



Quality of Service Command Reference for Cisco NCS 4000 Series

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Preface

This section explains the objectives, intended audience, and organization of this publication and describes the conventions that convey instructions and other information.

This section provides the following information:

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- [Audience , on page v](#)
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- [Related Documentation, on page vi](#)
- [Document Conventions, on page vi](#)

Document Objectives

This guide describes the various commands available to configure and maintain Quality of Service (QoS) for the Cisco NCS 4000 Series Routers.

Audience

The Cisco command reference documentation set is intended primarily for users who configure and maintain Cisco networking devices (such as switches) but who may not be familiar with the tasks or the Cisco IOS XR commands necessary to perform particular tasks. This document also helps to know about the QoS features and configuration options in the Cisco NCS 4000 Series Routers.

Document Organization

This document is organized into the following chapters:

Chapter	Description
Basic QoS Commands , on page 1	This chapter describes the basic QoS commands.
QoS Classification Commands, on page 15	This chapter describes the QoS Classification commands.

Chapter	Description
Marking and Policing Commands, on page 29	This chapter describes the Marking and Policing commands.
Congestion Management Commands, on page 37	This chapter describes the congestion management commands.
Congestion Avoidance Commands, on page 45	This chapter describes the congestion avoidance commands.

Related Documentation

Use this guide in conjunction with the following referenced publications:

- *Quality of Service Configuration Guide for Cisco NCS 4000 Series*
- *Configuration Guide for Cisco NCS 4000 Series*
- *Command Reference for Cisco NCS 4000 Series*

Document Conventions

OTN and DWDM Command Reference Guide for Cisco NCS 4000 Series uses the following conventions:

Convention	Description
^ or Ctrl	Both the ^ symbol and Ctrl represent the Control (Ctrl) key on a keyboard. For example, the key combination ^D or Ctrl-D means that you hold down the Control key while you press the D key. (Keys are indicated in capital letters but are not case sensitive.)
bold font	Commands and keywords and user-entered text appear in bold font .
<i>Italic font</i>	Document titles, new or emphasized terms, and arguments for which you supply values are in <i>italic font</i> .
Courier font	Terminal sessions and information the system displays appear in <i>courier font</i> .
Bold Courier font	Bold Courier font indicates text that the user must enter.
[x]	Elements in square brackets are optional.
...	An ellipsis (three consecutive non-bold periods without spaces) after a syntax element indicates that the element can be repeated.
	A vertical line, called a pipe, indicates a choice within a set of keywords or arguments.

Convention	Description
[x y]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
{x y}	Required alternative keywords are grouped in braces and separated by vertical bars.
[x {y z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
string	A non quoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
< >	Nonprinting characters such as passwords are in angle brackets.
[]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.
R/S/I/P	<i>Rack/Slot/Instance/Port</i>

Reader Alert Conventions

This document uses the following conventions for reader alerts:



Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.



Tip Means *the following information will help you solve a problem*.



Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.



Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.



Warning Means *reader be warned*. In this situation, you might perform an action that could result in bodily injury.

IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS
Waarschuwing BELANGRIJKE VEILIGHEIDSINSTRUCTIES

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES
Varoitus TÄRKEITÄ TURVALLISUUSOHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelyyn liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET
Attention IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS
Warnung WICHTIGE SICHERHEITSHINWEISE

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡Advertencia! **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

Varning! **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

Figyelem	<p>FONTOS BIZTONSÁGI ELOÍRÁSOK</p> <p>Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján kereshető meg.</p> <p>ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!</p>
Предупреждение	<p>ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ</p> <p>Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.</p> <p>СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ</p>
警告	<p>重要的安全性说明</p> <p>此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。</p> <p>请保存这些安全性说明</p>
警告	<p>安全上の重要な注意事項</p> <p>「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。</p> <p>これらの注意事項を保管しておいてください。</p>
주의	<p>중요 안전 지침</p> <p>이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.</p> <p>이 지시 사항을 보관하십시오.</p>
Aviso	<p>INSTRUÇÕES IMPORTANTES DE SEGURANÇA</p> <p>Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.</p> <p>GUARDE ESTAS INSTRUÇÕES</p>

Advarsel VIGTIGE SIKKERHEDSANVISNINGER

Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemesbeskadigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.

GEM DISSE ANVISNINGER

تحذير

إرشادات الأمان الهامة

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض لإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمة الكهربائية وكن على علم بالإجراءات القياسية للحيلولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في آخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز. قم بحفظ هذه الإرشادات

Upozorenje

VAŽNE SIGURNOSNE NAPOMENE

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznat sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

SAČUVAJTE OVE UPUTE

Upozornění

DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY

Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.

USCHOVEJTE TYTO POKYNY

Προειδοποίηση

ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθεις πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ

אזהרה

הוראות בטיחות חשובות

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כדי לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

שמור הוראות אלה

Opomena

ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

ЧУВАЈТЕ ГИ ОБИЕ НАПАТСТВИЈА

Ostrzeżenie WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA

Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.

NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ**Upozornenie DŮLEŽITÉ BEZPEČNOSTNÉ POKYNY**

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhľadajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

USCHOVAJTE SI TENTO NÁVOD



Basic QoS Commands

This chapter has details about the generic QoS commands. These are standard commands, which are used before applying the QoS policies or methods.

- [class-map](#), on page 2
- [class \(policy-map\)](#), on page 4
- [end-class-map](#), on page 6
- [end-policy-map](#), on page 7
- [policy-map](#), on page 8
- [show policy-map interface](#), on page 10
- [show running-configuration class-map](#), on page 12
- [show running-configuration policy-map](#), on page 13

class-map

To define a traffic class and the associated rules that match packets to the class, use the **class-map** command in the global configuration mode. To remove an existing class map from the router, use the **no** form of this command.

```
class-map [type [traffic | qos]] [match-all] [match-any] class-map-name
no class-map [type [traffic | qos]] [match-all] [match-any] class-map-name
```

Syntax Description

type qos	(Optional) Specifies a quality-of-service (QoS) class-map.
traffic	(Optional) Specifies traffic type class-map.
match-all	(Optional) Specifies a match on all of the match criteria.
match-any	(Optional) Specifies a match on any of the match criteria. This is the default.
<i>class-map-name</i>	Name of the class for the class map. The class name is used for the class map and to configure policy for the class in the policy map. The class name can be a maximum of 63 characters, must start with an alphanumeric character, and in addition to alphanumeric characters, can contain any of the following characters: . _ @ \$ % + # : ; - =

Command Default

Type is QoS when not specified.

Command Modes

Global configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

The **class-map** command specifies the name of the class for which you want to create or modify class map match criteria. Use of this command enables class map configuration mode in which you can enter any **match** command to configure the match criteria for this class. Packets arriving on the interface are checked against the match criteria configured for a class map to determine if the packet belongs to that class.

These commands can be used in a class map match criteria for the ingress direction:

- **match [not] dscp**
- **match [not] mpls experimental topmost**
- **match [not] precedence**
- **match [not] protocol**

Task ID

Task ID	Operations
qos	read, write

Examples

These examples show how to specify class1 as the name of a class and defines a class map for this class.

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match dscp ipv4 1
```

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match precedence ipv4 1
```

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match cos 1
```

class (policy-map)

To specify the name of the class whose policy you want to create or change, use the **class** command in policy map configuration mode. To remove a class from the policy map, use the **no** form of this command.

