Content

Chapter 1 QoS Configuration

Explanation：

The layer 3 switch in this chapter represents the a general sense of router or wireless controller which is running routing protocol.

1.1 Introduction to QoS

QoS (Quality of Service) is a set of capabilities that allow you to create differentiated services for network traffic, thereby providing better service for selected network traffic. QoS is a guarantee for service quality of consistent and predictable data transfer service to fulfill program requirements. QoS cannot generate extra bandwidth but provides more effective bandwidth management according to the application requirement and network management policy.

1.1.1 QoS Terms

QoS: Quality of Service, provides a guarantee for service quality of consistent and predictable data transfer service to fulfill program requirements. QoS cannot generate new bandwidth but provides more effective bandwidth management according to the application requirement and network management.

QoS Domain: QoS Domain supports QoS devices to form a net-topology that provides Quality of Service, so this topology is defined as QoS Domain.

CoS: Class of Service, the classification information carried by Layer 2 802.1Q frames, taking 3 bits of the Tag field in frame header, is called user priority level in the range of 0 to 7.

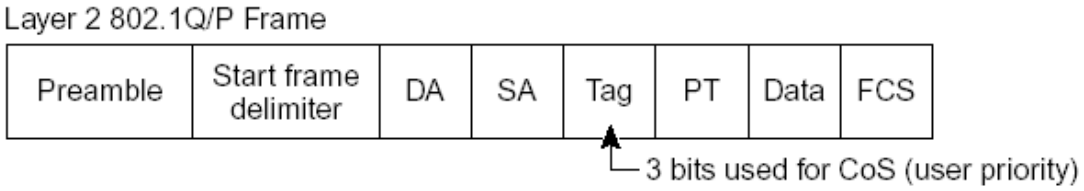

Fig 1-1 CoS priority

ToS: Type of Service, a one-byte field carried in Layer 3 IPv4 packet header to symbolize the service type of IP packets. Among ToS field can be IP Precedence value or DSCP value.

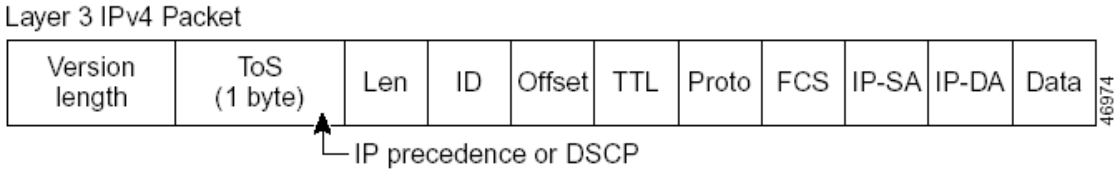

Fig 1-2 ToS priority

IP Precedence: IP priority. Classification information carried in Layer 3 IP packet header, occupying 3 bits, in the range of 0 to 7.

DSCP: Differentiated Services Code Point, classification information carried in Layer 3 IP packet header, occupying 6 bits, in the range of 0 to 63, and is downward compatible with IP Precedence.

MPLS TC*(EXP)*:

A field of the MPLS packets means the service class, there are 3 bits, the ranging from 0 to 7.

Internal Priority: The internal priority setting of the switch chip, it's valid range relates with the chip, it's shortening is Int-Prio or IntP.

Drop Precedence: When processing the packets, firstly drop the packets with the bigger drop precedence, the ranging is 0-2 in three color algorithm, the ranging is 0-1 in dual color algorithm. It's shortening is Drop-Prec or DP.

Classification: The entry action of QoS, classifying packet traffic according to the classification information carried in the packet and ACLs.

Policing: Ingress action of QoS that lays down the policing policy and manages the classified packets.

Remark: Ingress action of QoS, perform allowing, degrading or discarding operations to packets according to the policing policies.

Scheduling: QoS egress action. Configure the weight for eight egress queues WRR (Weighted Round Robin).

In-Profile: Traffic within the QoS policing policy range (bandwidth or burst value) is called In-Profile.

Out-of-Profile: Traffic out the QoS policing policy range (bandwidth or burst value) is called Out-of-Profile.

1.1.2 QoS Implementation

To implement the switch software QoS, a general, mature reference model should be given. QoS can not create new bandwidth, but can maximize the adjustment and configuration for the current bandwidth resource. Fully implemented QoS can achieve

complete management over the network traffic. The following is as accurate as possible a description of QoS.

The data transfer specifications of IP cover only addresses and services of source and destination, and ensure correct packet transmission using OSI layer 4 or above protocols such as TCP. However, rather than provide a mechanism for providing and protecting packet transmission bandwidth, IP provide bandwidth service by the best effort. This is acceptable for services like Mail and FTP, but for increasing multimedia business data and e-business data transmission, this best effort method cannot satisfy the bandwidth and low-lag requirement.

Based on differentiated service, QoS specifies a priority for each packet at the ingress. The classification information is carried in Layer 3 IP packet header or Layer 2 802.1Q frame header. QoS provides same service to packets of the same priority, while offers different operations for packets of different priority. QoS-enabled switch or router can provide different bandwidth according to the packet classification information, and can remark on the classification information according to the policing policies configured, and may discard some low priority packets in case of bandwidth shortage.

If devices of each hop in a network support differentiated service, an end-to-end QoS solution can be created. QoS configuration is flexible, the complexity or simplicity depends on the network topology and devices and analysis to incoming/outgoing traffic.

1.1.3 Basic QoS Model

The basic QoS consists of four parts: Classification, Policing, Remark and Scheduling, where classification, policing and remark are sequential ingress actions, and Queuing and Scheduling are QoS egress actions.

