DSCP Markings For Collapse Calls

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Feature Summary and Revision History

Table 1: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI SMI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Table 2: Revision History

Revision Details	Release
Provided updated output for **show subscribers user-plane-only full all** and **show user-plane-service statistics qos-group sessmgr all** CLI commands.	2022.04.0
First introduced	2021.02.0

Feature Description

Currently, QCI-based DSCP markings are applicable for Pure-S and Pure-P calls. The DSCP markings are based on QCI-QOS-Mapping associated with respective S-GW service or P-GW service. For collapse calls QCI-QOS-Mapping associated with PGW-service is applicable. This feature helps to apply the DSCP markings for collapse calls based on associated S-GW and P-GW services for uplink and downlink traffic. For uplink traffic, DSCP markings associated with logical P-GW service are applicable. For downlink traffic, DSCP markings associated with logical S-GW service are applicable. The DSCP markings are present in IP header of data traffic as a part of GTP-U header and Inner IP. There's option to enabled or disable this functionality by CLI configuration. When you enable the feature, then only the new functionality is applicable otherwise existing functionality also works. By default, this feature is disabled, so that there's no impact on customers who upgrades to this feature.

DSCP Markings for 5G Calls

The QCI/QOS mapping table in SMF drives the DSCP values being put on the packets. It's similar configuration as in PGW-CP. The DSCP values are sent as part of FAR during call establishment (Sx establishment request/Sx modification request). The DSCP values are being applied to inner packet and outer GTPU packet.

DSCP Markings for 4G Collapsed Datapath Calls

For collapsed Datapath calls:

- On Sxa leg, DSCP marking is sent in FAR from SGWC/Cn-SGWC.
- On N4 leg, DSCP marking is sent in FAR from SMF.
- For uplink packets, UPF applies the DSCP marking as per SMF configuration.
- For downlink packets, UPF applies the DSCP marking as per SGWC/Cn-SGWC configuration in GTPU header.
- For inner packet, DSCP marking is as per SMF configuration.

The SMF configuration/logic of sending the DSCP marking is similar as PGW-C. In case of the DSCP marking for the ECS charging action, priority is given to the charging action configuration for inner packet DSCP marking.

How It Works

Following are the steps that describe the DSCP markings for the collapse calls.

- In case of Collapse call:
  - For ACCESS side, QCI-QOS mapping table associated with SGW-service is used.
  - For CORE side, QCI-QOS mapping table associated with PGW-service is used.
- The preceding conditions apply once you enable the feature, otherwise QCI-QOS mapping table associated with PGW-service is applicable for both sides.

- APN associated QCI-QOS mapping table is preferred over the P-GW service QCI-QOS mapping table.
- APN-Profile associated QCI-QOS mapping table is preferred over SGW-Service QCI-QOS mapping table for ACCESS side DSCP markings.
- In case, only P-GW service has QCI-QOS mapping table configuration, then these DSCP markings is applicable on both ACCESS & CORE side for collapse call.
- In case only S-GW service has QCI-QOS mapping table configuration then these DSCP markings is applicable on ACCESS side for collapse call.
- There's a new configurable parameter inside the SAEGW service which indicates whether the feature is enabled or disable.
- For Pure-P to Collapse HO and conversely, transport layer markings are updated in FAR as a part of Sx Modify request.
- Layer2 markings are also modified based on QCI-QOS mapping table picked for ACCESS and CORE side.
- DSCP markings continue to apply on existing bearers post session recovery.
- DSCP markings continue for the bearers on standby chassis once it switches to active mode.

SessMgr SMF Changes

DSCP markings for Uplink/CORE and Downlink/ACCESS are present at bearer level inside sessmgr_sub_session_t → sessmgr_qci_tab_t.

User datagram DSCP markings are updated in IP header of inner packet. That is, packet sent from UE to Internet and the opposite way.

Encaps header DSCP markings are updated in IP header of outer IP layer having GTP-U header (Outer header).

