

# Network-initiated Session Modification Procedures


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# Feature Summary and Revision History

## Summary Data

***Table 1: Summary Data***

| | |
|---|---|
| Applicable Product(s) or Functional Area | SMF |
| Applicable Platform(s) | SMI |
| Feature Default Setting | Enabled – Always-on |
| Related Changes in this Release | Not Applicable |
| Related Documentation | Not Applicable |

## Revision History

***Table 2: Revision History***

| Revision Details | Release |
|---|---|
| Added VoNR related hardening fix. | 2022.04.0 |
| First introduced. | Pre-2020.02.0 |

# Feature Description

The purpose of PDU session modification procedure is to create dedicated QoS flows for a UE. There are two ways to create dedicated QoS flows with different QoS characteristics to the default QoS flow for the UE such as the:

- UE-initiated PDU session modification
- Network-initiated PDU session modification

**Note** The PDU modify procedure is triggered if the Policy Update Response includes the policy parameters.

The network can be AN, AMF, or PCF.

The SMF receives a UE-initiated session modification request or network-initiated session modification request to augment the PDU session of UE to either modify an existing or creating a new QoS flow suitable for the user traffic.

**Note** If there is a failure during a PCF-initiated flow deletion procedure, the SMF deletes the PCC rules and communicates the details on the deleted PCC rules to UPF and PCF.

# How it Works

This section describes how this feature works.

## Call Flows

This section describes the following call flows:

- Network-initiated Modification Call Flow for Active User Plane and UE in CM-Connected State, on page 2
- Network-initiated Modification Call Flow for Inactive User Plane and UE in CM-Connected State, on page 4
- Network-initiated Modification Call Flow for Inactive User Plane and UE in CM-Idle State, on page 4

### Network-initiated Modification Call Flow for Active User Plane and UE in CM-Connected State

This section describes how the N4 session modification works after network initiation when the UE is in CM-Connected state and the User Plane is activated. The network can be PCF, UDM, or SMF.

The following figure depicts the network-initiated modification call flow when the UE is in CM-Connected state and the User Plane is activated.

*Figure 1: Network-initiated Modification Call Flow for UE in CM-Connected State and Activated User Plane*

