

APN, QCI, and ARP-based DSCP Mapping for WPS Sessions

- Feature Summary and Revision History, on page 1
- Feature Description, on page 2
- How it Works, on page 4
- Configuring IMS Authorization Service for WPS, on page 8
- Configuring DSCP Mapping, on page 9
- Monitoring and Troubleshooting, on page 12

Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	• P-GW • S-GW • SAEGW
Applicable Platform(s)	• ASR 5500 • VPC-DI • VPC-SI
Feature Default	Disabled - Configuration Required
Related Changes in This Release	Not applicable
Related Documentation	Not applicable

Revision History

Revision Details	Release
First introduced. **Important** This feature is not validated for all customer deployment scenarios. For more information, contact your Cisco Account representative.	21.23

Feature Description

The APN, QCI and ARP-based DSCP Mapping for WPS Sessions feature enables P-GW and S-GW to support DSCP marking based on APN, QCI and ARP functionality for Wireless Priority Service subscribers.

Prioritization of Control Plane Traffic: WPS user's control plane traffic is prioritized over other subscribers between different Network Functions in the LTE Core.

Priority Levels: P1, P2, and P3 are the three priority levels available for WPS users:

- P1 and P2 users are identified in HSS/PCRF and GW uses their priority (APN, QCI, and ARP) during default and dedicated bearer creation, modification, update, or deletion.
- P1 and P2 WPS users are always treated as High Priority.
- DSCP markings for prioritized user's control plane IP packets is marked with DSCP=47 while all other users control packets IP packets is marked with DSCP=32.
- Non-WPS users and P3 WPS users (for example, with QCI=5 and ARP PL =5) are given high priority dynamically based on a call being placed. Example: WPS-P1 user calling non-WPS user.
- For the LTE Core, the indication of higher priority for a user comes over Rx based on the presence of MPS-Identifier-AVP and value of Service-Info-Status-AVP in the Rx-AAR. PCRF takes appropriate actions and then propagates appropriate QCI, ARP values over to P-GW on Gx session.

Diameter Interfaces:

- P-GW, Policy Change Rule Function (PCRF), and Diameter Routing Agent (DRA) uses the configuration of Diameter interfaces such as Gx and Rx interfaces to support policy and charging control for subscribers.

Non-Diameter Interfaces: P-GW and S-GW uses non-diameter interfaces such as S5, S8, S11, or S1U with its peer respectively.

Characteristics of Low and High Priority Channels for Diameter based Interfaces

Low Priority channels are used for non-WPS user sessions and High Priority channels are used for WPS user sessions. These channels are identified by different Differentiated Services Code Point (DSCP) markings. The peer connections towards DRA for PGW (Gx) isshown in the figure.

Figure 1: High-Level Overview of Low and High Priority Channels over Gx Interface

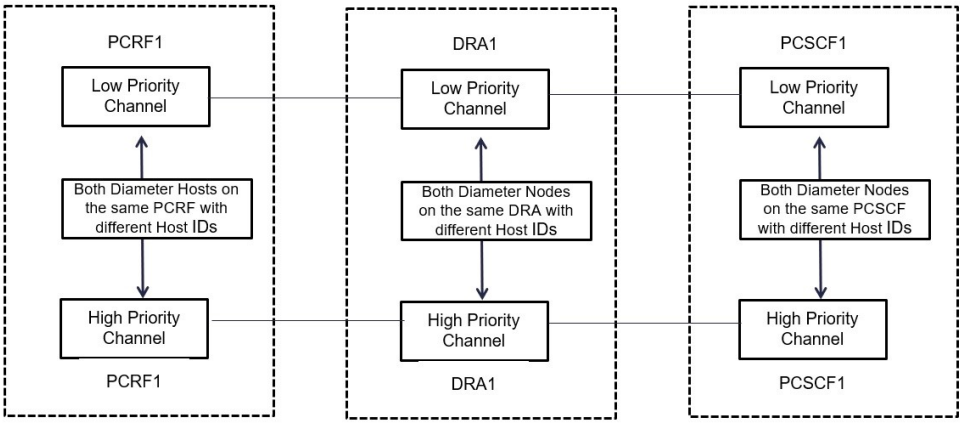


Table 1: Low and High Priority Channels on Gx Interface

Priority Channel	Diameter Interfaces	IP Layer DSCP	TCP Connection over IP layer	Diameter Host FQDN
Low Priority	Gx	Equal to 32	32 **Note** This channel is for non-WPS diameter messages but may carry WPS diameter messages in error scenarios, for example when all the Red Peers are down.	Not Modified Examples: 0 0 0 1-diamproxy. PGW-Gx', 'dra1', 'pcrf1
High Priority	Gx	Equal to 47	47	Specific to High Priority Examples: 0001-diamproxy. PGW-Gx-wps', ' dra1-wps', 'pcrf1-wps'.

Characteristics of Low Priority and High Priority Channels for S11, S5, or S8 interfaces

The S5 and S11 interfaces are GTPv2 based (which uses UDP as the transport protocol), Low and High Priority channels have the following characteristics.

Table 2: Low and High Priority Channels on Other Interfaces

Priority Channel	Diameter Interfaces	IP Layer DSCP	TCP Connection over IP layer	Diameter Host FQDN
Low Priority	S11 or S5 or S8	32	—	—
High Priority	S11 or S5 or S8	47	—	—

How it Works

The following is a high-level overview of how this feature works.

