

Paging Policy Differentiation

This chapter describes the Paging Policy Differentiation feature and explains how it is configured. The product administration guides provide examples and procedures for configuration of basic services on the system. It is recommended that you select the configuration example that best meets your service model and configure the required elements for that model, as described in the *P-GW Administration Guide*, the *S-GW Administration Guide*, or the *SAEGW Administration Guide* before using the procedures in this chapter.

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Feature Description

S-GW/P-GW provide configuration control to change the DSCP value of the user-datagram packet and outer IP packet (GTP-U tunnel IP header). DSCP marking is done at various levels depending on the configuration. When the Paging Policy Differentiation (PPD) feature is enabled, however, the user-datagram packet DSCP (tunneled IP packet) marking does not change.

Currently, standards specify QCI to DSCP marking of outer GTP-U header only. All configurations present at ECS, P-GW, and S-GW to change the user-datagram packet DSCP value are non-standard. The standards-based PPD feature dictates that P-CSCF or similar Gi entity marks the DSCP of user-datagram packet. This user-datagram packet DSCP value is sent in DDN message by S-GW to MME/S4-SGSN. MME/S4-SGSN uses this DSCP value to give paging priority.



Important P-GW and S-GW should apply the PPD feature for both Default and Dedicated bearers. As per the specifications, P-GW transparently passes the user-datagram packet towards S-GW. This means, if PPD feature is enabled, operator can't apply different behavior for Default and Dedicated bearers.

Relationships

Since P-GW/S-GW support non-standard based DSCP marking, there is a conflict when both standard based PPD feature and non-standard based user-datagram packet DSCP configuration is enabled. To avoid this conflict:

- APN and service level configuration is ignored if PPD feature is enabled.
- S-GW/P-GW can alter the outer GTP-U header DSCP value, even if PPD feature is enabled.
- User-datagram packet DSCP value is unaltered by ECS, P-GW, and S-GW if PPD feature is enabled.
- At P-GW, APN-level configuration is added to enable/disable the PPD feature.
- At S-GW, service-level configuration is added to enable/disable the PPD feature. This is to send DSCP in Paging and Service Information IE of all the DDN messages triggered by either IMS-PDN or Internet-PDN, etc.



Important It is up to MME/S4-SGSN to use the Paging and Service Information IE of DDN message.

- Separate Paging feature and PPD feature co-exist in system. That means, if both features are enabled, both Paging and Service Information IE and Separate-paging IE are sent in DDN.
- Currently on P-GW, the DSCP configuration is getting applied at sub-session level during call setup time. So, when the PPD CLI is enabled for P-GW, it is applicable for new calls.
- Currently on S-GW, the DSCP configuration is getting applied at S-GW service level. So, when PPD CLI is enabled in S-GW service, it is applicable for both new and existing calls.
- Once the PPD CLI is enabled, it exists even after Session Recovery and ICSR switch over.
- The Paging and Service Information IE is used to carry per bearer paging and service information.

License

PPD is a license enabled feature. S-GW Paging Profile license key is required to enable PPD functionality for P-GW, S-GW, and SAEGW.



Important Contact your Cisco account representative for information on how to obtain a license.

How It Works

Architecture

S-GW

When S-GW supports the PPD feature, it shall include new Paging and Service Information IE in the Downlink Data Notification message triggered by the arrival of downlink data packets at the S-GW. The Paging Policy Indication value within this IE will contain the value of the DSCP in TOS (IPv4) or TC (IPv6) information received in the IP payload of the GTP-U packet from the P-GW.

At S-GW, service-level configuration enables/disables the PPD feature. Once the PPD is configured, the feature is enabled and applicable for both existing and new calls.

P-GW

User-datagram packet DSCP value is unaltered by P-GW for downlink data. The PPD feature is supported only for S5/S8 interface. For all Handoff scenarios from other interface to S5/S8 interface, the PPD feature will get enabled if APN had it during its call setup time at that interface.

