Quality of Service Policies Aggregation

The Quality of Service Policies Aggregation (QoS Policies Aggregation) feature allows the default traffic classes of different policy maps on the same physical interface to be configured as a single traffic class within the Modular QoS CLI.

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 QoS Policies Aggregation, on page 16.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 module.

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.

Prerequisites for QoS Policies Aggregation

This feature is configured using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC). It is most useful in QoS configurations where several policy maps attached to the same physical interface want identical treatment of multiple default traffic classes in different policy maps.

Restrictions for QoS Policies Aggregation

This feature only works when multiple policy maps are attached to the same physical interface. This feature cannot be used to collectively classify default traffic classes of policy maps on different physical interfaces.

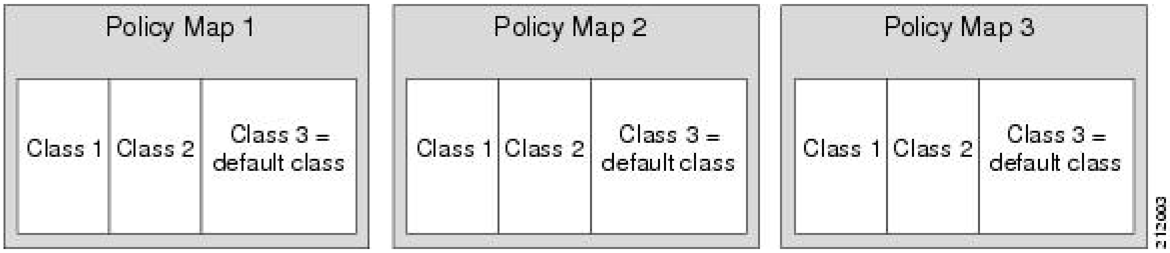
Information About QoS: Policies Aggregation

Understanding Fragments in Class Definition Statements

The QoS Policies Aggregation feature introduces the idea of fragments in class definition statements. A default traffic class definition statement can be marked as a fragment within a policy map. Other policy maps on the same interface can also define their default traffic class statements as fragments, if desired. A separate policy map can then be created with a service fragment class definition statement that will be used to apply QoS to all of the fragments as a single group.

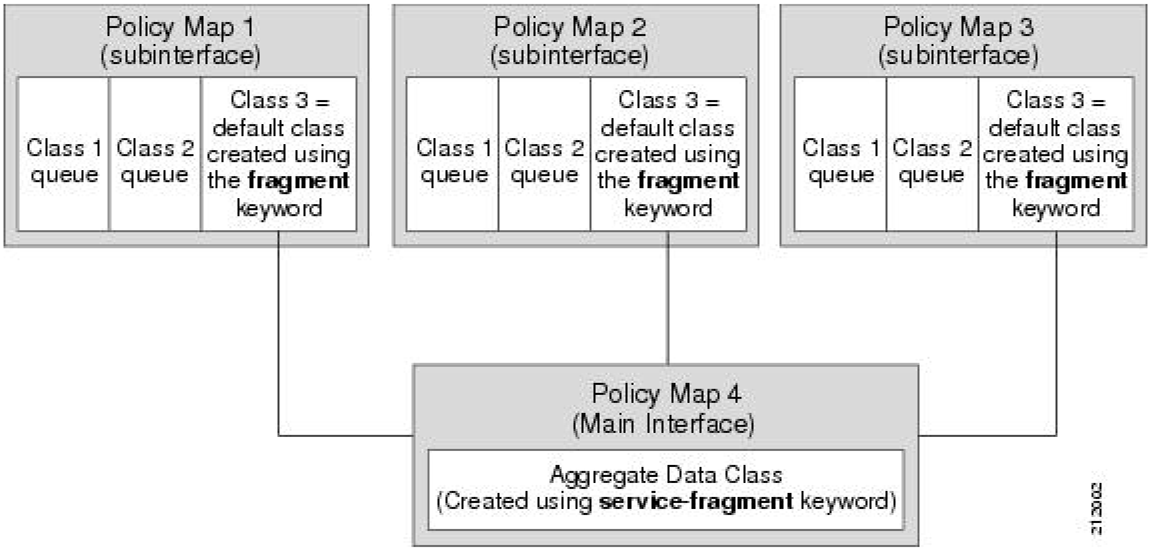
The figure below provides an example of one physical interface with three attached policy maps that is not using fragments. Note that each policy map has a default traffic class that can classify traffic only for the default traffic within its own policy map.