The P-GW/S-GW selects either High Priority or Low Priority channels based on the wps profile. The following table describes the DSCP marking rules based on the configured APN name, QCI values, and ARP PL in the default or any of the dedicated bearer of a session. WPS session detection is based on the configured APN name, QCI and ARP PL values in the default or dedicated bearer of a session. The S5, S8 and S11 interface contain IP packets marked with DSCP=47 IP based on APN, QCI, and ARP PL parameters as shown in the table. Other IP packets are marked with DSCP=32.

Table 3: WPS Message Prioritization based on APN, QCI, and ARP Priority Level

APN Name	QCI	ARP PL	DSCP
APN-x/APN-y/*	66,69	*	47
APN-x/APN-y/*	*	1,2	47
APN-x/APN-y/*	8	3	47
APN-x/APN-y/*	9	5	47
APN-x/APN-y/*	2	4	47

The following table explains the process of dynamic transport selection based on transaction or Origin Host:

Table 4: Procedure

Process	Description
Identifying WPS and Non-WPS users	• Use the CLI command **priority-select** at diameter end point to enable or disable WPS users. This CLI command is at policy-control configuration in IMS-authorization service. • P-GW receives Create session request with every WPS session is tagged with the APN name, QCI, and ARP PL values. • P-GW verifies whether that APN name, QCI, and ARP PL value is matching the WPS. • Session Manager checks whether the received ARP PL value matches the WPS session or not. • If the above criteria of matching WPS session and enabling of priority select is met then, the user is called as WPS user. Else, the user is called as Normal user.
Prioritizing Session	At Policy Change Rule Function (PCRF) you can define two priority levels such as Low Priority session for non-WPS users and high priority session for WPS users. • **Always-On WPS Sessions**: GTPv2-S5, GTPv2-S11, GTPv2-S8, and Gx sessions, which belongs to WPS users are always treated as high priority. • **On-Demand WPS Sessions**: GTPv2-S5, GTPv2-S11, GTPv2-S8, and Gx sessions, which belong to Non-WPS users can be uplifted to higher priority (lower ARP PL value) dynamically. The most common example of this is when a WPS user makes a WPS call (that is initiated by dialing a call starting with *272) to non-WPS user. These types of sessions are called On-Demand WPS sessions. • Control plane Gx messages belonging to high priority sessions shall use High Priority channels. • Control plane Gx messages belonging to non-high priority sessions shall use low priority channels.

Process	Description
Differentiating paths between normal users and WPS users	On Gx interface, different connections are made to form the second path at the CLI level: • P-GW creates two sets of DRA peer connections. One set for higher priority and other for normal priority messages. • P-GW sends CCR-Initial and CCR-Update Gx messages on specific pair of connections based on type of session (WPS session or non WPS session). • After the peer is configured with priority-select flag, all CCR messages for WPS session is initiated over High Priority peer. if P-GW identifies the users as a WPS user it will bind to the high priority peer with DSCP marking as 47. However, non WPS subscriber's Diameter message is initiated over Low Priority peer and the DSCP is set to 32. **Note** If the DSCP configuration for peer is not specified, then global dscp value configured under diameter endpoint is used. If global dscp value under diameter endpoint is not configured, then dscp value "0" is used. The following actions are performed before triggering CCR-I message with respect to WPS users: • Selection of High Priority peer. • If an existing AVP string is configured in peer configuration, Origin Host ID is appended with a string. If string is not configured, default **-wps** string is appended to Origin Host ID. • DRA/PCRF responds with CCA-I over high priority channel upon reception of the CCR-I. The subsequent messages follow the high priority channel.

Call Flow

The key call flow for this feature include transitioning from non-WPS to WPS Session and PCRF initiated Bearer Deletion.

If CSR (Creation Session Request) has one bearer and ARP PL, QCI does not match with ARP PL, QCI defined in WPS profile for corresponding APN, the Session is treated as Non-WPS Session. All Gx messages follow low priority channel to PCRF. However, if any dedicated bearer triggered by Mobile has ARP PL, QCI matched with ARP PL, QCI in WPS profile for corresponding APN , low priority session is transitioned to WPS session.



Note "Green peer" is "Low priority channel". "Red peer" is "High priority channel"