```
class [type qos] {class-name | class-default}
no class [type qos] {class-name | class-default}
```

Syntax Description

type qos	(Optional) Specifies a quality-of-service (QoS) class.
<i>class-name</i>	Name of the class for which you want to configure or modify policy.
class-default	Configures the default class.

Command Default

No class is specified.
Type is QoS when not specified.

Command Modes

Policy map configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

Within a policy map, the **class (policy-map)** command can be used to specify the name of the class whose policy you want to create or change. The policy map must be identified first.

To identify the policy map (and enter the required policy map configuration mode), use the **policy-map** command before you use the **class (policy-map)** command. After you specify a policy map, you can configure the policy for new classes or modify the policy for any existing classes in that policy map.

The class name that you specify in the policy map ties the characteristics for that class—that is, its policy—to the class map and its match criteria, as configured using the **class-map** command.

The **class-default** keyword is used for configuring default classes. It is a reserved name and cannot be used with user-defined classes. It is always added to the policy map (type qos) even if the class is not configured. For example, the following configuration shows that the class has not been configured, but the running configuration shows ‘class class-default’.

```
RP/0/(config)# policy-map pml
RP/0/(config-pmap)# end-policy-map
RP/0/(config)# end
!
RP/0/# show running-config
!
policy-map pml
  class class-default
  !
end-policy-map
!
```


Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to create a policy map called policy1, which is defined to shape class1 traffic at 30 percent and default class traffic at 20 percent.

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match precedence 3
RP/0/(config-cmap)# exit
```

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/config-pmap-c)# shape average percent 30
RP/0/(config-pmap-c)# exit
```

```
RP/0/(config-pmap)# class class-default
RP/0/(config-pmap-c)# shape average percent 20
```

The default class is used for packets that do not satisfy configured match criteria for class1. Class1 must be defined before it can be used in policy1, but the default class can be directly used in a policy map, as the system defines it implicitly.

end-class-map

To end the configuration of match criteria for the class and to exit class map configuration mode, use the **end-class-map** command in class map configuration mode.

end-class-map

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes Class map configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	qos	read, write

Examples

These examples show how to end the class map configuration and exit class map configuration mode:

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match dscp ipv4 1
RP/0/(config-cmap)# end-class-map
```

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match precedence ipv4 1
RP/0/(config-cmap)# end-class-map
```

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match cos 1
RP/0/(config-cmap)# end-class-map
```

end-policy-map

To end the configuration of a policy map and to exit policy map configuration mode, use the **end-policy-map** command in policy map configuration mode.

end-policy-map

Syntax Description This command has no keywords or arguments.

Command Default No default behavior or values

Command Modes Policy map configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines No specific guidelines impact the use of this command.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to end the policy map configuration and exit policy map configuration mode.

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# police rate 250
RP/0/(config-pmap)# end-policy-map
```

policy-map

To create or modify a policy map that can be attached to one or more interfaces to specify a service policy, use the **policy-map** command in global configuration mode. To delete a policy map, use the **no** form of this command.

policy-map [**type qos**] *policy-name*
no policy-map [**type qos**] *policy-name*

Command Default

A policy map does not exist until one is configured. Because a policy map is applied to an interface, no restrictions on the flow of data are applied to any interface until a policy map is created.

Type is QoS when not specified.

Command Modes

Global Configuration mode

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

Use the **policy-map** command to specify the name of the policy map to be created, added to, or modified before you can configure policies for classes whose match criteria are defined in a class map. Entering the **policy-map** command enables policy map configuration mode in which you can configure or modify the class policies for that policy map.

You can configure class policies in a policy map only if the classes have match criteria defined for them. Use the **class-map** and **match** commands to configure the match criteria for a class.

A single policy map can be attached to multiple interfaces concurrently.

Task ID

Task ID	Operations
qos	read, write

Examples

These examples show how to create a policy map called `policy1` and configures two class policies included in that policy map. The policy map is defined to contain policy specification for `class1` and the default class (called `class-default`) to which packets that do not satisfy configured match criteria are directed.

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match dscp ipv4 136

RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# set precedence 3
RP/0/(config-pmap-c)# exit

RP/0/(config-pmap)# class class-default
```

```
RP/0/(config-pmap-c)# queue-limit 1000000 bytes
```

show policy-map interface

To display policy information and statistics for all classes configured for all service policies on the specified interface, use the **show policy-map interface** command in EXEC mode.

show policy-map [**interface** {*interface type* | **all**} *interface-path-id*] [**input** | **output**]

Syntax Description		
<i>interface type</i>		Interface type. For more information, use the question mark (?) online help function.
all		Specifies all interfaces.
<i>interface-path-id</i>		Physical interface or virtual interface.
	Note	Use the show interfaces command to see a list of all interfaces currently configured on the router.
		For more information about the syntax for the router, use the question mark (?) online help function.
input		(Optional) Displays per class statistics on inbound traffic for the specified policy map and interface.
output		(Optional) Displays per class statistics on outbound traffic for the specified policy map and interface.

Command Default None

Command Modes EXEC mode

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines The **show policy-map interface** command displays the statistics for classes in the service policy attached to an interface.

Task ID	Task ID	Operations
	qos	read

Examples

This sample output shows how to display policy statistics information for all classes on the **interface hundredGigE 0/6/0/0** that are in the output direction:

```
RP/0/# show policy-map interface hundredGigE 0/6/0/0 output
```

```

Wed Dec  9 16:18:10.179 UTC
HundredGigE0/6/0/0 output: test-pol-out

Class qos-grp1
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          :      885333442/900384110514    57036859
  Transmitted                       :      299199945/304286344065    19278557
  Total Dropped                     :      586133497/596097766449    37758302
  Queueing statistics
  Queue ID                          :      10409
  Taildropped(packets/bytes)        :      586133497/596097766449
Class qos-grp2
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          :              0/0              0
  Transmitted                       :              0/0              0
  Total Dropped                     :              0/0              0
  Queueing statistics
  Queue ID                          :      10410
  Taildropped(packets/bytes)        :      0/0
Class class-default
  Classification statistics          (packets/bytes)    (rate - kbps)
  Matched                          :      1487720301/1513011546117    98203543
  Transmitted                       :      1182422140/1202523316380    78285945
  Total Dropped                     :      305298161/310488229737    19917598
  Queueing statistics
  Queue ID                          :      10408
  Taildropped(packets/bytes)        :      305298161/310488229737

```

This table describes the significant fields shown in the display.

Table 1: show policy-map interface Field Descriptions

Field	Description
Classification Statistics	
Matched	Number of packets or bytes that matched this class.
Transmitted	Number of packets or bytes transmitted for this class.
Total Dropped	Number of packets or bytes dropped for this class.
Policing Statistics	
Policed(conform)	Number of packets or bytes that conformed to the police rate for this class.
Policed(exceed)	Number of packets or bytes that exceeded the police rate for this class.
Policed(violate)	Number of packets or bytes that violated the police rate for this class.
Policed and dropped	Number of packets or bytes dropped by the policer of this class.
Queueing Statistics	
Queue ID	VOQ number of the packet in this class.
Taildropped (bytes)	Number of bytes taildropped for this queue.

show running-configuration class-map

To display the configured class-map details, use the **show running-configuration class-map** command in EXEC mode.

show running-configuration class-map

Syntax Description	This command has no keywords or arguments.
---------------------------	--

Command Default	None
------------------------	------

Command Modes	EXEC
----------------------	------

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines	The show running-configuration class-map is used for getting the class-map details.
-------------------------	--

Task ID	Task ID	Operation
	qos	read

Example

This example shows the configured class-map details:

```
show running-config class-map
class-map match-any CLASS_1_egress_COS
macth qos-group1
end-class-map
!
class-map match-any CLASS_2_egress_COS
macth qos-group2
end-class-map
!
class-map match-any CLASS_3_egress_COS
macth qos-group3
end-class-map
!
class-map match-anyCLASS_1_ingress_COS
macth cos4
end-class-map
!
class-map match-anyCLASS_2_ingress_COS
macth cos7
end-class-map
!
class-map match-anyCLASS_3_ingress_COS
macth cos3
end-class-map
!
```


show running-configuration policy-map

To display the configured policy-map details, use the **show running-configuration policy-map** command in EXEC mode.

show running-configuration policy-map

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes EXEC

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines The **show running-configuration policy-map** command is used for getting the policy-map details.

