Dynamic Transport Selection based on Transaction or Origin-Host

Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	P-GW
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 has not been validated for all customer deployment scenarios. Please contact your Sales Account team for support.	21.22

Feature Description

Reliable and secure telecommunications systems are necessary for effectively managing national security incidents and emergencies. The National Security and Emergency Preparedness (NS/EP) is a set of voice, video, and data services that belong to services available from public packet-switched Service Providers and that provide priority services in support of NS/EP communications. The NS/EP communication systems include landline, wireless, broadcast, and cable television, radio, public safety systems, satellite communications, and the Internet.

Wireless Priority Services (WPS) is one of the NS/EP communications programs that provide personnel priority access and prioritized processing in all nationwide and several regional cellular networks, increasing the probability of call completion.

WPS users, also known as first responders, are responsible for the command and control functions that are critical to the management of response to national security and emergencies. When your network carries the traffic for WPS users' all the network elements individually and collectively must adhere to the following conditions:

- **Prioritization of Control Plane Traffic**:WPS user’s control plane traffic is prioritized over other subscribers between different Network Functions in the LTE Core.
- 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 (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
- **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.
  - P-GW and SGW 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 indicate normal priority users and High Priority channels indicate WPS users during 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

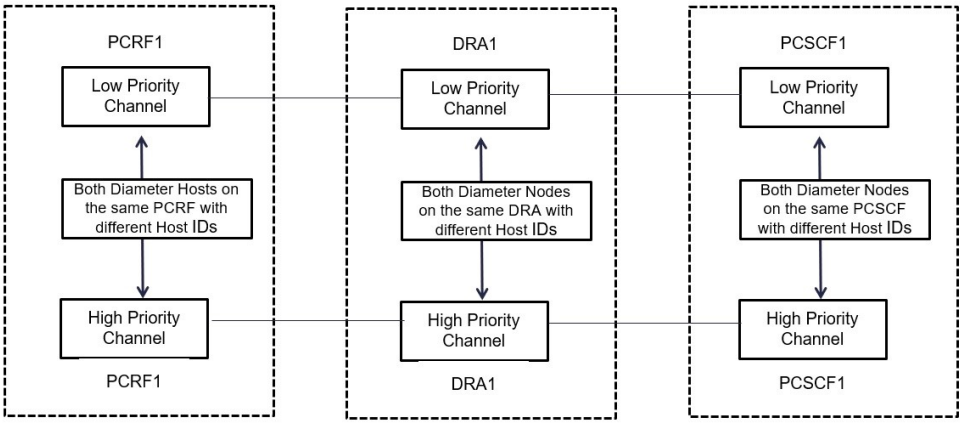


Table 1: Low and High Priority Channels on Gx Interface

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 PGW selects either High Priority or Low Priority channels based on the **wps profile**. If APN name, QCI, and ARP are matched as shown in the table, session is detected as WPS session at IMSA.

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

APN Name	QCI	ARP	DSCP
IMS	66,69	*	47
IMS	*	1,2	47
IMS	8	3	47
IMS	9	5	47
IMS	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. • PGW receives Create session request with every eMPS session is tagged with the Allocation and Retention Priority (ARP) value. • PGW verifies whether that ARP value is matching the WPS. • Session Manager checks whether the received ARP value matches the eMPS session or not. • If the above criteria of matching eMPS 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 belong 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 eMPS sessions. • Control plane Gx messages that belong to high priority sessions uses High Priority channels. • Control plane Gx messages that belong to nonhigh priority sessions uses high priority channels.

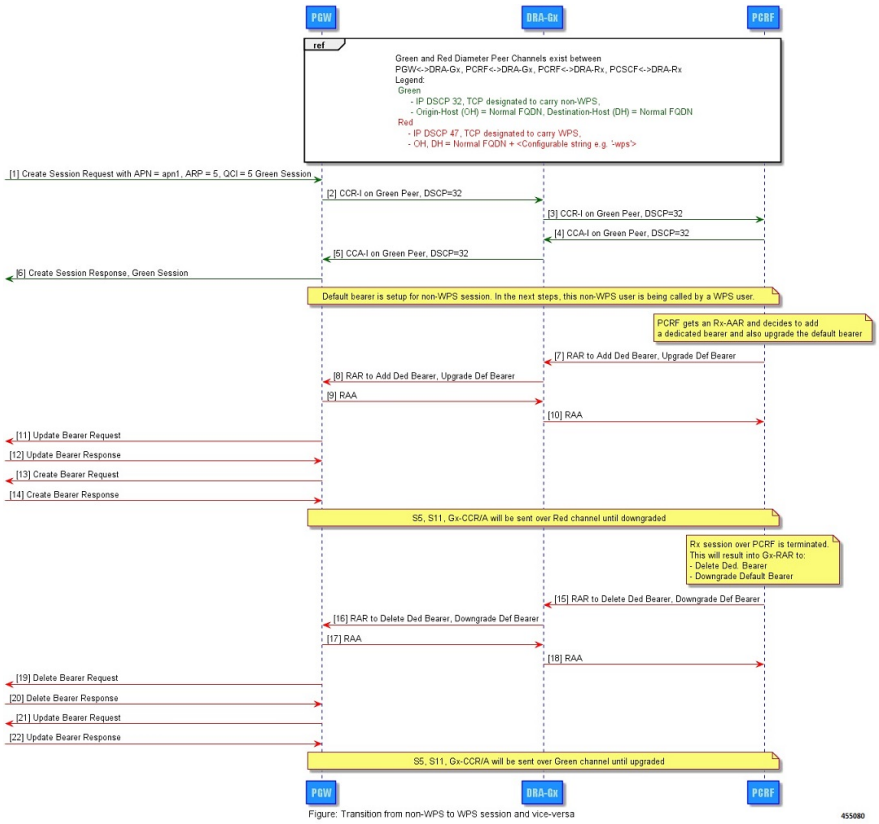
Process	Description
Differentiating paths between normal users and WPS users	On Gx interface, different connections are made to form the second path at the CLI level: • P-GW creates two sets of DRA peer connections. One set for higher priority and other for normal priority messages. • P-GW sends CCR-Initial 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 are initiated over High Priority peer. If P-GW identifies the users as a WPS user, it binds 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.

