Network-initiated Service Request

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
First introduced.	Pre-2020.02.0

Feature Description

The SMF sets up N3 tunnel to forward downlink packet to the UE for a PDU session when the UE is in the CM-Idle state.

The N3 tunnel profile helps in defining the Forwarding Action Rules (FAR) while moving from active to idle transition state.

The N3 tunnel profile configuration includes:

- Enabling control plane notification (notify)
- Enabling packet buffering on UPF (buffer UPF)

How it Works

This section describes how this feature works.

Call Flows

This section describes the following call flows:

- UE-initiated Idle to Active Transition Call Flow, on page 2
- Network-initiated Idle to Active Transition Call Flow, on page 4

UE-initiated Idle to Active Transition Call Flow

The following figure depicts the UE-initiated idle to active transition call flow.

Figure 1: UE-initiated Idle to Active Transition Call Flow

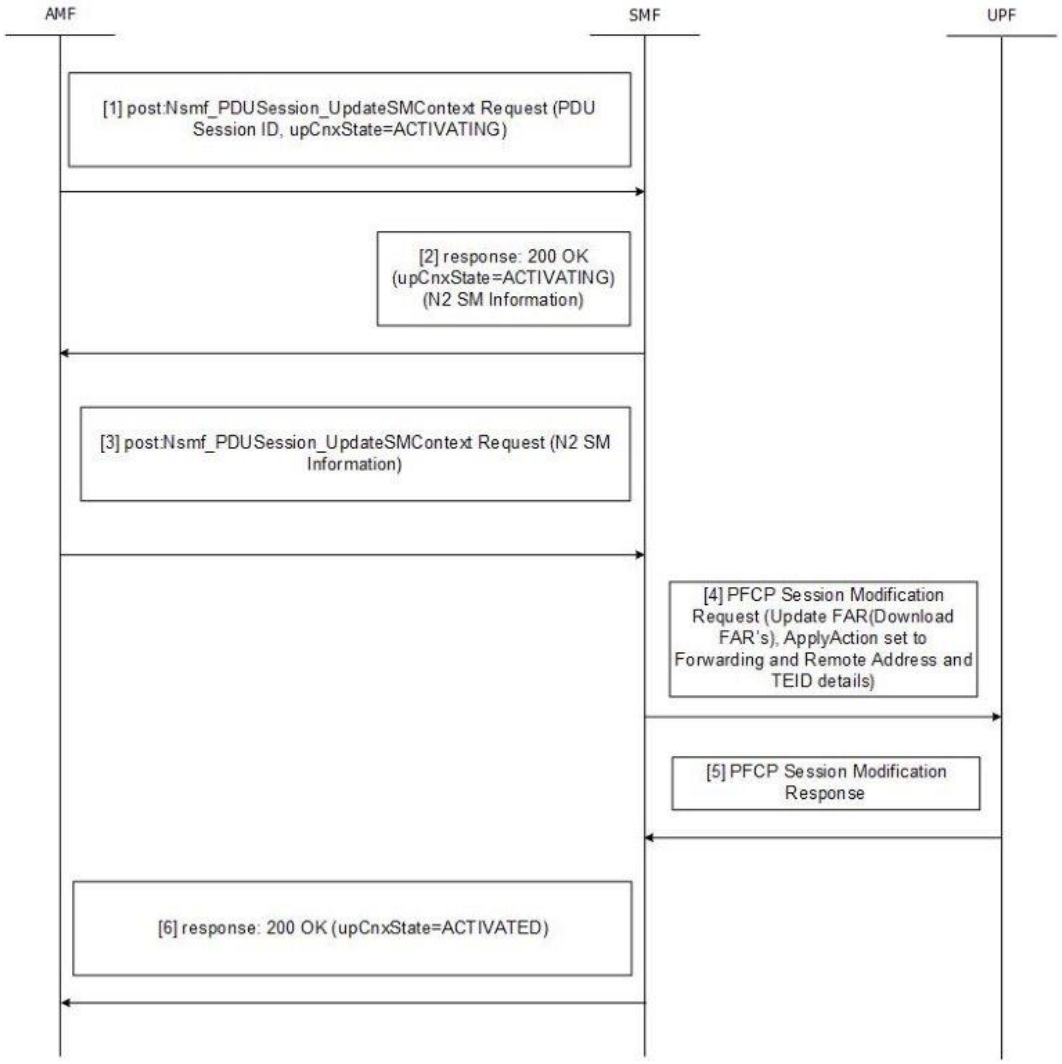

Table 3: UE-initiated Idle to Active Transition Call Flow Description

Step	Description
1	The AMF requests SMF to activate the user plane connection of the PDU session by sending a POST request with the following information: • upCnxState attribute set to ACTIVATING. • User location, user location timestamp, and access type associated to the PDU session (if modified) • Other information (if necessary)

Step	Description