Task ID	Task ID	Operation
	qos	read

Example

This example shows the configured policy-map details.

```
show running-config policy-map
policy-map egress_POLICY_L2
class CLASS_1_egress_COS
shape average 2 gbps
!
class CLASS_2_egress_COS
shape average 4 gbps
!
class CLASS_3_egress_COS
shape average 4 gbps
!
class class-default
!
end-policy-map
!
policy-map ingress_POLICY_L2
classCLASS_1_ingress_COS
set traffic-class1
!
classCLASS2_ingress_COS
set qos-group2
!
classCLASS_3_ingress_COS
set qos-group3
!
```

show running-configuration policy-map

```
class class-default
!  
end-policy-map
!
```



QoS Classification Commands

This chapter describes the commands used for QoS packet classification.

- [match dscp, on page 16](#)
- [match mpls experimental topmost, on page 19](#)
- [match precedence, on page 21](#)
- [match qos-group, on page 23](#)
- [random-detect discard-class, on page 25](#)
- [set mpls experimental, on page 27](#)
- [shape average, on page 28](#)

match dscp

To identify specific IP differentiated services code point (DSCP) values as match criteria for a class map, use the **match dscp** command in class map configuration mode. To remove a DSCP value from a class map, use the **no** form of this command.

```
match [not] dscp {[ipv4 | ipv6]} dscp-value [dscp-value1 . . . dscp-value7] |[min-value - max-value]
```

```
no match [not] dscp {[ipv4 | ipv6]} dscp-value [dscp-value1 . . . dscp-value7] |[min-value - max-value]
```

Syntax Description

not (Optional) Negates the specified match result.

ipv4 (Optional) Specifies the IPv4 DSCP value.

ipv6 (Optional) Specifies the IPv6 DSCP value.

dscp-value IP DSCP value identifier that specifies the exact value or a range of values. Range is 0 - 63. Up to 64 IP DSCP values can be specified to match packets. Reserved keywords can be specified instead of numeric values.

min-value Lower limit of DSCP range to match. Value range is 0 - 63.

max-value Upper limit of DSCP range to match. Value range is 0 - 63.

Command Default

Matching on IP Version 4 (IPv4) and IPv6 packets is the default.

Command Modes

Class map configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

The **match dscp** command is supported only in the ingress direction. The minimum value is 0 and maximum value is 63. The maximum allowed entries: 64.

The **match dscp** command specifies a DSCP value that is used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match dscp** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish

The **match dscp** command examines the higher-order six bits in the type of service (ToS) byte of the IP header. If you specify more than one **match dscp** command in a class map, the new values are added to the existing statement.

The IP DSCP value is used as a matching criterion only. The value has no mathematical significance. For instance, the IP DSCP value 2 is not greater than 1. The value simply indicates that a packet marked with the IP DSCP value of 2 should be treated differently than a packet marked with an IP DSCP value of 1. The

treatment of these marked packets is defined by the user through the setting of policies in policy map class configuration mode.

Table 2: IP DSCP Reserved Keywords

DSCP Value	Reserved Keyword
0	default
10	AF11
12	AF12
14	AF13
18	AF21
20	AF22
22	AF23
26	AF31
28	AF32
30	AF33
34	AF41
36	AF42
38	AF43
46	EF
8	CS1
16	CS2
24	CS3
32	CS4
40	CS5
48	CS6
56	CS7
ipv4	ipv4 dscp
ipv6	ipv6 dscp

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to configure the service policy called policy1. In this example, class map dscp14 evaluates all packets entering for an IP DSCP value of 14. If the incoming packet has been marked with the IP DSCP value of 14, the packet is queued to the class queue with the bandwidth setting of 1000 mbps.

```
RP/0/(config)# class-map dscp14
RP/0/(config-cmap)# match dscp ipv4 14
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class dscp14
RP/0/(config-pmap-c)#bandwidth 1000 mbps
RP/0/(config-pmap-c)#exit
RP/0/(config-pmap)# exit

RP/0/(config)# interface HundredGigE 0/7/0/0
RP/0/(config-if)# service-policy input policy1
```

match mpls experimental topmost

To identify specific three-bit experimental (EXP) field values in the topmost Multiprotocol Label Switching (MPLS) label as match criteria for a class map, use the **match mpls experimental topmost** command in class map configuration mode. To remove experimental field values from the class map match criteria, use the **no** form of the command.

```
match [not] mpls experimental topmost exp-value [exp-value1 . . . exp-value7]
no match [not] mpls experimental topmost exp-value [exp-value1 . . . exp-value7]
```

Syntax Description	<table border="1"> <tr> <td>not</td> <td>not</td> </tr> <tr> <td><i>exp-value</i></td> <td>Experimental value that specifies the exact value from 0 to 7. Up to eight experimental values can be specified to match MPLS headers.</td> </tr> </table>	not	not	<i>exp-value</i>	Experimental value that specifies the exact value from 0 to 7. Up to eight experimental values can be specified to match MPLS headers.
not	not				
<i>exp-value</i>	Experimental value that specifies the exact value from 0 to 7. Up to eight experimental values can be specified to match MPLS headers.				
Command Default	No default behavior or values				
Command Modes	Class map configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 6.1.42</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 6.1.42	This command was introduced.
Release	Modification				
Release 6.1.42	This command was introduced.				
Usage Guidelines	<p>The match mpls experimental topmost command is supported only in the ingress direction. The minimum value is 0 and maximum value is 7. The maximum allowed entries: 8.</p> <p>The match mpls experimental topmost command is used by the class map to identify MPLS experimental values matching on a packet.</p> <p>To use the match mpls experimental topmost command, you must first enter the class-map command to specify the name of the class whose match criteria you want to establish. If you specify more than one match mpls experimental topmost command in a class map, the new values are added to the existing match statement.</p> <p>This command examines the three experimental bits contained in the topmost label of an MPLS packet. Up to eight experimental values can be matched in one match statement. For example, match mpls experimental topmost 2 4 5 7 returns matches for experimental values of 2, 4, 5, and 7. Only one of the four values is needed to yield a match (OR operation).</p> <p>The experimental values are used as a matching criterion only. The value has no mathematical significance. For instance, the experimental value 2 is not greater than 1. The value indicates that a packet marked with the experimental value of 2 should be treated differently than a packet marked with the EXP value of 1. The treatment of these different packets is defined by the user through the setting of QoS policies in policy map class configuration mode.</p>				
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>qos</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	qos	read, write
Task ID	Operations				
qos	read, write				

