

DSCP Marking

This feature enables the SaMOG Gateway to perform DSCP marking on the uplink and downlink data packets on S2a and WLAN interfaces.

The following sections provide more detailed information:

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Feature Description

Overview

The SaMOG Gateway supports DSCP marking on the uplink and downlink data packets. Service providers can use this feature to prioritize traffic across intermediate routers and deliver QoS services to subscribers. In an ePDG and SaMOG cascading network architecture for a Voice over WiFi (VoWiFi) over WLAN access, the SaMOG Gateway performs DSCP marking and prioritization to VoWiFi traffic using the Flow-based Local Breakout (LBO).

DSCP marking is supported on the EoGRE, PMIPv6, and L3-IP network access types, and GTP-U (GGSN-GTPv1 and PGW-GTPv2) and GRE (PMIPv6-based S2a) S2a-U variants on the network side. SaMOG can perform DSCP marking on IPv4, IPv6, and dual PDNs.

Relationship to Other Features

Flow-based Local Breakout

In an ePDG cascading architecture with SaMOG for VoWiFi over trusted WLAN access, DSCP marking in the SaMOG Flow-based LBO model ensures that the desired DSCP marking is performed by ePDG in the downlink packets towards the TWAN in the access network.

Session Recovery

The QCI-QoS-Map table will be restored for the recreated session after session recovery. DSCP values are applied to the consecutive traffic based on the QCI-QoS mapping table configuration during the time of session recovery.

Web Authorization

DSCP marking will not be performed to the traffic redirected to the web portal during the pre-authentication phase. The traffic from the UE session in this phase is intended for session establishment and authorization, and has no QCI value. DSCP marking will be performed on the subscriber traffic during the TAL phase.

During reauthorization, if the QCI value is modified for the subscriber call, the new QCI's DSCP value will be applied.

How DSCP Marking Works

Architecture

The SaMOG Gateway performs DSCP marking on the data traffic based on the QCI value derived for the subscriber's call. The QCI value is obtained based on the following order of priority:

- QoS negotiated with internal P-GW
- AAA server supplied QoS value

The QCI-QOS mapping table for DSCP marking can be configured using the **qci** *qci_value* **[{ uplink | downlink } encaps-header { copy-inner | copy-outer | dscp-marking** *dscp_hex_value* **}]** command under the QCI-QOS Mapping Table Configuration Mode. This configuration enables the SaMOG Gateway to mark the DSCP value in the outermost IP packet sent out of SaMOG (i.e, EoGRE/GRE/GTPU tunnel's IP header).

A default DSCP value of 0x00 is marked on all uplink and downlink data traffic during the following scenarios:

- • When no QCI-QoS mapping table is mapped (for the APN profile or CGW service).
- When no QCI-specific DSCP marking is configured under the QCI-QoS mapping table.

QCI-QoS Mapping Table Selection

The DSCP marking is performed based on the QCI-QoS mapping table configuration under the Context Configuration mode. The QCI-QoS mapping table is mapped to the subscriber call in the following order of priority:

- Mapping under the APN Profile Configuration Mode
- Mapping under the CGW Service Configuration Mode

The SaMOG Gateway will use the QCI-QoS mapping table configured for the APN profile for the subscriber session call. If no table is associated, SaMOG will look for the QCI-QoS mapping table configured for the CGW service.

For more configuration information, refer Configuring DSCP Marking, on page 3.

DSCP Configuration Change

When the DSCP configuration for a QCI changes, the new QCI/DSCP configuration will be applied to new calls only. The new DSCP marking will not be applied to subscriber calls that are currently active.

When session recovery occurs after the QCI-QoS mapping table is modified, the SaMOG gateway uses the latest CLI configuration.

Modifying the QCI Value

The QCI value for the SaMOG bearer can be modified in one of the following ways:

- From the AAA server using the RAR/CoA messages
- From the P-GW using the Update-Bearer-Request message

The new QCI value for the SaMOG bearer is then applied to all consecutive data traffic.

QCI Value for Flow-based LBO Model

The traffic sent to the flow-based LBO network uses the QCI value configured using the **local-offload flow qci** *qci_value* command under the APN Profile Configuration Mode.

If the configured QCI value is between 128 and 254, the DSCP configuration using the **operator-defined-qci** command under the QCI-QoS Mapping Table Configuration Mode mapped to the APN profile is used.

If the QCI value is between 1 and 9, the DSCP configuration using the **qci** command under the QCI-QOS Mapping Table Configuration Mode mapped to the APN profile is used.

For more configuration information, refer Configuring DSCP Marking, on page 3.

