QoS Configuration

Table of Contents

Chapter 1   QoS Configuration

If you concern how to fully use the bandwidth of your line and effectively use your network resources, you need to configure the service quality.

1.1   Overview

1.1.1   QoS Concept

The switch is normally in best-effort served mode. In this mode, the switch equally treats all flows and tries its best to forward all flows. In this case, all flows have the same chance to be dropped if congestion occurs. In real network conditions, different flows have different importance. The QoS function of the switch provides different services to different flows according to the importance of the flow, providing more important flows better service.
The current network provides two methods to distinguish the importance of the flow.

- Distinguish the importance based on the tag in the 802.1Q frame. The tag has two bytes. Three bits in the highest byte represent the priority levels. There are eight priority levels, 0 and 7 representing the lowest priority and the highest priority level respectively.
- Distinguish the importance based on the DSCP field in the IP header of the IP message. The DSCP field occupies 6 bits in the TOS domain of the IP header.

In real network application, the verging switches distribute different priorities to different flows according to their importance. Other switches provide different flows different services according to the priority information contained in the flow. The peer-to-peer (P2P) QoS service is realized.
Additionally, you can configure a switch in the network, enabling the switch to specially handle message with special features. The action performed by the switch is called as one-hop action.
The QoS function of the switch makes the network bandwidth effectively use, which greatly improves the performance of the network.

1.1.2   P2P QoS Model

The service model describes the capability of the P2P QoS, that is, the capability to send special network communication from one peer to another peer. The QoS software supports two kinds of service models: best-effort served service and differentiated service.

a. Best-effort service

It is a single service model. In this mode, the application can send any number of data at

necessary time without applying permission or previous notification of network. For the best-effort service, network can transmit data without concerning reliability, delay range or putthrough. The QoS function of the switch in best-effort service model complies with the "first come, first served" order.

b. Differentiated service

For the differentiated service, if the to-be-sent service is special, the corresponding QoS label must be designated in each packet.   The designation can be embodied in different modes such as setting IP priority in the IP packet. The switch uses the QoS rule to classify the service and perform intelligent queue.   The QoS function of switch provides strict priority, weighted round robin (WRR) and "first come, first served" (FCFS) to send the differentiated service.

1.1.3   Algorithm of QoS Queue of QoS Queue

The algorithm of QoS Queue of QoS queue guarantees the QoS realization. Our switches provide the queue algorithm for the strict priority, weighted round robin (WRR) and "first come, first served" (FCFS).

a. Strict priority

The queue algorithm of the strict priority means first providing service to a flow with the high priority until the flow with the high priority does not exist. The queue algorithm provides better service for the flows with high priority. Its shortcoming is that the flows with low priority cannot get service and die eventually.

b. Weighted round robin

WRR algorithm is an effective way to solve the shortcoming of the queue algorithm of strict priority. A certain bandwidth is distributed to each priority queue. Each priority queue is provided service according to the order from high priority to low priority. When the queue with high priority has already used up all the distributed bandwidth, the WWW algorithm turns to the queue with low priority and provides service to it.

c. First come first served

FCFS algorithm strictly follows the order the message reaches the switch to provide service for the flows. The message flow that first reaches the switch is first provided with service.

1.2   QoS Configuration Task List

Generally, the switch tries its best to deliver every message. When congestion occurs, all messages have the same chance to be dropped. In fact, different message has different

importance. Important message should be provided with better service. The QoS function provides different message with different priorities for providing different services. Therefore, the network has better performance and can be effectively used.

The section describes how to configure the QoS function of the switch.

The QoS configuration tasks are listed as follows:

- Configuring global CoS priority queue
- Configuring the bandwidth of the CoS priority queue
- Configuring the schedule strategy for the CoS priority queue
- Configuring the schedule standard for the CoS priority queue
- Configuring the default CoS value of the port
- Configuring CoS priority queue of the port
- Establishing QoS strategy mapping
- Configuring the description of QoS strategy mapping
- Configuring the matched data flow of the QoS strategy mapping
- Configuring actions for the matched data flow of the QoS strategy mapping
- Applying the QoS strategy on the port
- Displaying the QoS strategy mapping table
- Configuring the limitation for the port flow rate

1.3   QoS Configuration Tasks

1.3.1   Configuring global QoS Priority Queue

Configuring QoS priority queue is to map eight CoS values defined by IEEE802.1p to the priority queue. The switch has eight priority queues. The switch adopts the corresponding strategy according to different queues and makes the QoS service realized.

If you configure the CoS priority queue in global configuration mode, the CoS priority mapping at all ports is to be affected. When the priority queue is configured at the layer-2 port, the port will use the priority queue. Otherwise, the global configuration is to be used.

Perform the following operations in privileged mode to configure the global CoS priority queue:

Command	Purpose
configure	Enters the global configuration mode.
[**no**] **cos map** *quid cos1..cosn* **(1~8)**	Set the COS priority queue. **quid** is the ID of the COS priority. **cos1..cosn** is the cos value defined in IEEE802.1p.
exit	Returns to the management mode.
write	Saves configuration.