Examples

This example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface.

```
RP/0/(config)# class-map mplsmap1
RP/0/(config-cmap)# match mpls experimental topmost 1
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class mplsmap1
RP/0/(config-pmap-c)# bandwidth 1000 mbps
RP/0/(config-pmap-c)#exit
RP/0/(config-pmap)#exit

RP/0/(config)# interface HundredGigabitEthernet 0/1/0/9
RP/0/(config-if)# service-policy input policy1
```


match precedence

To identify IP precedence values as match criteria, use the **match precedence** command in class map configuration mode. To remove precedence values from a class map, use the **no** form of this command.

```
match [not] precedence [{ipv4 | ipv6}] precedence-value [precedence-value1 . . . precedence-value7]
no match [not] precedence [{ipv4 | ipv6}] precedence-value [precedence-value1 . . .
precedence-value7]
```

Syntax Description	not	(Optional) Negates the specified match result.
	ipv4	(Optional) Specifies the IPv4 precedence value.
	ipv6	(Optional) Specifies the IPv6 precedence value.
	<i>precedence-value</i>	An IP precedence value identifier that specifies the exact value. Reserved keywords can be specified instead of numeric values. Up to eight precedence values can be matched in one match statement.

Command Default Matching on both IP Version 4 (IPv4) and IPv6 packets is the default.

Command Modes Class map configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines The **match precedence** command is supported only in the ingress direction. The minimum value is 0 and maximum value is 7. The maximum allowed entries: 8.

The **match precedence** command specifies a precedence value that is used as the match criteria against which packets are checked to determine if they belong to the class specified by the class map.

To use the **match precedence** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. If you specify more than one **match precedence** command in a class map, the new values are added to the existing statement.

The **match precedence** command examines the higher-order three bits in the type of service (ToS) byte of the IP header. Up to eight precedence values can be matched in one match statement. For example, **match precedence ipv4 0 1 2 3 4 5 6 7** returns matches for IP precedence values of 0, 1, 2, 3, 4, 5, 6, and 7. Only one of the eight values is needed to yield a match (OR operation).

The precedence values are used as a matching criterion only. The value has no mathematical significance. For instance, the precedence value 2 is not greater than 1. The value simply indicates that a packet marked with the precedence value of 2 is different than a packet marked with the precedence value of 1. The treatment of these different packets is defined by the user through the setting of QoS policies in policy map class configuration mode.

This table lists the IP precedence value number and associated name in descending order of importance.

Table 3: IP Precedence Values and Names

Value	Name
0	routine
1	priority
2	immediate
3	flash
4	flash-override
5	critical
6	internet
7	network

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to configure the service policy called policy1 and attach service policy policy1 to an interface. In this example, class map ipprec5 evaluates all packets entering HundredGigabit Ethernet interface 0/1/0/9 for a precedence value of 5. If the incoming packet has been marked with the precedence value of 5, the packet is queued to the class queue with the bandwidth setting of 1000 mbps.

```
RP/0/# configure
RP/0/(config)# class-map ipprec5
RP/0/(config-cmap)# match precedence ipv4 5
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class ipprec5
RP/0/(config-pmap-c)# bandwidth 1000 mbps
RP/0/(config-pmap)# exit

RP/0/(config)# interface HundredGigabitEthernet 0/1/0/9
RP/0/(config-if)# service-policy input policy1
```

match qos-group

To identify specific quality-of-service (QoS) group values as match criteria in a class map, use the **match qos-group** command in class map configuration mode. To remove a specific QoS group value from the matching criteria for a class map, use the **no** form of this command.

Syntax Description

not (Optional) Negates the specified match result.

qos-group-value QoS group value identifier that specifies the exact value from 1 to 7. Range is not supported.

Command Default

No match criteria are specified.

Command Modes

Class map configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

The **match qos-group** command is supported only in the egress direction. The egress default class will implicitly match qos-group 0. The minimum value is 1 and maximum value is 7. The maximum allowed entries: 7.

The **match qos-group** command sets the match criteria for examining QoS groups marked on the packet. One class map can match only one qos-group value from 1 to 7. The qos-group values 1 to 7 maps to queue 1 to 7 on the egress port. Queue 0 is reserved for class-default.

The QoS group value is used as a matching criterion only. The value has no mathematical significance. For instance, the QoS group value 2 is not greater than 1. The value simply indicates that a packet marked with the QoS group value of 2 should be treated differently than a packet marked with a QoS group value of 1. The treatment of these different packets is defined using the **service-policy** command in policy map class configuration mode.

The QoS group setting is limited in scope to the local router. Typically, the QoS group is set on the local router to be used locally and the router to give differing levels of service based on the group identifier.

In the ingress policy-map, in order to designate the traffic class to a certain CoSQ other than CoSQ 0, the class-map needs to have an explicit set qos-group x statement, where 'x' is the CoSQ in the range of 0 to 7. The default CoSQ is 0. In the egress policy-map, a class-map with a corresponding match qos-group x will allow further Quality of Service actions to be applied to the traffic class. For example,

```
class-map prec1
  match prec 1

policy-map test-ingress
  class prec1
    set qos-group 1
    police rate percent 50

class-map qg1
  match qos-group 1
```

```
policy-map test-egress
  class qgl
    shape average percent 70
```

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows a service policy called policy1 attached to an HundredGigabit Ethernet interface 0/1/0/9.

```
RP/0/(config)# class-map qosgroup5
RP/0/(config-cmap)# match qos-group 5
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class qosgroup5
RP/0/(config-pmap-c)# bandwidth 1000 mbps
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# exit

RP/0/(config)# interface HundredGigabitEthernet 0/1/0/9
RP/0/(config-if)# service-policy output policy1
```

random-detect discard-class

To configure the Weighted Random Early Detection (WRED) thresholds for packets with a specific discard class value, use the **random-detect discard-class** command in policy map class configuration mode. To return the thresholds to the default for the discard class, use the **no** form of this command.

random-detect discard-class *discard-value* *min-threshold* [*units*] *max-threshold* [*units*]
no random-detect discard-class *discard-value* *min-threshold* [*units*] *max-threshold* [*units*]

Syntax Description

<i>discard-value</i>	Discard class value. The value is 0 or 1.
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is from 0 to 1073741823 in bytes.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is from the value of the <i>min-threshold</i> argument to 1073741823. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified discard class value.
<i>units</i>	(Optional) Units for the threshold values.

Command Default

Default unit for *max-threshold* and *min-threshold* is **packets**.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

WRED is a congestion avoidance mechanism that slows traffic by randomly dropping packets when congestion exists. WRED is most useful with protocols like TCP that respond to dropped packets by decreasing the transmission rate.

When you configure the **random-detect discard-class** command on an interface, packets are given preferential treatment based on the discard class of the packet.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to set the discard class values for discard class 1 to a minimum byte threshold of 1000000 and a maximum byte threshold of 2000000:

```
RP/0/(config)# policy-map policy1
```

```
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# random-detect discard-class 1 1000000 bytes 2000000 bytes
```

set mpls experimental

To set the experimental (EXP) value of the Multiprotocol Label Switching (MPLS) packet topmost or imposition labels, use the **set mpls experimental** command in policy map configuration mode. To leave the EXP value unchanged, use the **no** form of this command.

```
set mpls experimental {topmost} exp-value
no set mpls experimental {topmost} exp-value
```

Syntax Description	topmost	Specifies to set the EXP value of the topmost label.
	<i>exp-value</i>	Value of the MPLS packet label. Range is 0 to 7.

