



URSP Support in PCF

Table 1: Feature History

Feature Name	Release Information	Description
URSP Support in PCF	2023.04	PCF offers UE Route Selection Policy or URSP support for the UE to determine the routing of outgoing traffic. Default Setting: Enable – Always on

- [Feature Summary and Revision History, on page 1](#)
- [Feature Description, on page 2](#)
- [How it Works, on page 3](#)
- [Bulk Statistics Support, on page 26](#)

Feature Summary and Revision History

Summary Data

Table 2: Summary Data

Applicable Products or Functional Area	PCF
Applicable Platform(s)	SMI
Feature Default Setting	Enabled - Always-on
Related Documentation	Not Applicable

Revision History

Table 3: Revision History

Revision Details	Release
First Introduced.	2023.04.0

Feature Description

PCF offers UE Route Selection Policy (URSP) support which the UE uses to determine the routing of an outgoing traffic. The UE can route the traffic to an established PDU Session and offload to the non-3GPP access outside a PDU Session.

PCF provides the UE policy procedures and controls through the AMF interface (N15) using the NAS Signalling. The NAS messages are transparent to the AMF which cannot be decoded by the AMF or gNB on its way between UE to PCF and conversely.

Based on the UE policy, UE initiates the separate PDU sessions. The operator defines these policies on PCF which are pushed to the UE through the AMF based on the following UE values and other parameters:

- Current PLMN
- Location Area
- Service Area
- Network Slice allowed in the network
- DNN configuration

How it Works

Table 4: Feature History

Feature Name	Release Information	Description
Enhancement to URSP Support in PCF	2024.01	<p>PCF supports the following functionalities in URSP:</p> <ul style="list-style-type: none"> • PCF helps to process the UPSI list from the UE in UE Policy create request to re-install the delta of UE Policies. • Process the update message from AMF and subscribe to new AMF for notification. • Notifies with the UE Policy Control Update messages during LOC Change or PLMN change and connectivity change from UE. • Attempt the URSP delivery when the UE sends <code>MANAGE_UE_POLICY_COMMAND_REQUEST</code> message. • Evaluate the Table Driven URSP configuration and derive the UE Policy. <p>Default Setting: Enabled - Always on</p>

The URSP rule includes atleast one traffic descriptor and a route selection descriptor.

Following are the different types of traffic descriptors and route selection components:

Traffic Descriptors

The URSP rule includes one or more traffic descriptors that specifies the matching criteria.

- OSId and OSAppId(s) - The OSId identifier identifying the operating system. OSAppId(s) identifier is associated with a given application and uniquely identifying the application within the UE for a given operating system.
- DNN - This is matched against the DNN information provided by the application.
- Match all

Route Selection Components

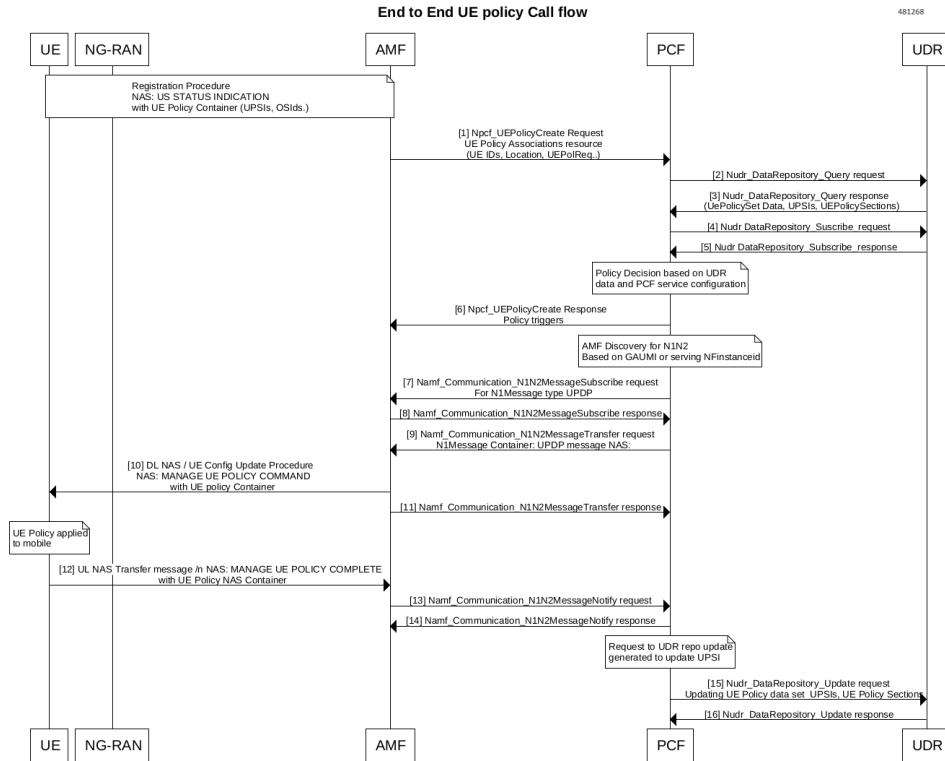
- SSC Mode Selection Policy (SSCMSP) - This is used by the UE to associate the matching application with SSC modes. The modes take the following types:
 - SSC 1
 - SSC 2
 - SSC 3
- Network Slice Selection Policy (NSSP) - This is used by the UE to associate the matching application with SNSSAI.
- DNN Selection Policy - This is used by the UE to associate the matching application with DNN.
- PDU Session Type Policy - This is used by the UE to associate the matching application with a PDU Session Type. It takes the following session types:
 - IPv4
 - IPv6
 - IPv4 and IPv6
- Non-Seamless Offload Policy - Used by the UE to determine that the matching application should be non-seamlessly offloaded to non-3GPP access (i.e., outside of a PDU Session).
- Access Type preference - If the UE needs to establish a PDU Session for the matching application, this indicates the any of the preferred Access Type from the following:
 - 3GPP
 - Non 3GPP

Call Flows

UE Registration Scenario

When UE registers on the network, AMF initiates the UE Policy Create Request to PCF. PCF must respond with a set of policy rules based on the policy logic which takes in to account the status of the UE (SPLMN, Location area) in the network.