Figure 1: Physical Interface with Policy Maps—Not Using Fragments



The figure below shows the same configuration configured with fragments, and adds a fourth policy map with a class definition statement that classifies the fragments collectively. The default traffic classes are now classified as one service fragment group rather than three separate default traffic classes within the individual policy maps.

Figure 2: Physical Interface with Policy Maps—Using Fragments


Policy Map 1
(subinterface)
Class 1 queue
Class 2 queue
Class 3 = default class created using the **fragment** keyword
Policy Map 2
(subinterface)
Class 1 queue
Class 2 queue
Class 3 = default class created using the **fragment** keyword
Policy Map 3
(subinterface)
Class 1 queue
Class 2 queue
Class 3 = default class created using the **fragment** keyword
Policy Map 4
(Main Interface)
Aggregate Data Class
(Created using **service-fragment** keyword)
212002

Understanding Fragments for Gigabit Etherchannel Bundles

When fragments are configured for Gigabit Etherchannel bundles, the policy maps that have a default traffic class configured using the **fragment** keyword are attached to the member subinterface links, and the policy maps that have a traffic class configured with the **service-fragment** keyword to collectively classify the fragments is attached to the physical interface.

All port-channel subinterfaces configured with fragments that are currently active on a given port-channel member link will use the aggregate service fragment class on that member link. If a member link goes down, the port-channel subinterfaces that must switch to the secondary member link will then use the aggregate service fragment on the new interface.

How to Configure QoS: Policies Aggregation

How to Configure QoS Policies Aggregation for an Interface

Configuring a Fragment Traffic Class in a Policy Map

Before You Begin

This procedure only shows how to configure the default traffic class as a fragment within a policy map. It does not include steps on configuring other classes within the policy map, or other policy maps on the router.

Like any policy map, the configuration is not managing network traffic until it has been attached to an interface. This procedure does not cover the process of attaching a policy map to an interface.

Note the following points about attaching and removing a policy map:

- To configure QoS Policies Aggregation, you must attach the policy map that contains the **service-fragment** keyword to the main interface first, and then you must attach the policy map that contains the **fragment** keyword to the main interface.
- To disable QoS Policies Aggregation, you must remove the policy map that contains the **fragment** keyword from the subinterface first, and then you must remove the policy map that contains the **service-fragmen**t keyword from the subinterface.

Note Only the default class statement in a policy map can be configured as a fragment.

Fragments only work when multiple policy maps are attached to the same physical interface. This process cannot be used to classify default traffic classes as fragments on policy maps on different physical interfaces.

Only queueing features are allowed in classes where the **fragment** keyword is entered, and at least one queueing feature must be entered in classes where the **fragment** keyword is used.

A policy map with a class using the **fragment** keyword can only be applied to traffic leaving the interface (policy maps attached to interfaces using the **service-policy output** command).

The **fragment** keyword cannot be entered in a child policy map.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class class-default fragment** *fragment-class-name*
5. *qos-queueing-feature*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**policy-map** *policy-map-name* **Example:** `Router(config)# policy-map subscriber1`	Specifies the name of the traffic policy to configure and enters policy map configuration mode.

Step 4	**class class-default fragment** *fragment-class-name*
	Example:
	`Router(config-pmap)#`
	`class class-default fragment BestEffort`
		Specifies the default traffic class as a fragment, and names the fragment traffic class.

Step 5	*qos-queueing-feature*	Enters a QoS configuration command. Only queueing features are supported in default traffic classes configured as fragments. The queueing features that are currently supported are **bandwidth**, **shape**, and **random-detect exponential-weighting-constant**. Multiple QoS queueing commands can be entered.

Example

In the following example, a fragment named BestEffort is created in policy map subscriber1 and policy map subscriber 2.

```
policy-map subscriber1
class voice
set cos 5
priority level 1
class video
set cos 4
priority level 2
class class-default fragment BestEffort
shape average 200000000
bandwidth remaining ratio 10
policy-map subscriber 2
class voice
set cos 5
priority level 1
class video
set cos 4
priority level 2
class class-default fragment BestEffort
shape average 200000000
bandwidth remaining ratio 10
```

What to Do Next

After configuring multiple default class statements as fragments in a policy map, a separate policy map with a class statement using the **service-fragment** keyword must be configured to apply QoS to the class statements configured as fragments.

This process is documented in the Configuring a Service Fragment Traffic Class, on page 6.

