enters policy map configuration mode.
Step 7	<p>class <i>class-name</i></p> <p>Example:</p> <pre>Device(config-pmap)# class traffic-class7</pre>	<p>Specifies the name of the class to be associated with the policy and enters policy class map configuration mode. Command options for policy class map configuration mode include the following:</p> <ul style="list-style-type: none"> • <i>word</i>: Class map name. • class-default: System default class matching any otherwise unclassified packets.
Step 8	<p>shape average {<i>Kb/s</i> percent}</p> <p>Example:</p> <pre>Device(config-pmap-c)# shape average percent 10</pre>	<p>Configures the traffic shaping average. The parameters include:</p> <ul style="list-style-type: none"> • <i>Kb/s</i>: Use this command to configure a specific value. The range is 1.2 Mbps to 400 Gbps.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • percent: Allocates a maximum bandwidth to a particular class. The queue can oversubscribe bandwidth in case other queues do not utilize the entire port bandwidth. The total sum cannot exceed 100 percent, and in case it is less than 100 percent, the rest of the bandwidth is divided along all non-priority queues based on bandwidth remaining ratio.
Step 9	priority level <i>level</i> Example: Device(config-pmap-c) # priority level 1	Configures multi-level priority queue.
Step 10	exit Example: Device(config-pmap-c) # exit	Exits policy class map configuration mode and enters class map configuration mode.
Step 11	exit Example: Device(config-pmap) # exit	Exits policy map configuration mode and enters global configuration mode.
Step 12	interface <i>interface-id</i> Example: Device(config) # interface HundredGigE1/0/9	Identifies the main interface and enters interface configuration mode.
Step 13	no switchport Example: Device(config-if) # no switchport	Switches the interface that is in Layer 2 mode into Layer 3 mode for Layer 3 configuration.
Step 14	exit Example: Device(config-if) # exit	Exits interface configuration mode and enters global configuration mode.
Step 15	interface <i>interface-id.subinterface-id</i> Example: Device(config) # interface HundredGigE1/0/9.1	Identifies the subinterface and enters subinterface configuration mode.

	Command or Action	Purpose
Step 16	encapsulation dot1Q <i>vlan-id</i> Example: Device(config-subif)# encapsulation dot1Q 11	Enables IEEE 802.1Q encapsulation of traffic on the subinterface.
Step 17	service-policy type queuing output <i>policy name</i> Example: Device(config-subif)# service-policy type queuing output subif_q_policy	Attaches two queue policy-map to the subinterface.
Step 18	end Example: Device(config-subif)# end	Returns to privileged EXEC mode.

Enabling Subinterface Priority Propagation Mode

This procedure provides the steps of enable subinterface priority propagation mode on the main interface.

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	interface <i>interface-id</i> Example: Device(config)# interface HundredGigE1/0/23	Identifies the main interface and enters interface configuration mode.
Step 4	no switchport Example: Device(config-if)# no switchport	Switches the main interface that is in Layer 2 mode into Layer 3 mode for Layer 3 configuration.

	Command or Action	Purpose
Step 5	queuing mode sub-interface priority-propagation Example: <pre>Device(config-if)# queuing mode sub-interface priority-propagation</pre>	Enables subinterface priority propagation mode. Note This mode can be enabled only when no policy is applied on the main interface.
Step 6	end Example: <pre>Device(config-subif)# end</pre>	Exits subinterface configuration mode and returns to privileged EXEC mode.

Configuring Hierarchical QoS Policy on Subinterface

This procedure provides the steps to configure HQoS policy on a subinterface.

Procedure

	Command or Action	Purpose
Step 1	enable Example: <pre>Device> enable</pre>	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	configure terminal Example: <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 3	class-map match-all {classname} Example: <pre>Device(config)# class-map match-all traffic-class7</pre>	Configures the class-map to match all criterias for traffic entering the traffic class, and enters class map configuration mode.
Step 4	match traffic-class class value Example: <pre>Device(config-cmap)# match traffic-class 7</pre>	Matches QoS traffic class value.
Step 5	exit Example: <pre>Device(config-cmap)# exit</pre>	Exits class map configuration mode and enters global configuration mode.