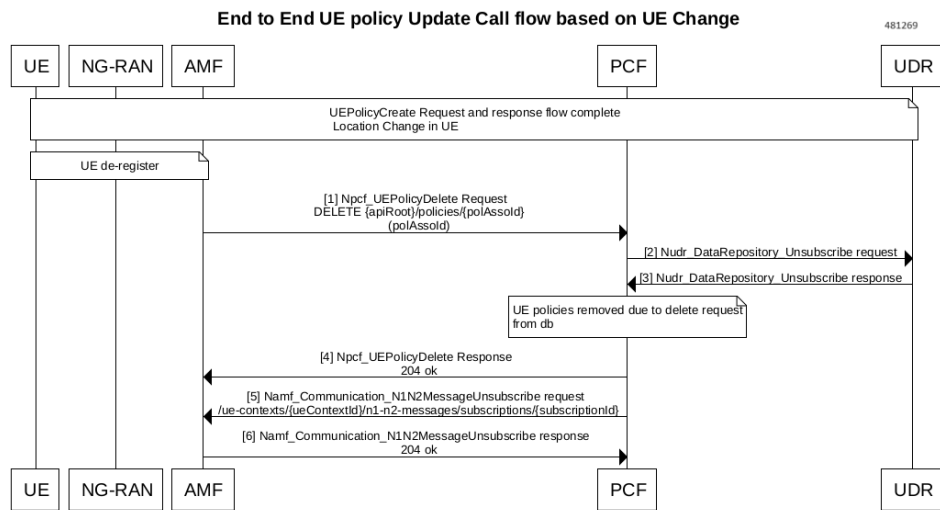
Figure 1: UE Registration Call Flow



UE De-Registration Scenario

If the UE de-register from the network, AMF triggers UE Policy Delete Request of the UE policy to PCF. PCF will delete any Policy Association stored in the database or in the UDR for the subscriber

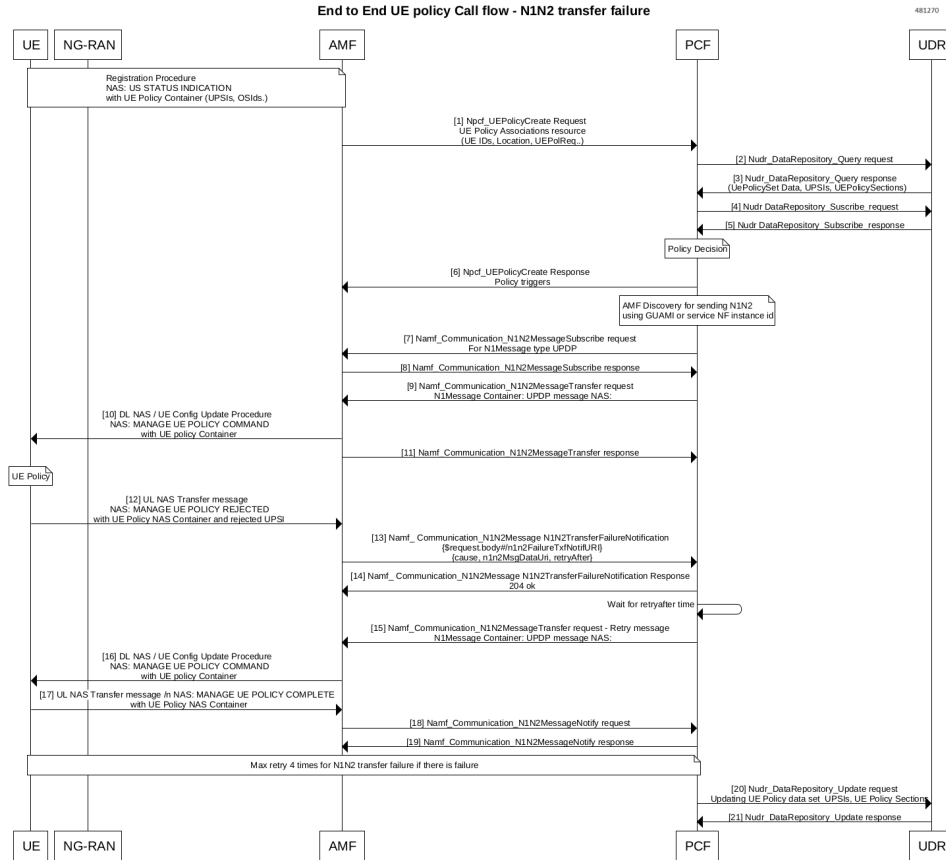
Figure 2: UE De-Registration Scenario



N1N2 Transfer Failure

Following is the call flow for N1N2 transfer failure:

Figure 3: N1N2 Transfer Failure



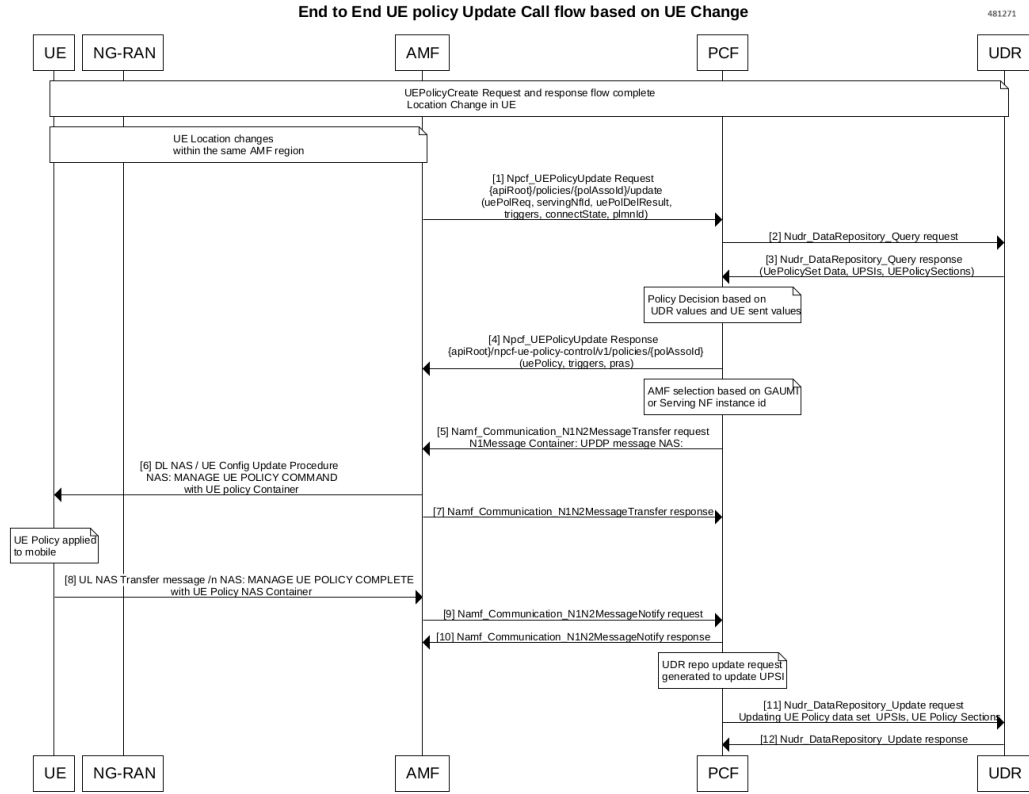
UE CM-IDLE State

PCF detected the change in UE policy by means of all the use cases while UE is in RM-registered and CM-Connected states.

