CHAPTER 14

Home Agent Quality of Service

This chapter discusses concepts related to Quality of Service on the Cisco Mobile Wireless Home Agent, and provides details about how to configure this feature.

This chapter includes the following sections:

Overview of HA QoS

Currently, the Home Agent does not support the ability to limit traffic based on rate specified on a per-user basis for various user-subscribed services such as Voice over IP (VoIP), Push-to-Talk (PTT) etc. The per-binding flow policing feature provides the ability to forward packets at rates enforced by a NAI-based user and appropriate for each binding registered on the Home Agent.

Note Per-binding flow means one binding per NAI.

The key benefits of this feature include the following:

- Utilizes the robust Modular QoS CLI (MQC) for performing QoS actions.
- Ensures the original DSCP options are preserved in the downstream packets originated from the internet to the MN, by copying the DSCP from the inner to the outer tunnel header.
- Identifies, classifies, and polices traffic for individual or all users in a realm registered on the Home Agent. This is done for upstream and downstream traffic. The use of MQC allows operators to group user traffic according to a classmap and policymap, and specify the bandwidth requirements at the time of binding flow identification.
- Supports Redundancy. During a switchover from the active to the standby, the QoS bindings are identified and synchronized. However, the packet counters are not synchronized.

QoS Policing

On the Cisco HA, QoS policing is enabled as follows:

Step 1 A user attaches a service-policy to an APN virtual interface recognized by the QoS infrastructure. This is done using the extended **ip mobile realm** command for convenience of performing policing for a group of NAI-based users (on a per-realm basis). This allows a user-configured policymap to be applied to the APN interface, which helps to classify Mobile IP data packets through the HA. Also the peak-rate can be specified to MQC in either input (downstream) or output (upstream) directions.

Step 2 Using MQC classmap/policymap commands, a "match flow pdp" filter is configured that classifies packets for individual flows (bindings) and informs the HA to send police parameters during flow identification. Police rate pdp peak-rate pdp commands, along with the burst values and the various actions needed, are configured under the policy-map, for the class-map for which the match type is flow **pdp**. Peak-rate values for the upstream and downstream are configured using the **ip mobile realm** command.

After the initial RRQ processing, when a binding is registered on the Home Agent, the first packet corresponding to a binding is intercepted in CEF path and policing rules are applied to it. Based on this behavior, police action is invoked on subsequent packets according to configured peak rate, conform burst, and exceed burst values. MQC QoS determines when a user police request has exceeded the configured rate and accordingly permits or drops the packet. For every active binding, a QoS flow exists and a run time state is stored on the HA.

Restrictions

Please note following restrictions:

- Only single-rate policing is allowed. There is no bandwidth reservation, so policing is done based on a maximum bandwidth rate specified by user.
- Once the service policy attachment and police actions are configured they cannot be modified. To modify policy or associated parameters, the existing service policy needs to be removed and a new one configured in its place.
- Policing can be applied only to users registering using a NAI username.
- In the MQC command set when **match flow pdp** is configured for a class only the police command can be configured. Other actions are not allowed.
- There is no traffic shaping feature implemented.
- QoS Policing can be enforced only on a per realm basis.
- QoS Policing rate limiting parameters can only be configured and enforced for NAI or realm that are configured under **ip mobile host nai** configuration.

Configuring HA QoS

To enable the HA QoS feature, perform the following tasks:

	Command	Purpose
Step 1	`Router(conf t)# class-map class-name`	Specifies a class map name and enters global classmap mode.
Step 2	`Router(config-cmap)#match flow pdp`	Classifies HA packets for each binding belonging to a class of MN users with a specified rate.
Step 3	`Router(config-pmap-c)# police rate pdp [burst bytes] [peak-rate pdp [peak-burst bytes]] conform-action action [exceed-action action [violate-action action]]`	Invokes a specified police action on a binding flow. **peak-rate pdp** keywords ensure that policing is done based on the rate specified for each binding flow.
Step 4	`Router(config)ip mobile realm [nai | realm] [service-policy {input policy-name [peak-rate rate] |output policy-name [peak-rate rate]}]`	Configures a policy and associated rate for one or more user bindings belonging to that policy on the basis of NAI/realm. This can be configured for both upstream and downstream traffic.

The above configuration details have the following restrictions:

- You cannot remove one of the policies (either input or output) if both policies are configured.
- You cannot modify the existing service-policy for a realm without unconfiguring and then configuring it.
- You cannot configure output-policy first, and then input policy.

QoS Configuration Examples

Here is a configuration example for the QoS feature on the Cisco Mobile Wireless HA:

```
class-map match-all class-mip
 match flow pdp

policy-map policy-mip-flow
 class class-mip
   police rate pdp burst 1400  peak-rate pdp peak-burst 1700
     conform-action transmit
     exceed-action transmit
     violate-action drop

ip mobile realm @cisco.com service-policy input policy-mip-flow peak-rate 9000 output
policy-mip-flow peak-rate 8000
```

Verifying the Configuration

To dislay various statistics for the HA QoS feature, perform the following tasks:

	Command	Purpose
Step 1	`Router#`**`show ip mobile binding police nai`** *`@example.com`*	Displays when QoS policing is enabled, statistics for each individual binding, and is provided as an extension to the existing **show ip mobile binding** command. Details such as police rate in bps, and the packets that have conformed, exceeded, or violated the rate are displayed.

Show Command Examples

The following examples display QoS binding statistics and aggregate statistics:

```
HA1#sh ip mob bind police nai vrf-testuser202@vrf-test2.com
Mobility Binding QoS Statistics:
vrf-testuser202@vrf-test2.com:
  Downlink Policing
      police:
          rate 8000 , bc 1500 bytes
         peak-rate 108000, be 3375 bytes
        conformed 11 packets, 15400 bytes; actions:
          transmit
        exceeded 133 packets, 186200 bytes; actions:
          transmit
        violated 1284 packets, 1797600 bytes; actions:
          drop
  Uplink Policing
      police:
          rate 8000 , bc 1500 bytes
         peak-rate 57000, be 3000 bytes
        conformed 18 packets, 24876 bytes; actions:
          transmit
        exceeded 108 packets, 149256 bytes; actions:
          transmit
        violated 1622 packets, 2241604 bytes; actions:
          drop
```