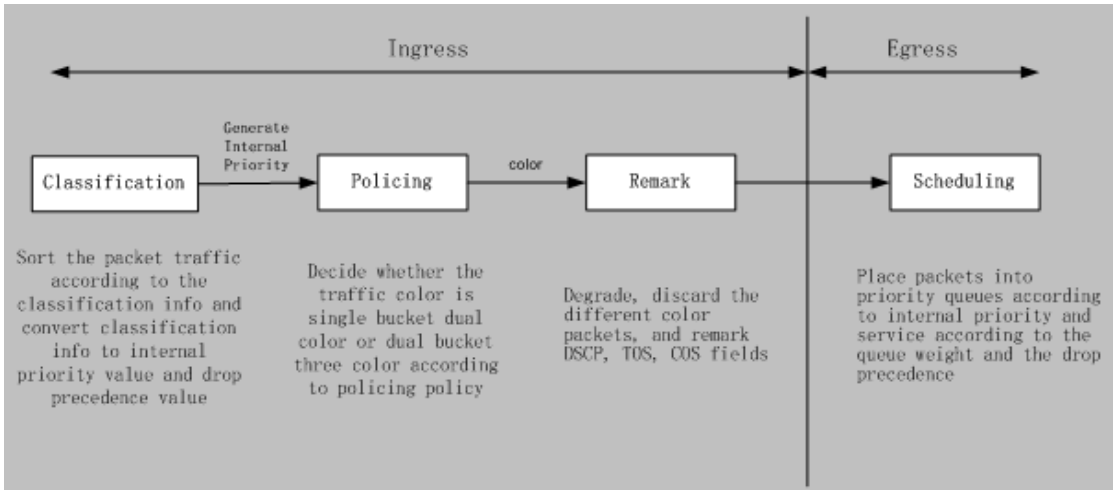

Fig 1-3 Basic QoS Model

Classification: Classify traffic according to packet classification information and generate internal priority and drop precedence based the classification information. For different

packet types and switch configurations, classification is performed differently; the flowchart below explains this in detail.

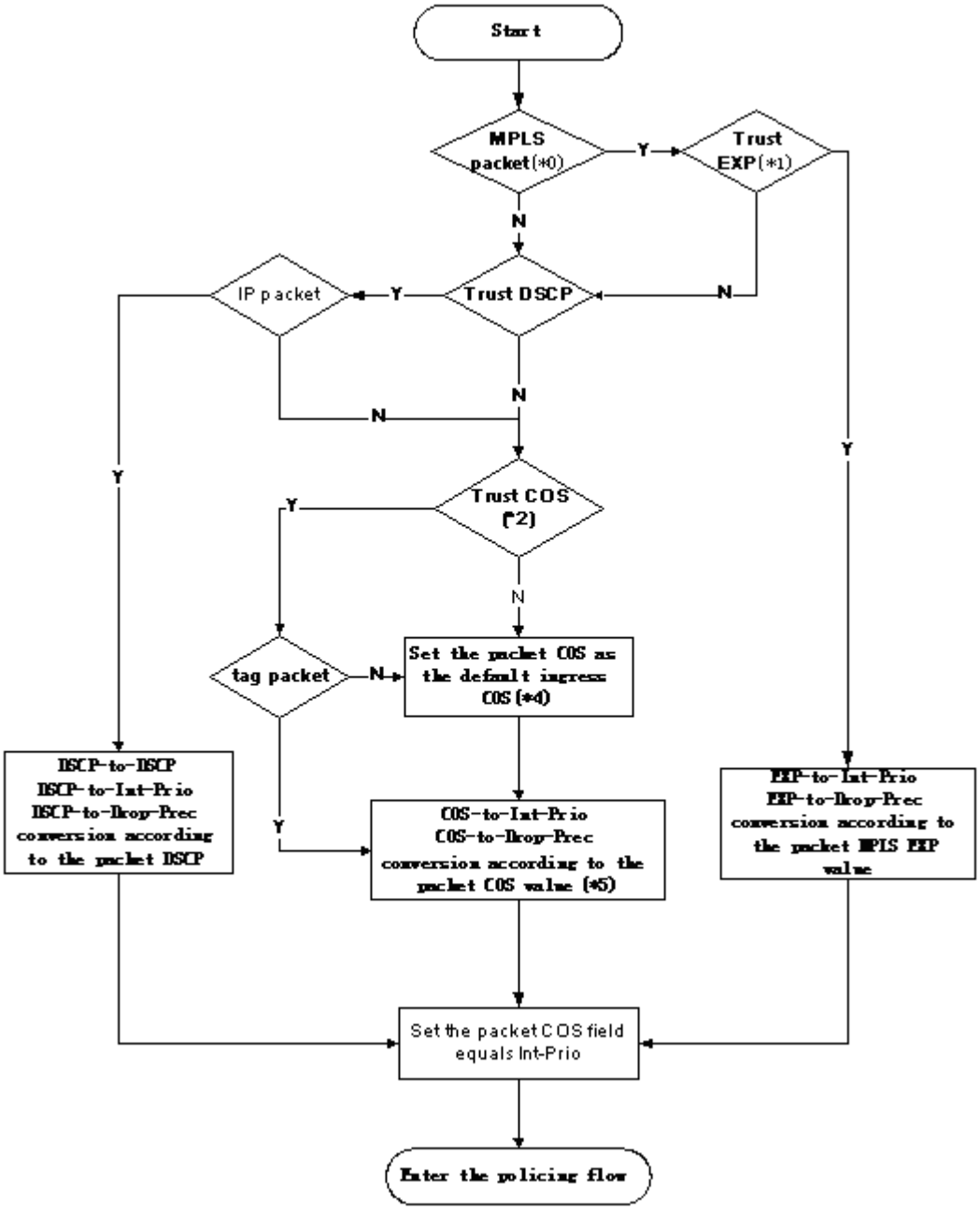

Fig 1-4 Classification process

Policing and remark: Each packet in classified ingress traffic is assigned an internal priority value and a drop precedence value, and can be policed and remarked.