- Once the PCF sends UE policy in the N1N2 message transfer fails as UE in CM-IDLE state, AMF triggers the event notification that the UE is in CM-IDLE state.

AMF triggers the event notification once the UE is back in the CM connected state. After which, PCF retries the updated policy in N1N2MessageTransfer.

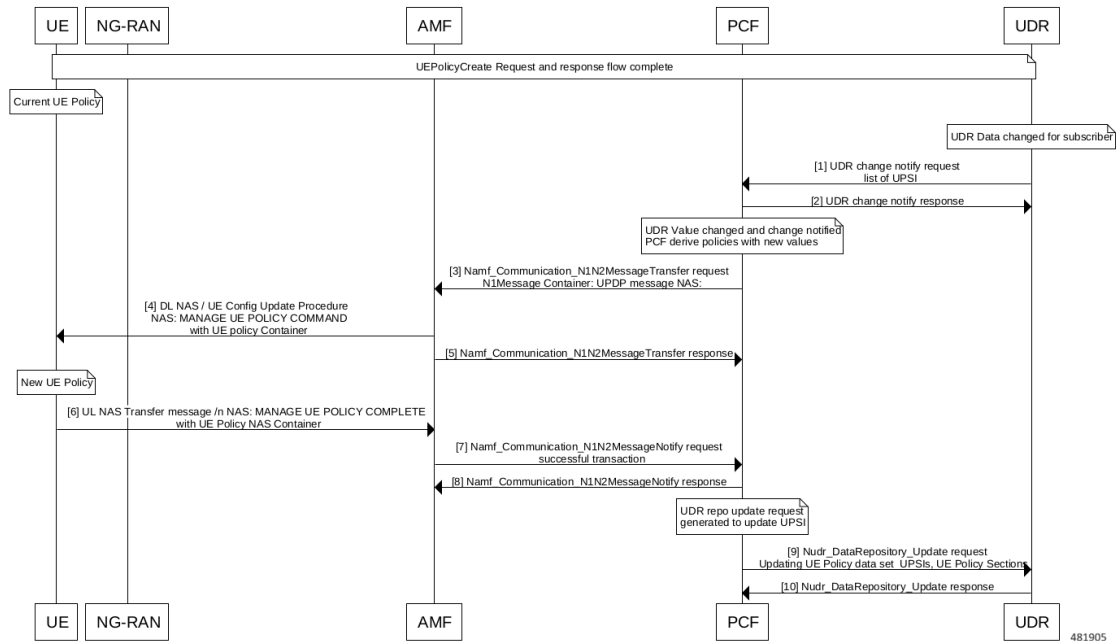
Figure 4: End to End UE Policy Update Call flow Based on UE Change



UDR Data-Based UE Policy Update Call Flow

Following is the UE Policy update call flow for UDR notification with SubscCats attribute change.

Figure 5: UDR Data-Based UE Policy Update Call Flow



UE Policy Procedures

URSP is pre-configured in the UE or provisioned to UE from PCF. The pre-configured policy is applied by the UE only when it has not received the same type of policy from the PCF.

- PCF selects the UE policy information applicable for each UE based on local configuration, and operator policies.
- PCF provides the UE policy information to the AMF through N15 or Namf interface and then from AMF to the UE through the N1 interface and AMF will not change the UE policy information provided by the PCF.
- PCF adds policy control trigger through Npcf_UEPolicyControl Create Response to AMF.
- The PCF is responsible for delivery of UE policy. If the PCF is notified about UE policy information delivery failure, then PCF will retry based on the configuration.
- If the UE has an URSP rule (except the URSP rule with the `match all` traffic descriptor) that matches the application as the UE shall perform the association of the application to the corresponding PDU session.
- If no URSP rule is applicable for the application, the UE shall perform the association of the application to a PDU session according to the applicable UE local configurations.

UE Policy Delivery

- PCF provides the UE policy information during UE Policy Association Establishment and UE Policy Association Modification procedures.

- The PCF includes the UE policy information delivered to the UE into a Policy Section identified by a Policy Section Identifier (PSI).
- The PCF may divide the UE policy information into different Policy Sections, each one identified by a PSI. Each policy section provides a list of self-contained UE policy information to the UE, through AMF. The PCF ensures that a policy section is under a predefined size limit, known by the PCF.
- The size limit is configured in the PCF. The PLMN ID is provided to the UE together with UE policy information and it is used to indicate which PLMN a policy section list belongs to.
- If the UE has no policy sections with the same PSI, the UE stores the policy section.
- If the UE has an existing policy section with the same PSI, the UE replaces the stored policy section with the received information.
- The UE removes the stored policy section if the received information contains only the PSI.
- The UE keeps the received UE policies stored even when registering in another PLMN.
- The UE provides the list of stored PSIs (Policy Section Identifier) which identify the policy sections associated to the home PLMN that are currently stored in the UE.
- The UE may trigger an initial registration with the list of stored PSIs to request a synchronization for example if the UE powers up without USIM being changed.
- If USIM is changed, the UE does not provide any PSI. If no policies are stored in the UE for the home PLMN, the UE does not provide any PSI associated to the home PLMN.
- PCF subscribes to the AMF to be notified about the UE response to an update of UE policy information.
- PCF invokes `Namf_Communication_N1N2MessageTransfer` service operation then AMF shall transfer transparently the UE Policy to UE.
- After the successful N1Message Notification from AMF, UE Policy gets installed in the UE. So PCF will send the UDR update message with the installed UE Policy details.
- When UE is not reachable AMF reports to the PCF that the UE Policy could not be delivered to the UE using `Namf_Communication_N1N2TransferFailureNotification`.

Principles of PTI Handling For UE Policy Delivery Service Procedures

Procedure Transaction Identity (PTI)

When the PCF or the UE initiates a procedure, it shall include a valid PTI value in the message header of the command message or the request message.

When the PCF initiates a transaction related procedure, it shall include a valid PTI value in the message header of the command message.

If a response message is sent as a result of a received command or request message, the UE or the PCF shall include in the response message the PTI value received within the received command or request message.

If a command message is sent as a result of a received request message, the PCF shall include in the command message the PTI value received with the request message.

Network Requested UE Policy Management Procedure Initiation

To initiate the network-requested UE policy management procedure, the PCF shall:

- Allocate a PTI value currently not used and set the PTI IE to the allocated PTI value.
- Encode the information about the UE policy sections to be added, modified, or deleted in a UE policy section management list IE as specified in subclause D.6.2 and include it in a MANAGE UE POLICY COMMAND message.
- Send the MANAGE UE POLICY COMMAND message to the UE via the AMF .
- Start the timer T3501.



Note The PCF starts a different timer T3501 for each allocated PTI value.

UPSI Handling by UE

PCF Processes the UPSI (UE Policy Section Identifier) from UE Policy association request to identify the delta and re-install the delta of UE Policies.

