UPF Selection Support

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Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	cnSGW-C
Applicable Platform(s)	SMI
Feature Default Setting	UPF Selection using DCNR Support: Disabled – Configuration required to enable UPF Selection using DNN Support: Enabled – Always-on UPF Selection using Location Support: Disabled – Configuration required to enable Combined UPF Selection for cnSGW-C and SMF: Disabled – Configuration required to enable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
Added support for UPF selection using Location. Added support for Combined UPF selection for cnSGW-C and SMF.	2021.02.0
First introduced.	2021.01.0

Feature Description

This feature describes the following UPF selection methods.

- DNN and DCNR
- Location support
- cnSGW-C and SMF to select same UPF instance

UPF Selection using DNN and DCNR Support

Feature Description

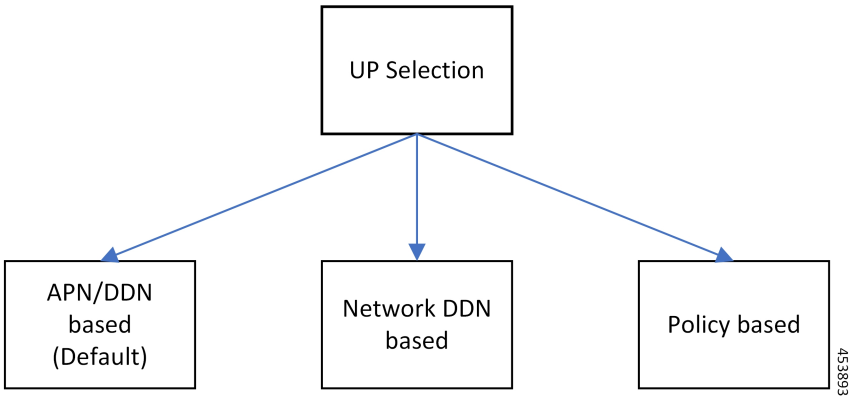
The following are the three UPF selection methods:

- DNN or APN based
- Network based
- Policy based

Note DNN is enabled when UPF selection policy isn't associated.

How it Works

This section describes how the feature works.



UPF Selection Methods

DNN or APN Based

- Create Session request message has APN information. This APN gets configured as part of DNN-list in the Network element profile for each user-plane.
- The PDN establishment considers these user-planes.
- UPF selection uses Capacity and Priority if many user-planes are available.

Network Based

- UPF selection considers DNN which got configured as part of the APN or DNN profile.
- This DNN is local SGW network specific DNN name.
- The same network DNN or APN name gets configured as part of DNN-list in the network element profile for each user-plane.
- Instead of using APN that comes in CSReq, local DNN is used for the UPF selection based on the DNN list.

  For example, in case of roaming scenario where APN is not known, this configuration helps in UPF selection.
- PDN establishment considers these user-planes.
- UPF selection uses Capacity and Priority if many user-planes are available.

UPF Selection Policy Based

- UPF selection profile configuration with parameters determines UPF for each precedence. The supported max number of precedencies are four.
- Each precedence parameter is a *Logical AND* condition. If DNN and DCNR are configured as precedence 1, then it searches for the DNN supported user-plane and enables DCNR based support. If this search criteria fails, it moves to the next (mostly 2) precedence and tries to evaluate that condition.
- UPF selection policy is associated with a DNN profile.

- UPF group provides characteristics to the network element profile which belongs to the same UPF group profile.
- UPF selection uses Capacity and Priority if many user-planes available.

Note

- cnSGW-C rejects the call with Create Session Response specifying cause as NO_RESOURCE_AVAILABLE when no UPF matches the precedence criteria.

Configuring UPF Selection Methods

This section describes how to configure the UPF selection methods.

Configuring UPF Group Profile-based UPF Selection

This section describes how to configure UPF group profile-based UPF selection.

Use the following commands to configure the UPF group profile-based UPF selection.

```
config
  profile upf-group upf_group_name
    dcnr [true | false]
    end
```

NOTES:

- **profile upf-group** *upf_group_name*—Specify the UPF group name. Must be a string.
- **dcnr [true | false]**—Specify to enable or disable support for dual connectivity with new radio. Default value is false.

Sample Configuration

Following is a sample configuration.

```
config
profile upf-group G1
 dcnr true
 end
```

Configuring Network-based UPF Selection

Table 3: Feature History

Feature Name	Release Information	Description
Dual Stack Support for Data Plane	2024.02.0	cnSGW-c enables the dual stack transport for Data Plane using the **dual-stack-transport { false | true }** CLI command in the UPF network profile. With this support, you can: • Configure new eNBs and UPFs with IPv6 addresses for network expansion. • Continue with the existing eNBs and UPFs with IPv4 addresses for phased migration to IPv6 addresses. **Default Setting:** Disabled – Configuration Required

Use the following commands to configure the network-based UPF selection

```
config
   profile network-element upf upf_name
      node-id  node_id_value
      n4-peer-address ipv4  ipv4_address
      n4-peer-address ipv6  ipv6_address
      n4-peer-port  port_number
      dual-stack-transport { true | false }
      upf-group-profile upf_group_profile_name
      dnn-list dnn_list
      priority priority_value
      capacity capacity_value
      end
```

NOTES:

- **network-element upf** *upf_name*—Specify the UPF profile name.
- **node-id** *node_id_value*—Specify the Node ID of the UPF node.
- **n4-peer-address ipv4** *ipv4_address*—Specify the IPv4 address.
- **n4-peer-address ipv6** *ipv6_address*—Specify the IPv6 address.
- **dual-stack-transport { true | false }**—Enable the dual stack feature that allows you to specify an IPv6 or IPv4 address. Specify true to enable this feature.
- **upf-group-profile** *upf_group_profile_name*—Specify the UPF group profile name.

- **dnn-list** *dnn_list*—Specify the DNN list supported by the UPF node.
- **priority** *priority_value*—Specify the static priority relative to other UPFs. This value is used for load balancing and must be an integer in the range of 0–65535. The default value is 1.
- **capacity** *capacity_value*—Specify the capacity relative to other UPFs. This value is used for load balancing and must be an integer in the range of 0–65535. The default value is 10.

Sample Configuration

The following is a sample configuration.

```
config
profile network-element upf UP1
 node-id      upf1@sgw.com
 upf-group-profile G1
 dnn-list [dnn1 dnn2]
 priority 20
 capacity 65535
 end
```

Configuring Policy based UPF Selection

This section describes how to configure Policy based UPF selection.

Use the following commands to configure the Policy based UPF Selection.

```
config
 policy upf-selection upf_selection_policyname
   precedence precedence_value location
   exit
   precedence precedence_value dnn
   exit
 exit
```

NOTES:

- **upf-selection** *upf_selection_policyname* - Specify the UPF selection policy name.
- **precedence** *precedence_value* - Specify the precedence for entry. Must be an integer in the range of 1-4.