Policing can be performed based on the flow to configure different policies that allocate bandwidth to classified traffic, the assigned bandwidth policy may be dual bucket dual color or dual bucket three color. The traffic, will be assigned with different color, can be discarded or passed, for the passed packets, add the remarking action. Remarking uses a new DSCP value of lower priority to replace the original higher level DSCP value in

the packet. The following flowchart describes the operations.

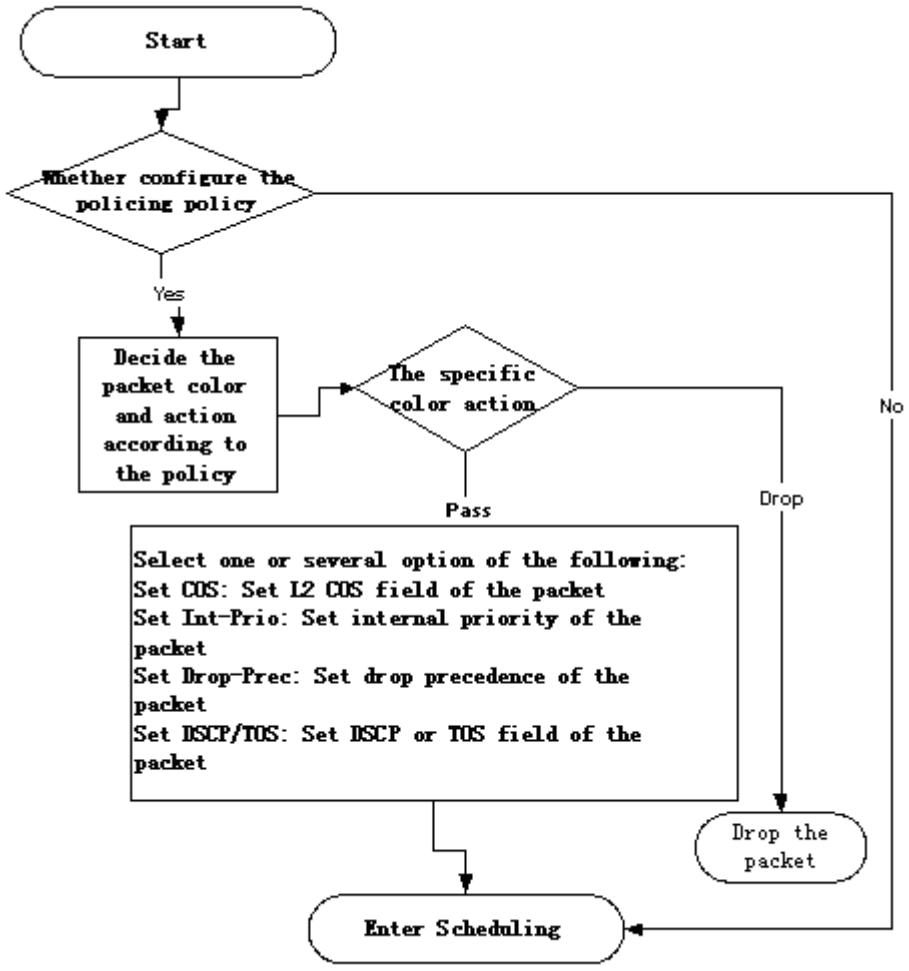

Fig 1-5 Policing and Remarking process

Queuing and scheduling: There are the internal priority and the drop precedence for the egress packets, the queuing operation assigns the packets to different priority queues according to the internal priority, while the scheduling operation perform the packet forwarding according to the priority queue weight and the drop precedence. The following flowchart describes the operations during queuing and scheduling.