Upon receipt of the MANAGE UE POLICY COMMAND message with an unused PTI value, the UE shall:

- Store the received UE policy section of the instruction, if the UE has no stored UE policy section associated with the same UPSI as the UPSI associated with the instruction.
- Replace the stored UE policy section with the received UE policy section of the instruction, if the UE has a stored UE policy section associated with the same UPSI as the UPSI associated with the instruction.
- Delete the stored UE policy section, if the UE has a stored UE policy section associated with the same UPSI as the UPSI associated with the instruction and the UE policy section contents of the instruction is empty.

Network Requested UE Policy Management Procedure Not Accepted by the UE

If the UE could not execute all instructions included in the UE policy section management list IE successfully, the UE shall:

- Set the PTI IE to the PTI value received within the MANAGE UE POLICY COMMAND message and encode the UPSI associated with the instructions which could not be executed successfully. The associated UE policy delivery service cause indicating the cause of the failure in a UE policy section management result IE and include it in a MANAGE UE POLICY COMMAND REJECT message.
- Transport the MANAGE UE POLICY COMMAND REJECT message using the NAS transport procedure. Upon receipt of the MANAGE UE POLICY COMMAND REJECT message, the PCF shall stop timer T3501. Any instruction that was included in the UE policy section management list IE and associated UPSI is not included in a UE policy section management result IE of the received MANAGE UE POLICY COMMAND REJECT message is considered as successfully executed.

The PCF should ensure that the PTI value assigned to this procedure is not released immediately.

UE Policy NAS: UE Initiated UE State Indication Procedure

The purpose of the UE-initiated UE state indication procedure is:

- To deliver the UPSI(s) of the UE policy section(s)
- To indicate whether UE supports ANDSP (Access Network Discovery & Selection Policy).
- To deliver one or more OS Ids of the UE to the PCF.



Note UE sends state indication to AMF and AMF will initiate UE policy association create/update request with the UE state transferred transparently using uePolReq attribute.

PCF compares UE state with the policy decision and determine if policy sections need to add/updated/remove. PCF shall send only the modified policy sections to UE to update the policy using one or more MANAGE UE POLICY command.

UE Initiated UE State Indication Procedure Initiation

To initiate the UE-initiated UE state indication procedure, the UE shall create a UE STATE INDICATION message. The UE:

- Shall allocate an unused PTI value and set the PTI IE to the allocated PTI value.
- If not operating in the SNPN access operation mode, shall include the UPSI of the UE policy section which are identified by a UPSI with the PLMN ID part indicating the HPLMN or the selected PLMN available in the UE in the UPSI list IE.
- Shall specify whether the UE supports the ANDSP in the UE policy class mark IE.
- Includes one or more OS IDs in the UE OS Id IE.

The UE shall send the UE STATE INDICATION message. The UE shall transport the created UE STATE INDICATION message using the registration procedure.

When receiving the UE STATE INDICATION message, the (V-)(H-)PCF shall determine, based on the UPSIs, the ANDSP support indication and the OSId(s) indicated in that message, UPSCs (UE Policy Section Code) stored in the UDR and local policy, whether any new UE policy section(s) need to be installed and whether any existing UE policy section(s) need to be updated or deleted.

The UE policy network class mark is included when the PCF of a PLMN or an SNPN intends to provide the UE with information about the policy aspects of the network.

UE State Indication

The UE STATE INDICATION message is sent by the UE to the PCF to:

- Deliver the UPSI of the UE policy section stored in the UE.
- Indicate whether the UE supports ANDSP.
- Deliver one or more OS Ids of the UE.

Message type: UE STATE INDICATION

Direction: UE to network

Figure 6: UE STATE INDICATION Message Content

IEI	Information Element	Type/Reference	Presence	Format	Length
	PTI	Procedure transaction identity 9.6	M	V	1
	UE STATE INDICATION message identity	UE policy delivery service message type D.6.1	M	V	1
	UPSI list	UPSI list D.6.4	M	LV-E	9-65531
	UE policy classmark	UE policy classmark D.6.5	M	LV	2-4
41	UE OS Id	OS Id D.6.6	O	TLV	18-242

Figure 7: UE Policy Delivery Service Message Type

Bits							
8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1
0	0	0	0	0	0	1	0
0	0	0	0	0	0	1	1
0	0	0	0	0	1	0	0
0	0	0	0	0	1	0	1
0	0	0	0	0	1	1	0

Reserved
 MANAGE UE POLICY COMMAND message
 MANAGE UE POLICY COMPLETE message
 MANAGE UE POLICY COMMAND REJECT message
 UE STATE INDICATION message
 UE POLICY PROVISIONING REQUEST message (see NOTE)
 UE POLICY PROVISIONING REJECT message (see NOTE)

All other values are reserved

AMF Relocation

When AMF relocation UE context transfers from an OLD AMF to a new AMF, the PCF processes the UE Policy Update message from the new AMF and update the UE session.

PCF unsubscribes the N1Message Notification subscription from an old AMF and subscribes the N1Message Notification to a new AMF. Any further UE Policy Delivery happens through a new AMF.

UE Policy Delivery Service Message Type

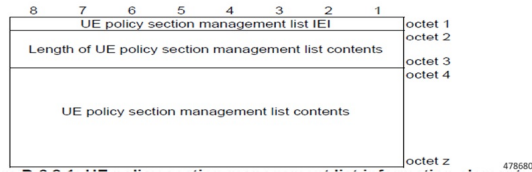
UE Policy Section Management List

The purpose of the UE policy section management list information element is to transfer from the PCF to the UE a list of instructions to be performed at the UE for management of UE policy section stored at the UE.

The UE policy section management list information element has a minimum length of 12 octets and a maximum length of 65534 octets.

The value part of the UE policy section management list information element consists of one or several UE policy section management sub lists.

Figure 8: UE Policy Section Management List

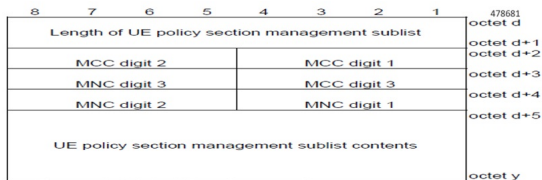


UE Policy Section Management Sublist

Following are the details of UE policy section management sub list:

- Length of UE policy section management sub list (octets d to d+1). This field contains the binary encoding of the length of the UE policy section management sub list in units of octets.
- Mobile country code (MCC) from octet d+2, and bits 4 to 1 of octet d+3.
- Mobile network code (MNC) from bits 8 to 5 of octet d+3, and octet d+4 .
- The coding of this field is the responsibility of each administration, but BCD coding shall be used. The MNC shall consist of 2 or 3 digits. If a network operator decides to use only two digits in the MNC, MNC digit 3 shall be coded as 1111.

Figure 9: UE Policy Section Management Sublist



The UE policy section management sub list contents consist of one or several instructions.