2	Upon receipt of the request, the SMF starts activating the N3 tunnel of the PDU session. The SMF returns a 200 OK response with the following information:
	• upCnxState attribute set to ACTIVATING
	• N2 SM information with the following information to request the 5G-AN to assign resources to the PDU session.
	  • Transport layer address
	  • Tunnel endpoint of the uplink termination point for the user plane data for the current PDU session (that is, GTP-U F-TEID of UPF for uplink traffic)

3	Then, the AMF requests the SMF by sending POST request with the following information: • N2 SM information received from the 5G-AN, including the transport layer address and tunnel endpoint of the downlink termination point for the user data for the current PDU session (that is, GTP-U F-TEID of 5G-AN for downlink traffic), if the 5G-AN succeeded in establishing resources for the PDU sessions.
4	The SMF initiates PFCP Session Modification procedure towards UPF with downlink FAR updated with the following options: • Forwarding Action enabled along with remote node forwarding parameter details such as the IP address and GTP-U F-TEID.
5	Upon receipt of successful response from UPF node, the SMF sets the upCnxState attribute to ACTIVATED for the PDU session.
6	SMF then initiates 200 OK response including the upCnxState attribute set to ACTIVATED towards AMF.

Network-initiated Idle to Active Transition Call Flow

The following figure depicts the network-initiated idle to active transition call flow.