Figure 2: Transitioning from Non-WPS to WPS Session and Vice Versa

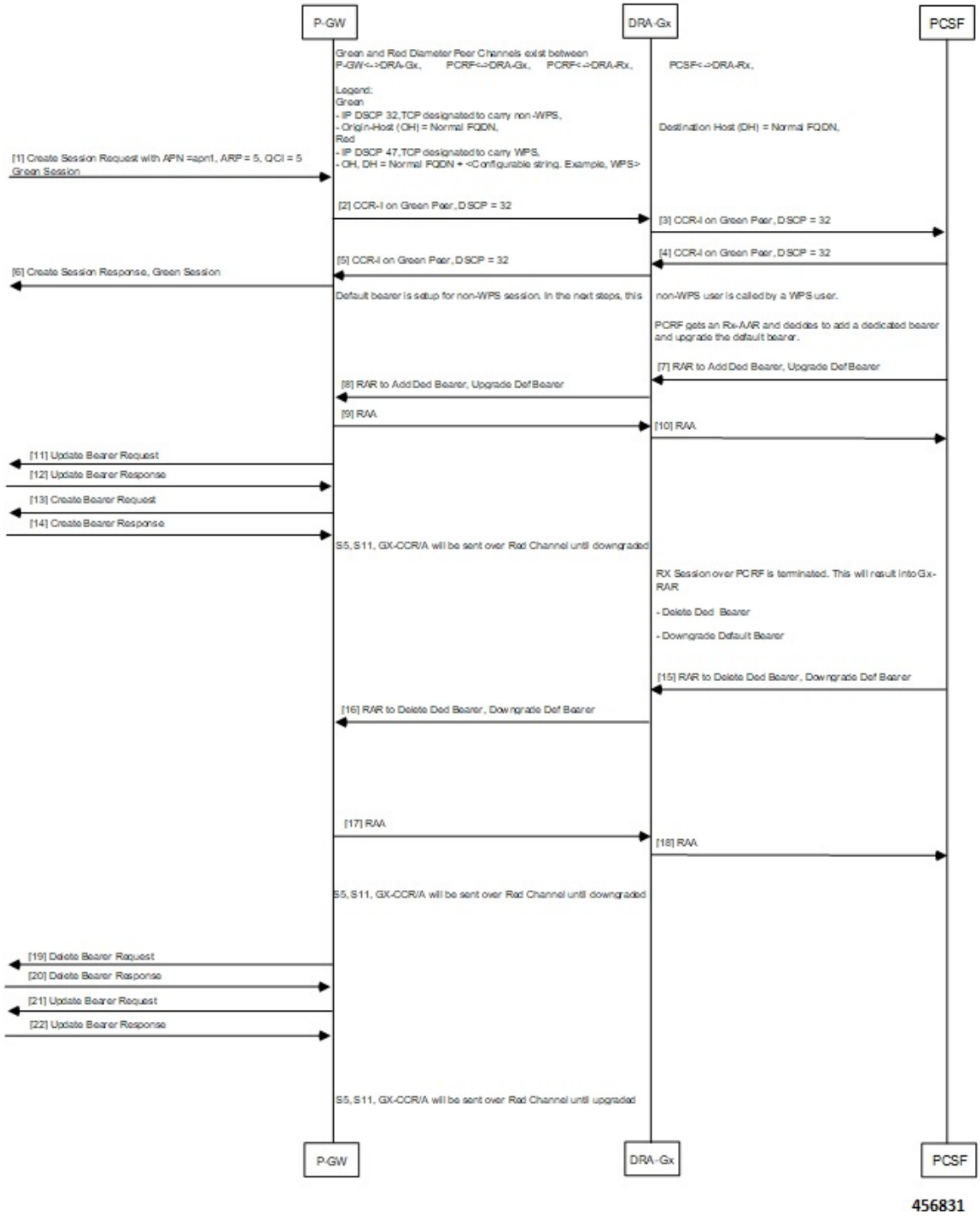


Table 5: Procedure

Step	Description
1 through 6	Low Priority channels are used for a non-WPS session.
7 through 14	P-GW receives dedicated bearer with APN, ARP PL, QCI matched with ARP PL in WPS APN profile, the following operations are performed, and CCR-U is sent to DRA/PCRF. • Non-WPS session is transitioned to WPS session. CLP is updated as WPS session. • P-GW Identifies high priority peer. • Appends the String "-wps" or configured origin-host-suffix string to Origin host ID. The subsequent outgoing messages on Gx, S5, S11, or S8 will follow the high priority channel until the session is downgraded again.
15 through 22	P-GW receives RAR with QCI or ARP PL that are not defined in WPS APN profile, the session is downgraded from WPS session to non-WPS.

Configuring IMS Authorization Service for WPS

Use the following sample configuration to configure IMSA service at context level for IMS subscribers:

```
configure
   context context_name
      ims-auth-service imsa_service_name
         policy-control
            diameter origin endpoint endpoint_name priority-select
            diameter dictionary dictionary
            no event-report-indication
            custom-reauth-trigger  qos-change default-bearer-qos-change
ue-ip-addr-allocate resource-modification-request  ue-ip-addr-release
apn-ambr-mod-failure default-bearer-qos-mod-failure
            diameter host-select table { 1 | 2 } algorithm round-robin
            diameter host-select row-precedence  precedence_value  table { 1 |
 2 } host  primary_host_name  [ realm  primary_realm_id  ] [ secondary host
secondary_host_name  [ realm  secondary_realm_id  ] ] priority-host [ -noconfirm
]
            exit
         exit
```

NOTES:

- *context_name* must be the name of the context where you want to enable IMSA service.
- *imsa_service_name* must be the name of the IMSA service to be configured for Rel. 8 Gx interface authentication.

- To enable Rel. 8 Gx interface support, pertinent Diameter dictionary must be configured. For information on the specific Diameter dictionary to use, contact your Cisco account representative.
- The Round Robin algorithm for PCRF selection is effective only over a large number of PCRF selections, and not at a granular level.
- **priority-select**: Enables Wireless Priority Services (WPS) for subscribers. This is a mandatory parameter to define peer as Red peer.



Note **priority-select** keyword is used under IMSA as well as under 'diameter endpoint' configuration. Both must be enabled for current feature to work.

- **priority-host**: Configures host as red host. If priority-host keyword configured in a row, both primary and secondary peers are treated as red host .



Note To remove this keyword, configure **no-priority-host**.

Configuring DSCP Mapping

This section describes how to configure the DSCP mapping:

- Configuring a WPS APN Profile.
- Associating an WPS profile with P-GW and S-GW service
- Enabling Gx Prioritization for WPS Sessions
- Differentiating Low Priority and High Priority Peers

Configuring WPS APN Profile

Use the following commands to configure WPS APN profile, which is used to identify a bearer or session as an WPS bearer or session.

```
configure
     wps-apn-profile  wps_apn_name
     [ no ] wps-apn-row row_number qci qci_value earp arp_pl_value dscp dscp_value
end
```

NOTES:

- **wps-apn-profile** *wps_apn_name*: Configures WPS profile for an APN. This APN name is used for wps session detection. **wps-apn-profile all** is used when this WPS APN Profile is to be applied for all APNs.



