



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

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Feature Summary and Revision History

Summary Data

| | |
|--|--|
| Applicable Product(s) or Functional Area | <ul style="list-style-type: none"> • P-GW • S-GW • SAEGW |
| Applicable Platform(s) | <ul style="list-style-type: none"> • 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 |
|--|---------|
| <p>First introduced.</p> <p>Important This feature is not validated for all customer deployment scenarios. For more information, contact your Cisco Account representative.</p> | 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) is shown in the figure.

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

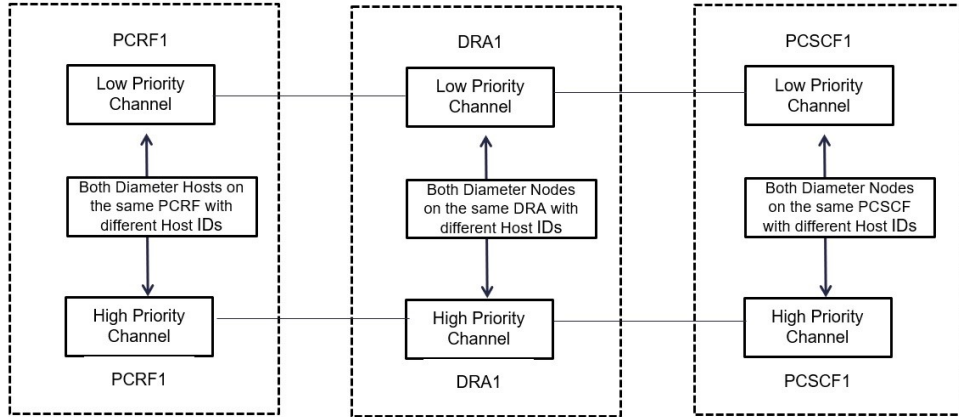


Table 1: Low and High Priority Channels on Gx Interface

| 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 | <ul style="list-style-type: none"> • 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 | <p>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.</p> <ul style="list-style-type: none"> • 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 | <p>On Gx interface, different connections are made to form the second path at the CLI level:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>The following actions are performed before triggering CCR-I message with respect to WPS users:</p> <ul style="list-style-type: none"> • 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

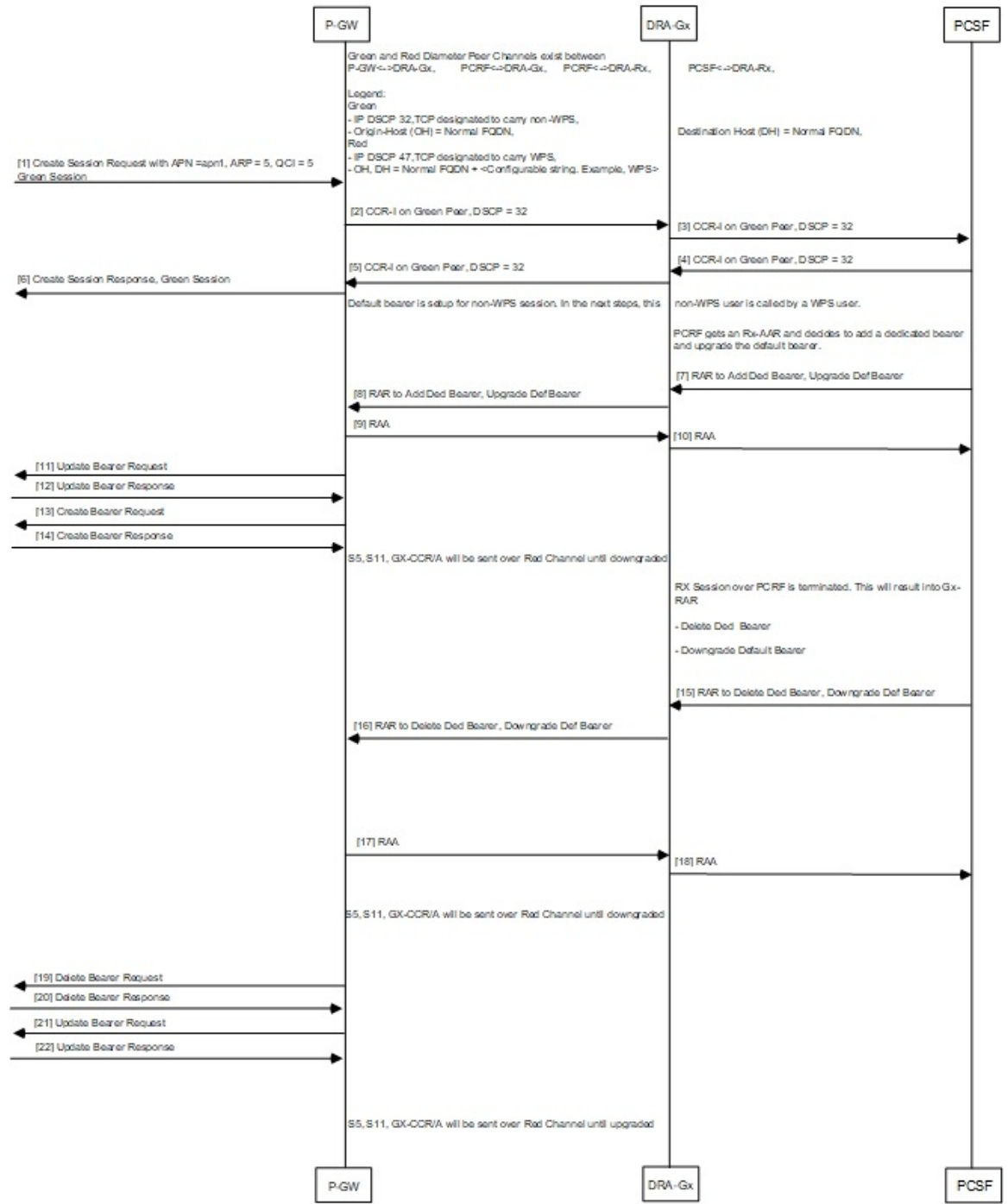
The key call flow for this feature include transitioning from non-WPS to WPS Session and PCRF initiated Bearer Deletion.

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



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Table 5: Procedure

| Step | Description |
|---------------|---|
| 1 through 6 | Low Priority channels are used for a non-WPS session. |
| 7 through 14 | <p>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.</p> <ul style="list-style-type: none"> • 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. <p>The subsequent outgoing messages on Gx, S5, S11, or S8 will follow the high priority channel until the session is downgraded again.</p> |
| 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 to 16.

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: <ul style="list-style-type: none"> • 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 }
```

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 | |

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

| 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_egtpc_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-creseessreq-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-creseessreq-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-creseessresp-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. |