Figure 2: Network-initiated Idle to Active Transition Call Flow

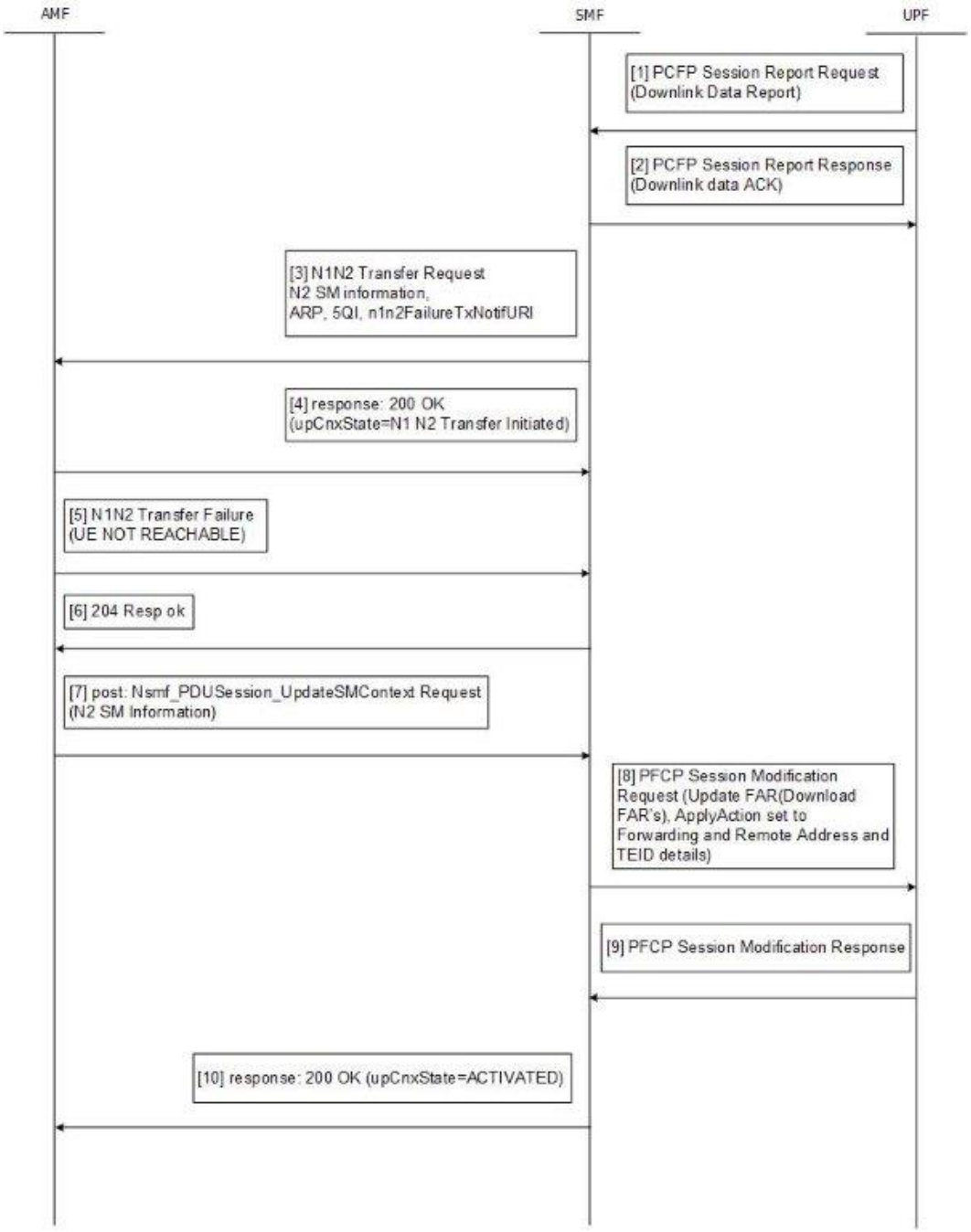

Table 4: Network-initiated Idle to Active Transition Call Flow Description

Step	Description
1	The UPF sends PFCP Session Report request to the SMF. • Report Type as DLDR (Downlink Data Report) • The Downlink Data Report IE contains corresponding PDR ID.
2	The SMF sends the PFCP Session Report response.
3	The SMF sends N1N2MessageTransfer to AMF with the following attributes: • SUPI, PDU Session ID • N2SMInformation as "ngapIeType":77 (id-PDUSessionResourceSetupListSUReq), "ngapMessageType":27 (id-PDUSessionResourceSetup) • PDUSessionResourceSetupListSUReq includes the following information: • PDU session id • QFI • QoS profile • GTP-U F-TEID of UPF for uplink traffic • QFI • QoS profile • S-NSSAI • User Plane Security Enforcement • UE Integrity Protection Maximum Data Rate • Cause • Area of validity for N2 SM information • ARP • Paging Policy Indication • 5QI • N1N2TransferFailure Notification Target Address (n1n2FailureTxfNotifURI)
4	The SMF receives N1N2 Transfer Response with the following status codes: • 200/202 OK and cause as "N1_N2_TRANSFER_INITIATED" (proceed to Step 6) • 409/504 and cause “UE_IN_NON_ALLOWED_AREA” (proceed to Step 7)
5	The AMF sends the N1N2 Transfer failure response. If the UE is not reachable, proceed to Step 7.