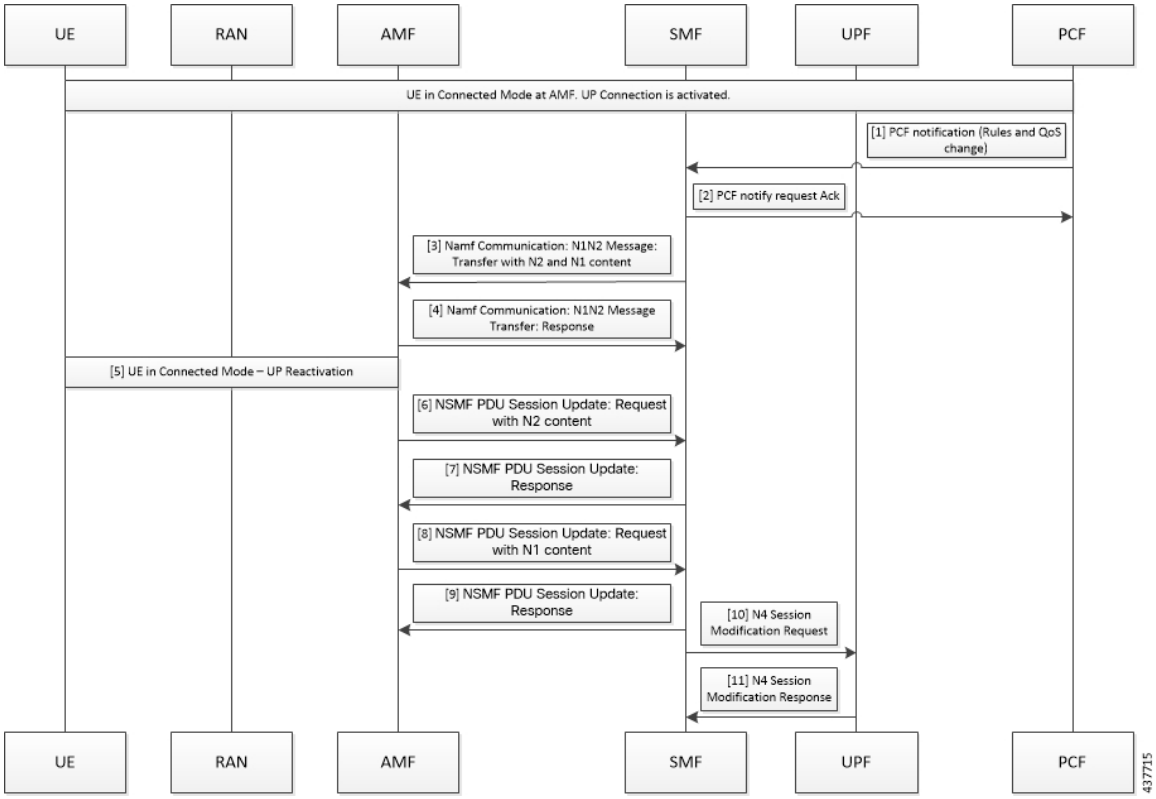



*Table 3: Network-initiated Modification Call Flow Description for UE in CM-Connected State and Activated User Plane*

| Step | Description |
|---|---|
| 1 | The PCF sends the notification towards SMF with policy decision to apply. |
| 2 | The SMF sends an acknowledgment for the policy notification to the PCF. |
| 3 | The SMF identifies the changes in QoS model that occur due to policy decision and triggers the NAMF Communication N1 and N2 message transfer toward AMF. This message transfer includes the following details:<br>• PDU Session ID<br>• N2 SM information<br>• N1 SM information<br>• N1 and N2 transfer failure notification target address<br>N2 includes the PDU session resource modify request transfer IE and N1 includes the PDU session modification request. |
| 4 | As UE is in CM-Connected state, the AMF initiates N1 and N2 transfer response. This response includes the “200 OK” status code and “N1_N2_TRANSFER_INITIATED” cause. |
| 5 | The user plane modification procedures begin both towards RAN and UE. |

| Step | Description |
|---|---|
| 6 | After receiving a response from RAN, the AMF sends the NSMF PDU Session Update SM Context Request towards the SMF. This request contains the SM information of the N2 interface. |
| 7 | The SMF responds to the AMF with “200 OK” status code for the NSMF PDU Session Update SM Context Request. |
| 8 | After receiving a response from the UE, the AMF sends the NSMF PDU Session Update SM Context Request toward SMF. This request contains the SM information of the N1 interface. |
| 9 | The SMF responds to the AMF with “200 OK” status code for NSMF PDU Session Update SM Context Request. |
| 10 | Based on the new QoS information, the SMF initiates the N4 Modification procedure towards the UPF to modify the session. |
| 11 | The UPF modifies the session and sends the acknowledgment of modification to the SMF. |

## Network-initiated Modification Call Flow for Inactive User Plane and UE in CM-Connected State

This section describes the network-initiated modification procedure when the UE is in CM-Connected state and the User Plane (UP) context is deactivated.

1. The PCF sends a policy update notification to the SMF for a PDU session with rules and QoS change. The SMF handles the updated policy rules when received in a notification from the PCF.
2. The SMF returns the “200 OK” status code to the PCF.
3. The SMF sends only N1 message PDU Session Modification Command to the UE with the modified rules and QoS change, using the NAMF Communication N1 N2 Message Transfer service operation towards the AMF.
4. The AMF sends the NAMF Communication N1 N2 Message Transfer response to the SMF. This response includes the “200 OK” status code and the “N1N2_TRANSFER_INITIATED” cause.
5. The SMF waits for the Nsmf_PDUSession_UpdateSMContext message from the AMF.
6. After receiving the response from UE, the SMF updates the subscriber session in the UPF with the modified parameter values and the UP context state remains as Deactivated.
7. The SMF sends N4 Session Modification request to the UPF updating the User Plane tunnel modified rules and the QoS details.
8. The UPF sends the N4 Session Modification response for the PDU session.
9. The SMF activates the UP connection as a result of the trigger to send downlink or uplink data.

## Network-initiated Modification Call Flow for Inactive User Plane and UE in CM-Idle State

This section describes the network-initiated modification procedure when the UE is in CM-Idle state and the User Plane (UP) context is deactivated.