Command Default No MPLS experimental value is set

Command Modes Policy map class configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines After the MPLS experimental bits are set, other QoS services can then operate on the bit settings. This command is supported only in ingress direction. Unconditional MPLS experimental marking is supported. The network gives priority (or some type of expedited handling) to the marked traffic. Typically, the MPLS experimental value is set at the edge of the network (or administrative domain) and queuing is acted on it thereafter.

Task ID	Task ID	Operations
	qos	read, write

Examples This example shows how to set the MPLS experimental to 5:

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# set mpls experimental topmost 5
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# exit

RP/0/(config)# interface HundredGigE 0/1/0/0
RP/0/(config-if)# service-policy input policy1
```

shape average

To shape traffic to the indicated bit rate according to the algorithm specified, use the **shape average** command in policy map class configuration mode. To remove traffic shaping, use the **no** form of this command.

```
shape average {percent percentage | rate [units]}
no shape average
```

Syntax Description

percent <i>percentage</i>	Specifies the interface bandwidth in percentage. Values can be from 1 to 100.
<i>rate</i>	Average shaping rate in the specified units. Values can be from 1 to 4294967295.
<i>units</i>	(Optional) Units for the bandwidth.

Command Default

units: bps

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

The **shape average** command is supported only in the egress direction.

When you use the **shape average** command, egress shaping is done at the Layer 1 level and includes the Layer 1 header in the rate calculation. The minimum shape rate is 469 kbps. If you have both shape and bandwidth configured for a class, ensure that the shape percent value is always greater than the percent value for bandwidth. For bundled interfaces, **shape average** can be configured only as a percentage.

The **priority** and **shape average** commands can be configured together in the same class.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how to set traffic shaping to 100000 kbps:

```
RP/0/ (config)# policy-map policy1
RP/0/ (config-pmap)# class class1
RP/0/ (config-pmap-c)# shape average 100000 kbps
```




Marking and Policing Commands

This chapter describes the commands to configure marking and policing.

- [set dscp, on page 30](#)
- [set discard-class, on page 31](#)
- [set precedence, on page 33](#)
- [set qos-group, on page 35](#)

set dscp

To mark a packet by setting the IP differentiated services code point (DSCP) in the type of service (ToS) byte, use the **set dscp** command in policy-map class configuration mode. To remove a previously set DSCP value, use the **no** form of this command.

```
set dscp[tunnel] dscp-value
no set dscp[tunnel] dscp-value
```

Syntax Description

tunnel	(Optional) Sets the DSCP on the outer IP header. This command is available on Layer 3 interfaces in the ingress direction.
dscp-value	Number from 0 to 63 that sets the DSCP value. Reserved keywords can be specified instead of numeric values.

Command Default

No default behavior or values

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

After the DSCP bit is set, other quality-of-service (QoS) services can then operate on the bit settings. The **set dscp** is supported only in the ingress direction.

The network gives priority (or some type of expedited handling) to marked traffic. Typically, you set the DSCP value at the edge of the network (or administrative domain); data then is queued based on the DSCP value.

Task ID

Task ID	Operations
qos	read, write

Examples

In this example, the DSCP ToS byte is set to 6 in the policy map called policy-in. All packets that satisfy the match criteria of class1 are marked with the DSCP value of 6. The network configuration determines how packets are marked.

```
RP/0/ (config)# policy-map policy-in
RP/0/ (config-pmap) # class class1
RP/0/ (config-pmap-c) # set dscp 6
```

set discard-class

To set the discard class and Quality of Service (QoS) group identifiers on IP Version 4 (IPv4) or Multiprotocol Label Switching (MPLS) packets, use the **set discard-class** command in policy map class configuration mode. To leave the discard-class values unchanged, use the **no** form of this command.

set discard-class *discard-class-value*
no set discard-class *discard-class-value*

Syntax Description *discard-class-value* Discard class ID. An integer 0 to 1, to be marked on the packet.

Command Default No default behavior or values

Command Modes Policy map class configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines The **set discard-class** command associates a discard class ID with a packet. After the discard class is set, other QoS services such as Weighted Random Early Detection (WRED) can operate on the bit settings. Discard-class indicates the discard portion of the per hop behavior (PHB). The **set discard-class** command is typically used in Pipe mode. Discard-class is required when the input PHB marking is used to classify packets on the output interface. The **set discard-class** command is supported only in the ingress direction. Unconditional discard-class marking is supported. The discard-class values can be used to specify the type of traffic that is dropped when there is congestion.



Note Marking of the discard class has only local significance on a node.

Task ID	Task ID	Operations
	qos	read, write

Examples This example shows how to set the discard class value to 1 for packets that match the MPLS experimental bits 1:

```
RP/0/(config)# class-map cust1
RP/0/(config-cmap)# match mpls experimental topmost 1
RP/0/(config-cmap)# exit
RP/0/(config)# policy-map policy2
```

```
RP/0/(config-pmap)# class cust1
RP/0/(config-pmap-c)# set discard-class 1
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# exit
RP/0/(config)# interface HundredGigE 0/1/0/0
RP/0/(config-if)# service-policy input policy2
```

set precedence

To set the precedence value in the IP header, use the **set precedence** command in policy map class configuration mode. To leave the precedence value unchanged, use the **no** form of this command.

```
set precedence [tunnel] value
no set precedence [tunnel] value
```

Syntax Description	<p>tunnel (Optional) Sets the IP precedence on the outer IP header.</p> <hr/> <p>value Number or name that sets the precedence bits in the IP header. Range is from 0 to 7. Reserved keywords can be specified instead of numeric values.</p>				
Command Default	No default behavior or values				
Command Modes	Policy map class configuration				
Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 6.1.42</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 6.1.42	This command was introduced.
Release	Modification				
Release 6.1.42	This command was introduced.				
Usage Guidelines	<p>Precedence can be set using a number or corresponding name. After IP Precedence bits are set, other QoS services can then operate on the bit settings.</p> <p>The set precedence command is supported only in the ingress direction. Unconditional precedence marking is supported.</p> <p>The network gives priority (or some type of expedited handling) to the marked traffic. IP precedence can be set at the edge of the network (or administrative domain) and have queueing act on it thereafter.</p> <p>The mapping from keywords such as 0 (routine) and 1 (priority) to a precedence value is useful only in some instances. That is, the use of the precedence bit is evolving. You can define the meaning of a precedence value by enabling other features that use the value. In the case of high-end Internet QoS, IP precedences can be used to establish classes of service that do not necessarily correspond numerically to better or worse handling in the network.</p>				
Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>qos</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	qos	read, write
Task ID	Operations				
qos	read, write				

Examples

This example shows how to set the IP precedence to 5 (critical):

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match dscp ipv4 customer1
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy1
```

```
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# set precedence 5
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# exit

RP/0/(config)# interface HundredGigE 0/1/0/9
RP/0/(config-if)# service-policy input policy1
```

set qos-group

To set the quality of service (QoS) group identifiers on packets, use the **set qos-group** command in policy map class configuration mode. To leave the QoS group values unchanged, use the **no** form of this command.

set qos-group *qos-group-value*
no set qos-group *qos-group-value*

Syntax Description	<i>qos-group-value</i> QoS group ID. An integer from 1 to 7, to be marked on the packet. The <i>qos-group-value</i> is used to select a CoSQ and eventually to a VOQ
---------------------------	---

Command Default	No group ID is specified.
------------------------	---------------------------

Command Modes	Policy map class configuration
----------------------	--------------------------------

Command History	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Release 6.1.42</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Release 6.1.42	This command was introduced.
Release	Modification				
Release 6.1.42	This command was introduced.				