DSCP markings are sent from SMF to UPF inside FAR IE as follows:

- Transport Level Marking - The DSCP markings is configured in encaps header for ACCESS side and User-datagram on CORE side for collapse call.
- Transport Level Marking Options—Includes two options and are applicable only for outer header:
  - Copy-inner: Copy the inner packets markings to outer header
  - Copy-outer: Relay the DSCP markings for outer header

Inner Packet Marking—DSCP markings is configured in user datagram for ACCESS side. For CORE side, it's N/A for collapse call.

Logic to fetch the DSCP marking has changed for collapse call:

- Fetch the DSCP markings based on QCI and "qrp_pl" for session from the associated SGW Service for ACCESS/downlink side.
- Fetch the DSCP markings based on QCI and "qrp_pl" for session from the associated PGW Service for CORE/uplink side.
- For ACCESS/downlink side, QCI-QOS-mapping table associated with APN-profile takes preference over SGW Service QCI-QOS-mapping table.

- For CORE/uplink side QCI-QOS-mapping table associated with APN config takes preference over PGW Service QCI-QOS-mapping table.
- In case SGW Service QCI-QOS-mapping table isn't configured, then PGW Service QCI-QOS-mapping table is applicable on both ACCESS/CORE side.
- In case PGW Service QCI-QOS-mapping table isn't configured, then SGW Service QCI-QOS-mapping table is applicable on ACCESS side and no DSCP markings are applicable on CORE side.
- DSCP markings are updated on UPF in create/update FAR sent as a part of Sx/N4 Establishment/Modification request from SMF to UPF.
- Update the TLM, IPM, and TLMO in case of HO from Pure-P to Collapse and vice versa in Sx/N4 Modification request as a part of Update FAR IE.
- Update the Layer2 markings in case of HO from Pure-P to Collapse and vice versa in Sx/N4 Modification request as a part of Update FAR IE.

Following table depicts the various possible config combinations and outcome for DSCP markings to be applied on ACCESS and CORE side for COLLAPSE call:

S. No.	Feature Enable / Disable	PGW Service QOS-QCI Table Configured (Q1)	SGW Service QOS-QCI Table Configured (Q2)	APN QOS-QCI Table Configured (Q3)	APN-Profile QOS-QCI Table Configured (Q4)	ACCESS/Downlink DSCP Markings for Collapse Call	CORE/Uplink DSCP Markings for Collapse Call
1	ENABLE	YES	YES	YES	YES	Q4 (APN-Profile)	Q3(APN)
2	ENABLE	YES	YES	YES	NO	Q2 (SGW-Service)	Q3(APN)
3	ENABLE	YES	YES	NO	YES	Q4 (APN-Profile)	Q1 (PGW-service)
4	ENABLE	YES	YES	NO	NO	Q2 (SGW-Service)	Q1 (PGW-service)
5	ENABLE	YES	NO	YES	YES	Q4 (APN-Profile)	Q3(APN)
6	ENABLE	YES	NO	YES	NO	Q3(APN)	Q3(APN)
7	ENABLE	YES	NO	NO	YES	Q4 (APN-Profile)	Q1 (PGW-service)
8	ENABLE	YES	NO	NO	NO	Q1 (PGW-service)	Q1 (PGW-service)
9	ENABLE	NO	YES	YES	YES	Q4 (APN-Profile)	Q3(APN)
10	ENABLE	NO	YES	YES	NO	Q2 (SGW-Service)	Q3(APN)
11	ENABLE	NO	YES	NO	YES	Q4 (APN-Profile)	N/A (NO DSCP)
12	ENABLE	NO	YES	NO	NO	Q2 (SGW-Service)	N/A (NO DSCP)
13	ENABLE	NO	NO	YES	YES	Q4 (APN-Profile)	Q3(APN)
14	ENABLE	NO	NO	YES	NO	Q3(APN)	Q3(APN)
15	ENABLE	NO	NO	NO	YES	Q4 (APN-Profile)	N/A (NO DSCP)
16	ENABLE	NO	NO	NO	NO	N/A (NO DSCP)	N/A (NO DSCP)
17	DISABLE	YES	YES	YES	YES	Q3(APN)	Q3(APN)