1.3.2   Configuring the Bandwidth of the CoS Priority Queue

The bandwidth of the CoS priority queue is the bandwidth distributed for each priority when the schedule strategy of the COS priority queue is WRR.

Using the command affects the bandwidth of the CoS priority queues on all ports. The command is valid only when the schedule strategy is WRR. The command decides the bandwidth value of the Cos priority queue when the wrr schedule strategy is used.

Perform the following operations in privileged mode to configure the bandwidth of the CoS priority queue:

command	description
configure	Enters global configuration mode.
[**no**] **scheduler wrr bandwidth** *weight1...weightn* **(1~8)**	Sets the bandwidth of CoS priority queue. weight1...weightn represent eight CoS CoS priority queue values.
exit	Returns to management configuration mode.
write	Saves configuration.

1.3.3   Configuring the Schedule Strategy for the CoS Priority Queue

Each port of the switch has multiple output queues. This series of switches have eight priority queues. The following methods can be used to schedule the output queue:

- SP (Sheer Priority): sheer priority schedule. The packet of low priority queue will be forwarded only when the high priority queue is vacant. If there are packets in the high priority queue, these packets are to be sent first.
- WRR (Weighted Round Robin): It is to distribute a bandwidth value for each queue and the bandwidth is then distributed to each queue according to their value.

Perform the following operations in privileged mode to configure the schedule strategy of the CoS priority queue.

Command	Purpose
configure	Enter the global configuration mode.
[**no**] **scheduler policy** { **sp** | **wrr** }	Set the schedule strategy for the QoS priority queue. **sp** represents the sp schedule strategy. **wrr** represents the **wrr** schedule strategy.
exit	Returns to the management mode.
write	Saves configuration.

1.3.4   Configuring the Schedule Standard for the CoS Priority Queue

The schedule standard for the priority queue is the standard to value the bandwidth ratio of

the priority queue when the schedule strategy of the COS priority queue is WRR. There are two types of schedule standard.

- packet-count: It uses the number of packets to represent occupied bandwidth.
- latency: It uses the sent time segment to represent occupied bandwidth.

This series of switches only support packet-count. The packet-count is the default schedule standard. Therefore, there is no command to select the schedule strategy standard.

1.3.5 Configuring the Default CoS Value of the Port

If the port receives the frame without label, the switch will add a default COS priority to it. Configuring the default CoS value is to set the default Cos value to the designated value of the unlabelled frame.

Perform the following operations in privileged mode to the default Cos value on the port.

Command	Purpose
configure	Enter the global configuration mode.
interface g0/1	Logs in to the port that will be configured.
[**no**] **cos default** *cos* **(0~7)**	Configures the CoS value for the unlabelled frame. **Cos** represents the corresponding cos value.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.
write	Saves configuration.

1.3.6 Configuring CoS Priority Queue of the Port

When the priority queue is set on the layer-2 port, the port uses the configured priority queue. Otherwise, the global COS priority queue configuration is adopted.

Perform the following operations in privileged mode to configure the default CoS value.

Command	Purpose
configure	Enters the global configuration mode.
interface g0/1	Logs in to the port that will be configured.
[**no**] **cos map** *quid cos1..cosn* **(1~8)**	Sets the cos priority queue. quid is the ID of the COS priority. **cos1..cosn** is the cos value defined in IEEE802.1p.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.3.7 Establishing QoS Strategy Mapping

QoS strategy mapping means to adopt certain requlations to distinguish headers of a certain feature, and to perform the designated operations on the headers.

Only one rule can be used to match the IP access list and the MAC access list of the data flow. If not, the configuration will fail. When the action is **permit**, the rule is used to distinguish data flow. When the action is **deny**, the rule is not used to match the data flow. The port number of IP access list must be fixed.

Perform the following operations in privileged mode to create the QoS strategy mapping:

Command	Purpose
configure	Enters the global configuration mode.
[no]policy-map *name*	Enters the QoS strategy table configuration mode. **name** represents the strategy name.
description description-text	Configures the description of the Qos strategy. **description-text** is the text to describe the strategy.
[**no**]**classify** {**ip access-group** *access-list-name* | **dscp** *dscp-value* | **mac access-group** *mac-access-name* | **vlan** *vlan-id* | **cos** *cos* | **any** }	Configures the matched data flow of the QoS strategy table. **access-list-name** is the name of matched IP access list. **dscp-value** stands for the **diffserv** field in the IP message. **mac-list-name** is the name of matched MAC access list. **vlan-id** stands for the ID of the matched VLAN. **cos** stands for the matched cos value. **any** means to match any packet.
action{**bandwidth** *max-band* | **cos** *cos-value* | **dscp** *dscp-value* | **redirect** *interface-id* | **drop** | **monitor** }	Configures the matched data flow strategy of the QoS strategy table. **max-band** stands for the maximum bandwidth occupied by the data flow. **cos-value** means to set the **cos** field of the matched flow to **cos-value**. **dscp-value** means to set the **dscp** field of the matched flow to **dscp-value**. **interface-id** stands for the exit of the redirection match flow. **drop** stands for the dropped message.

	stat stands for statistics information collected by the switch. **monitor** means to send packets to the mirroring port.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.3.8 Configuring Description of QoS Strategy Mapping

Perform the following operations in privileged mode to configure the description of QoS strategy mapping:

Command	Purpose
configure	Enters the global configuration mode.
[**no**]**policy-map** *name*	Enters the QoS strategy list configuration mode. **name** represents the strategy name.
description description-text	Configures the description of the Qos strategy. **description-text** is the text to describe the strategy.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.3.9 Configuring the Matched Data Flow of the QoS Strategy Mapping

The classification rule of the QoS data flow is the filtration rule configured by administrator according to requirements.