Step	Description

6	Then, the AMF requests the SMF by sending POST request with the following information:
	• N2 SM information received from the 5G-AN includes the following information if the 5G-AN succeeded in establishing resources for the PDU sessions.
	  • Transport layer address
	  • Tunnel endpoint of the downlink termination point for the user data for the current PDU session (that is, GTP-U F-TEID of 5G-AN for downlink traffic)

7	The SMF initiates PFCP Session Modification procedure towards UPF with downlink FAR updated with the following options:
	• If N2 Transfer is successful, Forwarding Action is enabled along with remote node forwarding parameter details such as IP address and GTP-U F-TEID.
	• If the cause of transfer failure is ATTEMPTING_TO_REACH_UE or UE_IN_NON_ALLOWED_AREA:
	  • Update FAR > Apply Action > NOCP: 1
	  • Update FAR > Apply Action > DROP: 1
	  • PFCPSMReq-Flags > DROBU: 1
	• If the cause of transfer failure is UE_NOT_REACHABLE:
	  • Update FAR > Apply Action > NOCP: 0
	  • Update FAR > Apply Action > DROP: 1
	  • PFCPSMReq-Flags > DROBU: 1

8	Upon receipt of successful response from UPF node, the SMF sets the upCnxState attribute to ACTIVATED for the PDU session.
9	The SMF then initiates 200 OK response including the upCnxState attribute set to ACTIVATED towards AMF (only if Step 6 is completed and response is received from Step 8).

Handling Temporary Rejects from AMF

During network-initiated service request, SMF handles the temporary reject for N1N2 response message from AMF as mentioned in 3GPP TS 23.502, section 4.2.3.3.

Figure 3: Temporary Rejection Call Flow for Network-triggered Service Request - 1