QCI Value for LBO – Enhanced Model

The QCI value for the LBO – Enhanced model is obtained based on the negotiated QCI-QoS value from the internal or external P-GW.

Limitations

This following limitations apply to the DSCP Marking feature:

- Currently, SaMOG supports DSCP marking on Flow-based LBO and LBO – Enhanced models. LBO Basic is not supported.
- DSCP marking cannot be performed on control signalling messages.

Configuring DSCP Marking

Associating the QCI-QoS Mapping Table

Use the following configuration to associate the QCI-QoS mapping table with the specified APN profile or CGW Service.

For APN Profile:

```
config
    apn-profile profile_name
        associate qci-qos-mapping mapping_table_name
        end
```

For CGW Service:

```
config
    context context_name
        cgw-service service_name
            associate qci-qos-mapping mapping_table_name
            end
```

Notes:

- By default, this configuration is disabled.
- To remove the configuration:
  - APN Profile Configuration mode: use the **remove associate qci-qos-mapping** command.
  - CGW Service Configuration mode: Use the **no associate qci-qos-mapping** command.
- *mapping_table_name* must be an alphanumeric string between 1 and 63 characters.

Configuring Downlink DSCP Marking

Use the following configuration to configure DSCP marking for downlink packets.

```
config
    qci-qos-mapping mapping_table_name
        qci qci_value downlink encaps-header { copy-inner | copy-outer |
dscp-marking dscp_hex_value }
        end
```

Notes:

- Use the **no qci** *qci_value* command to remove the configuration.
- *qci_value* must be an integer from 1 through 9.
- **encaps-header**: Specifies that the DSCP marking must be set on the encapsulation header for IP-in-IP, GRE, or GTP encapsulation.
- **copy-inner**: Specifies to copy the DSCP value from the inner IP packet's header in the S2a-u (GTP-U/PMIP-GRE) to the outer tunnel header towards UE (EoGRE/PMIP-GRE/Direct-IP).
- **copy-outer**: Specifies to copy the DSCP value from the outer tunnel header of the S2a-u (GTP-U/PMIP-GRE) to the outer tunnel header towards UE (EoGRE/PMIP-GRE/Direct-IP).
- **dscp-marking** *dscp_hex_value*: Specifies to enable marking of the specified *dscp_hex_value* in the downlink direction per QCI.
  - *dscp_hex_value* must be a hexadecimal number from 0x00 through 0x3F.

- When this configuration does not exist for the subscriber session's QCI, SaMOG will not perform DSCP marking to the downlink packets, and 0x00 (best effort) value will be marked.

Configuring Uplink DSCP Marking

Use the following configuration to configure DSCP marking for uplink packets

```
config
   qci-qos-mapping mapping_table_name
      qci qci_value uplink encaps-header { copy-inner | copy-outer |
dscp-marking dscp_hex_value }
      end
```

Notes:

- Use the **no qci** *qci_value* command to remove the configuration.
- *qci_value* must be an integer from 1 through 9.
- **encaps-header**: Specifies that the DSCP marking must be set on the encapsulation header for IP-in-IP, GRE, or GTP encapsulation.
- **copy-inner**: Specifies to copy the DSCP value from the inner IP packet's header from the UE (EoGRE/PMIP-GRE/Direct-IP) to the outer tunnel in the S2a-u (GTP-U/PMIP-GRE) towards P-GW.
- **copy-outer**: Specifies to copy the DSCP value from the outer tunnel header from the UE (EoGRE/PMIP-GRE/Direct-IP) to the outer tunnel in the S2a-u(GTP-U/PMIP-GRE) towards P-GW.
- **dscp-marking** *dscp_hex_value*: Specifies to enable marking of the specified *dscp_hex_value* in the uplink direction per QCI.
  - *dscp_hex_value* must be a hexadecimal number from 0x00 through 0x3F.
- When this configuration does not exist for the subscriber session's QCI, SaMOG will not perform DSCP marking to the uplink packets, and 0x00 (best effort) value will be marked.

Configuring QCI Value for Flow-based Local Breakout

Use the following configuration to specify the QCI for flow-based Local Breakout (LBO).

```
config
   apn-profile profile_name
      local-offload flow qci qci_value
      end
```

Notes:

- By default, this configuration is disabled.
- Use the **no local-offload flow qci** command to remove the configuration.
- *qci_value* must be an integer from 1 through 9, or 128 through 254.
  - For QCI range configured from 128 through 254, the DSCP configuration using the **operator-defined-qci** command (refer Configuring Downlink DSCP Marking for Flow-based Local Breakout, on page 6 and Configuring Uplink DSCP Marking for Flow-based Local Breakout, on

page 6) under the QCI-QoS Mapping Table Configuration Mode mapped to this APN profile is used.