Usage Guidelines

The **set qos-group** command is supported only in the ingress direction.

The **set qos-group** will be used as internal priority to choose the queue on the egress port.

In the ingress policy-map, in order to designate the traffic class to a certain CoSQ other than CoSQ 0, the class-map needs to have an explicit set qos-group x statement, where 'x' is the CoSQ in the range of 0 to 7. The default CoSQ is 0. In the egress policy-map, a class-map with a corresponding match qos-group x will allow further Quality of Service actions to be applied to the traffic class. For example,

```
class-map prec1
  match prec 1

policy-map test-ingress
  class prec1
    set qos-group 1
    police rate percent 50

class-map qg1
  match qos-group 1

policy-map test-egress
  class qg1
    shape average percent 70
```

Task ID	<table border="1"> <thead> <tr> <th>Task ID</th> <th>Operations</th> </tr> </thead> <tbody> <tr> <td>qos</td> <td>read, write</td> </tr> </tbody> </table>	Task ID	Operations	qos	read, write
Task ID	Operations				
qos	read, write				

Examples

This example sets the QoS group to 5 for packets that match the MPLS experimental bit 1:

```
RP/0/(config)# class-map class1
RP/0/(config-cmap)# match mpls experimental topmost 1
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# set qos-group 5
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# exit

RP/0/(config)# HundredGigE interface 0/1/0/0
RP/0/(config-if)# service-policy input policy1
```




Congestion Management Commands

This chapter describes the commands used to manage congestion.

- [police rate](#), on page 38
- [priority \(QoS\)](#), on page 40
- [show qos interface](#) , on page 41
- [show policy-map targets](#), on page 43

police rate

To configure traffic policing and enter policy map police configuration mode, use the **police rate** command in policy map class configuration mode. To remove traffic policing from the configuration, use the **no** form of this command.

```
police rate {value [units] | percent percentage} [burst burst-size [burst-units]] [peak-rate {value [units] | percent percentage}] [peak-burst peak-burst [burst-units]]
no police rate {value [units] | percent percentage} [burst burst-size [burst-units]] [peak-rate {value [units] | percent percentage}] [peak-burst peak-burst [burst-units]]
```

Syntax Description		
	<i>value</i>	Committed information rate (CIR). Range is from 1 to 4294967295.
	<i>units</i>	(Optional) Unit of measurement for the CIR.
	percent <i>percentage</i>	Specifies the police rate as a percentage of the CIR. Range is from 1 to 100. See the Usage Guidelines for information on how to use this keyword.
	burst <i>burst-size</i>	(Optional) Specifies the burst size in the specified <i>burst-units</i> . The default burst value is 10 milliseconds of the CIR. The maximum burst value allowed is 4194304 bytes.
	<i>burst-units</i>	(Optional) Unit of measurement for the burst values.
	peak-rate <i>value</i>	(Optional) Specifies the Peak Information Rate (PIR) in the specified <i>units</i> .
	peak-burst <i>peak-burst</i>	(Optional) Specifies the peak burst size in the specified <i>burst-units</i> . The default peak burst value is 10 milliseconds of the PIR. The maximum peak-burst value allowed is 8388608 bytes. Also, the difference of the peak-burst value and burst value cannot be larger than 4194304 bytes.

Command Default No restrictions on the flow of data are applied to any interface.

Command Modes Policy map class configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines Policer conditional set is unsupported.

Policing can be applied only in the ingress direction.

For **police rate** commands, interpret the **percent** keyword in this way:

- For a one-level policy, the **percent** keyword specifies the CIR as a percentage of the link rate. For example, the command **police rate percent 35** configures the CIR as 35% of the link rate.



Note Configured values take into account the Layer 2 encapsulation applied to traffic. This applies to ingress policing. For Ethernet transmission, the encapsulation is considered to be 14 bytes, whereas for IEEE 802.1Q, the encapsulation is 18 bytes.



Note A police rate minimum of 21 kbps is supported.

Task ID**Task ID Operations**

qos	read, write
-----	----------------

In this example, traffic policing is configured with an average rate of 200 pps, and a normal burst size of 50 packets, for all packets in class-map class1, leaving HundredGigE interface 0/1/0/0:

```
RP/0/(config)# policy-map pps-1r2c
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# police rate 200 pps burst 50 packets
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# exit

RP/0/(config)# HundredGigE interface 0/1/0/0
RP/0/(config-if) service-policy input policy1
```

priority (QoS)

To assign priority to a traffic class based on the amount of available bandwidth within a traffic policy, use the **priority** command in policy map class configuration mode. To remove a previously specified priority for a class, use the **no** form of this command.

priority [**level** *priority-level*]
no priority

Syntax Description	level <i>priority-level</i> (Optional) Sets multiple levels of priority to a traffic class. Level 1 through 7. Default level is 1. Level 1 traffic has higher priority.
---------------------------	--

Command Default	No default action.
------------------------	--------------------

Command Modes	Policy map class configuration
----------------------	--------------------------------

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines	The priority command configures low-latency queueing (LLQ), providing strict priority queueing (PQ). Strict PQ allows delay-sensitive data such as voice to be dequeued and sent before packets in other queues are dequeued. The priority command is supported only in the egress direction. No policer is allowed with a priority class. To limit the priority traffic use the shape average command.
-------------------------	--

The **priority** command sets up classes based on a variety of criteria (not just User Datagram Protocol [UDP] ports) and assigns a priority to them.

The **bandwidth** and **priority** commands cannot be used in the same class, within the same policy map. These commands can be used together in the same policy map.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to configure priority queueing for the policy map named policy1 :

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# priority level 1
```

show qos interface

To display QoS information for a specific interface, use the **show qos interface** command in the EXEC mode.

```
show qos interface interface-name {input | output}[location node-id]
```

Syntax Description		
<i>interface-name</i>		Interface name. For more information about the syntax for the router, use the question mark (?) online help function. Note Use the show interfaces command to see a list of all interfaces currently configured on the router.
input		Attaches the specified policy map to the input interface.
output		Attaches the specified policy map to the output interface.
location <i>node-id</i>		(Optional) Displays detailed QoS information for the designated node. The <i>node-id</i> argument is entered in the rack/slot/module notation.

Command Default No default behavior or values

Command Modes EXEC mode

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines The **show qos interface** command displays configuration for all classes in the service policy that is attached to an interface.

Use this command to check the actual values programmed in the hardware from the action keywords in the **police rate** command.

Task ID	Task ID	Operations
	qos	read

Examples

This is the sample output shows the QoS information on a **interface hundredGigE 0/6/0/18** that are in the output direction:

```
RP/0/# show qos interface hundredGigE 0/6/0/18 output
Wed Dec 2 22:34:25.476 UTC
```

show qos interface

```

NOTE:- Configured values are displayed within parentheses
Interface HundredGigE0/6/0/18 ifh 0x3000210 -- output policy
NPU Id:                               3
Total number of classes:                3
Interface Bandwidth:                    100000000 kbps
VOQ Base:                               11176
VOQ Stats Handle:                       0x887a6e18
Accounting Type:                         Layer1 (Include Layer 1 encapsulation and above)
-----
Level1 Class (HP7)                      = qos-1
Egressq Queue ID                        = 11177 (HP7 queue)
Queue Max. BW.                          = 0 kbps (default)
TailDrop Threshold                      = 125304832 bytes / 10 ms (default)
WRED not configured for this class

