

3-Level User-Defined Queuing Policy Support

3-level user-defined queuing policy support feature allows 3 level policy with topmost layer user defined classes to support and enhance the flexibility of the traffic class in the hierarchy.

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Restrictions for 3-Level User-Defined Queuing Policy Support

- User-defined class in top layer of a 3-level hierarchical queuing policy is not supported on port-channel main interface.

  User-defined class at the topmost layer is not supported on any logical target. Logical targets include service-group, tunnel, session, dealer interface, etc.

Information About 3-Level User-Defined Queuing Policy Support

Three-Parameter Scheduler in Hierarchical QoS

Classic IOS uses max value (shape) and min value (bandwidth) to define each scheduler node behavior when traffic congestion happens, or 2 parameter scheduler.

ASR 1000 utilize a different 3-parameter scheduler: max value (shape), min value (bandwidth) and excess value (bandwidth remaining) which is to adjust sharing of excess bandwidth. In a 2-parameter scheduler, the excess bandwidth are shared by the classes proportionally (same as the bandwidth ratio for each class); But in a 3-parameter scheduler, the excess bandwidth are shared equally by default after satisfying minimum bandwidth requirements, but it can be tuned when using ‘bandwidth remaining’ command. ISR 4000 platforms share the same design.

In Classic IOS, it is permitted to configure bandwidth at the leaf and intermediate nodes of a hierarchy. In IOS XE, bandwidth (bandwidth rate , or bandwidth percent) is only allowed at the leaf node of a hierarchy. In other words, bandwidth (bandwidth rate , or bandwidth percent) class cannot be attached with a child policy-map containing queuing features. This is a restriction in software and may be lifted in the future.

For current deployments where a Classic IOS QoS policy-map is being moved to a IOS XE platform, the best option is to convert the intermediate node bandwidth commands to bandwidth remaining commands. bandwidth remaining percent or bandwidth remaining ratio commands could be used to achieve very similar behavior.

Guidelines for Hierarchical Policies

In general, three levels of hierarchy are supported on ASR 1000. Hierarchical policy can be applied on most of the physical and logical targets that supports QoS.

If you mix queuing and non-queuing policies together in a hierarchy, the non-queuing policy-maps must be at the leaf level of the policy-map (for example, child policy beneath grandparent and parent queuing policies).

If the policy-map is applied to a virtual interface (such as a tunnel or session), there may be additional restrictions limiting the hierarchy to two levels of queuing, depending on the configuration.

- Queuing features: shape, bandwidth, bandwidth remaining, random-detect, fair-queue, queue limit, and priority.
- Non-queuing features: police, mark, and account.

Hierarchy Feature Combination	Ingress Policy Support	Egress Policy Support
One-level Non-queuing Policy	Yes	Yes
Two-level Non-queuing Policy (including color-aware police)	Yes	Yes
Three-level Non-queuing Policy (including hierarchical color-aware police)	Yes	Yes
One-level Queuing Policy	-	Yes
Two-level Queuing Policy	-	Yes
Three-level Queuing Policy	-	Yes
Two-level Mixed Policy, Queuing feature at parent level	-	Yes
Three-level Mixed Policy, Queuing feature at grandparent level, or at grandparent + parent level	-	Yes

User-defined Traffic Class in Top-level Policy of HQoS

Any traffic class configured explicitly by 'class-map' is called 'user-defined class'. Class-default classes need not be configured, and can be used in any policy to match all the traffic that does not belong to user-defined classes.

In a three-level queuing policy-map, only class-default class can be configured in the highest level before Release Polaris 16.3. From Polaris 16.3, user-defined class in top layer of a 3-level hierarchical policy is supported.

How to Configure 3-Level User-Defined Queuing Policy Support

Configuring 3-level Hierarchical QoS Policy

```
enable
configure terminal
class-map vlan10
 match vlan10
class-map vlan20
 match vlan 20
class-map ef
 match dscp ef
policy-map child
 class ef
  priority
  police 1000000
 class class-default
 police 3000000
policy-map parent
 class vlan10
  shape average 4000000
  service-policy child
 class vlan20
  shape average 8000000
  service-policy child
policy-map grand-parent
 class class-default
  shape average 10000000
  service-policy parent
end
```

Configuring User-Defined Traffic Class in Top Level Policy

```
ip access-list extended PEER
permit ip host 200.0.0.2 any

class-map match-all ef
 match dscp ef
class-map match-all vlan100
 match vlan 100
class-map match-all vlan101
 match vlan 101
class-map match-all PEER
 match access-group name PEER

policy-map child
 class ef
  bandwidth remaining percent 15
 class class-default
  fair-queue
  queue-limit 512 packets
  bandwidth remaining percent 85

policy-map parent
 class PEER
  shape average 8000000
  bandwidth remaining percent 10
```

```
  service-policy child
class class-default
 shape average 8000000

policy-map grandparent
 class vlan100
  shape average 8000000
  bandwidth remaining ratio 1000
  service-policy parent
 class vlan101
  shape average 8000000
  bandwidth remaining ratio 1000
  service-policy parent
 class class-default
  bandwidth remaining ratio 1
  shape average 10000000
end
```

Additional References for 3-Level User-Defined Queuing Policy Support

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

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/cisco/web/support/index.html

Feature Information for 3-Level User-Defined Queuing Policy Support

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

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

Table 1: Feature Information for 3-Level User-Defined Queuing Policy Support

Feature Name	Releases	Feature Information
3-Level User-Defined Queuing Policy Support	Cisco IOS XE Denali 16.3.1.	This feature is introduced on Cisco ASR 1000, ISR4000, CSR1000v platforms. User-defined class can be configured in top layer of a 3-level hierarchical policy.