Sample Configuration

Following is a sample configuration.

```
config
policy upf-selection upf_pol1
  precedence 1
    [ location ]
  exit
  precedence 2
    [ dnn ]
  exit
exit
```

Troubleshooting Information

This section describes the troubleshooting information that enables you to view the UPF selection using DNN and DCNR configuration issues.

Configuration Errors

```
show config-error | tab
ERROR COMPONENT   ERROR DESCRIPTION
-------------------------------------------------------------------------------------------------------
SGWProfile        Subscriber policy name : sub_policy in profile sgw1 is not configured
SubscriberPolicy  Operator policy : op_policy1 under subscriber policy sub_policy2 is not
configured
OperatorPolicy    Dnn policy name : dnn_policy1 in operator policy op_policy2 is not
configured
DnnPolicy        Dnn profile name : dnn_profile1 in dnn policy dnn_policy2 is not configured
DnnProfile        UPF selection policy name : upf_sel_policy1 in dnn profile dnn_profile2
is not configured
```

UPF Selection using Location Support

Feature Description

This feature supports Location-based UPF selection in Create Session Request message. It performs this selection as per the received TAI or ECGI or both TAI and ECGI values together.

Configuring the UPF Selection Feature

This section describes how to configure the UPF selection using location.

Configuring ECGI for EPS

This section describes how to configure ECGI for EPS.

New configuration and profile **ecgi-group** added to configure the list of individual ECGI values or the range of ECGI.

You can configure both ECGI list and ECGI range. ECGI range configuration is optional.

Use the following commands to configure the ECGI Configuration for EPS.

```
config
  profile ecgi-group ecgi_group_name
    mcc mcc_value
    mnc mnc_value
      ecgi list ecgi_list_name
      ecgi range start start_value end end_value
  exit
```

NOTES:

- **ecgi-group** *ecgi_group_name* - Specify the ECGI group name.
- **mcc** *mcc_value* - Specify the MCC value. Must be a three digit number. For example, 123

- **mnc** *mnc_value* - Specify the MNC value. Must be a two or three digit number. For example, 23 or 456
- **ecgi list** *ecgi_list* - Specify the list of ECGI values - 7 digit hex string Eutra Cell ID. For example, A12345f. Must be a string.
- **ecgi range start** *start_value* **end** *end_value* - Specify the ECGI range start and end values. Must be a string.

Note

- You can configure multiple ECGI range values.
- You can configure multiple [PLMN and ECGI values] under **ecgi-group** configuration.
- You can configure maximum of 16 PLMNs under **ecgi-group** configuration.
- You can configure maximum of 64 ECGI values in the ECGI list under a PLMN.
- Maximum defined number of ECGI ranges under a PLMN is 64.

Sample Configuration

Following is the sample configuration.

```
config
profile ecgi-group e1 mcc 123 mnc 45
ecgi list [ 1234567 abcdef0 ]
ecgi range start 1111111 end fffffff
exit
```

Verifying ECGI for EPS Configuration

This section describes how to verify the ECGI Configuration for EPS.

Use the following `show` command to view the ECGI configuration for EPS.

```
show running-config profile ecgi-group
profile ecgi-group e1
mcc 123 mnc 45
ecgi list [ 1234567 abcdef0 ]
ecgi range start 1111111 end fffffff
exit
exit
exit
```

Configuring TAI-Group

This section describes how to configure TAI-Group.

You can enhance the following TAI-Group configuration to support multiple TAI-Group configurations with different names.

Use the following commands to configure the TAI-Group.

```
config
  profile tai-group tai_group_name
    mcc mcc_value
    mnc mcc_value
```

```
        tac list tac_list
        tac range start start_value end end_value
    exit
```

NOTES:

- **tai-group** *tai_group_name* - Specify the TAI group name.
- **mcc** *mcc_value* - Specify the MCC value. Must be a three digit number. For example, 123
- **mnc** *mnc_value* - Specify the MNC value. Must be a two or three digit number. For example, 23 or 456
- **tac list** *tac_list* - Specify the list of TAC values - [0-9a-fA-F]{4}|[0-9a-fA-F]{6} - 4 digit or 6 digit hex string - Example A123, 1a2B3F. Must be a string.
- **tac range start** *start_value* **end** *end_value* - Specify the TAC range start and end values. Must be a string.

Note

- You can configure maximum of 16 PLMNs under a TAI-Group.
- You can configure maximum of 64 TAC values in a TAC list under a PLMN.
- Maximum defined number of TAC ranges under a PLMN is 64.

Sample Configuration

Following is the sample configuration.

```
config
profile tai-group TAI-GRP1
  mcc 123 mnc 234
    tac list [ 1a25 A123 ]
    tac range start B234 end b999
    exit
    tac range start C213 end c999
    exit
  exit
  mcc 231 mnc 45
    tac list [ 2a2B B123 ]
    tac range start d111 end d999
    exit
  exit
exit
```

Configuring Location-area-group

This section describes how to configure Location-area-group.

You can add new configuration and profile location-area-group. Configuration of **ecgi-group** and **tai-group** are optional.

Use the following commands to configure the Location-area-group.

```
config
  profile location-area-group location_area_group_name
    tai-group tai_group_name
```

```
    ecgi-group ecgi_group_name
  exit
```

NOTES:

- **location-area-group** *location_area_group_name* - Specify the location area group name.
- **tai-group** *tai_group_name* - Specify the TAI group name.
- **ecgi-group** *ecgi_group_name* - Specify the ECGI group name.

Sample Configuration

Following is the sample configuration.

```
config
profile location-area-group LOC_AREA_GRP_1
  tai-group TAI-AUTO-GRP1
  ecgi-group ECGI-AUTO-GRP1
exit
profile location-area-group LOC_AREA_GRP_2
  tai-group TAI-AUTO-GRP2
exit
```

Configuring UPF Group and UPF Selection Policy Enhancement

This section describes how to configure UPF Group and UPF Selection Policy Enhancement.

You can add new configuration under upf-group-profile to configure location-area-group-list.

Use the following commands to configure the UPF group anf UPF selection policy enhancement.

```
config
  profile upf-group upf_group_name
    location-area-group-list [area_group_list]
  exit
```

```
config
  policy upf-selection selection_policy_name
   precedence value  [ selection_parameter_list ]
  exit
```

NOTES:

- **upf-group** *upf_group_name* - Specify the UPF group name.
- **location-area-group-list** *area_group_list* - Specify the list of Location Area Group supported by UPF node.
- **upf-selection** *selection_policy_name* - Specify the UPF selection policy name.
- **precedence** *value* **[** *selection_parameter_list* **]** - Specify the precedence for entry. Must be an integer in the range of 1-4.

Note If pdn-type-subscription and pdn-type-session both are configured, pdn-type-subscription is considered.