Configuring a Service Fragment Traffic Class

This task describes how to configure a service fragment traffic class statement within a policy map. A service fragment traffic class is used to apply QoS to a collection of default class statements that have been configured previously in other policy maps as fragments.

Before You Begin

This procedure assumes that fragment default traffic classes were already created. The procedure for creating fragment default traffic classes is documented in the Configuring a Fragment Traffic Class in a Policy Map, on page 3.

Like any policy map, the configuration is not managing network traffic until it has been attached to an interface. This procedure does not cover the process of attaching a policy map to an interface.

Note

A service fragment can only be used to collectively classify fragments from the same physical interface. Fragments from different interfaces cannot be classified using the same service fragment.

Only queueing features are allowed in classes where the **service-fragment** keyword is entered, and at least one queueing feature must be entered in classes when the **service-fragment** keyword is used.

A policy map with a class using the **service-fragment** keyword can only be applied to traffic leaving the interface (policy maps attached to interfaces using the **service-policy output** command).

A class configured using the **service-fragment** keyword cannot be removed when it is being used to collectively apply QoS to fragments that are still configured on the interface. If you wish to remove a class configured using the **service-fragment** keyword, remove the fragment traffic classes before removing the service fragment.

The **fragment** keyword cannot be entered in a child policy map.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. class class-name service-fragment fragment-class-name
5. *qos-queueing-feature*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**policy-map** *policy-map-name* **Example:** `Router(config)# policy-map BestEffortFragments`	Specifies the name of the traffic policy to configure and enters policy map configuration mode.

Step 4	class class-name service-fragment fragment-class-name
	Example:
	`Router(config-pmap)# class data service-fragment BestEffort`
		Specifies a class of traffic that is the composite of all fragments matching the *fragment-class-name*. The *fragment-class-name* when defining the fragments in other policy maps must match the *fragment-class-name* in this command line to properly configure the service fragment class.

Step 5	*qos-queueing-feature*	Enters a QoS configuration command. Only queueing features are supported in default traffic classes configured as fragments. The queueing features that are currently supported are **bandwidth**, **shape**, and **random-detect exponential-weighting-constant**. Multiple QoS queueing commands can be entered.

Example

In the following example, a policy map is created to apply QoS to all fragments named BestEffort.

```
policy-map main-interface
class data service-fragment BestEffort
shape average 400000000
```

In the following example, two fragments are created and then classified collectively using a service fragment.

```
policy-map subscriber1
class voice
set cos 5
priority level 1
class video
set cos 4
priority level 2
class class-default fragment BestEffort
shape average 200000000
bandwidth remaining ratio 10
policy-map subscriber 2
class voice
set cos 5
priority level 1
class video
set cos 4
```

```
priority level 2
class class-default fragment BestEffort
shape average 200000000
bandwidth remaining ratio 10
policy-map main-interface
class data service-fragment BestEffort
shape average 200000000
shape average 200000000
bandwidth remaining ratio 10
```

Troubleshooting Tips

Ensure that all class statements that should be part of the same service fragment share the same *fragment-class-name*.

What to Do Next

The policy map (traffic policy) must be attached to an interface. This task is documented in the "Attaching a Traffic Policy to an Interface Using the MQC" section in chapter "Applying QoS Features Using the MQC."

How to Configure QoS Policies Aggregation on Gigabit Etherchannels

To properly configure QoS Policies Aggregation on a Gigabit Etherchannel bundle, the following actions must be executed:

- fragment traffic classes have to be configured and attached to the member link subinterfaces
- service fragment traffic classes have to be configured and attached to the main physical interfaces

Configuring Fragments on Gigabit Etherchannel Member Link Subinterfaces

Before You Begin

This procedure assumes that a service fragment traffic class has already been created. A service fragment traffic class cannot be configured without configuring a fragment class. The procedure for creating a fragment class is documented in the Configuring a Fragment Traffic Class in a Policy Map, on page 3. The procedure for creating a service fragment traffic classes is documented in the Configuring a Service Fragment Traffic Class, on page 6.

These instructions do not provide any details about the options that can be configured for Gigabit Etherchannel member link subinterfaces. These instructions only document the procedure for attaching a policy map that already has a fragment traffic class to a member link subinterface.