Important Different **wps-apn-profile** must be defined for different APNs.

- **wps-apn-row**: This configuration is used for marking a bearer/PDN as an WPS. QCI and eARP PL are used for wps session detection. You can configure maximum of 16 rows and an integer value from 1 to16.

  For the **qci and earp**, **all** is the wild card match.

- **dscp**: This configuration is used at S-GW or P-GW, to mark various outgoing GTP-C and Gx messages associated with an WPS PDN with configured DSCP marking. The dscp value is an integer between 1..63.

Associating WPS APN Profiles with P-GW and S-GW Services

This section describes how to associate a WPS APN profile with P-GW and S-GW services.

```
configure
   context  context_name
      [ no ] pgw-service service_name
         [ no ] associate wps-apn
         end
```

Notes:

- **no**: Disables WPS APN profile association with P-GW service.
- **associate wps-apn**: Associates WPS APN profile with P-GW service.

```
configure
   context context_name
      [ no ] sgw-service  service_name
         [ no ] associate wps-apn
         end
```

Notes:

- **no**: Disables WPS APN profile association with S-GW service.
- **associate wps-apn**: Associates WPS APN profile with S-GW service.

Enabling Gx Prioritization for WPS Sessions

This section describes how to enable Gx prioritization levels for WPS sessions

```
configure
   context context_name
      [ no ]ims-auth-service service_name
         [ no ] policy control
             [ no ] diameter origin endpoint  endpoint_name  priority-select
             [ no ] diameter session-prioritization
            diameter host-select row-precedence precedence_value table { 1 |
2 } host primary_host_name [ realm primary_realm_id ] [ secondary host
secondary_host_name [ realm secondary_realm_id  ] ]  priority-host [ -noconfirm
]
         end
```

Notes:

- **priority-select**: Enables Wireless Priority Services (WPS) for the selected IMS authorization service.



Note The **priority-select** keyword is mandatory for WPS feature.

- **no diameter session-prioritization**: Enables or disables Gx signalling prioritization for WPS sessions:
  - By default, the **diameter session-prioritization** CLI command is disabled and Gx messages does not get prioritized based on WPS value.
  - If previously configured, use the **no diameter session-prioritization** CLI command to set the default behavior
  - The **diameter session-prioritization** CLI takes effect when Gx, along with WPS APN profile, is enabled in the configuration.
  - The **diameter session-prioritization**configuration attaches DRMP-0 AVP to Diameter Messages going over the High Priority channel. DRA/PCRF takes appropriate actions based on DRMP-0, incase of fallback from High Priority to Low Priority channel takes place on P-GW to DRA or DRA to PCRF Gx links.



Note Diameter session-prioritization is an existing CLI and it is not mandatory for configuring WPS feature.

- **priority-host**: Configures host as red host. If priority-host keyword configured in a row, both primary and secondary peers are treated as red host.

Differentiating Low Priority and High Priority Peers

This section describes how to differentiate between low and priority peers. Priority-endpoint configuration under policy-control ensures WPS feature is only applicable to IMS auth service under policy control area. It is applicable for Gx interface

```
configure
   context context_name
      [ no ] diameter endpoint pgw-gx
        peer  primary_peer_name [ realm primary_realm_name ] address ip_address [
port port_number ]
         peer  secondary_peer_name [ realm secondary_realm_name ] address ip_address
 [ port port_number ] priority-select dscp dscp_value origin-host-suffix
suffix_name
          end
```

NOTES:

- **priority-select**: Defines peer as high priority wps peer. It is optional to configure to both parameters. Following conditions apply during peer configuration:
  - If **priority-select** is not configured, peer will not be treated as high priority **WPS** peer.

- If no DSCP at peer is configured, endpoint level DSCP is filled in IP packets towards DRA/PCRF. Otherwise, configured DSCP is filled in IP packet.
- If Priority-select is set and **origin-host-suffix** is configured in peer, configured string is added to Origin Host ID. Otherwise, default "-wps" string is added to origin host id (for example, pgw-gx-wps).
- **dscp**: DSCP can also be configured on low priority peer. The dscp value is a integer between 1..63.

Monitoring and Troubleshooting

This section describes troubleshooting information, show commands and Outputs, IMSA level statistics, eGTPC statistics, and Bulk statistics.

Show Commands and Outputs

show ims-authorization policy-control statistics

Use this CLI command to view the output field details of `Rule Installation Failure` statistics, number of prioritized DRMP messages, WPS and Non-WPS session statistics

Field	Description
DPCA WPS Session Stats	
Total Current Sessions	The total number of DPCA WPS session currently running on this system
Switched from Priority Chnl	Indicates the total subscribers moved from Wireless Priority to Normal
Switched to Priority Chnl	Indicates the total subscribers moved from Normal to Wireless Priority
DPCA WPS Message Stats	
Priority Channel Indicates message statistics for WPS session, which is sent or received on high priority channel.	
Total messages Received	Total policy control messages received for IMS authorization policy control.
Total Messages Sent	Total messages sent to IMS authorization policy control server.
Total CCR	Total Credit Control Request (CCR) messages received.
Total CCA	Total Credit Control Answer (CCA) messages sent in response to CCRs.
CCR-Initial	Total number of initial CCR messages received.
CCA-Initial	Total number of initial CCA messages sent in response to initial CCR messages.