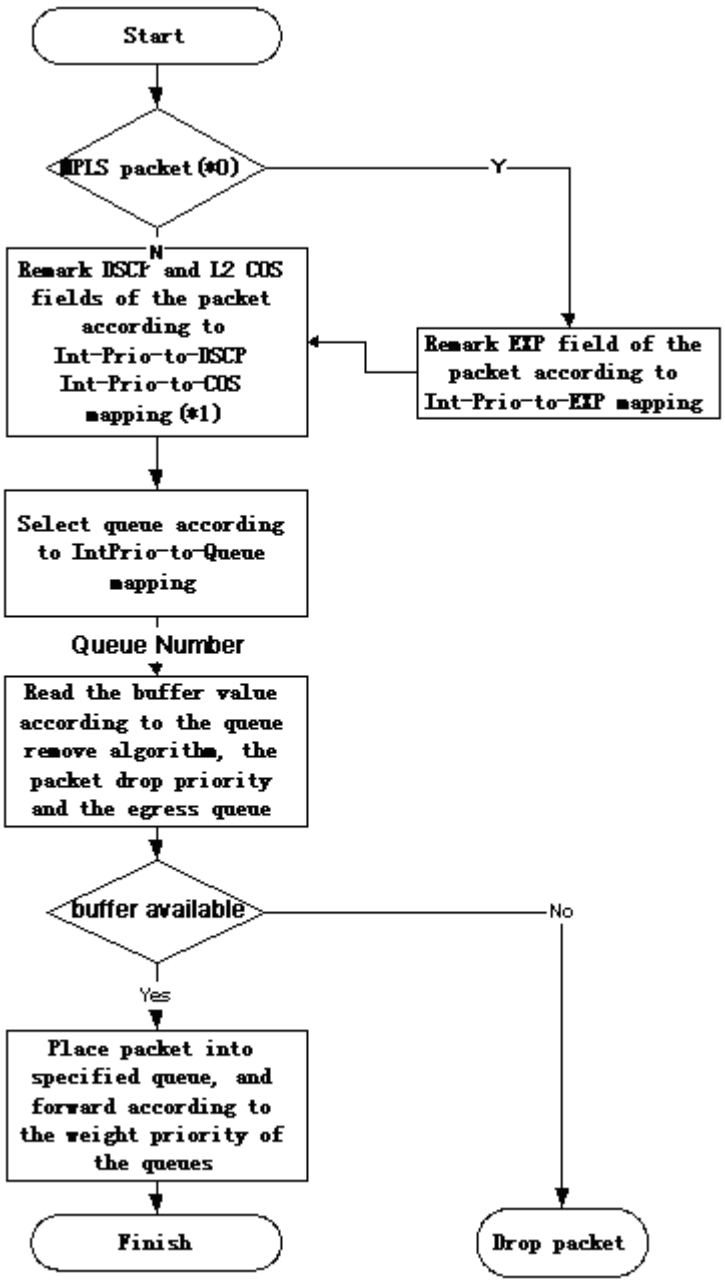

Fig 1-6 Queuing and Scheduling process

1.2 QoS Configuration Task List

Configure class map

Set up a classification rule according to ACL, CoS, VLAN ID, IPv4 Precedent, DSCP, IPV6 FL to classify the data stream. Different classes of data streams will be processed with different policies.

Configure a policy map

After data steam classification, a policy map can be created to associate with the class map created earlier and enter class mode. Then different policies (such as bandwidth limit, priority degrading assigning new DSCP value) can be applied to different data streams. You can also define a policy set that can be use in a policy map by several classes.

Apply QoS to the ports or the VLAN interfaces

Configure the trust mode for ports or bind policies to ports. A policy will only take effect on a port when it is bound to that port.

The policy may be bound to the specific VLAN.

It is not recommended to synchronously use policy map on VLAN and its port.

Configure queue management algorithm

Configure queue management algorithm, such as sp, wrr, wdrr, and so on.

Configure QoS mapping

Configure the mapping from CoS to DP, DSCP to DSCP, IntP or DP, IntP to DSCP.

1. Configure class map.

Command	Explanation
Global Mode	
class-map <*class-map-name*> **no class-map <*class-map-name*>**	Create a class map and enter class map mode; the "**no class-map <*class-map-name*>**" command deletes the specified class map.
match {access-group <acl-index-or-name> | ip dscp <dscp-list>| ip precedence <ip-precedence-list>| ipv6 access-group <acl-index-or-name> | ipv6 dscp <dscp-list>| ipv6 flowlabel <flowlabel-list>|vlan <vlan-list> | cos <*cos-list*> | exp <exp-list>} **no match {access-group | ip dscp | ip precedence | ipv6 access-group | ipv6 dscp | ipv6 flowlabel | vlan | cos | exp}**	Set matching criterion (classify data stream by ACL, CoS, VLAN ID, IPv4 Precedent, IPv6 FL or DSCP, etc) for the class map; the no command deletes specified matching criterion.

2. Configure a policy map

Command	Explanation
Global Mode	
policy-map <*policy-map-name*>	Create a policy map and enter policy

no policy-map <*policy-map-name*>	map mode; the no command deletes the specified policy map.
class <*class-map-name*> [insert-before <class-map-name>] **no class <*class-map-name*>**	After a policy map is created, it can be associated to a class. Different policy or new DSCP value can be applied to different data streams in class mode; the no command deletes the specified class.
set {ip dscp <new-dscp> | ip precedence <new-precedence> | internal priority <new-inp> | drop precedence <new-dp> | cos <new-cos>} **no set {ip dscp | ip precedence | internal priority | drop precedence | cos }K**	Assign a new DSCP, CoS, IP Precedence value for the classified traffic; the no command cancels the newly assigned value.
Single bucket mode: **policy <bits_per_second> <normal_burst_bytes> ({conform-action ACTION | exceed-action ACTION})** **Dual bucket mode:** **policy <bits_per_second> <normal_burst_bytes> [pir <peak_rate_bps>] | <maximum_burst_bytes> [{conform-action ACTION | exceed-action ACTION | violate-action ACTION }]** **ACTION definition:** **drop | transmit | set-dscp-transmit <dscp_value> | set-prec-transmit <ip_precedence_value> | set-cos-transmit <cos_value> | set-internal-priority <inp_value> | set-Drop-Precedence <dp_value>** **no policy**	Configure a policy for the classified flow. The non-aggregation policy command supports three colors. Analyze the working mode of the token bucket, whether it is singe rate single bucket, single rate dual bucket, dual rate dual bucket, set corresponding action to different color packets. The no command will delete the mode configuration. Single bucket mode is supported by the specific switch.
policy aggregate <*aggregate-policy-name*> **no policy aggregate <*aggregate-policy-name*>**	Apply a policy to classified traffic; the no command deletes the specified policy set.
accounting **no accounting**	Set statistic function for the classified traffic. After enable this function under

	the policy class map mode, add statistic function to the traffic of the policy class map. In single bucket mode, the messages can only red or green when passing policy. In the print information, in-profile means green and out-profile means red. In dual bucket mode, there are three colors of the packets. In the print information, in-profile means green and out-profile means red and yellow.
Policy class map configuration mode	
drop **no drop** **transmit** **no transmit**	Drop or transmit data package that match the class, the no command cancels the assigned action.