Sample Configuration

Following is the sample configuration.

```
config
profile upf-group G1
 location-area-group-list [ LOC_AUTO_GRP_1 ]
exit
profile upf-group G2
 location-area-group-list [ LOC_AUTO_GRP_2 ]
exit
profile upf-group G3
 location-area-group-list [LOC_AUTO_GRP_1 LOC_AUTO_GRP_2 ]
exit
```

```
config
policy upf-selection upf_pol1
  precedence 1
    [ location ]
  exit
  precedence 2
    [ dnn ]
  exit
exit
```

Combined UPF Selection for cnSGW-C and SMF

Feature Description

This feature supports cnSGW-C and SMF to select the same UPF instance when the UPF and SMF are deployed on same cluster and UPF instance is available. If the UPF instance is not available, the UPF selection is based on the existing configurations.

Standards Compliance

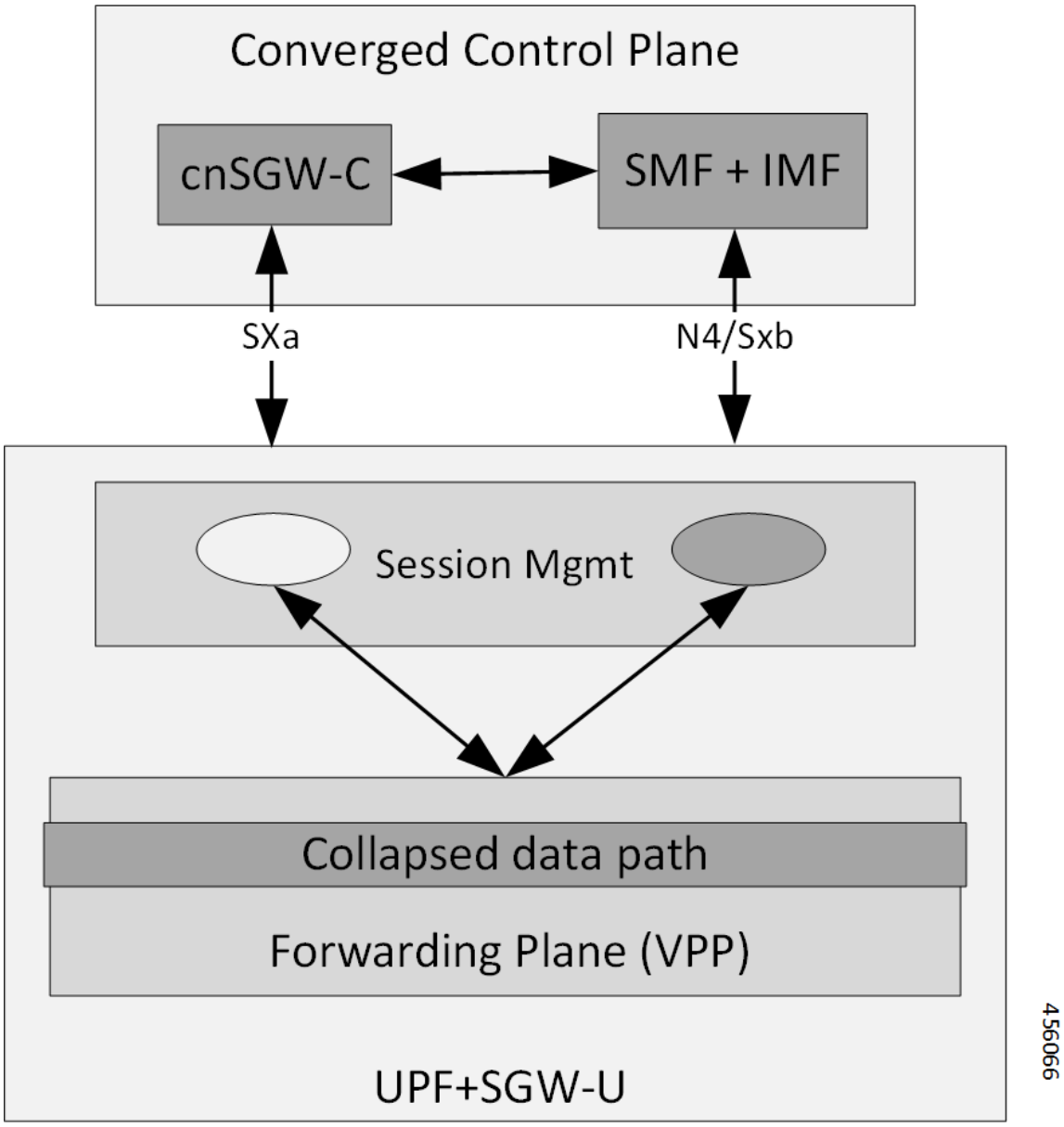
The Combined UPF Selection for cnSGW-C and SMF feature complies with the following standards:

- *3GPP TS 23.401*
- *3GPP TS 23.402*
- *3GPP TS 29.274*
- *3GPP TS 23.214*
- *3GPP TS 29.244*
- *3GPP TS 24.008*

How it Works

This section describes how this feature works.

System Architecture



cnSGW-C and SMF/IWF uses the same UPF instance, so that UPF can use those sessions to the collapsed data path.

Control plane (cnSGW-C and SMF) selects the same User-plane in various scenarios (initial attach, handover, and so on).

Following actions takes place during Initial Attach:

- cnSGW-C passes the SGW-U FQDN information of selected UPF instance to SMF in Initial attach.
- SMF selects the UPF instance as per the received SGW-U FQDN.

- Same UPF FQDN is configured at cnSGW-C and at SMF to create a correlation as part of the network element profile.

Call Flows

This section describes the key call flows of Combined UPF Selection for cnSGW-C and SMF feature.

Initial Attach on 4G for 5G Capable Device Call Flow

This section describes the Initial Attach on 4G for 5G Capable Device call flow.

