

# Message Interactions 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 | Enabled – Always-on |
| Related Documentation | Not Applicable |

## Revision History

***Table 2: Revision History***

| Revision Details | Release |
|---|---|
| Procedures added for:<br>• Collision Resolver<br>• Multiple CBR<br>• Double Delete Optimized<br>• Abort Handling of Low priority and Handling Suspension | 2021.02.0 |

| Revision Details | Release |
|---|---|
| First introduced. | 2021.01.0 |

# Feature Description

The Message Interactions feature provides the capability to receive and process the messages from different peers (UPF, MME, and PGW), and performs the priority resolution.

The following are the examples of message interaction scenarios and priorities:

- The Modify Bearer Request (MBR) and Update Bearer Request (UBR) received for the same PDN1 waits for the Sx Modify Response from UPF. The UBR is processed after the MBR is completed. In this scenario, the UBR process is suspended until the MBR is processed.
- The UBR1 received for the PDN1 while processing a Release Access Bearer (RAB) for the same PDN1. The UBR is processed after the RAB is completed. In this scenario, the UBR1 process is suspended when the RAB procedure is in progress.
- The existing PDN procedure is stopped when the disconnect procedure (Delete Session Request (DSR), Delete Bearer Request (DBR), or Clear Sub) is sent for the same PDN. For example, cnSGW-C receives the DSR for the PDN when the CBR1 and UBR1 procedures are in progress for the same PDN1. The DSR processing is started, and CBR1 and UBR1 processing is stalled. For more information, see the Graceful Stop the Existing PDN Procedure Call Flow, on page 6 call flow.
- The existing UE procedure (RAB or DDN) is stopped when the disconnect procedure (DSR, DBR, or Clear Sub) for the PDN is received. For example, cnSGW-C receives the DBR for the PDN while processing the RAB or DDN. The DBR procedure is started, and the RAB or DDN procedure is stopped.
- The incoming procedure for the PDN is stopped when the disconnect procedure (DSR, DBR, or Clear Sub) for the same PDN is in progress. For example, the UBR receives the PDN when sending the DSR for the same PDN. The UBR procedure is stopped, and the DSR procedure continues.
- The new incoming UE procedure is stopped when processing the disconnect procedure (DSR, DBR, or Clear Sub) for the same PDN. For example, the RAB received for the PDN1 when processing the multi-PDN call DSR for the same PDN1. The RAB procedure is stopped and rescheduled after the DSR for PDN1 gets completed.
- The CBR and the UBR message handling are stopped when the initial attach procedure is in progress.
- Optimization of the double delete handling. For example, the cnSGW-C receives the DSR from MME and DBR in the PGW, for which the DBR Sx modify step is pending toward the UPF. The DBR signaling is not initiated toward the S11 interface.
- The processing of the low priority procedures is stopped when the high priority procedure is received on the same bearer. For example, cnSGW-C receives the DBR for the PDN on a dedicated bearer while processing UBR on the same bearer. The DBR handling procedure is started, and the processing of the existing UBR procedure on the same bearer is stopped.

# How it Works

This section describes how this feature works.

## Call Flows

This section describes the key call flows for this feature.

### CBR Multi-PDN Call Flow

This section describes the CBR Multi-PDN call flow.