Instructions:

- Instruction contents length (octets d+5 to d+6) This field contains the binary encoding of the instruction contents length in units of octets.

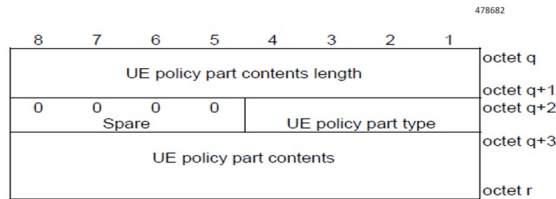
- UPSC (octets d+7 to d+8) This field contains the binary encoding of the UPSC. The value of the UPSC is set by the PCF.
- UE policy section contents (octets d+9 to k)

The UE policy section contents consist of one or several UE policy parts.

UE Policy Part

UE policy part contents length (octets q to q+1) . This field contains the binary encoding of the UE policy part contents length in units of octets.

Figure 10: UE Policy Part



UE policy part type (bits 4 to 1 of octet q+2)

Bits

0 0 0 1 URSP

Bits 8 to 5 of octet q+2 are spare and shall be coded as zero.

UE policy part contents

This field contains a UE policy part encoded as specified in 3GPP TS 24.526 [19] for the UE policy part type field set to URSP or ANDSP and encoded as specified in 3GPP TS 24.588 [19C] for the UE policy part type field set to V2XP (V2X Policy).

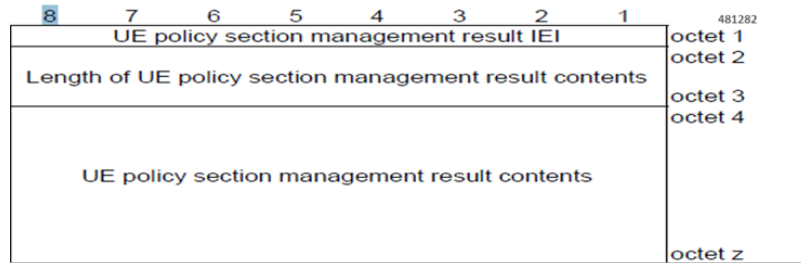
UE Policy Section Management Result

The purpose of the UE policy section management result information element is to transfer from the UE to the PCF information about instructions for UE policy section management which the UE could not execute successfully.

The UE policy section management result information element has a minimum length of 12 octets and a maximum length of 65534 octets.

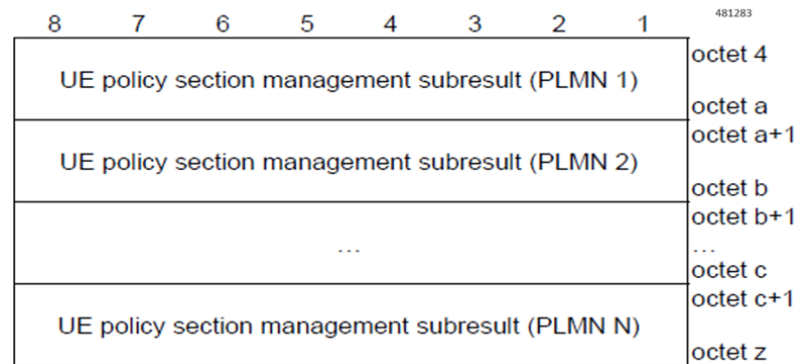
Value part of the UE policy section management result information element (octets 4 to z).

Figure 11: UE Policy Section Management Result Information Element



The value part of the UE policy section management result information element consists of one or several UE policy section management sub results.

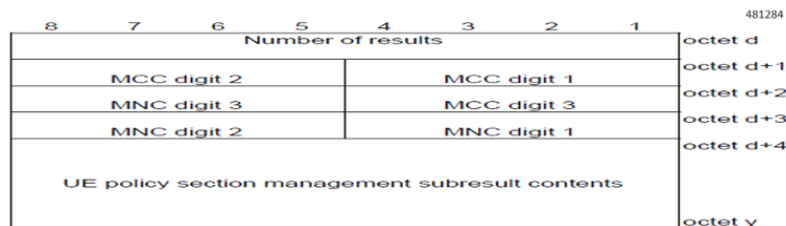
Figure 12: UE Policy Section Management Result Contents



UE Policy Section Management Sub Result

- Number of results (octet d) - This field contains the binary encoding of number of results included in the UE policy section management sub result.
- MCC, Mobile country code (octet d+1, and bits 4 to 1 of octet d+2).
- MNC, Mobile network code (bits 8 to 5 of octet d+2, and octet d+3) - The coding of this field is the responsibility of each administration, but BCD coding shall be used. The MNC shall consist of 2 or 3 digits. If a network operator decides to use only two digits in the MNC, MNC digit 3 shall be coded as "1111".
- UE policy section management sub result contents (octets d+4 to y) - The contents consist of one or several results.

Figure 13: UE Policy Section Management Sub Result



Result (octet f to f+4)

UPSC (octet f to f+1) - This field contains the binary encoding of the UPSC. The value of the UPSC is set by the PCF.

Failed instruction order (octets f+2 to f+3) - This field contains the binary encoding of the order of the failed instruction in the UE policy section management sublist.

Cause (octet f+4)

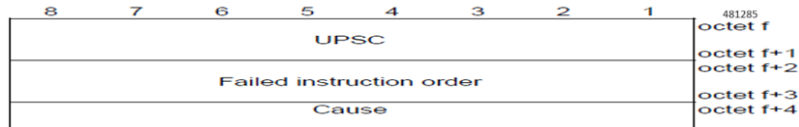
Bits

8 7 6 5 4 3 2 1

0 1 1 0 1 1 1 1 Protocol error, unspecified

The receiving entity shall treat any other value as 0110 1111, "protocol error, unspecified".

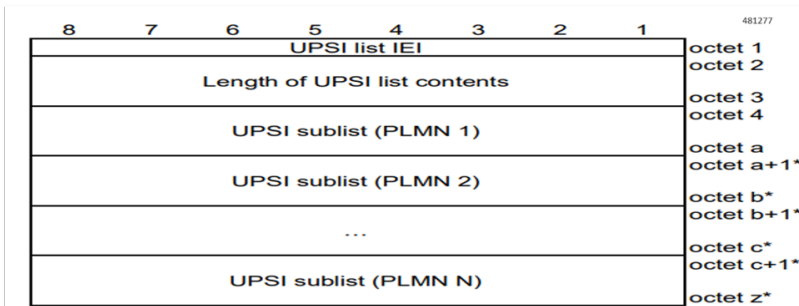
Figure 14: Result



UPSI List

The UPSI list information element transfers the list of UPSIs from the UE to the PCF. The UPSI list information element has a minimum length of 10 octets and a maximum length of 65532 octets.

Figure 15: UPSI List Information Element



UPSI List Information Element

MCC - Mobile country code (octet d+2, and bits 4 to 1 of octet d+3).