Figure 1: Initial Attach on 4G for 5G Capable Device Call Flow

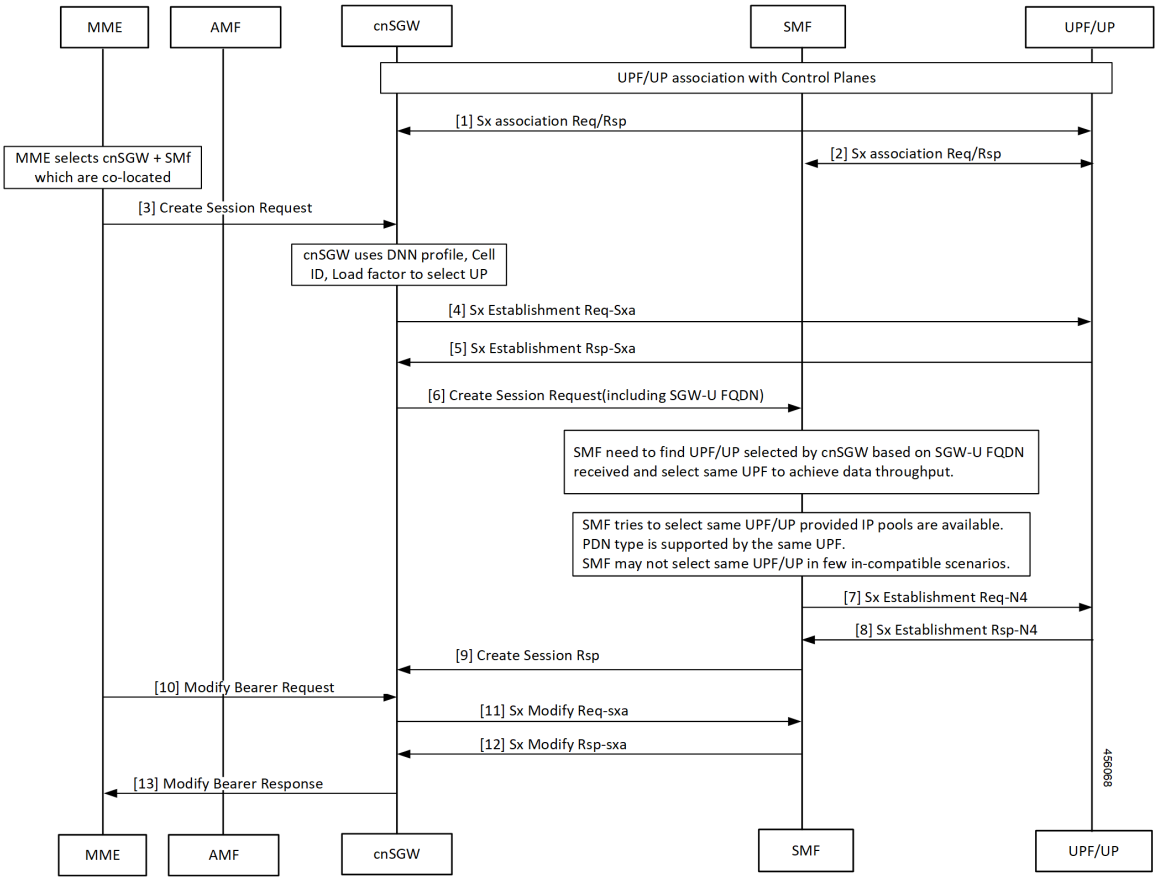


Table 4: Initial Attach on 4G for 5G Capable Device Call Flow Description

Step	Description
1	Established UPF association with control planes. cnSGW-C sends Sx Association Req/Rep to UPF.
2	SMF sends Sx Association Req/Rep to UPF.
3	MME sends Create Session Request to cnSGW-C after selecting co-located cnSGW-C and SMF.

Step	Description
4	cnSGW-C sends Sx Establishment Req (SXA) to UPF after selecting UPF using DNN profile, Cell ID, and local factors.
5	cnSGW-C receives Sx Establishment Res from UPF.
6	cnSGW-C sends Create Session Request to SMF including SGW-U FQDN.
7	SMF must find cnSGW-C selected UPF as per received SGW-U FQDN and select the same UPF to achieve data throughput. SMF tries to select same UPF when IP pools are available. Same UPF supports the PDN type. SMF may not select same UPF in few in-compatible scenarios. SMF send Sx Establishment Req N4 to UPF.
8	SMF receives Sx Establishment Res-N4 from UP.
9	cnSGW-C receives Create Session Response from SMF.
10	MME sends Modify Bearer Request to cnSGW-C.
11	cnSGW-C sends Sx Modify Req (SXA) to SMF.
12	cnSGW-C receives Sx Modify Res (SXA) to SMF.
13	cnSGW-C sends Modify Bearer Response to MME.

UPF Registration with User Plane ID Call Flow

This section describes the UPF Registration with User Plane ID call flow.

Figure 2: UPF Registration with User Plane ID Call Flow

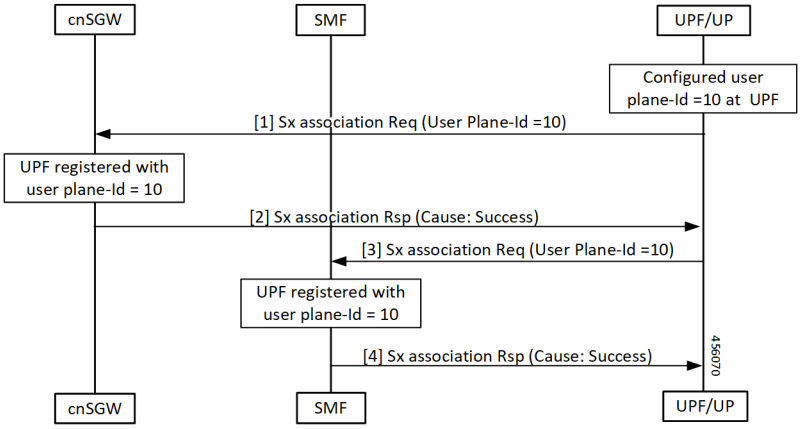


Table 5: UPF Registration with User Plane ID Call Flow Description

Step	Description
1	Configured User-plane ID at UPF cnSGW-C receives Sx association Request from UPF with configured User-plane ID.
2	UPF receives Sx association Response with Cause = SUCCESS from cnSGW-C.
3	SMF receives Sx association Request from UPF with configured User-plane ID.
4	UPF receives Sx association Response with Cause = SUCCESS from SMF.

Inter-SGW Handover on 4G RAT for 5G Capable Devices Call Flow

This section describes the Inter-SGW Handover on 4G RAT for 5G Capable Devices call flow.