3. Apply QoS to port or VLAN interface

Command	Explanation
Interface Configuration Mode	
mls qos trust dscp **no mls qos trust dscp**	Configure port trust; the no command disables the current trust status of the port.
mls qos cos {<*default-cos*> } **no mls qos cos**	Configure the default CoS value of the port; the no command restores the default setting.
service-policy input <*policy-map-name*> **no service-policy input {<*policy-map-name*>}**	Apply a policy map to the specified port; the no command deletes the specified policy map applied to the port. Egress policy map is not supported yet or deletes all the policy maps applied on the ingress direction of the port
Global Mode	
service-policy input <*policy-map-name*> vlan <*vlan-list*>	Apply a policy map to the specified VLAN interface; the no command

no service-policy input {<*policy-map-name*>} *vlan* <vlan-list>	deletes the specified policy map applied to the VLAN interface or deletes all the policy maps applied in the ingress direction of the vlan interface .

4. Configure queue management algorithm and weight

Command	Explanation
Port Configuration Mode	
mls qos queue algorithm {sp | wrr | wdrr} **no mls qos queue algorithm**	Set queue management algorithm, the default queue management algorithm is wrr.
mls qos queue wrr weight <weight0..weight7> **no mls qos queue wrr weight**	Set queue weight based a port, the default queue weight is 1 2 3 4 5 6 7 8.
mls qos queue wdrr weight <weight0..weight7> **no mls qos queue wdrr weight**	Set queue weight based a port, the default queue weight is 10 20 40 80 160 320 640 1280.
mls qos queue <queue-id> bandwidth <minimum-bandwidth> <maximum-bandwidth> **no mls qos queue <queue-id> bandwidth**	Set bandwidth guarantee based a port.

5. Configure QoS mapping

Command	Explanation
Global Mode	
mls qos map (cos-dp <dp1…dp8> | dscp-dscp <in-dscp list> to <out-dscp> | dscp-intp <in-dscp list> to <intp> | dscp-dp <in-dscp list> to <dp>) **no mls qos map (cos-dp | dscp-dscp | dscp-intp | dscp-dp)** **mls qos map intp-dscp <dscp1..dscp8>** **no mls qos map intp-dscp**	Set the priority mapping for QoS, the no command restores the default mapping value.

6. Clear accounting data of the specific ports or VLANs

Command	Explanation
Admin Mode	
clear mls qos statistics [interface <interface-name> | vlan <vlan-id>]	Clear accounting data of the specified ports or VLAN Policy Map. If there are no parameters, clear accounting data of all policy map.

7. Show configuration of QoS

Command	Explanation
Admin Mode	
show mls qos maps [cos-dp | dscp-dscp | dscp-intp | dscp-dp | intp-dscp]	Display the configuration of QoS mapping.
show class-map [<class-map-name>]	Display the classified map information of QoS.
show policy-map [<policy-map-name>]	Display the policy map information of QoS.
show mls qos {interface [<interface-id>] [policy | queuing] | vlan <vlan-id>}	Displays QoS configuration information on a port.

1.3 QoS Example

Example 1:

Enable QoS function, change the queue out weight of port ethernet 1/0/1 to 1:1:2:2:4:4:8:8, set the port in trust CoS mode without changing DSCP value, and set the default CoS value of the port to 5.

The configuration steps are listed below:

Switch#config
Switch(config)#interface ethernet 1/0/1
Switch(Config-If-Ethernet1/0/1)# mls qos queue wrr weight 1 1 2 2 4 4 8 8
Switch(Config-If-Ethernet1/0/1)#mls qos cos 5

Configuration result:

When QoS enabled in Global Mode, the egress queue bandwidth proportion of port ethernet1/0/1 is 1:1:2:2:4:4:8:8. When packets have CoS value coming in through port

ethernet1/0/1, it will be map to the queue out according to the CoS value, CoS value 0 to 7 correspond to queue out 1, 2, 3, 4, 5, 6, 7, 8 respectively. If the incoming packet has no CoS value, it is default to 5 and will be put in queue6. All passing packets would not have their DSCP values changed.

Example 2:

In port ethernet1/0/2, set the bandwidth for packets from segment 192.168.1.0 to 10 Mb/s, with a burst value of 4 MB, all packets exceed this bandwidth setting will be dropped.

The configuration steps are listed below:

```
Switch#config
Switch(config)#access-list 1 permit 192.168.1.0 0.0.0.255
Switch(config)#class-map c1
Switch(Config-ClassMap-c1)#match access-group 1
Switch(Config-ClassMap-c1)#exit
Switch(config)#policy-map p1
Switch(Config-PolicyMap-p1)#class c1
Switch(Config-PolicyMap-p1-Class-c1)#policy 10000 4000 exceed-action drop
Switch(Config-PolicyMap-p1-Class-c1)#exit
Switch(Config-PolicyMap-p1)#exit
Switch(config)#interface ethernet 1/0/2
Switch(Config-If-Ethernet1/0/2)#service-policy input p1
```

Configuration result:

An ACL name 1 is set to matching segment 192.168.1.0. Enable QoS globally, create a class map named c1, matching ACL1 in class map; create another policy map named p1 and refer to c1 in p1, set appropriate policies to limit bandwidth and burst value. Apply this policy map on port ethernet1/0/2. After the above settings done, bandwidth for packets from segment 192.168.1.0 through port ethernet 1/0/2 is set to 10 Mb/s, with a burst value of 4 MB, all packets exceed this bandwidth setting in that segment will be dropped.