MNC - Mobile network code (bits 8 to 5 of octet d+3, and octet d+4). The coding of this field is the responsibility of each administration, but the BCD coding shall be used. The MNC shall consist of 2 or 3 digits. If a network operator decides to use only two digits in the MNC, MNC digit 3 shall be coded as "1111".

UPSC (octets d+5 to d+6) - This field contains the binary encoding of the UPSC. The value of the UPSC is set by the PCF.

Figure 16: UPSI Sublist

8	7	6	5	4	3	2	1	
Length of UPSI sublist								octet d ⁴⁸¹²⁷⁸
MCC digit 2				MCC digit 1				octet d+1
MNC digit 3				MCC digit 3				octet d+2
MNC digit 2				MNC digit 1				octet d+3
UPSC								octet d+4
UPSC								octet d+5
UPSC								octet d+6
UPSC								octet d+7*
...								octet d+8*
UPSC								octet d+9*
UPSC								octet e*
UPSC								octet e+1*
UPSC								octet e+2*

UE Policy Association

UE Policy Association Management Service

- Npcf_UEPolicyControl Create Request - This message is for UE Policy Establishment.
- Npcf_UEPolicyControl Delete Request - Provides means to delete UE Policy Association.
- Npcf_UEPolicyControl Update Request - Provides corresponding policies to the PCF whenever the policy control request trigger is met when AMF is relocated due to UE Mobility.

UE Policy Delivery to UE via AMF using NAS Procedures

- Namf_Communication_N1N2Message N1N2MessageTransfer (UE Specific) - This service operation is used by PCF to transfer N1 and/or N2 information to the UE and/or 5G-AN through the AMF.
- Namf_Communication_N1N2Message N1N2MessageSubscribe (UE Specific) - This message is used by PCF to subscribe to the AMF for notifying N1 messages of a specific type or N2 information of a specific type.
- Namf_Communication_N1MessageNotify - This N1MessageNotify service operation is invoked by the AMF, towards the PCF which subscribed to be notified with UPDP messages received from the UE.
- Namf_Communication_N1N2MessageUnSubscribe - This service operation is used by PCF to unsubscribe to the AMF to stop notifying N1 messages of a specific type .
- Namf_Communication_N1N2Message N1N2TransferFailureNotification (UE Specific) - This notification to inform PCF that an earlier Namf_Communication_N1N2Message Transfer failed, since AMF failed to deliver the N1 message to the UE as the UE failed to respond to paging.

UDR Query APIs

Following are the APIs for UDR query `UEPolicySet`:

- GET - Retriever the policy data set for a subscriber.
- PATCH - Modify the policy data set for a subscriber.

UE Policy Association Creation

UE Policy Association create request will be triggered by AMF in following scenarios:

- UE initial registration with the network.
- UE registration with 5GS when the UE moves from EPS to 5GS and there is no existing UE Policy Association between AMF and PCF for this UE.

The AMF creates the UE policy association with the PCF when a UE policy is received from the UE.

The AMF sends a Npcf_UEPolicyControl Create Request with SUPI, may include Access Type and RAT, PEI (Permanent Equipment Identifier), ULI, UE time zone, Serving Network (PLMN ID, or PLMN ID and NID), the Internal-Group-ID-list and UE Policy Container (the list of stored PSIs, operating system identifier).

PCF gets policy subscription related information and the latest list of PSIs from the UDR using Nudr_DM_Query service operation (SUPI, Policy Data, UE context policy control data, Policy Set Entry)

Then PCF sends a Npcf_UEPolicyControl Create Response to the AMF. The PCF relays the Policy Control Request Trigger parameters in the Npcf_UEPolicyControl Create Response.

To establish a UE policy association with the PCF, AMF request with

`{apiRoot}/npcf-ue-policy-control/v1/policies` as Resource URI and the PolicyAssociationRequest data structure as request body shall include the following attributes:

- Notification URI as `notificationUri` attribute
- SUPI as `supi` attribute
- Features supported by the NF service consumer as `suppFeat` attribute

Following are the optional attributes:

- GPSI as `gpsi` attribute.
- Access type as `accessType` attribute
- Permanent Equipment Identifier (PEI) as `pei` attribute
- User Location Information as `userLoc` attribute
- UE Time Zone as `timeZone` attribute
- Identifier of the serving network (the PLMN Identifier or the SNPN Identifier), as `servingPlmn` attribute
- RAT type as `ratType` attribute

```
{
  "notificationUri": "string",
  "altNotifIpv4Addrs": [
    "string"
  ],
  "altNotifIpv6Addrs": [
    "string"
  ],
  "altNotifFqdns": [
    "string"
  ],
  "supi": "string",
  "gpsi": "string",
  "accessType": "string",
  "pei": "string",
  "userLoc": "string",
  "timeZone": "string",
  "servingPlmn": "string",
  "ratType": "string" [
```

```

    "string"
  ],
  "suppFeat": "string"
}

```

Following is the response body:

- The negotiated supported features are encoded as a `suppFeat` attribute.
- The information provided by the NF service consumer when requesting the creation of this policy association encoded as a `request` attribute.
- Following Policy Control Request Trigger are encoded as the `triggers` attribute:
 - Location change (tracking area)
 - Change of UE presence in PRA
 - Change of PLMN, if the `PlmnChange` feature is supported.
 - Change of UE connectivity state, if the `ConnectivityStateChange` feature is supported.



Note Supports only the `PlmnChange` and `Connectivity Change` feature numbers.

UDR GET QUERY

As a part of UE policy association creation and modification request, PCF makes UDR GET request to get UDR profile for the subscriber on ue-policy-set URI.

The response for UDR Get request on UE Policy set has upsi list and urPolicySections, pei, osIds.

As a part of UE Policy Association create request, PCF subscribes to the UDR on any changes of UE Policy Set for the subscriber.

PCF requests notifications from the UDR on changes in the policy data subscription information, and in this case, the PCF shall invoke the `Nudr_DataRepository_Subscribe` service operation by sending an HTTP POST request to the `PolicyDataSubscriptions` resource (`/policy-data/subs-to-notify/{subsId}`).

N1 N2 Message Subscribe and Unsubscribe

To subscribe to notifications of N1 message for UE Policy Delivery Result, or subsequent UE policy requests, the PCF invokes `Namf_Communication_N1N2MessageSubscribe` service operation to the AMF by sending the HTTP POST method with the URI of the `N1N2 Subscriptions Collection for Individual UE Contexts` resource.

This subscribe request has `ueContextId`, `n2NotifyCallbackUri` and `n1MessageClass` (UPDP) attributes provided by the PCF.

UE Policy Association Termination

The following cases are considered for UE Policy Association Termination:

- UE Deregistration from the network.

- The mobility with change of AMF .
- 5GS to EPS mobility with N26 if the UE is not connected to the 5GC over a non-3GPP access in the same PLMN.