Figure 3: Inter-SGW Handover on 4G RAT for 5G Capable Devices Call Flow

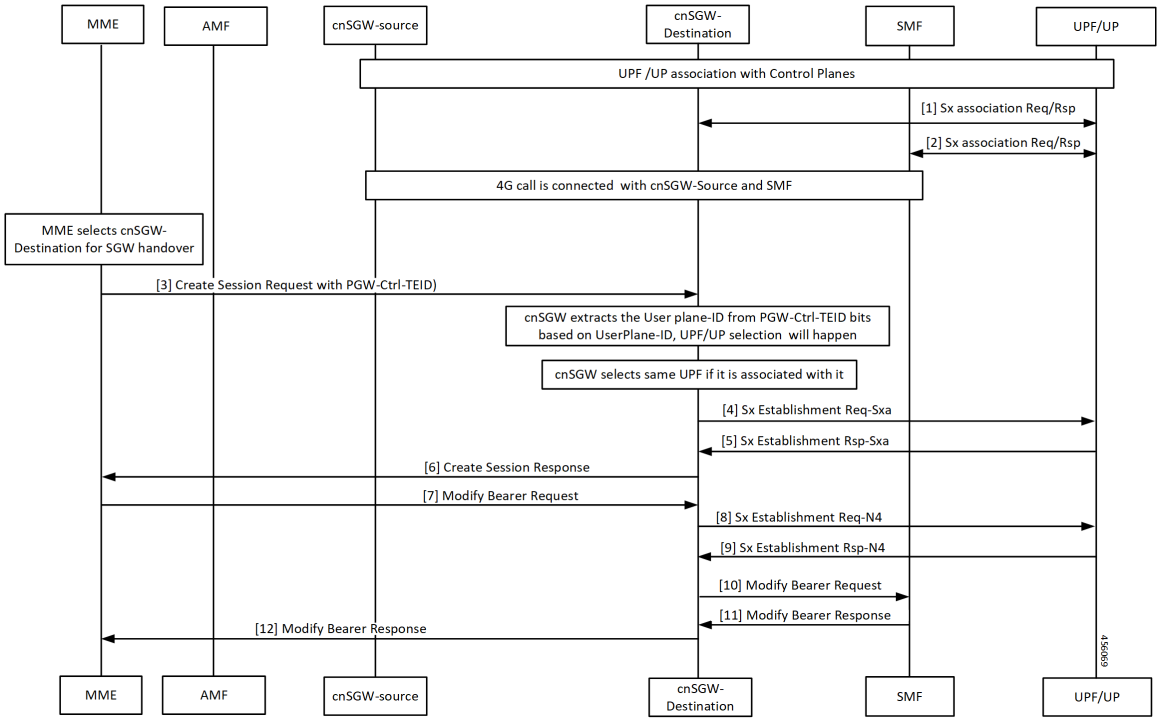


Table 6: Inter-SGW Handover on 4G RAT for 5G Capable Devices Call Flow Description

Step	Description
1	Established UPF association with control planes. UPF sends Sx Association Req/Rep to destination cnSGW-C.
2	UPF sends Sx Association Req/Rep to SMF.

Step	Description
3	4G call connected between cnSGW-C-source and SMF. MME selects cnSGW-C-Destination for the SGW handover. MME sends Create Session Req with PGW-Ctrl-TEID to cnSGW-C-Destination.
4	cnSGW-C extracts same associated UPF ID from PGW-Ctrl-TEID. cnSGW-C-Destination sends Sx Establishment Req (SXA) to UPF.
5	cnSGW-C-Destination receives Sx Establishment Rsp (SXA) from UPF.
6	cnSGW-C-Destination sends Create Session Response to MME.
7	cnSGW-C-Destination receives Modify Bearer Request from MME.
8	cnSGW-C-Destination sends Sx Establishment Req-N4 to UPF.
9	cnSGW-C-Destination receives Sx Establishment Rsp-N4 from UPF.
10	cnSGW-C-Destination sends Modify Bearer Request to SMF.
11	cnSGW-C-Destination receives Modify Bearer Response from SMF.
12	cnSGW-C-Destination forwards Modify Bearer Request to MME.

5G to EPS Handover Using N26 Interface – cnSGW-C and SMF Separate Node Call Flow

This section describes the 5G to EPS Handover Using N26 Interface – cnSGW-C and SMF Separate Node call flow.

Figure 4: 5G to EPS Handover Using N26 Interface – cnSGW-C and SMF Separate Node Call Flow

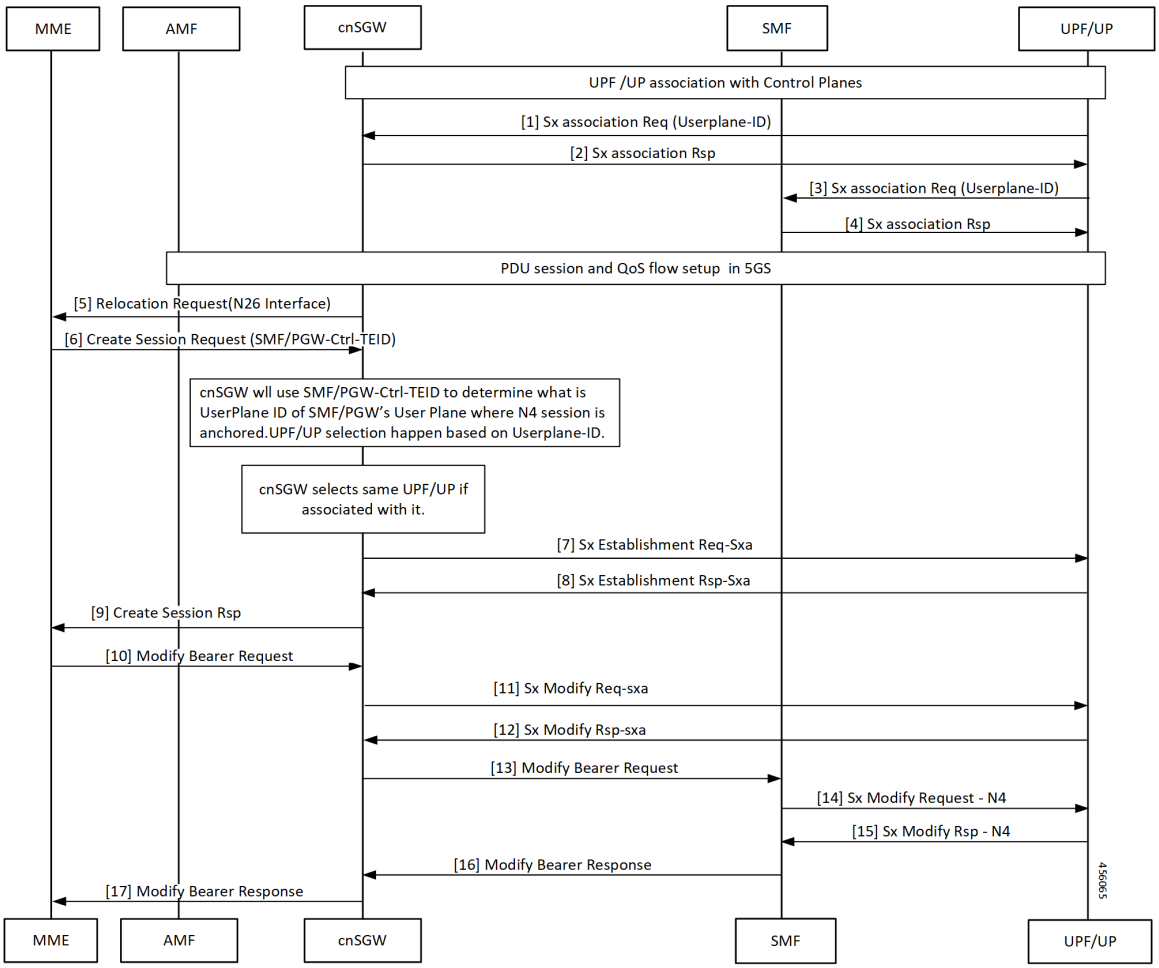


Table 7: 5G to EPS Handover Using N26 Interface – cnSGW-C and SMF Separate Node Call Flow Description