Example 3:

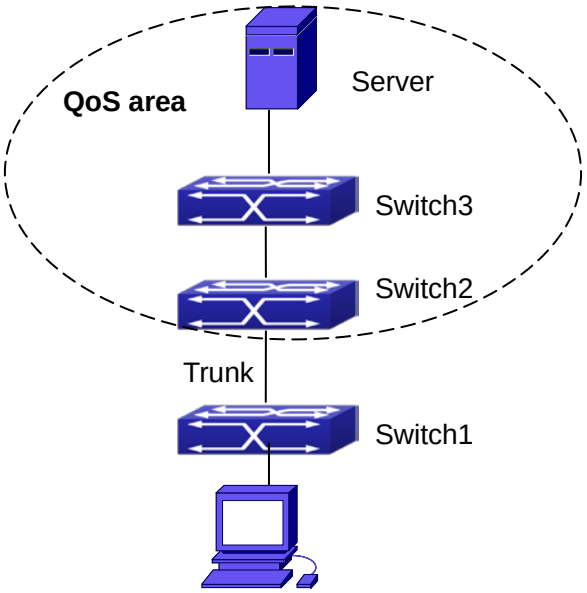

Fig 1-7 Typical QoS topology

As shown in the figure, inside the block is a QoS domain, Switch1 classifies different traffics and assigns different IP precedences. For example, set CoS precedence for packets from segment 192.168.1.0 to 5 on port ethernet1/0/1. The port connecting to switch2 is a trunk port. In Switch2, set port ethernet 1/0/1 that connecting to swtich1 to trust cos. Thus inside the QoS domain, packets of different priorities will go to different queues and get different bandwidth.

The configuration steps are listed below:

QoS configuration in Switch1:

Switch#config
Switch(config)#access-list 1 permit 192.168.1.0 0.0.0.255
Switch(config)#class-map c1
Switch(Config-ClassMap-c1)#match access-group 1
Switch(Config-ClassMap-c1)#exit
Switch(config)#policy-map p1
Switch(Config-PolicyMap-p1)#class c1
Switch(Config-PolicyMap-p1-Class-c1)#set ip precedence 5
Switch(Config-PolicyMap-p1-Class-c1)#exit
Switch(Config-PolicyMap-p1)#exit
Switch(config)#interface ethernet 1/0/1
Switch(Config-If-Ethernet1/0/1)#service-policy input p1

QoS configuration in Switch2:

Switch#config

Switch(config)#interface ethernet 1/0/1

1.4 QoS Troubleshooting

- ☞ trust cos and exp can be used with other trust or Policy Map.
- ☞ trust dscp can be used with other trust or Policy Map. This configuration takes effect to IPv4 and IPv6 packets.
- ☞ trust exp, trust dscp and trust cos may be configured at the same time, the priority is: EXP>DSCP>COS.
- ☞ If the dynamic VLAN (mac vlan/voice vlan/ip subnet vlan/protocol vlan) is configured, then the packet COS value equals COS value of the dynamic VLAN.
- ☞ Policy map can only be bound to ingress direction, egress is not supported yet.
- ☞ At present, it is not recommended to synchronously use policy map on VLAN and VLAN's port.

Chapter 2 PBR Configuration

2.1 Introduction to PBR

PBR（Policy-Based Routing）is a method which determines the next-hop of the data packets by policy messages such as source address, destination address, IP priority, TOS value, IP protocol, source port No, destination port No, etc.

2.2 PBR Configuration

1. Configure a class-map
2. Set match standard of the class-map
3. Configure a policy-map
4. Configure a policy map corresponding to a class map
5. Configure nexthop IPv4 address
6. Configure the port binding policy map
7. Configure the VLAN binding policy map

1. Configure a class-map

Command	Explanation
Global Configuration Mode	
class-map <*class-map-name*> **no class-map <*class-map-name*>**	Set up or delete a class-map.

2. Set match standard of the class-map

Command	Explanation
Class-map Configuration Mode	
match ip {access-group <*acl-index-or-name*>} **no match ip {access-group}**	Set the match standard of the class-map

3. Configure a policy-map

Command	Explanation
Global Configuration Mode	

policy-map <*policy-map-name*> **no policy-map <*policy-map-name*>**	Set up or delete a policy-map.

4. Configure a policy map corresponding to a class map

Command	Explanation
Policy-map Configuration Mode	
class <*class-map-name*> **no class <*class-map-name*>**	Correspond a class-map, and enter the policy map mode.

5. Configure nexthop IPv4 address

Command	Explanation
Policy-class-map Mode	
set ipv4 [default] nexthop [vrf <vrf>] <*nexthop-ip*> **no set ipv4 nexthop**	Set nexthop IP for the classified traffic, the no command cancels the new assigned value.

6. Configure the port binding policy map

Command	Explanation
Port Mode	
service-policy {input <*policy-map-name*> | output <*policy-map-name*>} **no service-policy {input <*policy-map-name*> | output <*policy-map-name*>}**	Apply a policy map to the specified port. Only one policy map can be applied to each direction of each port. Egress policy map is not supported yet.