Field	Description
CCA-Initial Accept	Total number of initial CCA messages accepted in response to initial CCR messages.
CCA-Initial Reject	Total number of initial CCA messages rejected in response to initial CCR messages.
CCA-Initial Dropped	Total number of CCA-I messages that are dropped due to S-GW restoration, DPCA is off, or not present, or if the IMSA session is in preservation mode.
CCA-Initial Timeouts	Total number of initial CCA messages timed out in response to initial CCR messages.
CCR-Update	Total number of Credit Control Request (CCR) messages received after initial CCR for update.
CCA-Update	Total Credit Control Answer (CCA) messages sent in response to update CCRs.
CCA-Update Timeouts	Total Credit Control Answer (CCA) messages sent in response to update CCRs but timed out.
CCA-Update Errors	Total number of errors in parsing the CCA-Update Message.
CCA-Update Dropped	Total number of CCA-U messages that are dropped due to S-GW restoration, DPCA is off, or not present, or if the IMSA session is in preservation mode.
CCR-Final	Total number of final CCR messages received to end application.
CCA-Final	Total number of final CCA messages sent in response to final CCR messages to end sessions.
CCA-Final Timeouts	Total number of final CCA messages sent in response to final CCR messages to end sessions but timed out.
CCA-Final Errors	Total number of errors in parsing the CCA-Terminate Message.
CCA-Final Dropped	Total number of CCA-T messages, which are dropped due to S-GW restoration, DPCA is off ,or not present, or if the IMSA session is in preservation mode.
ASR	Total number of Abort-Session-Requests (ASRs) received.
ASA	Total number of Abort-Session-Accept (ASA) messages sent in response to Abort-Session-Requests (ASRs).
RAR	Total number of Re-Auth-Requests (RARs) received for re-authorization..
RAA	Total number of Re-Auth-Requests(RARs) answered with Re-Auth-Answer (RAA) message.

Field	Description
RAR-CCR collision	Total number of Re-Auth-Request (RAR) messages received from PCRF when there is any outstanding Credit Control Request (CCR) message.
Non-Priority Channel	**Indicates message statistics for WPS session, which is supposed to be sent/received on Priority channel but sent/received on Non-priority channel**
Total messages Received	Total policy control messages received for IMS authorization policy control.
Total Messages Sent	Total messages sent to IMS authorization policy control server.
Total CCR	Total Credit Control Request (CCR) messages received.
CCR-Initial	Total number of initial CCR messages received.
CCA-Initial	Total number of initial CCA messages sent in response to initial CCR messages.
CCA-Initial Accept	Total number of initial CCA messages accepted in response to initial CCR messages.
CCA-Initial Reject	Total number of initial CCA messages rejected in response to initial CCR messages.
CCA-Initial Dropped	Total number of CCA-I messages which are dropped due to S-GW restoration, DPCA is off, or not present, or if the IMSA session is in preservation mode
CCA-Initial Timeouts	Total number of initial CCA messages timed out in response to initial CCR messages.
CCR-Update	Total number of Credit Control Request (CCR) messages received after initial CCR for update.
CCA-Update	Total Credit Control Answer (CCA) messages sent in response to update CCRs.
CCA-Update Timeouts	Total Credit Control Answer (CCA) messages sent in response to update CCRs but timed out.
CCA-Update Errors	Total number of errors in parsing the CCA-Update Message
CCA-Update Dropped	Total number of CCA-U messages which are dropped due to S-GW restoration, DPCA is off or not present or if the IMSA session is in preservation mode.
CCR-Final	Total number of final CCR messages received to end application.
CCA-Final	Total number of final CCA messages sent in response to final CCR messages to end session/s..

Field	Description
CCA-Final Timeouts	Total number of final CCA messages sent in response to final CCR messages to end session/s but timed out.
CCA-Final Errors	Total number of errors in parsing the CCA-Terminate Message.
CCA-Final Dropped	Total number of CCA-T messages which are dropped due to S-GW restoration, DPCA is off or not present or if the IMSA session is in preservation mode.
ASR	Total number of Abort-Session-Requests (ASRs) received.
ASA	Total number of Abort-Session-Accept (ASA) messages sent in response to Abort-Session-Requests (ASRs).
RAR	Total number of Re-Auth-Requests (RARs) received for re-authorization.
RAA	Total number of Re-Auth-Requests (RARs) answered with Re-Auth-Answer (RAA) message.
RAR-CCR collision	Total number of Re-Auth-Request (RAR) messages received from PCRF when there is any outstanding Credit Control Request (CCR) message.

show diameter peers full all

Use this CLI command to view peer details.

Counters	Description
Priority Channel	Indicates peer is high priority or not. The options are: • Yes: Indicates peer is WPS. • No: Indicates peer is non-WPS.

show wps-apn-profile{all | name wps_apn_profile_name}

View a particular or all WPS APN profile(s) configured with its associated attributes.

show pgw-service { name <name> | all }

Field	Description
WPS APN Profile(s) Associated	Indicates **wps apn profile** associated with P-GW service or not. The options are Yes and No.

You can view similar output field information for the **show sgw-service { name <name> | all }** command.

show pgw-service { name_*name* | all }

The output of this command is modified to reflect the WPS APN profile associated with the P-GW service.

Field	Description
WPS APN Profile(s) Associated	Indicates **wps apn** profile associated with pgw service or not. The options are **Yes** and **No**.

show sgw-service { name_*name* | all }

The output of this command is modified to reflect the WPS APN profile associated with the S-GW service.

Field	Description
WPS APN Profile(s) Associated	Indicates **wps apn** profile associated with sgw service or not. The options are **Yes** and **No**.

show subscribers pgw-only full all

The output of this command is modified to reflect whether the session is WPS or not.

Field	Description
WPS Bearer	Indicates whether the Bearer is a WPS or non-WPS. The options are **Yes** and **No**.

show sgw-service statistics all

The output of this command is modified to display the WPS PDN statistics information.