	Command or Action	Purpose
Step 6	policy-map type queueing <i>child policy name</i> Example: <pre>Device(config)# policy-map type queueing child</pre>	Specifies the child queueing profile policy and enters policy map configuration mode.
Step 7	class <i>class-name</i> Example: <pre>Device(config-pmap)# class traffic-class7</pre>	Specifies the name of the class to be associated with the policy and enters policy class map configuration mode. Command options for policy class map configuration mode include the following: <ul style="list-style-type: none"> • <i>word</i>: Class map name. • class-default: System default class matching any otherwise unclassified packets.
Step 8	shape average { <i>Kb/s</i> percent } Example: <pre>Device(config-pmap-c)# shape average 1000000</pre>	Configures the traffic shaping average. The parameters include: <ul style="list-style-type: none"> • <i>Kb/s</i>: Use this command to configure a specific value. The range is 1.2 Mbps to 400 Gbps. • percent: Allocates a maximum bandwidth to a particular class.
Step 9	priority level <i>level</i> Example: <pre>Device(config-pmap-c)# priority level 1</pre>	Specifies the priority level of the queue.
Step 10	exit Example: <pre>Device(config-pmap-c)# exit</pre>	Exits policy class map configuration mode and enters class map configuration mode.
Step 11	exit Example: <pre>Device(config-pmap)# exit</pre>	Exits policy map configuration mode and enters global configuration mode.
Step 12	policy-map type queueing <i>parent policy name</i> Example: <pre>Device(config)# policy-map type queueing parent</pre>	Specifies the parent queueing profile policy and enters policy map configuration mode.

	Command or Action	Purpose
Step 13	class class-default Example: Device(config-pmap) # class class-default	Specifies the class default to be associated with the parent policy and enters policy class map configuration mode.
Step 14	shape average {port shaper value} {Kb/s percent} Example: Device(config-pmap-c) # shape average 2000000000	Configures the traffic shaping average.
Step 15	service-policy child policy-map name Example: Device(config-pmap-c) # service-policy child	Configures the QoS service policy of the child.
Step 16	exit Example: Device(config-pmap-c) # exit	Exits policy class map configuration mode and enters class map configuration mode.
Step 17	exit Example: Device(config-pmap) # exit	Exits policy map configuration mode and enters global configuration mode.
Step 18	interface interface-id Example: Device(config) # interface HundredGigE1/0/5	Identifies the interface and enters interface configuration mode.
Step 19	no switchport Example: Device(config-if) # no switchport	Switches the interface that is in Layer 2 mode into Layer 3 mode for Layer 3 configuration.
Step 20	exit Example: Device(config-pmap) # exit	Exits interface configuration mode and enters global configuration mode.
Step 21	interface interface-id.subinterface-id Example:	Identifies the subinterface and enters subinterface configuration mode.

	Command or Action	Purpose
	Device (config) # interface HundredGigE1/0/5.1	
Step 22	encapsulation dot1Q <i>vlan-id</i> Example: Device (config-if) # encapsulation dot1Q 11	Enables IEEE 802.1Q encapsulation of traffic on the subinterface.
Step 23	service-policy type queueing output <i>parent</i> <i>policy name</i> Example: Device (config-if) # service-policy type queueing output parent	Attaches the parent queue policy-map to the subinterface.
Step 24	end Example: Device (config-if) # end	Returns to privileged EXEC mode.

Configuration Examples for Layer 3 Subinterface Queuing

The following sections provide configuration examples for Layer 3 subinterface queuing.