7. Configure the VLAN binding policy map

Command	Explanation
Global Configuration Mode	
service-policy input <*policy-map-name*> vlan <*vlan-list*> **no service-policy input <*policy-map-name*> vlan <*vlan-list*>**	Apply a policy map to the specified VLAN interface; the no command deletes the specified policy map applied to the VLAN interface.

2.3 PBR Examples

Example:

On port ethernet1/0/1, apply policy-based routing on packages from 192.168.1.0/24 segment, and set the next-hop as 218.31.1.119, meanwhile the local network IP of this network ranges within 192.168.0.0/16. To assure normal communication in local network, messages from 192.168.1.0/24 to local IP 192.168.0.0/16 are not applied with policy routing. The interface address of 192.168.1.0/24 of this device is 192.168.1.1.

Configuration procedure is as follows:

```
Switch#config
Switch(config)#ip access-list extended a1
Switch(Config-IP-Ext-Nacl-a1)# permit ip 192.168.1.0 0.0.0.255 192.168.0.0 0.0.255.255
Switch(Config-IP-Ext-Nacl-a1)#exit
Switch(config)#ip access-list extended a2
Switch(Config-IP-Ext-Nacl-a1)# permit ip 192.168.1.0 0.0.0.255 any-destination
Switch(Config-IP-Ext-Nacl-a1)#exit
Switch(config)#mls qos
Switch(config)#class-map c1
Switch(Config-ClassMap-c1)#match access-group a1
Switch(Config-ClassMap-c1)# exit
Switch(config)#class-map c2
Switch(Config-ClassMap-c2)#match access-group a2
Switch(Config-ClassMap-c2)# exit
Switch(config)#policy-map p1
Switch(Config-PolicyMap-p1)#class c1
Switch(Config-PolicyMap-p1-Class-c1)#set ip nexthop 192.168.1.1
Switch(Config-PolicyMap-p1-Class-c1)#exit
Switch(Config-PolicyMap-p1)#class c2
Switch(Config-PolicyMap-p1-Class-c2)#set ip nexthop 218.31.1.119
Switch(Config-PolicyMap-p1-Class-c2)#exit
Switch(config)#interface ethernet 1/0/1
Switch(Config-If-Ethernet1/0/1)#service-policy input p1
```

Configuration results:

First set ACL a1 and a2. a1 matches source IP segments 192.168.1.0/24 and destination IP segments 192.168.0.0/16. a2 matches source IP segments 192.168.1.0/24. Turn on QoS function in global mode and create two class-maps: c1 in which matches

ACL a1 and c2 in which matches ACL a2. And create a policy-map in which quote c1. Set the interface address of 192.168.1.0/24 of this device as 192.168.1.1. Set the next-hop IP as 218.31.1.119 and apply the policy-map at port ethernet1/0/1. After that, all messages on port ethernet 1/0/1 from segment 192.168.1.0/24 will be transmitted through 218.31.1.119 except those from 192.168.0.0/16 segment which are still be transmitted through normal L3 routing.

Chapter 3 IPv6 PBR Configuration

3.1 Introduction to PBR (Policy-based Router)

Policy-based routing provides a more powerful control over the forwarding and store of messages than traditional routing protocol to network managers. Traditionally, routers use the routing table derived from router protocol, and forward according to destination addresses. The policy-based router is more powerful and more flexible than the traditional one, because it enables network managers to choose the forwarding route not only according to destination addresses but also the size of messages, or source IP addresses. Policy can be defined as according to the balance of load in multiple routers or according to the quality of service (QOS) of the total flow forwarded in each line.

PBR (Policy-Based Routing) is a method which politically specifies the next hop when forwarding a data packet according to the source address, destination address, IP priority, TOS value, IP protocol, source port, destination port and other information of an IP packet.

3.2 PBR Configuration Task Sequence

1. Configure a class-map
2. Set the match standard in the class-map
3. Configure a policy-map
4. Configure to correlate a policy and a class-map
5. Configure the next hop IPv6 address
6. Configure the port binding policy map
7. Configure the VLAN binding policy map

1. Configure a class-map

Command	Explanation
Global Configuration Mode	
class-map <*class-map-name*> **no class-map <*class-map-name*>**	Create or delete a class-map.

2. Set the match standard in the class-map

Command	Explanation
Class-map Mode	

match ipv6 {access-group <*acl-index-or-name*>} **no match ipv6 {access-group }**	Set the match standard in the class-map.

3. Configure a policy-map

Command	Explanation
Global Configuration Mode	
policy-map <*policy-map-name*> **no policy-map <*policy-map-name*>**	Create or delete a policy-map.

4. Configure to correlate a policy and a class-map

Command	Explanation
Policy-map Mode	
class <*class-map-name*> **no class <*class-map-name*>**	Correlate with a class, and enter the policy-map mode.

5. Configure the next hop IPv6 address

Command	Explanation
Policy-class-map Mode	
set ipv6 [default] nexthop [vrf <vrf>] <*nexthop-ip*> **no set ipv6 nexthop**	Set the next hop IP for the classified flow, the no command cancels the new assigned value.

6. Configure the port binding policy-map

Command	Explanation
Port Configuration Mode	
service-policy {input <*policy-map-name*> | output <*policy-map-name*>} **no service-policy {input <*policy-map-name*> | output <*policy-map-name*>}**	Apply a policy map to the specified port. Only one policy map can be applied to each direction of each port. Egress policy map is not supported yet.