Field	Description
WPS PDNs	
Current Active	Increments when any PDN is setup as an WPS PDN or upgraded to WPS PDN. Decrements when an WPS PDN is released or when it degrades to a non-WPS PDN.
Cumulative Activated	Increments when any PDN is setup as an WPS PDN or upgrades to an WPS PDN.
Cumulative De-activated	Increments when an WPS PDN is released or when it degrades to a non-WPS PDN.

show subscribers sgw-only full all

The output of this command is modified to reflect whether the session is WPS or not

Field	Description
WPS Bearer	Indicates whether the Bearer is a WPS or non-WPS. The options are **Yes** and **No**.

show subscribers saegw-only full all

The output of this command is modified to reflect whether the session is WPS or not.

Field	Description
WPS Bearer	Indicates whether the Bearer is a WPS or non-WPS. The options are **Yes** and **No**.

show pgw-service statistics all

The output of this command is modified to display the WPS PDN statistics information.

Field	Description
WPS PDNs	
Current Active	Increments when any PDN is setup as an WPS PDN or upgraded to WPS PDN. Decrements when an WPS PDN is released or when it degrades to a non-WPS PDN.
Cumulative Activated	Increments when any PDN is setup as an WPS PDN or upgrades to an WPS PDN.
Cumulative De-activated	Increments when an WPS PDN is released or when it degrades to a non-WPS PDN.

show sgw-service statistics all

The output of this command is modified to display the WPS PDN statistics information.

Field	Description
WPS PDNs	
Current Active	Increments when any PDN is setup as an WPS PDN or upgraded to WPS PDN. Decrements when an WPS PDN is released or when it degrades to a non-WPS PDN.
Cumulative Activated	Increments when any PDN is setup as an WPS PDN or upgrades to an WPS PDN.
Cumulative De-activated	Increments when an WPS PDN is released or when it degrades to a non-WPS PDN.

show saegw-service statistics all

The output of this command is modified to display the WPS PDN statistics information.

Field	Description
WPS PDNs	

Field	Description
Colocated PDNs	Displays the WPS PDN statistics information for collapsed PDNs.
Current Active	Increments when any PDN is setup as an WPS PDN or upgraded to WPS PDN. Decrements when an WPS PDN is released or when it degrades to a non-WPS PDN.
Cumulative Activated	Increments when any PDN is setup as an WPS PDN or upgrades to an WPS PDN.
Cumulative De-activated	Increments when an WPS PDN is released or when it degrades to a non-WPS PDN PGW-Anchor WPS PDNs. Displays the WPS PDN statistics information for P-GW-Anchor PDNs.
PGW-Anchor WPS PDNs: Displays the WPS PDN statistics information for PGW-Anchor PDNs.	
Current Active	Increments when any PDN is setup as an WPS PDN or upgraded to WPS PDN. Decrements when an WPS PDN is released or when it degrades to a non-WPS PDN.
Cumulative Activated	Increments when any PDN is setup as an WPS PDN or upgrades to an WPS PDN.
Cumulative De-activated	Increments when an WPS PDN is released or when it degrades to a non-WPS PDN PGW-Anchor WPS PDNs. Displays the WPS PDN statistics information for P-GW-Anchor PDNs.
SGW-Anchor WPS PDNs: Displays the WPS PDN statistics information for SGW-Anchor PDNs.	
Current Active	Increments when any PDN is setup as an WPS PDN or upgraded to WPS PDN. Decrements when an WPS PDN is released or when it degrades to a non-WPS PDN.
Cumulative Activated	Increments when any PDN is setup as an WPS PDN or upgrades to an WPS PDN.
Cumulative De-activated	Increments when an WPS PDN is released or when it degrades to a non-WPS PDN.

show egtpc statistics interface pgw-ingress interface-type S5/S8

The following CLI commands are modified to display the WPS session related GTP-C message statistics for S5/S8 interface of P-GW Ingress.

Counter	Description
Total WPS Statistics: Displays cumulative GTP-C message statistics for messages received/transmitted on WPS Sessions.	
Create Session Request (Total RX)	This counter is incremented by P-GW when it receives Create session request message on S5/S8 interface that makes session as WPS.

Counter	Description
Create Session Response (Total TX)	If a session is WPS, this counter is incremented by P-GW when it transmits Create session response message on the S5/S8 interface,
Modify Bearer Request (Total RX)	If a session is WPS, this counter is incremented by P-GW when it receives Modify Bearer request message on the S5/S8 interface.
Modify Bearer Response (Total TX)	If a session is WPS, this counter will be incremented by P-GW when it transmits Modify Bearer response message on the S5/S8 interface.
Create Bearer Request (Total TX)	If a session is WPS, this counter is incremented by P-GW when it receives Create Bearer request message on the S5/S8 interface..
Create Bearer Response (Total RX)	If a session is WPS, this counter is incremented by P-GW when it receives Create Bearer response message on the S5/S8 interface.
Update Bearer Request (Total TX)	If a session is WPS, this counter is incremented by P-GW when it transmits Update Bearer request message on the S5/S8 interface.
Update Bearer Response (Total RX)	If a session is WPS, this counter is incremented by P-GW when it receives Update Bearer response message on the S5/S8 interface.
Current interval WPS Statistics: GTP-C message statistics for messages received/transmitted on WPS Sessions for current statistics collection interval. Statistics collection interval will be same as bulkstats collection interval. If bulk stats collection is not configured, then Current WPS Statistics is displayed similarly as Total WPS Statistics.	
Create Session Request (Total RX)	This counter is incremented by P-GW when it receives Create session request message on S5/S8 interface that makes a session as WPS.
Create Session Response (Total TX)	If a session is WPS, this counter is incremented by P-GW when it transmits Create session response message on the S5/S8 interface.
Modify Bearer Request (Total RX)	If a session is WPS, this counter is incremented by P-GW when it receives Modify Bearer request message on the S5/S8 interface.
Modify Bearer Response (Total TX)	If a session is WPS, this counter is incremented by P-GW when it transmits Modify Bearer response message on the S5/S8 interface.
Create Bearer Request (Total TX)	If a session is WPS, this counter is incremented by P-GW when it receives Create Bearer request message on the S5/S8 interface.
Create Bearer Response (Total RX)	If a session is WPS, this counter is incremented by P-GW when it receives Create Bearer response message on the S5/S8 interface.
Update Bearer Request (Total TX)	If a session is WPS, this counter is incremented by P-GW when it transmits Update Bearer request message on the S5/S8 interface.
Update Bearer Response (Total RX)	If a session is WPS, this counter is incremented by P-GW when it receives Update Bearer response message on the S5/S8 interface.