Example: Enabling Subinterface Queuing Policy

The following is an example of how to enable subinterface queuing policy.

```
Device# configure terminal
Device (config) # class-map match-all traffic-class7
Device (config-cmap) # match traffic-class 7
Device (config) # policy-map type queueing llq
Device (config-pmap) # class traffic-class7
Device (config-pmap-c) # shape average percent 10
Device (config-pmap-c) # priority level 1
Device (config-pmap-c) # exit
Device (config-pmap) # exit
Device (config) # interface HundredGigE1/0/9
Device (config-if) # no switchport
Device (config-if) # exit
Device (config) # interface HundredGigE1/0/9.1
Device (config-subif) # encapsulation dot1Q 11
Device (config-subif) # service-policy type queueing output subif_q_policy
Device (config-subif) # end
```

Example: Enabling Subinterface Priority Propagation Mode

The following is an example of how to enable subinterface priority propagation mode.

```
Device# configure terminal
Device(config)# interface HundredGigE1/0/23
Device(config-if)# no switchport
Device(config-if)# queuing mode sub-interface priority-propagation
Device(config-subif)# end
```

Example: Configuring Hierarchical QoS Policy on Subinterface

The following is an example of how to configure hierarchical QoS policy on subinterface.

```
Device# configure terminal
Device(config)# class-map match-all traffic-class7
Device(config-cmap)# match traffic-class 7
Device(config-cmap)# exit
Device(config)# policy-map type queueing child
Device(config-pmap)# class traffic-class7
Device(config-pmap-c)# shape average 1000000
Device(config-pmap-c)# priority level 1
Device(config-pmap-c)# exit
Device(config-pmap)# exit
Device(config)# policy-map type queueing parent
Device(config-pmap)# class class-default
Device(config-pmap-c)# shape average 2000000000
Device(config-pmap-c)# service-policy child
Device(config-pmap-c)# exit
Device(config-pmap)# exit
Device(config)# interface HundredGigE1/0/5
Device(config-if)# no switchport
Device(config-pmap)# exit
Device(config)# interface HundredGigE1/0/5.1
Device(config-if)# encapsulation dot1q 11
Device(config-if)# service-policy type queueing output parent
Device(config-if)# end
```

The following is an example of how to configure hierarchical QoS bandwidth remaining ratio on subinterface.

```
Device# configure terminal
Device(config)# class-map match-all traffic-class7
Device(config-cmap)# match traffic-class 7
Device(config-cmap)# exit
Device(config)# policy-map type queueing child
Device(config-pmap)# class traffic-class7
Device(config-pmap-c)# shape average 1000000
Device(config-pmap-c)# priority level 1
Device(config-pmap-c)# exit
Device(config-pmap)# exit
Device(config)# policy-map type queueing parent_ratio_5
Device(config-pmap)# class class-default
Device(config-pmap-c)# bandwidth remaining ratio 5
Device(config-pmap-c)# service-policy child
Device(config-pmap-c)# exit
Device(config-pmap)# exit
Device(config)# policy-map type queueing parent_ratio_10
Device(config-pmap)# class class-default
```

```

Device(config-pmap-c) # bandwidth remaining ratio 10
Device(config-pmap-c) # service-policy child
Device(config-pmap-c) # exit
Device(config-pmap) # exit
Device(config) # interface HundredGigE1/0/5
Device(config-if) # no switchport
Device(config-pmap) # exit
Device(config) # interface HundredGigE1/0/5.1
Device(config-if) # encapsulation dot1Q 11
Device(config-if) # service-policy type queueing output parent_ratio_5
Device(config-if) # exit
Device(config) # interface HundredGigE1/0/5.2
Device(config-if) # encapsulation dot1Q 15
Device(config-if) # service-policy type queueing output parent_ratio_10
Device(config-if) # end

```

Monitoring Layer 3 Subinterface Queuing Configuration

The following commands can be used to monitor layer 3 subinterface queuing configuration on the device.

Command	Description
show policy-map type queueing interface <i>interface-id[.subinterface]</i>	Displays the runtime representation and statistics of all the queueing policies configured on the device.
show running interface <i>interface-id[.subinterface]</i>	Displays the configured interface and values under it.
show running policy-map <i>name</i>	Displays a list of the policy maps along with traffic class information.

Feature History for Layer 3 Subinterface Queuing

This table provides release and related information for features explained in this module.

These features are available on all the releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Cupertino 17.8.1	Layer 3 Subinterface Queuing	Queuing support on Layer 3 subinterfaces has been introduced on the C9500X-28C8D model of the Cisco Catalyst 9500 Series Switches.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to [Cisco Feature Navigator](#).