7. Configure the VLAN binding policy map

Command	Explanation
Global Mode	

service-policy input <*policy-map-name*> vlan <*vlan-list*> **no service-policy input <*policy-map-name*> vlan < *vlan-list* >**	Apply a policy map to the specified VLAN interface; the no command deletes the specified policy map applied to the VLAN interface.

3.3 PBR Examples

Example:

On port ethernet 1/0/1, the default gateway address of this device is 3000::1, set the messages whose source IP is within the segment 2000:: /64 to do policy routing, the next hop is 3100::2.

The following is the configuration steps:

Switch#config
Switch(config)#interface vlan 1
Switch(Config-if-Vlan1)#ipv6 address 2000::1/64
Switch(Config-if-Vlan1)#ipv6 neighbor 2000::2 00-00-00-00-00-01 interface Ethernet 1/0/1
Switch(config)#interface vlan 2
Switch(Config-if-Vlan2)#ipv6 address 3000::1/64
Switch(Config-if-Vlan2)#ipv6 neighbor 3000::2 00-00-00-00-00-02 interface Ethernet 1/0/2
Switch(config)#interface vlan 3
Switch(Config-if-Vlan3)#ipv6 address 3100::1/64
Switch(Config-if-Vlan3)#ipv6 neighbor 3100::2 00-00-00-00-00-03 interface Ethernet 1/0/5
Switch(config)# ipv6 access-list extended b1
Switch(Config-IPv6-Ext-Nacl-b1)# permit 2000:: /64 any-destination
Switch(Config-IPv6-Ext-Nacl-b1)#exit
Switch(config)#class-map c1
Switch(config-ClassMap)#match ipv6 access-group b1
Switch(config-ClassMap)# exit
Switch(config)#policy-map p1
Switch(config-PolicyMap)#class c1
Switch(config-Policy-Class)# set ipv6 nexthop 3100::2
Switch(config--Policy-Class)#exit
Switch(config-PolicyMap)#exit
Switch(config)#interface ethernet 1/0/1
Switch(Config-Ethernet1/0/1)#service-policy input p1

Configuration result:

First, set an ACL containing one entry, names it as b1, matching source IP segment 2000::/64(permit). Globally enable QoS function, create a class-map:c1, and match ACL b1 in the class-map. Create a policy-map:p1, quoting c1 in p1, and set the next hop as 3100::2. Apply this policy-map on port ethernet 1/0/1. After that, the messages whose source IP are within the segment 2000::/64 received on port ethernet 1/0/1 will be forwarded through 3100::2.

3.4 PBR Troubleshooting Help

- ☞ At present, policy-map can only be bound to input port but not output port.
- ☞ Since hardware resources are limited, if the policy is too complicated to configure, relative information will be noticed to users.

Chapter 4 Flow-based Redirection

4.1 Introduction to Flow-based Redirection

Flow-based redirection function enables the switch to transmit the data frames meeting some special condition (specified by ACL) to another specified port. The fames meeting a same special condition are called a class of flow, the ingress port of the data frame is called the source port of redirection, and the specified egress port is called the destination port of redirection. Usually there are two kinds of application of flow-based redirection: 1. connecting a protocol analyzer (for example, Sniffer) or a RMON monitor to the destination port of redirection, to monitor and manage the network, and diagnose the problems in the network; 2. Special transmission policy for a special type of data frames.

The switch can only designate a single destination port of redirection for a same class of flow within a source port of redirection, while it can designate different destination ports of redirection for different classes of flows within a source port of redirection. The same class of flow can be applied to different source ports.

4.2 Flow-based Redirection Configuration Task Sequence

1. Flow-based redirection configuration
2. Check the current flow-based redirection configuration

1. Flow-based redirection configuration

Command	Explanation
Physical Interface Configuration Mode	
access-group <*aclname*> redirect to interface [ethernet <*IFNAME*>|<*IFNAME*>] **no access-group <*aclname*> redirect**	Specify flow-based redirection for the port; the "**no access-group <*aclname*> redirect**" command is used to delete flow-based redirection.

2. Check the current flow-based redirection configuration

Command	Explanation
Global Mode/Admin Mode	
show flow-based-redirect {interface [ethernet *<IFNAME>* |*<IFNAME>*]}	Display the information of current flow-based redirection in the system/port.

4.3 Flow-based Redirection Examples

Example:

User's request of configuration is listed as follows: redirecting the frames whose source IP is 192.168.1.111 received from port 1 to port 6, that is sending the frames whose source IP is 192.168.1.111 received from port 1 through port6.

Modification of configuration:

1: Set an ACL, the condition to be matched is: source IP is 192.168.1.111;

2: Apply the redirection based on this flow to port 1.

The following is the configuration procedure:

Switch(config)#access-list 1 permit host 192.168.1.111

Switch(config)#interface ethernet 1/0/1

Switch(Config-If-Ethernet1/0/1)# access-group 1 redirect to interface ethernet 1/0/6

4.4 Flow-based Redirection Troubleshooting Help

When the configuration of flow-based redirection fails, please check that whether it is the following reasons causing the problem:

- ☞The type of flow (ACL) can only be digital standard IP ACL, digital extensive IP ACL, nomenclature standard IP ACL, nomenclature extensive IP ACL, digital standard IPv6 ACL, and nomenclature standard IPv6 ACL;
- ☞Parameters of **Timerange** and **Portrange** can not be set in ACL, the type of ACL should be Permit.
- ☞The redirection port must be 1000Mb port in the flow-based redirection function.
- ☞Do not implement the forward across VLAN for flow-based redirection.