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 does not match with ARP defined in eMPS profile, the Session is treated as low priority Session. All Gx messages follow low priority channel to PCRF. However, if any dedicated bearer triggered by Mobile has ARP matched with ARP defined in eMPS profile, low priority session is transitioned to WPS session.

Note In this document Low priority channel and Green channel are used interchangeably and the same is true for Red and High priority channel.

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



Note In the StarOS 21.22 release, WPS session is the same as eMPS session and is based on eMPS profile.

Table 5: Procedure

Step	Description
1 through 6	Low Priority channels are used for a non-WPS session.
7 through 14	P-GW receives RAR with an ARP defined in eMPS profile, the following operations are performed. • Internally, the session is updated to an eMPS session. • P-GW identifies high priority peer and appends the string "-wps" (or configured origin-host-suffix string) to Origin Host AVP in the outgoing messages. The subsequent outgoing messages on Gx, S5 and S11 will follow the high priority channel until the session is downgraded again.
15 through 22	P-GW receives RAR with ARP not defined in eMPS profile, the session is downgraded from eMPS (WPS) session to non-WPS.

Step	Description
Note	When the session is in eMPS state and if there is no High priority Gx peer available, a Low Priority Peer shall be used for Gx traffic. If there is no peer is available, then the call gets dropped

Configuring Dynamic Transport Selection based on Transaction or Origin-Host

This section describes how to configure the Dynamic Transport Selection based on Transaction or Origin-Host.

1. Configuring eMPS Profile
2. Associating an eMPS profile with P-GW Service
3. Enabling Gx Prioritization for eMPS Sessions
4. Enabling WPS feature and priority services for APN services

Configuring eMPS Profile

This section describes how to configure eMPS profile. Use the following commands to configure eMPS profile, which is used to identify/mark a bearer/session as an eMPS bearer/session

```
configure
   [ no ] emps-profile emps_profile_name -noconfirm
      [ no ] earp { [string value] }
      [ no ] dscp-marking { dscp-value }
      end
```

Notes:

- **emps-profile emps_profile_name**: Configures eMPS profile for defining attributes of an eMPS session. The *emps_profile_name* is a string of size from 1 to 63.
- **-noconfirm**: Creates a new eMPS profile without prompting for confirmation.
- **earp**: Configures a maximum of 8 eARP priority level (PL) values so that sessions with configured eARP priority values can be marked as eMPS sessions. Maximum of 8 eARP values can be configured under an eMPS profile.
- **dscp-marking**: Specifies the DSCP value to be applied to eMPS sessions. The dscp_value is a hexadecimal number between 0x0 and 0x3F.

Note For supplemental information related to eMPS profile configuration (configuring the eMPS ARPs, which are used to identify a bearer/session as an eMPS bearer/session), and eMPS statistics, refer to the *Expanded Prioritization for VoLTE/Emergency Calls* chapter in the *P-GW Administration Guide or the SAEGW Administration Guide*.

Associating an eMPS-Profile with P-GW and S-GW Service

This section describes how to associate an eMPS profile with P-GW and S-GW services.

```
configure
  context context_name
    pgw-service service_name
      associate emps-profile emps_profile_name
      end
```

```
configure
  context context_name
    Sgw-service service_name
      associate emps-profile emps_profile_name
      end
```

Notes:

- **no**: Disables a emps-profile association with P-GW or S-GW service.
- **associate emps-profile***emps_profile_name*: Associates an eMPS profile with either P-GW or S-GW service.

Enabling Gx Prioritization for eMPS Sessions and Wireless Priority Services

This section describes how to enable Gx prioritization levels for eMPS 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
      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 eMPS 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 eMPS 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 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.

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 PGW-Gx-green-1  realm_address ipv4 address | ipv6 address portport_number

       peer PGW-Gx-wps-1  realm_address ipv4 address | ipv6 address port port_number
priority-select origin-host-suffix value dscp value
     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 is not treated as high priority **wps** peer.
  - **origin-host-suffix**: If **priority-select** is set for a peer, it is treated as **wps** peer. If **Origin-host-suffix** is configured for **wps** peer, configured string is appended to Origin Host ID otherwise, default **-wps** string is appended to Origin Host ID (for example, pgw-gx-wps).
  - **dscp**: If DSCP is not configured for high priority peer, endpoint level DSCP is filled in IP packets towards DRA/PCRF. Otherwise, configured DSCP is filled in IP packet.

Monitoring and Troubleshooting

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

Show Commands and Outputs

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.

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.
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.

Field	Description
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.
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.

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 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..
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.

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.

show diameter peers full all

Use this CLI command to view peer details.

Field	Description
Priority Channel	Indicates peer is high priority or not. The options are: • **Yes**: Indicates peer is WPS. • **No**: Indicates Peer is Non-WPS.
DSCP Configured	Indicates the dscp value to be used in Gx IP Packet. • If configured, displays peer specific DSCP. • If not configured, then it will display the dscp configured in endpoint.

Bulk Statistics

This section provides information on the bulk statistics for the Dynamic Transport Selection based on Transaction or Origin-Host feature on P-GW

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.