- For QCI range configured from 1 through 9, the DSCP configuration using the **qci** command (refer Configuring Downlink DSCP Marking, on page 4 and Configuring Uplink DSCP Marking, on page 5) under the QCI-QoS Mapping Table Configuration Mode mapped to this APN profile is used.

Configuring Downlink DSCP Marking for Flow-based Local Breakout

Use the following configuration to configure DSCP marking for downlink packets using flow-based LBO.

```
config
   qci-qos-mapping mapping_table_name
     operator-defined-qci qci_value { gbr | non-gbr } downlink encaps-header
 { copy-inner | copy-outer | dscp-marking dscp_hex_value }
      end
```

Notes:

- Use the **no operator-defined-qci** *qci_value* command to remove the configuration.
- *qci_value* must be an integer from 128 through 254.
- **gbr**: Specifies that the QCI type is Guaranteed Bit Rate (GBR).
- **non-gbr**: Specifies that the QCI type is non-Garanteed Bit Rate (GBR).
- **encaps-header**: Specifies that the DSCP marking must be set on the encapsulation header for IP-in-IP, GRE, or GTP encapsulation.
- **copy-inner | copy-outer**: Specifies to copy the DSCP value from the IP packet's header from the LBO network towards the IP header in the access side network (EoGRE/PMIP-GRE/Direct-IP).
- **dscp-marking** *dscp_hex_value*: Specifies to enable marking of the specified *dscp_hex_value* in the downlink direction per LBO QCI.
  - *dscp_hex_value* must be a hexadecimal number from 0x00 through 0x3F.
- When this configuration does not exist, SaMOG will not perform DSCP marking to the downlink packets for the flow-based LBO.

Configuring Uplink DSCP Marking for Flow-based Local Breakout

Use the following configuration to configure DSCP marking for uplink packets using flow-based LBO.

```
config
   qci-qos-mapping mapping_table_name
     operator-defined-qci qci_value { gbr | non-gbr } uplink encaps-header
 { copy-inner | copy-outer | dscp-marking dscp_hex_value }
      end
```

Notes:

- Use the **no operator-defined-qci** *qci_value* command to remove the configuration.

- *qci_value* must be an integer from 128 through 254.
- **gbr**: Specifies that the QCI type is Guaranteed Bit Rate (GBR).
- **non-gbr**: Specifies that the QCI type is non-Garanteed Bit Rate (GBR).
- **encaps-header**: Specifies that the DSCP marking must be set on the encapsulation header for IP-in-IP, GRE, or GTP encapsulation.
- **copy-inner**: Specifies to copy the DSCP value from the inner IP packet's header from the UE (EoGRE/PMIP-GRE/Direct-IP) to the LBO IP header towards the LBO network.
- **copy-outer**: Specifies to copy the DSCP value from the IP packet's header from the outer tunnel header from the UE (EoGRE/PMIP-GRE/Direct-IP) to the LBO IP header towards the LBO network.
- **dscp-marking** *dscp_hex_value*: Specifies to enable marking of the specified *dscp_hex_value* in the uplink direction per LBO QCI.
  - *dscp_hex_value* must be a hexadecimal number from 0x00 through 0x3F.
- When this configuration does not exist, SaMOG will not perform DSCP marking to the uplink packets for the flow-based LBO.

Monitoring and Troubleshooting DSCP Marking

DSCP Marking Show Command(s) and/or Outputs

show apn-profile full

The information is available in the output of the **show apn-profile full { all | name** *profile_name* **}** command in support of this feature:

```
Local Offload              : Enabled
  Type                     : Flow
  QCI                      : 129
```

Table 1: show apn-profile full { all | name profile_name } Command Output Descriptions

Field	Description
Local Offload	Indicates if Local Offload is enabled.
Type	Indicates the type of LBO.
QCI	Configured QCI value.

show cgw-service all

The output of the **show cgw-service all** command displays the QCI-QOS mapping table name:

```
Service name                    : cgw1
  QCI-QOS mapping table         : map1
```

*Table 2: **show cgw-service all** Command Output Descriptions*

Field	Description
Service name	Displays the configured name of the service.
QCI-QOS mapping table	Displays the configured QCI-QOS mapping name for that CGW service.

show subscribers samog-only full

The following counter is available to the output of the **show subscribers samog-only full** command in support of this feature:

```
Local Offload Flow Details:
    QCI                         : 129
```

*Table 3: **show subscribers samog-only full** Command Output Descriptions*

Field	Description
Local Offload Flow Details	
QCI	Configured QCI value.