Step	Description
1	cnSGW-C selects associated same UPF. cnSGW-C receives Sx Establishment Request with User-plane ID from UPF/UP.
2	cnSGW-C sends Sx Establishment Response from UPF/UP.
3	UPF/UP sends Sx Association Request with User-plane ID to SMF.
4	SMF sends Sx Association Response to UPF/UP.
5	cnSGW-C sends Relocation Request to MME on interface N26.
6	MME sends Create Session Request to cnSGW-C with SMF and PGW-ctrl-TEID information.
7	cnSGW-C selects associated same UPF. cnSGW-C sends Sx Establishment Req (SXA) to UPF/UP.

Step	Description
8	cnSGW-C receives Sx Establishment Rsp (SXA) from UPF/UP.
9	cnSGW-C sends Create Session response to MME.
10	MME sends Modify Bearer Request to cnSGW-C.
11	cnSGW-C sends Sx Modify Req (SXA) to UPF/UP.
12	cnSGW-C receives Sx Modify Rsp (SXA) from UPF/UP.
13	cnSGW-C sends Modify Bearer Request to SMF.
14	SMF sends Sx Modify Request – N4 to UPF/UP.
15	SMF receives Sx Modify Response from UPF/UP.
16	cnSGW-C receives Modify Bearer Response to SMF.
17	cnSGW-C forwards Modify Bearer Response to MME.

Wi-Fi to LTE Handover Call Flow

This section describes the Wi-Fi to LTE Handover call flow.

Figure 5: Wi-Fi to LTE Handover Call Flow

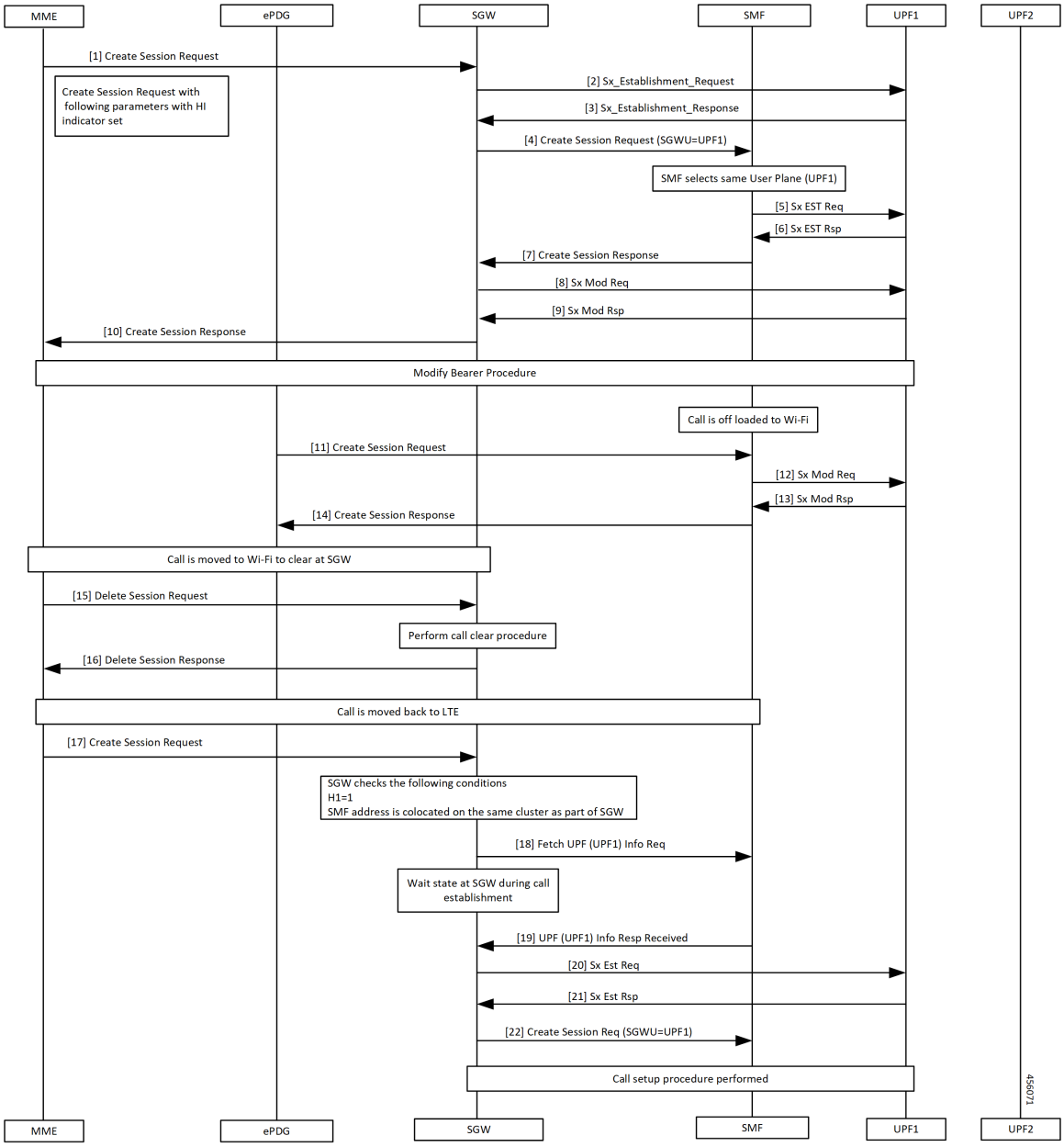


Table 8: Wi-Fi to LTE Handover Call Flow Description

Step	Description
1	MME sends create Session Request to SGW.
2	SGW sends Sx Establishment Request to UPF1.
3	SGW receives Sx Establishment Response from SMF.
4	SGW sends Create Session Request to SMF. SMF selects same UPF.

Step	Description
5	SMF sends Sx Establishment Request to UPF1.
6	SMF receives Sx Establishment Response from UPF1.
7	SMF sends Create Session Response to SGW.
8	SGW sends Sx Mod Request to UPF1.
9, 10	SGW receives Sx Mod Response from UPF1 and forwards to MME.
11	Modify Bearer procedure takes place and off-loaded call to Wi-Fi. ePDG sends Create Session Request to SGW.
12	SMF sends Sx Mod Request to UPF1.
13	SMF receives Sx Mod Response from UPF1.
14	ePDG receives Create Session Response from SGW.
15	Call moved to Wi-Fi to clear at SGW. MME sends Delete Session Request to SGW.
16	MME receives Delete Session Response from SGW after performing call clear procedure.
17	MME sends Create Session Request to SGW.
18	SGW sends fetch UPF (UPF1) info request to SMF after checking SMF as same cluster as cnSGW-C.
19	SGW receives UPF (UPF1) Info Response from SMF.
20	SGW sends Sx Establishment Request to UPF1.
21	SGW receives Sx Establishment Response from UPF1.
22	SGW sends Create Session Request with SGWU=UPF1 to UPF1 and performs call setup procedure.