Perform the following operations in privileged mode to configure the matched data flow of the strategy. The data flow will replace the previous configuration.

Command	Purpose
configure	Enters the global configuration mode.
[**no**]**policy-map** *name*	Enters the QoS strategy list configuration mode. **name** represents the strategy name.
[**no**]**classify** {**ip access-group** *access-list-name* | **dscp** *dscp-value* | **mac access-group** *mac-access-name* | **vlan** *vlan-id* | **cos** *cos* | **any** }	Configures the matched data flow of the QoS strategy table. **access-list-name** is the name of matched IP access list. **dscp-value** stands for the **diffserv** field in the IP message.

	mac-list-name is the name of matched MAC access list.
	vlan-id stands for the ID of the matched VLAN.
	cos stands for the matched cos value.
	any means to match any packet.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.3.10　Configuring Actions for Matched Data Flow of the QoS Strategy Mapping

Defining the action of the data flow means to take corresponding actions according to the data flow that complies with the filtration rule, including limiting bandwidth, dropping message, updating domains.

Perform the following operations in privileged mode to configure actions for the matched data flow:

Command	Purpose
configure	Enters the global configuration mode.
[**no**]**policy-map** *name*	Enters the QoS strategy list configuration mode.
	name represents the strategy name.
action　　{**bandwidth** *max-band* | **cos** *cos-value* | **dscp** *dscp-value* | **vlanID** *vlanid-value* | **redirect** *interface-id* | **drop** | **stat** | **monitor** }	Configures the matched data flow strategy of the QoS strategy table.
	max-band stands for the maximum bandwidth occupied by the data flow.
	cos-value means to set the **cos** field of the matched flow to **cos-value**.
	dscp-value means to set the **dscp** field of the matched flow to **dscp-value**.
	vlanid-value means to set the **vlanID** field of the matched flow to **vlanid-value**.
	interface-id stands for the exit of the redirection match flow.
	drop stands for the dropped message.
	stat stands for statistics information collected by the switch.
	monitor means to send packets to the mirroring port.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.3.11   Applying the QoS Strategy on the port

You can apply the QOS strategy to a port. Multiple strategies can be applied to one port; one strategy can be applied to multiple ports too. To the strategies applied on a port, the strategies that are first applied have high priority. If the message simultaneously configures two strategies and the configuration actions are conflicted, take the action of firstly matched strategy as standard. After the strategy is applied on the port, the switch adds a strategy by default on the port to block the data flow that is not allowed to pass. When all strategies on the port are deleted, the switch automatically deletes the default default strategy from the port.

Perform the following operations in privileged mode to apply the QoS strategies:

Command	Purpose
configure	Enters the global configuration mode.
interface g0/1	Logs in to the port that will be configured.
[**no**] **qos policy** *name* { **ingress|egress**}	Applies the QoS strategy on the port. **name** stands for the name of the QoS strategy. **ingress** means the QoS strategy has impact on the entrance. **egress** means the QoS strategy has impact on the exit.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.3.12   Displaying the QoS Strategy Mapping Table

You can run the **show** command to display all or the designated Qos strategy mapping table. Perform the following operations in privileged mode to display the QoS strategy mapping table:

Command	Purpose
show policy-map [*policy-map-name*]	Displays all or designated QoS strategy mapping table. **policy-map-name** stands for the name of the trategy mapping table.

1.3.13   Configuring the limitation for the Port Flow Rate

The flow rate of the entrance or exit can be limited through the configuration.

Perform the following operations in privileged mode to limit the flow rate of the port:

Command	Purpose
configure	Enters the global configuration mode.

interface g0/1	Logs in to the port that will be configured.
[**no**] **switchport rate-limit** *band* **(1~1000)** { ingress|egress}	Configures the limitation for the port flow rate. ***band*** stands for the flow rate to be limited. **ingress** means the flow limitation has impact on the entrance. **egress** means the flow limitation has impact on the exit.
exit	Returns to the global configuration mode.
exit	Returns to the management mode.

1.4   QoS Configuration Example

1.4.1   Example for Applying QoS Strategy on the Port

Configure the strategy that change the COS value of the message to 2 on the port. After the corresponding strategy is applied, another strategy to permit all data flows to pass must be configured. Otherwise, all data flows cannot get through:

ip access-list extended ipacl

permit ip 192.168.20.2 255.255.255.255 192.168.20.210 255.255.255.255

policy-map any

classify any

policy-map pmap

classify ip access-group ipacl

action cos 2

interface GigaEthernet0/2

  qos policy pmap ingress

  qos policy any ingress (pay attention to the order of two strategies applied)