At P-GW, APN-level configuration enables/disables the PPD feature. If PPD feature is enabled for the call and handoff happens from S5/S8 interface to any other interface, PPD feature should get disabled. Now, if handoff happens and this call will come back to S5/S8 interface, PPD feature should become enabled.

SAEGW

To support PPD feature in SAEGW, both S-GW and P-GW configuration is required.

Relationships to Other Features

- The PPD feature is license controlled under the license for S-GW Paging Profile. Once the license is enabled, both features co-exist together and work independently. That means, DDN message might carry both DSCP marking specified by PPD feature and Priority DDN value specified by S-GW Paging Profile feature.
- At S-GW, the user-datagram packet DSCP value is used to send in DDN. S-GW can't change the DSCP, as per the local configuration (APN profile or service level). At eNodeB, the scheduling of the packet is based on the QCI instead of DSCP, however, any EPC node should not change/modify the inner DSCP value.
- If the PPD feature is enabled, none of the EPS nodes should change the user-datagram packet DSCP value. Therefore, ECS should avoid overwriting DSCP value of user-datagram packet when PPD is enabled.

Standards Compliance

The PPD functionality complies with the following standards:

- 29.274, CR-1565, "Paging Policy Indication in Downlink Data Notification Message"
- 23.401, CR-2731 "Paging policy differentiation for IMS voice"

Configuring Paging Policy Differentiation Feature

For the PPD feature to work, it must be enabled for P-GW and S-GW.

Both P-GW and S-GW services apply PPD configuration independently. Therefore, for any downlink data packet from an APN, there could be a case where P-GW does not have PPD configuration but S-GW has PPD configuration. To avoid such a conflict, you must configure the PPD functionality on both P-GW (APN level granularity) and S-GW (service level granularity).

Configuration

The following CLI commands are used to manage the functionality for the PPD feature.

Enabling on P-GW

The following command enables the PPD feature on P-GW at APN level.

```
configure
     context context_name
        apn apn_name
               paging-policy-differentiation
               end
```

Enabling on S-GW

The following command enables the PPD feature on S-GW at service level.

```
configure
     context context_name
        sgw-service service_name
               paging-policy-differentiation
               end
```

Notes:

- This is to send DSCP in Paging and Service Information IE of all the DDN messages triggered by either IMS-PDN or Internet-PDN, etc.
- It is up to MME/S4-SGSN to use the Paging and Service Information IE of DDN message.
- If PPD feature is enabled at S-GW service, it is applicable for all calls irrespective of the APN profiles.

Disabling on P-GW

The following command disables the PPD feature on P-GW at APN level.

```
configure
     context context_name
        apn apn_name
               no paging-policy-differentiation
               end
```

Disabling on S-GW

The following command disables the PPD feature on S-GW at service level.

```
configure
     context context_name
        sgw-service service_name
               no paging-policy-differentiation
               end
```

Monitoring and Troubleshooting Paging Policy Differentiation

This section includes show commands in support of the PPD feature.

P-GW Show Commands

This section provides information regarding P-GW show commands and/or their outputs in support of the PPD feature.

show apn name <apn_name>

The following counter has been added to display PPD functionality.

```
Paging Policy Differentiation : Enabled
```

show subscribers pgw-only full all

The following counter has been added to display PPD functionality.

```
Paging Policy Differentiation : Enabled
```

SAEGW Show Commands

This section provides information regarding SAEGW show commands and/or their outputs in support of the PPD feature.

show subscribers saegw-only full all

The following counter has been added to display PPD functionality.

```
Paging Policy Differentiation : Enabled
```

S-GW Show Commands

This section provides information regarding S-GW show commands and/or their outputs in support of the PPD feature.

show sgw-service name <service_name>

The following counter has been added to display PPD functionality.

```
Paging Policy Differentiation : Enabled
```

show sgw-service name <service_name>