The SMF supports the following use cases during the network-initiated PDU session modification procedure:

- When the UE turns active with the service request for PDN activation
- When the UE turns active with the control service request

**Use case 1: When the UE turns active with the service request for PDN activation**

1. The PCF sends a policy update notification to the SMF for a PDU session with rules and QoS change. The SMF handles the updated policy rules when received in a notification from the PCF.
2. The SMF returns the “200 OK” status code to the PCF.
3. The SMF sends only N1 message PDU Session Modification Command to the UE with the modified rules and QoS change, using the NAMF Communication N1 N2 Message Transfer service operation towards the AMF.
4. The AMF sends the NAMF Communication N1 N2 Message Transfer response to the SMF. This response includes the “200 OK” status code and the “ATTEMPTING_TO_REACH_UE” cause.
5. The SMF stops the retransmission of the N1 - PDU Session Modification response message to the UE. Further, it stops the N1 PDU Modification Command retransmission timer and waits for a response from the UE.



**Note** The N1 PDU Modification Command retransmission timer is configurable. Use the **n1 t3591-pdu-mod-cmd timeout** *timeout* **max-retry** *retry_count* command in Access Profile Configuration mode to configure the timeout value and maximum attempts for the retransmission of N1 PDU Modification Command. The default timeout value is 2 seconds and the default retry count is 2.

6. The UE receives the paging request from the AMF and initiates the requested service to activate the PDU session. The UE includes the PDU Session ID in PDU Session-to-Activate list only if the UP context needs to be activated.

   The SMF initiates the Idle-to-Active PDU Session transition procedure and suspends the current modification procedure.
7. After the Idle-to-Active procedure is complete, the SMF restarts the modification procedure and sends both the N1 and N2 content in N1 N2 transfer message and waits for both N1 and N2 response from the UE and gNB respectively.
8. The SMF receives the N2 response from gNB, and the N1 response from the UE respectively.
9. The SMF sends N4 Session Modification request to the UPF updating the User Plane tunnel modified rules and the QoS details.
10. The UPF sends the N4 Session Modification response for the PDU session.

**Use case 2: When the UE turns active with the control service request.**

1. The PCF sends a policy update notification to the SMF for a PDU session with rules and QoS change. The SMF handles the updated policy rules when received in a notification from the PCF.
2. The SMF returns the “200 OK” status code to the PCF.
3. The SMF sends only N1 message PDU Session Modification Command to the UE with the modified rules and QoS change, using the NAMF Communication N1 N2 Message Transfer service operation towards the AMF.
4. The AMF sends the NAMF Communication N1 N2 Message Transfer response to the SMF. This response includes the “200 OK” status code and the “ATTEMPTING_TO_REACH_UE” cause.

5. The SMF stops the retransmission of the N1 - PDU Session Modification response message to the UE. Further, it stops the N1 PDU Modification Command retransmission timer and waits for a response from the UE.
6. The AMF initiates the paging procedure towards the UE and the UE turns active with the Service Request for control message.
7. The SMF receives the N1 response from the UE.
8. The SMF sends N4 Session Modification request to the UPF updating the User Plane tunnel modified rules and the QoS details. Then, the SMF sets the Forwarding Action Rule (FAR) action for the new rules as ‘drop’.
9. The UPF sends the N4 Session Modification response for the PDU session.

## Standards Compliance

The network-initiated messages support for UE in CM-Idle or CM-Connected state feature complies with the *3GPP TS 23.502, V15.6.0 (2019-10)*.

# OAM Support

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

## Bulk Statistics Support

The SMF maintains the following statistics triggered during the network-initiated modification procedure.

- Total number of attempted network-initiated modifications triggered when the UP context is deactivated.
- Total number of succeeded network-initiated modifications triggered when the UP context is deactivated.
- Total number of failed network-initiated modifications triggered when the UP context is deactivated.
- Total number of "ATTEMPTING_TO_REACH_UE" status received when the network-initiated modification procedure is triggered and the UP context is deactivated.
- Total number of "N1N2_TRANSFER_INITIATED" status received when the network-initiated modification procedure is triggered and the UP context is deactivated.