Note Fragments cannot be used for traffic on two or more physical interfaces. The GEC must all be on the same physical interface for this configuration to work properly.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface port-channel** *port-channel-interface-number.port-channel-subinterface-number*
4. **service-policy output** *fragment-class-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface port-channel** *port-channel-interface-number.port-channel-subinterface-number* **Example:** `Router(config)# interface port-channel 1.100`	Enters subinterface configuration mode to configure a Etherchannel member link subinterface.
Step 4	**service-policy output** *fragment-class-name* **Example:** `Router(config-subif)# service-policy output subscriber`	Attaches a service policy that contains a fragment default traffic class to the Etherchannel member link subinterface.

Example

In the following example, the service policy named subscriber has a fragment default traffic class and is attached to the member link subinterface of a Gigabit Etherchannel bundle.

Note This example only shows how to attach a fragment default traffic class to the member link subinterface of a Gigabit Etherchannel bundle. This configuration is incomplete and would not classify default traffic appropriately until the physical interface was configured to support a service fragment traffic class.

```
policy-map subscriber
  class voice
    priority level 1
  class video
    priority level 2
  class class-default fragment BE
    shape average 100000000
    bandwidth remaining ratios 80
policy-map aggregate-member-link
    class BestEffort service-fragment BE
    shape average 100000000
!
interface Port-channel1
 ip address 172.1.2.3 255.255.0.0
!
interface Port-channel1.100
 encapsulation dot1Q 100
 ip address 173.1.2.100 255.255.255.0
 service-policy output subscriber
!
```

Troubleshooting Tips

This configuration will not work until a service-fragment default traffic class is created to classify the default traffic classes marked as fragments. This service-fragment traffic class must be configured for this configuration to have any affect on network traffic.

What to Do Next

This configuration will not work until a service fragment default traffic class is created to classify the default traffic classes marked as fragments.

Follow the instructions in the Configuring Service Fragments on Physical Interface Supporting a Gigabit Etherchannel Bundle, on page 10 to complete this configuration.

Configuring Service Fragments on Physical Interface Supporting a Gigabit Etherchannel Bundle

Before You Begin

This procedure assumes that a service fragment traffic class has already been created. A service fragment traffic class cannot be configured without configuring a fragment class. The procedure for creating a fragment class is documented in the Configuring a Fragment Traffic Class in a Policy Map, on page 3. The procedure for creating a service fragment traffic classes is documented in the Configuring a Service Fragment Traffic Class, on page 6.

These instructions do not provide any details about the options that can be configured for Gigabit Etherchannel member link subinterfaces. These instructions only document the procedure for attaching a policy map that already has a fragment traffic class to a member link subinterface.

Note This process only works if all of the links of the GEC bundle are on the same physical interface.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *interface-number*
4. **service-policy output** *service-fragment-class-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface gigabitethernet** *interface-number* **Example:** `Router(config)# interface gigabitethernet 1/1/1`	Enters Gigabit Ethernet interface mode.
Step 4	**service-policy output** *service-fragment-class-name* **Example:** `Router(config-subif)# service-policy output aggregate-member-link`	Attaches a service policy that contains a service fragment default traffic class to the physical Gigabit Ethernet interface.

Example

In the following example, policy map subscriber is configured with a fragment class named BE. The fragment is then configured as part of a policy map named aggregate-member-link. Policy map subscriber is then attached to the bundle subinterfaces while policy map aggregate-member-link is attached to the physical interface.

```
port-channel load-balancing vlan-manual
class-map match-all BestEffort
!
class-map match-all video
!
class-map match-all voice
!
policy-map subscriber
  class voice
```

```
    priority level 1
  class video
    priority level 2
  class class-default fragment BE
    shape average 100000000
    bandwidth remaining ratios 80
policy-map aggregate-member-link
    class BestEffort service-fragment BE
    shape average 100000000
!
interface Port-channel1
 ip address 172.1.2.3 255.255.0.0
!
interface Port-channel1.100
 encapsulation dot1Q 100
 ip address 173.1.2.100 255.255.255.0
 service-policy output subscriber
!
interface Port-channel1.200
 encapsulation dot1Q 200
 ip address 173.1.2.200 255.255.255.0
 service-policy output subscriber
!
interface Port-channel1.300
 encapsulation dot1Q 300
 ip address 173.1.2.300 255.255.255.0
 service-policy output subscriber
!
interface GigabitEthernet1/1/1
 no ip address
 channel-group 1 mode on
 service-policy output aggregate-member-link
!
interface GigabitEthernet1/1/2
 no ip address
 channel-group 1 mode on
 service-policy output aggregate-member-link
```

Troubleshooting Tips

Ensure the *fragment-class-name* is consistent across service-fragment and fragment class definitions.