UE Policy Association Modification Initiated by the AMF

- When the AMF detects a Policy Control Request Trigger condition, then it invokes the Npcf_UEPolicyControl_Update service operation to the PCF by sending an HTTP POST request to the Individual UE Policy Association resource.
- The AMF sends a Npcf_UEPolicyControl Update Request with the following information:
 - UE Policy Association ID associated with the SUPI
 - Policy Control Request Trigger
- PCF sends a Npcf_UEPolicyControl Update Response to the AMF.
- If the PCF decides to update the UE policy that got delivered to UE, the PCF maintains the latest list of UE policy information delivered to the UE and updates the UE policy including the latest list of UPSIs and its content in the UDR by invoking the Nudr_DataRepository_Update service operation. The PCF sends an HTTP PUT or PATCH request to the UEPolicySet resource.



Note Supports only the `PlmnChange` and `Connectivity Change` feature numbers.

AMF requests the update of the associated UE Policy Association by providing the relevant parameters about the UE context in an HTTP POST request with

`{apiRoot}/npcf-ue-policy-control/v1/policies/{polAssoId}/update` as a Resource URI and the `PolicyAssociationUpdateRequest` data structure as the request body that shall include:

- A new Notification URI encoded in the `notificationUri` attribute (in case of AMF relocation).
- Observed Policy Control Request Triggers is encoded as `triggers` attribute.
- If a UE location change occurs, the UE location is encoded as an `userLoc` attribute.
- If a MANAGE UE POLICY COMPLETE message or a MANAGE UE POLICY COMMAND REJECT message of the UE policy delivery result, and at least parts of the contents relate to the UPSIs of the HPLMN, the parts of that message that relate to UPSIs of the HPLMN is encoded as the `uePolDelResult` attribute.
- If a UE PLMN change occurs and the `PlmnChange` feature is supported, the PLMN Identifier of the new serving network is encoded as `plmnId` attribute.

PCF shall determine the applicable UE policy based on the UE Policy Sections stored in the UDR.

If the PCF determines that the UE policy needs to be updated, it shall use the `Namf_Communication` service to provision the UE policy.

PCF shall send the determined UE policy using the `Namf_Communication_N1N2MessageTransfer` service operation.

A Policy Update data structure with only mandatory attribute is included in the 200 OK response when the PCF decides not to update the policies.

Configuration

Table 5: Feature History

Feature Name	Release Information	Description
UDR Notification for Subscriber Category Update	2024.02.0	PCF receives the UDR notification for the SubscCats attribute update and re-evaluates the Table Driven URSP Configuration in the UE.

Discover AMF Interface

The following sample configurations helps to discover the AMF interface:

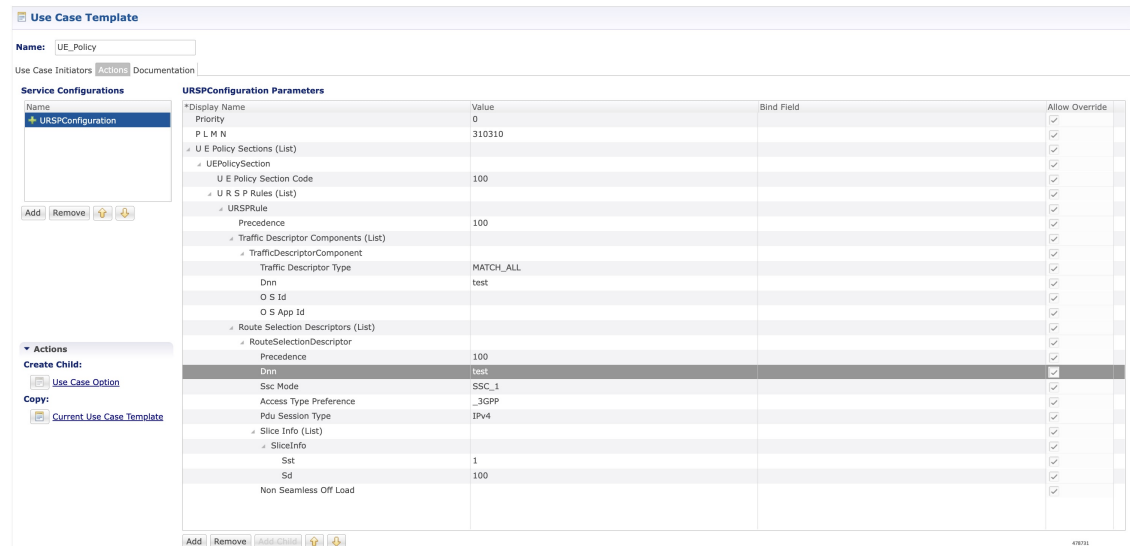
```
profile nf-pair nf-type AMF
nrf-discovery-group nrf-discovery-group
subscription-enabled true
subscription-extension 5
locality client loc1
locality preferred-server loc1
locality geo-server geoLocality
Exit
```

Use the below show command to display the list of profiles:

```
show rest-endpoint discovered-profiles
```

PCF stores the AMF attributes such as instanceId, PlmnId and NetworkId to create the AMF set. The PCF uses AMF endpoints while retrying to send the failed N1N1 Messages.

Figure 17: PB Image for Service Configuration



Ops Center Configuration

- By default, PCF skips the following device managers:
 - RX_TGPP
 - SY_V11
 - GX_TGPP
 - N36_TGPP
 - N1N2_TGPP
 - UE_TGPP

Following is an example to override the skipped device managers that are required for URSP:

```
engine pcf-green
  properties skipped.device.mgrs
    value RX_TGPP,GX_TGPP,SY_V11
  exit
exit
```

- Use the following configuration details for ops center:


```
nln2message.transfer.retry.interval.in.secs
```
- After the N1 message failure notification, PCF will retry after the configured interval using the following configuration:


```
nln2message.transfer.retry.times
```
- Use the following configuration to know the number of retry of the N1N2 message transfer after the failure or un-acknowledged status from the AMF.


```
nln2message.transfer.ack.timer.in.secs
```

URSP Table Driven Configuration

PCF shall determine and evaluate the Table Driven URSP configuration and derive the UE policy.

The PB derives the UEGroup based on the SubscCats category and SUPI. Further, it uses the UEGroup to derive the PLMNs and UPSCs. Each UPSC contains a list of Traffic Descriptors and Route Selection Descriptors.

Below are the CRD tables:

TableDrivenUEGroup:

Input: SubscCats, Subscriber_Id

Output: UEGroup

Subscriber_Id	SubscCats	UE_Group
imsi-1	Gold	UE_GROUP-1
imsi-2	Silver	UE_GROUP-2

Subscriber_Id	SubscCats	UE_Group
imsi-3	Platinum	UE_GROUP-3

On receiving the UDR notification, PCF compares the existing `SubscCats` attribute value with the current attribute value and re-evaluates the Table Driven URSP Configuration, if any delta exists and deliver to the UE through `N1N2Message`.