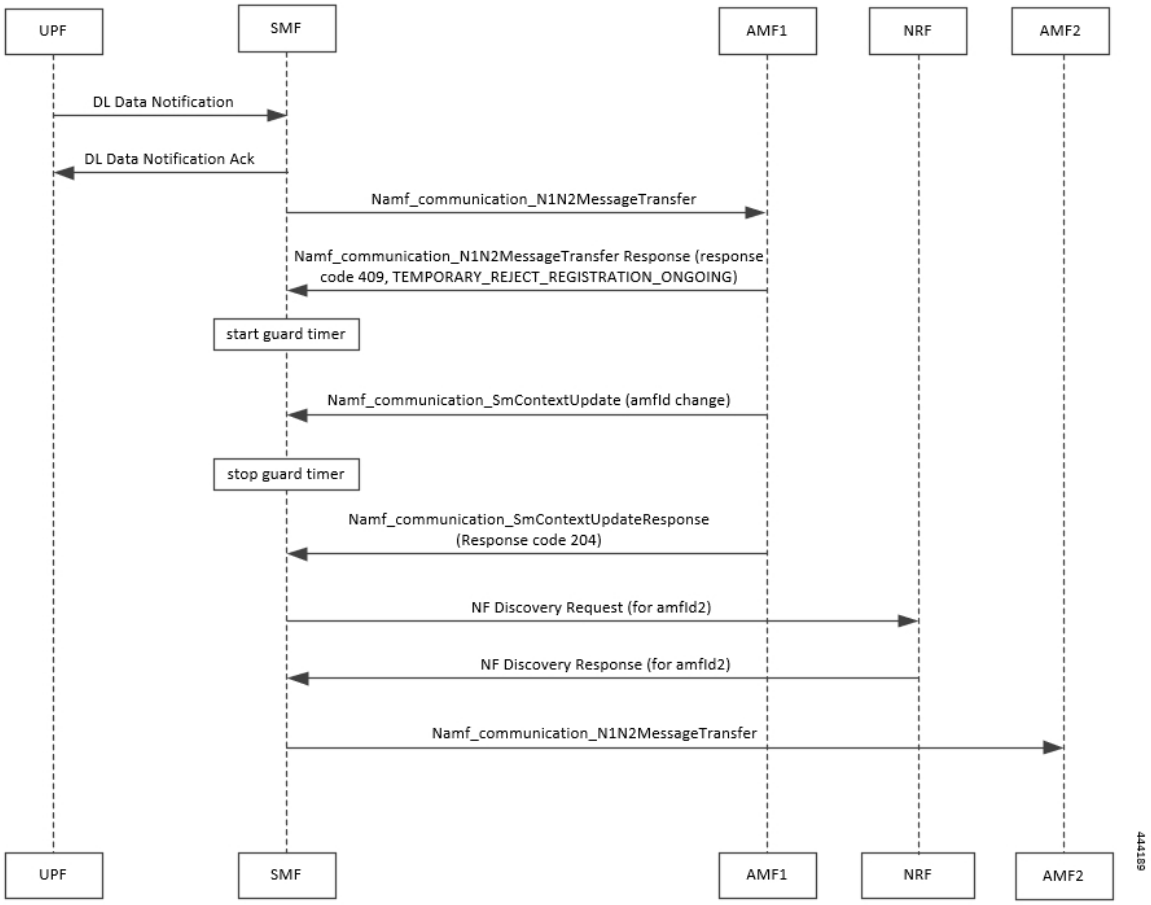

Table 5: Temporary Rejection Call Flow Description for Network-triggered Service Request - 1

Step	Description
1	On receiving a trigger for service request in UP IDLE session state, SMF initiates a N1N2 message towards the AMF as part of idle mode exit procedure.
2	If UE registration procedure with new AMF is in progress, then AMF responds with temporary reject for N1N2 message with response code 409 and cause as TEMPORARY_REJECT_REGISTRATION_ONGOING or TEMPORARY_REJECT_HANDOVER_ONGOING SMF.
3	On receiving the response, SMF starts a locally configured guard timer of 2 seconds.
4	While the guard timer is running, SMF expects either a SM Context Update with AMF ID change or SM Context Update for handover.

Step	Description
5	On receiving SM Context Update with AMF ID change, SMF: **1.** Stops the guard timer. **2.** Removes the reference to the discovery information for old AMF. **3.** Stores the new UE location information, PLMN information, and AMF information. **4.** Sends SM Context Update response success without content. **5.** Reinitiates N1N2 message transfer to the new AMF. This involves NF discovery and subsequent transmission to the new AMF.
6	On receiving SM Context Update for N2 handover, SMF: **1.** Starts the handover procedure. **2.** Suspends the idle mode exit procedure and stops the guard timer. **3.** Removes old AMF details and stores new AMF information as part of the handover procedure completion. **4.** Resumes idle mode exit procedure after handover procedure is complete. **5.** Reinitiates N1N2 message transfer, if required, to the new AMF. This involves NF discovery and subsequent transmission to the new AMF.

Figure 4: Temporary Rejection Call Flow for Network-triggered Service Request - 2