Level1 Class (HP6)                      = qos-2
Egressq Queue ID                        = 11178 (HP6 queue)
Queue Max. BW.                          = 0 kbps (default)
TailDrop Threshold                      = 125304832 bytes / 10 ms (default)
WRED not configured for this class

Level1 Class                            = class-default
Egressq Queue ID                        = 11176 (Default LP queue)
Queue Max. BW.                          = 101803495 kbps (default)
Queue Min. BW.                          = 0 kbps (default)
Inverse Weight / Weight                  = 1 / (BWR not configured)
TailDrop Threshold                      = 1253376 bytes / 10 ms (default)
WRED not configured for this class

```

This table describes the significant fields shown in the display.

Table 4: show QoS interface Field Descriptions

Field	Description
Level 1 class	Level 1 class identifier in decimal format.
Policer Bucket ID	Policer bucket identifier.
Policer Stats Handle	Policer statistics handle for this class.
Queue ID	VOQ number of the packet in this class.
Queue Max. BW	Maximum bandwidth of the queue.
Queue Min. BW	Minimum bandwidth of the queue.
Inverse Weight / Weight	Remaining bandwidth weight. Note The hardware weight is expressed in inverse value.
TailDrop Threshold	Number of bytes tailedropped for this queue and the default/user-configured queue-limit expressed in milliseconds/user-configured unit.

show policy-map targets

To display information about the interfaces on which policy maps are applied, use the **show policy-map targets** command in EXEC mode.

```
show policy-map targets [{location node-id | pmap-name name | type qos [{location node-id | pmap-name name}]}]
```

Syntax Description	location <i>node-id</i>	(Optional) Displays information about the interfaces on which policy maps are applied for the specified location. The <i>node-id</i> argument is entered in the <i>rack/slot/module</i> notation.
	pmap-name <i>name</i>	(Optional) Displays information about the interfaces on which the specified policy map is applied.
	type qos	(Optional) Displays information about the interfaces on which QoS policy maps are applied. This is the default type.

Command Default The default QoS policy type is QoS.

Command Modes EXEC

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines For a short period of time while a QoS policy is being modified, there might not be any policy in effect on the interfaces in which the modified policy is used. For this reason, modify QoS policies that affect the fewest number of interfaces at a time. Use the **show policy-map targets** command to identify the number of interfaces that will be affected during policy map modification.

Task ID	Task ID	Operations
	qos	read

Examples

In this example, the TenGigabit Ethernet interface 4/0/10/0 has one policy map attached as a main policy. Outgoing traffic on this interface will be affected if the policy is modified:

```
RP/0/# show policy-map targets

Wed Dec 2 22:35:13.993 UTC
1) Policymap: test-qlimit Type: qos
   Targets (applied as main policy):
     TenGigE0/4/0/10/0 output
     TenGigE0/6/0/30/1 output
   Total targets: 2

   Targets (applied as child policy):
```

```
Total targets: 0
```

```
2) Policymap: test-priority    Type: qos
  Targets (applied as main policy):
    HundredGigE0/6/0/35 output
    HundredGigE0/6/0/34 output
    HundredGigE0/6/0/33 output
    HundredGigE0/6/0/32 output
    HundredGigE0/6/0/31 output
    HundredGigE0/6/0/29 output
    HundredGigE0/6/0/28 output
    HundredGigE0/6/0/27 output
    HundredGigE0/6/0/25 output
    HundredGigE0/6/0/24 output
    HundredGigE0/6/0/23 output
    HundredGigE0/6/0/22 output
    HundredGigE0/6/0/21 output
    HundredGigE0/6/0/20 output
    HundredGigE0/6/0/19 output
    HundredGigE0/6/0/1 output
    HundredGigE0/6/0/3 output
    HundredGigE0/6/0/4 output
    HundredGigE0/6/0/5 output
    HundredGigE0/6/0/6 output
    HundredGigE0/6/0/7 output
    HundredGigE0/6/0/8 output
    HundredGigE0/6/0/9 output
    HundredGigE0/6/0/10 output
    HundredGigE0/6/0/11 output
    HundredGigE0/6/0/13 output
    HundredGigE0/6/0/14 output
    HundredGigE0/6/0/15 output
    HundredGigE0/6/0/16 output
    HundredGigE0/6/0/17 output
  Total targets: 30

  Targets (applied as child policy):
  Total targets: 0
```




Congestion Avoidance Commands

This chapter describes commands used to avoid congestion.

- [bandwidth \(QoS\)](#), on page 46
- [bandwidth remaining](#), on page 48
- [queue-limit](#), on page 50
- [random-detect](#), on page 52
- [service-policy \(interface\)](#), on page 54

bandwidth (QoS)

To specify the minimum bandwidth allocated to a class belonging to a policy map, use the **bandwidth** command in policy map class configuration mode. To remove the bandwidth specified for a class, use the **no** form of this command.

```
bandwidth {rate [units] | percent percentage-value}
no bandwidth {rate [units] | percent percentage-value}
```

Syntax Description		
	<i>rate</i>	Minimum bandwidth, in the units specified, to be assigned to the class. Range is from 1 to 4294967295.
	<i>units</i>	Specifies the units for the bandwidth.
	percent <i>percentage-value</i>	Specifies the amount of minimum guaranteed bandwidth, based on an absolute percentage of available bandwidth. Range is from 1 to 100.

Command Default The default units is kbps.

Command Modes Policy map class configuration

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines The **bandwidth** command is used to specify the minimum guaranteed bandwidth allocated for traffic matching a particular class. Bandwidth may be defined as a specific value or may be set as a percentage of the interface bandwidth.

If a percentage value is set, the accuracy that can be expected is 1 percent.

The **bandwidth** command is supported only in the egress direction.

A policy map can have a single bandwidth statement per class. Both percentage and actual value bandwidth configurations can be used within a policy map.

The **bandwidth** command does not specify how the bandwidth is to be shared. Instead it specifies how much bandwidth is guaranteed per class, by setting the number of tokens that are assigned to the token bucket of a particular class. For configured behavior to work correctly, you must ensure that the sum of the bandwidths plus any priority traffic is not greater than the bandwidth of the interface itself. If the interface is oversubscribed, unpredictable behavior results.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to guarantee 50 percent of the interface bandwidth to a class called class1 and 10 percent of the interface bandwidth to a class called class2:

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# bandwidth percent 50
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# class class2
RP/0/(config-pmap-c)# bandwidth percent 10
```

bandwidth remaining

To specify how to allocate leftover bandwidth to various classes, use the **bandwidth remaining** command in policy map class configuration mode. To return to the system defaults, use the **no** form of this command.

bandwidth remaining [{**percent** *percentage-value* | **ratio** *ratio-value*}]

no bandwidth remaining [{**percent** *percentage-value* | **ratio** *ratio-value*}]

Syntax Description

percent *percentage-value* Specifies the amount of guaranteed bandwidth, based on an absolute percentage of the available bandwidth. Range is from 1 to 100.

ratio *ratio-value* Specifies the amount of guaranteed bandwidth, based on a bandwidth ratio value. Range is 1 to 2000.