show egtpc statistics interface sgw-egress interface-type S5/S8

The following CLI commands are modified to display the WPS session related GTP-C message statistics for S5/S8 interface of S-GW Egress.

Counter	Description
Total WPS Statistics: Displays cumulative GTP-C message statistics for messages received/transmitted on WPS Sessions.	
Create Session Request (Total RX)	This counter is incremented by S-GW when it receives Create session request message on S5/S8 interface that makes session as WPS.
Create Session Response (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Create session response message on the S5/S8 interface,
Modify Bearer Request (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Modify Bearer request message on the S5/S8 interface.
Modify Bearer Response (Total TX)	If a session is WPS, this counter will be incremented by S-GW when it transmits Modify Bearer response message on the S5/S8 interface.
Create Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer request message on the S5/S8 interface..
Create Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer response message on the S5/S8 interface.
Update Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Update Bearer request message on the S5/S8 interface.
Update Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Update Bearer response message on the S5/S8 interface.
Current interval WPS Statistics: GTP-C message statistics for messages received/transmitted on WPS Sessions for current statistics collection interval. Statistics collection interval will be same as bulkstats collection interval. If bulk stats collection is not configured, then Current WPS Statistics is displayed similarly as Total WPS Statistics.	
Create Session Request (Total RX)	This counter is incremented by S-GW when it receives Create session request message on S5/S8 interface that makes a session as WPS.
Create Session Response (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Create session response message on the S5/S8 interface.
Modify Bearer Request (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Modify Bearer request message on the S5/S8 interface.
Modify Bearer Response (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Modify Bearer response message on the S5/S8 interface.
Create Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer request message on the S5/S8 interface.

Counter	Description
Create Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer response message on the S5/S8 interface.
Update Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Update Bearer request message on the S5/S8 interface.
Update Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Update Bearer response message on the S5/S8 interface.

show egtpc statistics interface sgw-ingress interface-type s11

The following CLI commands are modified to display the WPS session related GTP-C message statistics for S11 interface of S-GW Ingress

Counter	Description
Total WPS Statistics: Displays cumulative GTP-C message statistics for messages received/transmitted on WPS Sessions.	
Create Session Request (Total RX)	This counter is incremented by S-GW when it receives Create session request message on the S11 interface that makes session as WPS.
Create Session Response (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Create session response message on the S11 interface,
Modify Bearer Request (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Modify Bearer request message on the S11 interface.
Modify Bearer Response (Total TX)	If a session is WPS, this counter will be incremented by S-GW when it transmits Modify Bearer response message on the S11 interface.
Create Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer request message on the S11 interface..
Create Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer response message on the S11 interface.
Update Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Update Bearer request message on the S11 interface.
Update Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Update Bearer response message on the S11 interface.
Current interval WPS Statistics: GTP-C message statistics for messages received/transmitted on WPS Sessions for current statistics collection interval. Statistics collection interval will be same as bulkstats collection interval. If bulk stats collection is not configured, then Current WPS Statistics is displayed similarly as Total WPS Statistics.	
Create Session Request (Total RX)	This counter is incremented by S-GW when it receives Create session request message on S11 interface that makes a session as WPS.

Counter	Description
Create Session Response (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Create session response message on the S11 interface.
Modify Bearer Request (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Modify Bearer request message on the S11 interface.
Modify Bearer Response (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Modify Bearer response message on the S11 interface.
Create Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer request message on the S11 interface.
Create Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Create Bearer response message on the S11 interface.
Update Bearer Request (Total TX)	If a session is WPS, this counter is incremented by S-GW when it transmits Update Bearer request message on the S11 interface.
Update Bearer Response (Total RX)	If a session is WPS, this counter is incremented by S-GW when it receives Update Bearer response message on the S11 interface.

clear egtpc

The following CLI commands are modified to clear WPS statistics at interface level and eGTP-C service level:

- **clear egtpc statistics interface-type interface-pgw-ingress interface s5s8**: Clears interface statistics along with WPS statistics for all eGTP-C services of P-GW Ingress type and S5/S8 interface.
- **clear egtpc statistics interface-type [interface-sgw-ingress | interface-sgw-egress] interface [s11 | sgw-s5s8]** : Clears interface statistics along with WPS statistics for all eGTP-C services of S-GW Ingress type and S11 interface/S-GW Egress type and S5/S8 interface.
- **clear egtpc statistics egtp-service pgw_egtpc_service_name interface [s5s8]** : Clears interface statistics along with WPS statistics for all P-GW eGTP-C services and S5/S8 interface.
- **clear egtpc statistics egtp-service sgw_egptc_service_name interface [s11 | sgw-s5s8]** : Clears interface statistics along with WPS statistics for all S-GW eGTP-C services and S11 or S5/S8 interface.