TableDrivenUEPolicySectionCode:

Input: UE_Group

Output: PLMN, UPSC

UE_GROUP	PLMN	UPSC
UE_GROUP-1	PLMN-1	UPSC-1
UE_GROUP-2	PLMN-2	UPSC-2

TableDrivenUEPolicySectionCode Parameters			481273
*Display Name	Value	Pull value from...	
Priority	0		
Search Table	TableDrivenUEPolicySectionCode		
Search Column	UE_GROUP		
Search Value		Column: UE_GROUP(UE_GROUP)	
Input List (List)			
PLMN Source	PLMN_ID		
UPSC Source	UPSC		

TableDrivenUrspRule:

Input: PLMN, UPSC

Output: Rule_Precedence, TD_RefId, RSD_RefId

PLMN	UPSC	RulePrecedence	TD_RefId	RSD_RefId
PLMN-1	UPSC-1	RulePrecedence-1	TD_RefId-1	RSD_refId-1
PLMN-2	UPSC-2	RulePrecedence-2	TD_RefId-2	RSD_refId-2



Note Multiple URSP rules in the URSP shall not have the same precedence value.

TableDrivenURSPRule Parameters

*Display Name	Value	481274 Pull value from...
Priority	0	
Search Table	TableDrivenUrspRule	
Search Column	PLMN_ID	
Search Value		
Input List (List)		
InputColumn		
Column Name	UPSC	
Column Value		
Rule Precedence Source	RULE_PRECEDENCE	
Traffic Descriptor Ref Id Source	Traffic_Descriptor_RefID	
Route Selection Descriptor Ref Id Source	Route_Selection_Descriptor_RefID	

TableDrivenUrspTrafficDescriptor:

Input: TD_RefId

Output: TD_Type, TD_Value

TD_RefId	TD_Type	TD_Value
TD_RefId-1	DNN	Cisco123
TD_RefId-2	OS_ID_APP_ID	OS-ID : Application-Id
TD_RefId-3	MATCH_ALL	MATCH_ALL



Note List of ENUMs and their format:

- TD_Types: DNN, OS_ID_APP_ID, MATCH_ALL
- TD_Value format for type OS_ID_APP_ID: “OS-Id:Application-Id”

TableDrivenURSPTrafficDescriptor Parameters

*Display Name	Value	481275 Pull value from...
Priority	0	
Search Table	TableDrivenUrspTrafficDescriptor	
Search Column	Traffic_Descriptor_RefID	
Search Value		
Traffic Descriptor Type Source	Traffic_descriptor_Type	
Traffic Descriptor Value Source	Traffic_descriptor_Value	

TableDrivenUrspRouteSelectionDescriptor:

Input: RSD_RefId

Output: Precedence, RSD components

Table 6:

RSD_refId	Precedence	pduSessType	DNN	SliceInfo	Access_TypePref	SSC_Mode	Non-seamless_Offload
RSD_refId-1	1	IPV4	DNN 1	Slice-A	3GPP	3	false
RSD_refId-2	2	IPV6	DNN 2	Slice-A	3GPP	2	false
RSD_refId-3	3	IPV4V6	DNN 3	Slice-B	3GPP	3	false

**Note**

- List of ENUMs and their format:
 - pduSessType: IPV4, IPV6, IPV4V6
 - Access_TypePref: _3GPPor NON_3GPP
 - SSC_MODE: SSC_1, SSC_2, SSC_3
- SliceInfo value format: SST:SD or SST
- Non-seamless_Offload: True or False
- Each consisting of a precedence value of the route selection descriptor and either:
 - one PDU session type and, optionally, one or more DNN, SliceInfo, AccessTypePref, SSC_Mode
 - non-seamless non-3GPP offload indication

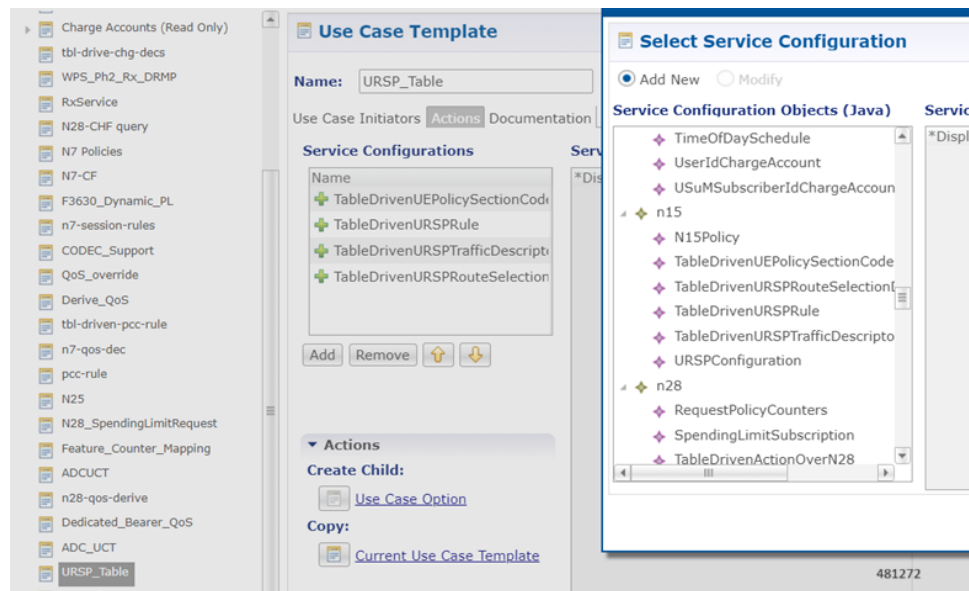
TableDrivenURSPRouteSelectionDescriptor Parameters

481276

*Display Name	Value	Pull value from...
Priority	0	
Search Table	TableDrivenUrspRouteSelectionDescriptor	
Search Column	Route_Selection_Descriptor_RefID	
Search Value		
Precedence Source	Precedence	
D N N Source	DNN	
S S C Mode Source	SSCMode	
Access Type Reference Source	AccessTypePref	
P D U Session Type Source	pduSessType	
Slice Info Source	SliceInfo	
Non Seamless Offload Source	NonseamlessOffload	

URSP Service Configuration

Figure 18: URSP Service Configuration



Bulk Statistics Support

Following are the KPIs details:

- Message type KPIs for Success, Error Code, response times, event triggers and message prioritization (engine queue level)
- UE policy for create and delete
- N1MessageNotify
- N1N2MessageSubscribe
- N1N2MessageUnSubscribe
- N1N2MessageTransfer
- N1N2TransferFailureNotification (along with failure cause)
- KPIs for UDR (UE policy Query, subscribe, unsubscribe, notify)
- n1n2_transfer_by_subscats_change_total—total number of n1n2 transfers by the subscats change.