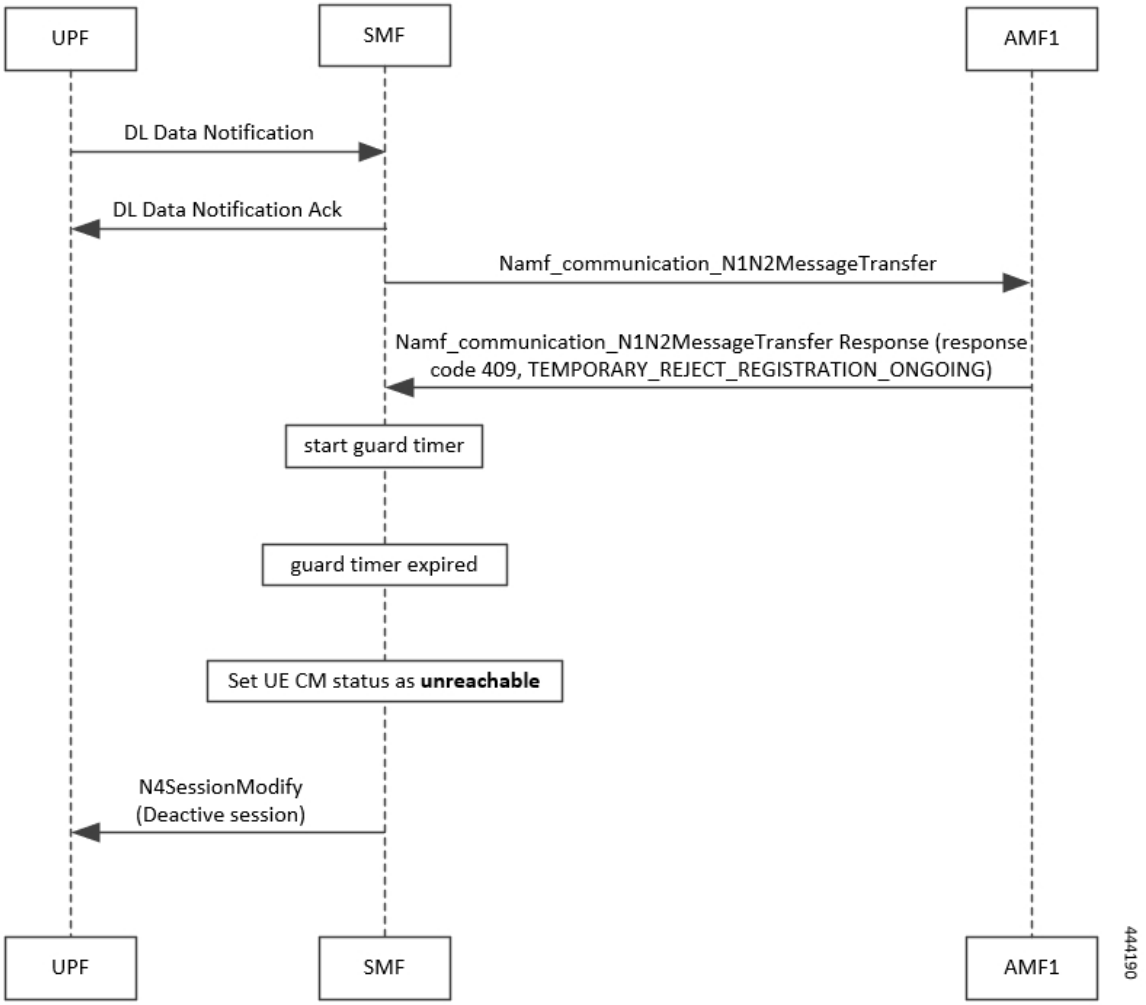

Table 6: Temporary Rejection Call Flow Description for Network-triggered Service Request - 2

Step	Description
1	On receiving a trigger for service request in UP IDLE session state, SMF initiates a N1N2 message towards the AMF as part of idle mode exit procedure.
2	If UE registration procedure with new AMF is in progress, then AMF responds with temporary reject for N1N2 message with response code 409 and cause as TEMPORARY_REJECT_REGISTRATION_ONGOING or TEMPORARY_REJECT_HANDOVER_ONGOING SMF.
3	On receiving the response, SMF starts a locally configured guard timer of 2 seconds.
4	Once the guard timer expires, SMF: **1.** Sets the UE CM status as *NotReachable*. **2.** Deactivates the UP session state.

Standards Compliance

The Network-initiated Service Request feature complies with the 3GPP TS 23.502, V15.6.0 (2019-10).

Limitations

This feature has the following limitations:

- It does not support location update and access-type changes.
- It does not support QoS flow modifications and errors.

Configuring N3 Tunnel Profile

To configure the N3 tunnel profile, use the following sample configuration:

```
config
   profile n3-tunnel n3_profile_name
      buffer upf
      notify
      end
```

NOTES:

- **profile n3-tunnel** *n3_profile_name*: Specify the N3 tunnel profile name. *n3_profile_name* must be a string.
- **buffer** *upf*: Configure buffering for Downlink Data.
- **notify**: Enable downlink data notification from UPF.