Bulk Statistics

This section provides information on the bulk statistics in support of the QCI and ARP based DSCP mapping feature.

IMSA Schema

The following bulk statistics are included in the IMSA Schema to track high and low priority categories for WPS and Non-WPS users.

Counters	Description
dpca-imsa-total-session-priority-channel	Shows the cumulative number of Wireless Priority subscribers.
dpca-imsa-total-sessions-switched-from-priority-channel	Shows the cumulative number of subscribers moved from Wireless Priority to Normal.
dpca-imsa-total-sessions-switched-to-priority-channel	Shows the cumulative number of subscribers moved from Normal to Wireless Priority.

PGW Schema

The following bulk statistics are included in the P-GW Schema.

Counters	Description
sessstat-pdn-wps-cumulative-activated	Shows the total number of P-GW PDNs that are either setup as an WPS PDN or upgrades to an WPS PDN.
sessstat-pdn-wps-cumulative-deactivated	The total number of P-GW PDNs that were either released or degrades to a non-WPS PDN.

SGW Schema

The following bulk statistics are included in the S-GW Schema.

Counters	Description
sessstat-pdn-wps-cumulative-activated	Shows the total number of S-GW PDNs that are either setup as an WPS PDN or upgrades to an WPS PDN.
sessstat-pdn-wps-cumulative-deactivated	The total number of S-GW PDNs that were either released or degrades to a non-WPS PDN.

SAEGW Schema

The following bulk statistics are added in the SAEGW schema to support Bulk Statistics Variables.

Counters	Description
pgw-anchor-pdns-wps-cumulative-activated	Shows the total number of P-GW anchored PDNs that are either setup as an WPS PDN or upgrades to an WPS PDN.
pgw-anchor-pdns-wps-cumulative-deactivated	Shows the total number of P-GW anchored PDNs that were either released or degrades to a non-WPS PDNs.
saegw-colocated-pdns-wps-cumulative-activated	Shows the total number of SAE-GW collapsed PDNs that are either setup as an WPS PDN or upgrades to an WPS PDN.
saegw-colocated-pdns-wps-cumulative-deactivated	Shows the total number of SAE-GW collapsed PDNs that were either released or degrades to a non-WPS PDN.

Counters	Description
sgw-anchor-pdns-wps-cumulative-activated	Shows the total number of S-GW anchored PDNs that are either setup as an WPS PDN or upgrades to an WPS PDN.
sgw-anchor-pdns-wps-cumulative-deactivated	Shows the total number of S-GW anchored PDNs that were either released or degrades to a non-WPS PDN.

eGTP-C Schema

The following new bulk statistics variables are added to the eGTP-C schema in support of this feature. These statistics are only for the current bulkstat intervals.

Counters	Description
s11-tun-recv-modbearerreq-wps	Shows the total number of tunnel modify bearer request messages received by the system for WPS subscriber on the s11 interface.
s11-tun-sent-modbearerresp-wps	Shows the total number of tunnel modify bearer response messages sent by the system for WPS subscriber on the s11 interface.
s11-tun-sent-crebearerreq-wps	Shows the total number of tunnel create bearer request messages sent by the system for WPS subscriber on the s11 interface.
s11-tun-recv-crebearerresp-wps	Shows the total number of tunnel create bearer response messages received by the system for WPS subscriber on the s11 interface.
s11-tun-sent-updbearerreq-wps	Shows the total number of tunnel update bearer request messages sent by the system for WPS subscriber on the s11 interface s11.
s11-tun-recv-updbearerresp-wps	Shows the total number of tunnel update bearer response messages received by the system for WPS subscriber on the s11 interface .
tun-sent-cresessreq-wps	Shows the total number of tunnel create session request messages sent by the system for WPS subscriber on the s5/s8 interface .
tun-recv-updbearerresp-wps	Shows the total number of tunnel update bearer response messages received by the system for WPS subscriber on the s5/s8 interface.
tun-sent-updbearerresp-wps	Shows the total number of tunnel update bearer response messages sent by the system for WPS subscriber on the s5/s8 interface .

P-GW eGTP-C S5/S8 Schema

The following bulk statistics are added to the P-GW eGTP-C S5/S8 schema in support of this feature. These statistics are only for the current bulkstat intervals.

Counters	Description
tun-recv-cresessreq-wps	Shows the total number of tunnel create session request messages received by the system for WPS subscriber on the S5/S8 interface.

Counters	Description
tun-sent-cresessresp-wps	Shows the total number of tunnel create session response messages sent by the system for WPS subscriber on the S5/S8 interface.
tun-recv-modbearerreq-wps	Shows the total number of tunnel modify bearer request messages received by the system for WPS subscriber on the S5/S8 interface.
tun-sent-modbearerresp-wps	Shows the total number of tunnel modify bearer response messages sent by the system for WPS subscriber on the S5/S8 interface.
tun-sent-crebearerreq-wps	Shows the total number of tunnel create bearer request messages sent by the system for WPS subscriber on the S5/S8 interface.
tun-recv-crebearerresp-wps	Shows the total number of tunnel create bearer response messages received by the system for WPS subscriber on the S5/S8 interface
tun-sent-updbearerreq-wps	Shows the total number of tunnel update bearer request messages sent by the system for WPS subscriber on the S5/S8 interface.
tun-recv-updbearerresp-wps	Shows the total number of tunnel update bearer response messages received by the system for WPS subscriber on the S5/S8 interface.