Command Default

No bandwidth is specified.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

Bandwidth, bandwidth remaining, shaping, queue-limit and WRED commands can be configured together in the same class.



Note

The **bandwidth remaining** command is supported only in the egress direction.

The available bandwidth is equally distributed among those queueing classes that do not have the remaining bandwidth explicitly configured.

The **bandwidth remaining** command is used to proportionally allocate bandwidth to the particular classes, but there is no reserved bandwidth capacity.

On egress, if the **bandwidth remaining** command is not present, then the bandwidth is shared equally among the configured queueing classes present in the policy-map.

Task ID

Task ID	Operations
qos	read, write

Examples

This example shows how the remaining bandwidth is shared by classes class1 and class2 in a 20:80 ratio.

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# bandwidth remaining percent 20
RP/0/(config-pmap-c)# exit
RP/0/(config-pmap)# class class2
RP/0/(config-pmap-c)# bandwidth remaining percent 80
```

queue-limit

To specify or modify the maximum number of packets the queue can hold for a class policy configured in a policy map, use the **queue-limit** command in policy map class configuration mode. To remove the queue packet limit from a class, use the **no** form of this command.

queue-limit *value* [*unit*]

no queue-limit

Syntax Description

value Maximum threshold for tail drop in bytes. Range is from 1 to 4294967295.

unit (Optional) Units for the queue limit value.

Note When the specified *units* is packets, packets are assumed to be 256 bytes in size.

Command Default

The default value is 10 milliseconds for all queues including the high-priority queues.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

When configuring the **queue-limit** command, you must configure one of the following commands: **priority**, **shape average**, **bandwidth** or **bandwidth remaining**, except for the default class. The default value is 10 milliseconds for all queues including the high-priority queues.

The **queue-limit** command is supported only in the egress direction.

Packets satisfying the match criteria for a class accumulate in the queue reserved for the class until they are serviced by the scheduling mechanism. The **queue-limit** command defines the maximum threshold for a class. When that threshold is reached, enqueued packets to the class queue result in tail drop (packet drop). Tail drop is a congestion avoidance technique that drops packets when an output queue is full, until congestion is eliminated.

Use the **show qos interface** command to display the queue limit and other QoS values.

These restrictions apply to queue limits:

- Queue limit should be at least the maximum MTU size, which is 9 * 1024 bytes = 9kb.
- Queue limit should be 3 GB, which is the maximum packet buffer size in ingress and egress queuing ASICs.
- Only time-based units are allowed on bundle targets.

Guaranteed Service Rate

The guaranteed service rate is defined as the service rate of the queue when all queues are backlogged and derived as:

$\text{minimum_bandwidth} + (\text{bandwidth_remaining_percent} * \text{unallocated_bandwidth})$

This example shows the guaranteed service rate calculation:

```
policy-map sample_policy
  class c1
    bandwidth percent 30
    bandwidth remaining percent 40
  class c2
    bandwidth percent 20
  class class-default
```

guaranteed service rate of c1 = 30 percent LR + (40 percent * 50 percent * LR)

guaranteed service rate of c2 = 20 percent LR + (30 percent * 50 percent * LR)

guaranteed service rate of class-default = 30 percent * 50 percent * LR

- Where LR is line rate of the target on which service policy "sample_policy" is attached.
- 50 percent is unallocated bandwidth.

Task ID

Task ID	Operations
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qos	read, write
-----	----------------

Examples

This example shows how to set the queue limit for a class to 1000000 packets for policy map policy1:

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# queue-limit 1000000
```

random-detect

To enable random early detection (RED), use the **random-detect** command in policy map class configuration mode. To remove RED, use the **no** form of this command.

random-detect {**default** | **discard-class** *value* | *min-threshold* [*units*] *max-threshold* [*units*]}
no random-detect

Syntax Description

default	Enables RED with default minimum and maximum thresholds.
discard-class <i>value</i>	Discard-class based WRED (up to 2 values, which is 0 and 1).
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is from 0 to 1073741823 in packets.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is from the value of the <i>min-threshold</i> argument to 1073741823. When the queue length exceeds the maximum threshold, RED drops all packets with the specified discard class value.
<i>units</i>	(Optional) Units for the threshold values.

Command Default

Default unit for *max-threshold* and *min-threshold* is **packets**.

Command Modes

Policy map class configuration

Command History

Release	Modification
Release 6.1.42	This command was introduced.

Usage Guidelines

The RED congestion avoidance technique takes advantage of the congestion control mechanism of TCP. By randomly dropping packets before periods of high congestion, RED tells the packet source to decrease its transmission rate. Assuming the packet source is using TCP, it decreases its transmission rate until all the packets reach their destination, indicating that the congestion is cleared. You can use RED as a way to cause TCP to slow transmission of packets. TCP not only pauses, but it also restarts quickly and adapts its transmission rate to the rate that the network can support.

RED distributes losses in time and maintains normally low queue depth while absorbing traffic bursts. When enabled on an interface, RED begins dropping packets when congestion occurs at a rate you select during configuration.

When time units are used, the guaranteed service rate is used to compute thresholds. The default minimum threshold is 6 ms and the maximum threshold is 10 ms.

When the value of the *units* argument is packets, packets are assumed to be 256 bytes in size.

Weighted Random Early Detection

The following restriction apply to Weighted Random Early Detection (WRED):

- For thresholds in time units, the guaranteed service rate is used to calculate the thresholds in bytes.

For bundles, queue limit and WRED thresholds are supported in time units only.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows how to enable RED using a minimum threshold value of 1000000 and a maximum threshold value of 2000000:

```
RP/0/(config)# policy-map policy1
RP/0/(config-pmap)# class class1
RP/0/(config-pmap-c)# random-detect 1000000 2000000
```

service-policy (interface)

To attach a policy map to an input interface or output interface to be used as the service policy for that interface, use the **service-policy** command in the appropriate configuration mode. To remove a service policy from an input or output interface, use the **no** form of the command.

```
service-policy {input | output} policy-map
no service-policy {input | output} policy-map
```

Syntax Description	input	output	<i>policy-map</i>
	Attaches the specified policy map to the input interface.	Attaches the specified policy map to the output interface.	Name of a service policy map (created using the policy-map command) to be attached.

Command Default No service policy is specified.

Command Modes Interface configuration.

Command History	Release	Modification
	Release 6.1.42	This command was introduced.

Usage Guidelines You can attach a single policy map to one or more interfaces to specify the service policy for those interfaces. The class policies composing the policy map are then applied to packets that satisfy the class map match criteria for the class. To apply a new policy to an interface, you must remove the previous policy. A new policy cannot replace an existing policy.

Task ID	Task ID	Operations
	qos	read, write

Examples

This example shows policy map policy2 applied to HundredGigabitEthernet 0/0/0/1.

```
RP/0/(config)# class-map class2
RP/0/(config)# match precedence ipv4 2
RP/0/(config-cmap)# exit

RP/0/(config)# policy-map policy2
RP/0/(config-pmap)# class-map class2
RP/0/(config-pmap-c)# set precedence 3
RP/0/(config-pmap)# exit

RP/0/(config)# HundredGigabitEthernet 0/0/0/1
RP/0/(config-if)# service-policy input policy2
```

This example shows policy map policy 1 applied to Bundle-Ether interface.

```
RP/0/(config)# interface Bundle-Ether1  
RP/0/(config-if)# service-policy input policy1  
RP/0/(config-if)# exit
```