Configuring the Combined UPF Selection for cnSGW-C and SMF

This section describes how to configure the Combined UPF Selection for cnSGW-C and SMF.

Configuring Converged-Core Profile

This section describes how to configure the Converged-Core Profile.

Use the following commands to configure the profile converged-core with UPF selection enabled.

```
config
  profile converged-core core_name
    max-upf-index value
    no upf-selection disable
  exit
```

Use the following commands to configure the profile converged-core with UPF selection disabled.

```
config
  profile converged-core core_name
    max-upf-index value
    upf-selection disable
  exit
```

NOTES:

- **converged-core** *core_name* - Specify the converged core prolile name.
- **max-upf-index** *value* - Specify the UPF index value. Must be an integer in the range of 1-1023.
- **no upf-selection disable** - Enable colocated UPF selection.
- **upf-selection disable**- Disable colocated UPF slection.

Sample configuration

Following is a sample configuration with UPF selection enabled.

```
config
profile converged-core cc1
max-upf-index 1023
no upf-selection disable
exit
```

Following is a sample configuration with UPF selection disabled.

```
config
profile converged-core cc1
max-upf-index 1023
upf-selection disable
exit
```

Verifying the Profile Converged-core Configuration

This section describes how to verify the Profile Converged-core configuration.

Use the following show command to view the Profile Converged-Core configuration with UPF selection enabled.

```
show running-config profile converged-core cc1
profile converged-core cc1
max-upf-index 1023
no upf-selection disable
exit
```

Use the following show command to view the Profile Converged-Core configuration with UPF selection disabled.

```
show running-config profile converged-core cc1
profile converged-core cc1
max-upf-index 1023
upf-selection disable
exit
```

Configuring Node-ID

This section describes how to configure the Node-ID.

Use the following commands to configure the Node-ID.

```
config
  profile network-element upf upf_name
    node-id node_id_value
  exit
```

NOTES:

- **network-element upf** *upf_name* - Specify the UPF peer network element name.
- **node-id** *node_id_value* - Specify the Node ID of the UPF node. Must be a string

Sample Configuration

Following is a sample configuration.

```
config
profile network-element upf upf1
node-id upf1@cn.com
exit
```

Block UPF to handle continuous Sxa session creation failures

Table 9: Feature History

Feature Name	Release Information	Description
Blocking UPF to handle Sxa session establishment failures	2025.02.0	This feature allows the cnSGWc to blocklist a specific UPF node when it continuously rejects session establishment requests. The UPF may reject these requests from the cnSGWc due to various errors, such as licensing issues. However, without information on the issues at the UPF, the cnSGWc might repeatedly select the same UPF, leading to an increased number of session creation failures. By enabling this feature, the network operators can prevent the cnSGWc from repeatedly selecting the same UPF for a defined time interval. **Commands Introduced:** • **[no] activated-features upf-blocklisting [use-alert** *custom_rule_name* **]**: This CLI is configured under converged core profile configuration mode to enable UPF blocklisting feature on cnSGWc. • **reactivate-peer condition [blocked] attributes [frequency** *frequency_timer* **]**: This CLI is configured under the endpoint configuration mode to reactivate blocked UPF after a frequency timer is over. **Default Setting:** Disabled—Configuration Required to Enable

During the Sxa session creation process, the cnSGWc selects a UPF based on configured options and parameters received in the create request. However, the selected UPF might occasionally be unable to handle the requests due to various issues, such as licensing problems, leading to repeated rejection of session establishment requests.

Since the cnSGWc lacks information about the issues at the UPF, it may continue to select the same UPF, resulting in repeated session creation failures.

This feature allows network operators to blocklist a UPF node by configuring alerts that trigger when the Sxa session establishment failure rate exceeds a defined threshold. It also enables the configuration of a time interval during which the specified UPF node remains blocklisted and allows for reactivating the blocked UPF once the timer expires.

How handling continuous Sxa session creation failures works

The network operator configures the alerts in the Alert Manager with rule name, procedure type, status, interface type, and other parameters defining the conditions for triggering.

Here is a sample of alert configuration:

```
alerts rules group PeerFailure
    rule upf_inactive
    expression "(sum by (namespace,upf_id,gr_instance_id)
    (proto_pfcp_msg_stats{status='failed'})) >= 1000”
    duration   5m
    severity   major
    type       "Communications Alarm"
    annotation summary
    value "NF=UPF Value={{ $value }} - UPF inactive"
    exit
   exit
exit
```

Note The rule name specified in the configuration for enabling UPF blockin activation configuration should be same as the rule name configured in the alert.

The Alert Manager informs the cnSGWc, when the session creation failure reaches a threshold limit. If UPF blocklisting and reactivation configurations are enabled, cnSGWc blocks the specific UPF for the defined frequency timer, and looks for an alternate UPF for session creation.

For more information on UPF blosklisting and UPF reactivation, see the Configure cnSGWc to handle continuous Sxa session creation failures topic.

Once the defined frequency timer expires, cnSGWc removes that UPF from the blocked status and considers it for session creation.

Configure cnSGWc to handle continuous Sxa session creation failures

Perform these tasks to resolve the continuous Sxa session creation failures:

- Enable UPF blocking
- Reactivate the blocked UPF

Enable UPF blocking

This task allows the operator to enable or disable the UPF blocklisting functionality. Also, it allows the operator to configure an optional custom rule name to be used for subscribing the alerts for UPF blocklisting and notification from Event Manager.

Follow these steps to enable UPF blocklisting:

Procedure

Step 1 Use the command **profile converged-core** *cc_profile_name* to enter the converged-core profile configuration mode.

Example:

```
[sgw] sgw# config
[sgw] sgw(config)# profile converged-core ccg1
[sgw] sgw(config-converged-core-ccg1)#
```

Step 2 Use the command **[no] activated-features upf-blocklisting [use-alert** *custom_rule_name* **]** to enable the UPF blocklisting and setting a custom rule name.

Example:

```
[sgw] sgw(config-converged-core-ccg1)# activated-features upf-blocklisting use-alert
upf_inactive1
[sgw] sgw(config-converged-core-ccg1)#
```

The **[use-alert** *custom_rule_name* **]** is an optional CLI. It allows the network operator to configure a custom rule name for alert subscriptions.