S. No.	Feature Enable / Disable	PGW Service QOS-QCI Table Configured (Q1)	SGW Service QOS-QCI Table Configured (Q2)	APN QOS-QCI Table Configured (Q3)	APN-Profile QOS-QCI Table Configured (Q4)	ACCESS/Downlink DSCP Markings for Collapse Call	CORE/Uplink DSCP Markings for Collapse Call
18	DISABLE	YES	YES	YES	NO	Q3(APN)	Q3(APN)
19	DISABLE	YES	YES	NO	YES	Q1 (PGW-service)	Q1 (PGW-service)
20	DISABLE	YES	YES	NO	NO	Q1 (PGW-service)	Q1 (PGW-service)
21	DISABLE	YES	NO	YES	YES	Q3(APN)	Q3(APN)
22	DISABLE	YES	NO	YES	NO	Q3(APN)	Q3(APN)
23	DISABLE	YES	NO	NO	YES	Q1 (PGW-service)	Q1(PGW-service)
24	DISABLE	YES	NO	NO	NO	Q1 (PGW-service)	Q1 (PGW-service)
25	DISABLE	NO	YES	YES	YES	Q3(APN)	Q3(APN)
26	DISABLE	NO	YES	YES	NO	Q3(APN)	Q3(APN)
27	DISABLE	NO	YES	NO	YES	N/A (NO DSCP)	N/A (NO DSCP)
28	DISABLE	NO	YES	NO	NO	N/A (NO DSCP)	N/A (NO DSCP)
29	DISABLE	NO	NO	YES	YES	Q3(APN)	Q3(APN)
30	DISABLE	NO	NO	YES	NO	Q3(APN)	Q3(APN)
31	DISABLE	NO	NO	NO	YES	N/A (NO DSCP)	N/A (NO DSCP)
32	DISABLE	NO	NO	NO	NO	N/A (NO DSCP)	N/A (NO DSCP)

Configuration

Configure the following command inside the SAEGW service to enable/disable this feature.

```
configure
  context egress
    saegw-service saegw_service_name
      downlink-dscp-per-call-type [ enabled | disabled ]
      end
```

Note For collapsed call, when you enable the feature, use the S-GW service QCI-QOS mapping DSCP markings for downlink. By default, the downlink-DSCP-per-call-type is Disabled.

Monitoring and Troubleshooting

This section provides information on CLI commands that are available for monitoring and troubleshooting for DSCP markings for collapse calls.

Show Commands Outputs

This section provides information about show CLI commands that are available in support of DSCP markings for collapse calls.

show saegw-service all

This show command is to check if the feature is enabled or Disabled.

```
Service name : SAEGW11
Service-Id : 47
Context : EPC1
Status : STARTED
sgw-service : SGW11
pgw-service : PGW11
sx-service : SX11C
User Plane Tunnel GTPU Service : SAEGW11SXU
Newcall policy : n/a
downlink-dscp-per-call-type : enabled
CUPS Enabled : Yes
Service name : SAEGW21
Service-Id : 25
Context : EPC2
Status : STARTED
sgw-service : SGW21
pgw-service : PGW21
sx-service : SX21C
User Plane Tunnel GTPU Service : SAEGW21SXU
Newcall policy : n/a
downlink-dscp-per-call-type : disabled
CUPS Enabled : Yes
```

show subscribers user-plane-only callid <call_id> far full all

Use this User Plane CLIs to validate the Transport level marking options and inner packet markings for UPLINK/DOWNLINK FAR.

show subscribers user-plane-only full all

Use this User Plane CLI to see the number of TOS marked packets for U/L and D/L.

```
ToS marked Uplink Pkts: 0
ToS marked Downlink Pkts: 0
```

show user-plane-service statistics qos-group sessmgr all

Use this User Plane CLI to see the statistics for U/L and D/L packets of QoS group Sessmgr instance.

```
Uplink Packets Marked: 0
Downlink Packets Marked: 0
```