What to Do Next

This is the final configuration step for configuring the QoS Policies Aggregation feature on a Gigabit Etherchannel (GEC) bundle.

Configuration Examples for QoS: Policies Aggregation

Example QoS Policies Aggregation

In the following example, QoS Policies Aggregation is used to define a fragment class of traffic to classify default traffic using the default traffic class named BestEffort. All default traffic from the policy maps named subscriber1 and subscriber2 is part of the fragment default traffic class named BestEffort. This default traffic is then shaped collectively by creating a class called data that uses the **service-fragment** keyword and the **shape** command.

Note the following about this example:

- The *class-name* for each fragment default traffic class is "BestEffort."
- The *class-name* of "BestEffort" is also used to define the class where the **service-fragment** keyword is entered. This class applies a shaping policy to all traffic forwarded using the fragment default traffic classes named "BestEffort."

```
policy-map subscriber1
class voice
set cos 5
priority level 1
class video
set cos 4
priority level 2
class class-default fragment BestEffort
shape average 200000000
bandwidth remaining ratio 10
policy-map subscriber 2
class voice
set cos 5
priority level 1
class video
set cos 4
priority level 2
class class-default fragment BestEffort
shape average 200000000
bandwidth remaining ratio 10
policy-map input_policy
class class-default
set dscp default
policy-map main-interface
class data service-fragment BestEffort
shape average 400000000
interface portchannel1.1001
encapsulation dot1q 1001
service-policy output subscriber1
service-policy input input_policy
interface portchannel1.1002
encapsulation dot1q 1002
service-policy output subscriber2
service-policy input input_policy
interface gigabitethernet 0/1
description member-link1
port channel 1
service-policy output main-interface
interface gigabitethernet 0/2
description member-link2
port channel 1
service-policy output main-interface
```

Example Gigabit Etherchannel QoS Policies Aggregation

In the following example, policy map subscriber is configured with a fragment class named BE. The fragment is then configured as part of a policy map named aggregate-member-link. Policy map subscriber is then attached to the bundle subinterfaces while policy map aggregate-member-link is attached to the physical interface.

```
port-channel load-balancing vlan-manual
class-map match-all BestEffort
!
class-map match-all video
!
class-map match-all voice
!
policy-map subscriber
  class voice
```

```
    priority level 1
  class video
    priority level 2
  class class-default fragment BE
    shape average 100000000
    bandwidth remaining ratios 80
policy-map aggregate-member-link
    class BestEffort service-fragment BE
    shape average 100000000
!
interface Port-channel1
 ip address 172.1.2.3 255.255.0.0
!
interface Port-channel1.100
 encapsulation dot1Q 100
 ip address 173.1.2.100 255.255.255.0
 service-policy output subscriber
!
interface Port-channel1.200
 encapsulation dot1Q 200
 ip address 173.1.2.200 255.255.255.0
 service-policy output subscriber
!
interface Port-channel1.300
 encapsulation dot1Q 300
 ip address 173.1.2.300 255.255.255.0
 service-policy output subscriber
!
interface GigabitEthernet1/1/1
 no ip address
 channel-group 1 mode on
 service-policy output aggregate-member-link
!
interface GigabitEthernet1/1/2
 no ip address
 channel-group 1 mode on
 service-policy output aggregate-member-link
```

Additional References

The following sections provide references related to the QoS Policies Aggregation feature.

Related Documents

Related Topic	Document Title
Modular Quality of Service Command-Line Interface	Applying QoS Features Using the MQC
Distribution of Remaining Bandwidth Using Ratio	Distribution of Remaining Bandwidth Using Ratio
Class-Based Shaping	Regulating Packet Flow on a Per-Class Basis -- Using Class-Based Traffic Shaping

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, 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

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. 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. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Command Reference

The following command is modified in the feature documented in this module. For information about these commands, see the *Cisco IOS Quality of Service 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 .

- **class (policy-map)**

Feature Information for QoS Policies Aggregation

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 QoS Policies Aggregation

Feature Name	Releases	Feature Information
QoS Policies Aggregation	12.2(33)SRA	The Quality of Service Policies Aggregation (QoS Policies Aggregation) feature allows the default traffic classes of different policy maps on the same physical interface to be configured as a single traffic class within the Modular QoS CLI.