Note

- The default value of the command **[use-alert** *custom_rule_name* **]**, is "upf_inactive" for the CLI **activated-features upf-blocklisting**, if the **use-alert** is not configured with a custom rule name.
- Changing the custom rule name during run-time requires the previous rule name to be removed. Configuring the new custom rule name before removing the previous rule name, results in activating both the rule names.
- The new alert configuration parameters should be configured with the new rule name in CEE alert configuration (CEE ops-center).

Step 3 Use the command **exit** to save and exit the converged core profile configuration mode.

Example:

```
[sgw] sgw(config-converged-core-ccg1)# exit
[sgw] sgw(config)#
```

This task enables blocklisting of a defined UPF.

Reactivate blocked UPF

This task allows the network operator to configure the frequency interval during which the specific UPF is marked as blocked for selection. Once the frequency interval ends, the UPF becomes available for selection.

Follow these steps to reactivate the blocklisted UPF:

Before you begin

Before performing this task, you must enable UPF blocking.

Procedure

Step 1 Use the command **instance instance-id***gr_instance_id* to create an instance of the instance profile.

Example:

```
[sgw] sgw# config
[sgw] sgw(config)# instance instance-id 1
[sgw] sgw(config-instance-id-1)#
```

Step 2 Use the command **endpoint pfcp** to enter the endpoint configuration mode.

Example:

```
[sgw] sgw(config-instance-id-1)# endpoint pfcp
[sgw] sgw(config-endpoint-pfcp)#
```

Step 3 Use the command **interface** *interface_type*to configure the parameters for Sxa interface.

Example:

```
[sgw] sgw(config-endpoint-pfcp)# interface sxa
[sgw] sgw(config-interface-sxa)#
```

Step 4 Use the command **reactivate-peer condition [blocked] attributes [frequency** *frequency_timer* **]** to reactivate the blocked UPF once the timer is over.

Example:

```
[sgw] sgw(config-interface-sxa)# reactivate-peer condition blocked attributes frequency
 60
[sgw] sgw(config-interface-sxa)#
```

- The value of the command **frequency** ranges between 60 to 86400.
- The frequency parameter does not have any default values.
- It is mandatory to configure the frequency parameter within the defined range. If the frequency parameter is not configured within the range, the system by default takes 0 as the input. As a result, the identified UPF does not get blocklisted even if the alarm is triggered.

Step 5 Use the command **exit** to save and exit the interface configuration mode.

Example:

```
[sgw] sgw(config-interface-sxa)# exit
[sgw] sgw(config-endpoint-pfcp)#
```

Monitoring and troubleshooting

This section discusses the bulkstatistics and show commands used for monitoring and troubleshooting this feature.

Show command and output

The show command **show userplane all** displays the current status of UPF under the NodeStatus parameter. The new state **BLOCKED (5)**indicates that the specific UPF's current status is blocked.

Here is an example of the show command output:

```
[sgw] sgw#show userplane all
{
  "10.1.46.72:10.1.47.208": {
    "NodeIdType": 1,
    "NodeId": "10.1.46.72",
    "NodePort": 8805,
    "NodeStatus": 5,
    "Capacity": 65535,
    "Priority": 10,
    "DnnList": [
      "ims1",
      "ims2",
      "intershat"
    ],
    "PrimaryNodeMgrInst": {
      "IsActive": true
    },
    "PeerNodeMgrInst": {
      "InstanceId": 1,
      "IsActive": true
    },
    "EpIp": "10.1.47.208",
    "EpPort": 8805,
    "UpEpKey": "10.1.46.72:10.1.47.208",
    "recoveryInfo": {
      "SvcRecoveryTime": 3948948938,
      "PeerRecoveryTime": 3948786054
    },
    "ConnectedTime": 3948949630,
    "IntfType": 4,
    "UpProfName": "upf1",
    "OverloadTimer": {},
    "NegotiatedCPFeatures": 2147483648,
    "IsAssocUpdSuccess": true,
    "UpfInactiveValidityTime": 1739960992
  }
```

Bulkstats

These statistics are introduced as part of this feature:

Statistics	Description	Label(s)
prometheus_alert_received_total	Total number of valid Prometheus alerts received on event manager on its rest ep.	alert_rule
prometheus_alert_invalid_data_total	Total number of Prometheus alerts with invalid data received on event manager on its rest ep.	err_code
pubsub_subscriptions_total	Total number of subscription for producer pod.	event_name, consumer_instance

Statistics	Description	Label(s)
pubsub_events_produced_total	Total number of event published to subscribed pod.	event_name, instance, retry, retry_attempt, cause
pubsub_events_produced_ack_total	Total number of event published status to subscribed pod.	event_name, consumer_instance, status, retry, retry_attempt
pubsub_events_consumed_ack_total	Total number of event publish ack to producer.	event_name, dest_host, retry, retry_attempt
proto_pfcp_msg_stats	The number of failures observed during session establishment procedure.	app_name, cause, cluster, data_center, gr_instance_id, instance_id, interface_type, message_name,upf_id, service_name, status, trans_type

Note The statistics **proto_pfcp_msg_stats** counter increases only when the UPF blocklisting feature is enabled under converged core profile configuration activated-feature list. It is mandatory to specify the "**upf_id**" under the list of labels grouped by as part of the expression to make this feature work. This parameter helps identify the UPF, which needs to be blocklisted. Without this, the functionality does not work as expected.

UPF Selection OAM Support

This section describes operations, administration, and maintenance information for this feature.

Bulk Statistics

UE Disconnect Statistics

```
sgw_ue_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",
reason="userplane_info_not_available",service_name="sgw-service"} 24
```

PDN Disconnect Statistics

```
sgw_pdn_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",
pdn_type="ipv4",rat_type="EUTRAN",reason="userplane_info_not_available",service_name="sgw-service"}
 8
```

```
sgw_pdn_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",
pdn_type="ipv4v6",rat_type="EUTRAN",reason="userplane_info_not_available",service_name="sgw-service"}
 15
```

```
sgw_pdn_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",
pdn_type="ipv6",rat_type="EUTRAN",reason="userplane_info_not_available",service_name="sgw-service"}
 1
```

SGW Service Statistics

```
sgw_service_stats{app_name="smf",cluster="cn",data_center="cn",fail_reason="userplane_selection_fail",
instance_id="0",interface="interface_sgw_ingress",reject_cause="no_resources_available",service_name=
"sgw-service",sgw_procedure_type="initial_attach",status="failure",sub_fail_reason=""}
 22
```

```
sgw_service_stats{app_name="smf",cluster="cn",data_center="cn",fail_reason="userplane_selection_fail",
instance_id="0",interface="interface_sgw_ingress",reject_cause="no_resources_available",service_name="sgw-service",
sgw_procedure_type="secondary_pdn_creation",status="failure",sub_fail_reason=""}
 2
```