***Figure 1: CBR Multi-PDN Call Flow***

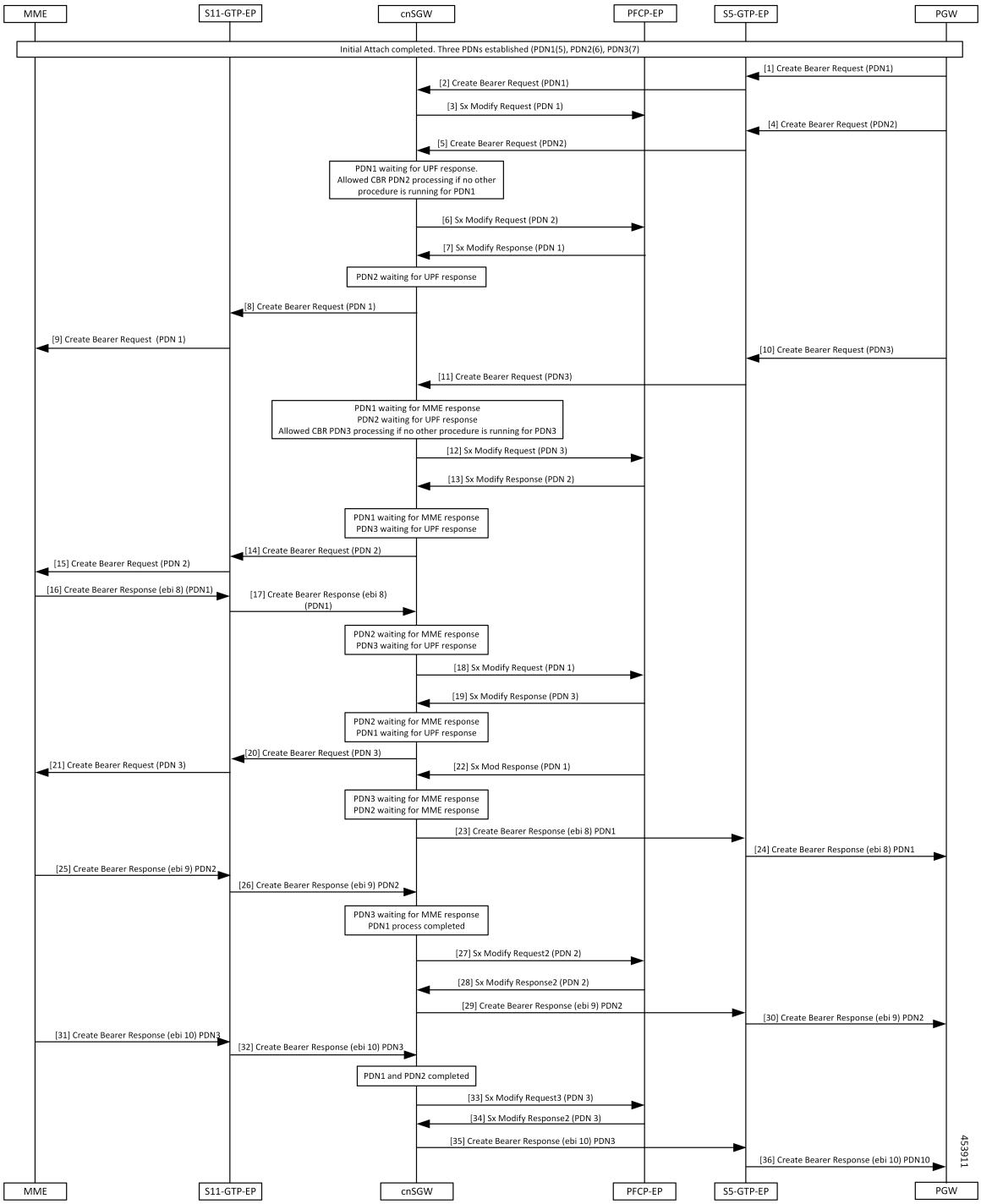


*Table 3: CBR Multi-PDN Call Flow Description*

| Step | Description |
|---|---|
| 1 | The Initial Attach process is completed with the three established PDNs.<br>The PGW sends a Create Bearer Request for PDN1 to the S5-GTP-EP. |
| 2 | The S5-GTP-EP sends the Create Bearer Request for PDN1 to the cnSGW. |
| 3 | The cnSGW sends a Sx Modify Request for PDN1 to the PFCP-EP. |
| 4 | The PGW sends a Create Bearer Request for PDN2 to the S5-GTP-EP. |
| 5 | The S5-GTP-EP sends the Create Bearer Request PDN2 to the cnSGW. |
| 6 | The cnSGW sends a Sx Modify Request to PFCP-EP for PDN2. |
| 7 | The PFCP-EP sends the Sx Modify Response for PDN1 to the cnSGW. |
| 8 | The cnSGW sends the Create Bearer Request for PDN1 to the S11-GTP-EP. |
| 9 | The S11-GTP-EP sends the Create Bearer Request for PDN1 to the MME. |
| 10 | The PGW sends the Create Bearer Request (PDN3) to the S5-GTP-EP. |
| 11 | The S5-GTP-EP sends the Create Bearer Request (PDN3) to the cnSGW. |
| 12 | The cnSGW sends the Sx Modify Request (PDN3) to the PFCP-EP. |
| 13 | The PFCP-EP sends the Sx Modify Response for PDN2 to the cnSGW. |
| 14 | The cnSGW sends the Create Bearer Request for PDN2 to the S11-GTP-EP. |
| 15 | The S11-GTP-EP sends the Create Bearer Request for PDN1 to the MME. |
| 16 | The MME sends the Create Bearer Response for PDN1 to the S11-GTP-EP. |
| 17 | The S11-GTP-EP sends the Create Bearer Response for PDN1 to the cnSGW. |
| 18 | The cnSGW sends the Sx Modify Request for PDN1 to the PFCP-EP. |
| 19 | The PFCP-EP sends the Sx Modify Response for PDN3 to the cnSGW. |
| 20 | The cnSGW sends the Create Bearer Request for PDN3 to the S11-GTPC-EP. |
| 21 | The S11-GTPC-EP sends the Create Bearer Request for PDN3 to the MME. |
| 22 | The PFCP-EP sends the Sx Modify Response2 for PDN1 to the cnSGW. |
| 23 | The cnSGW sends the Create Bearer Response for PDN1 to the S5-GTP-EP. |
| 24 | The S5-GTP-EP sends the Create Bearer Response for PDN1 to the PGW. |
| 25 | The MME sends the Create Bearer Response for PDN2 to the S11-GTPC-EP. |
| 26 | The S11-GTPC-EP sends the Create Bearer Response for PDN1 to the cnSGW. |

| Step | Description |
|---|---|
| 27 | The cnSGW sends the Sx Modify Request to the PFCP-EP for PDN2. |
| 28 | The PFCP-EP sends the Sx Modify Response for PDN2 to the cnSGW. |
| 29 | The cnSGW sends the Create Bearer Response for PDN2 to the S5-GTP-EP. |
| 30 | The S5-GTP-EP sends the Create Bearer Response for PDN2 to the PGW. |
| 31 | The MME sends the Create Bearer Response for PDN3 to the S11-GTPC-EP. |
| 32 | The S11-GTPC-EP sends the Create Bearer Response for PDN3 to the cnSGW. |
| 33 | The cnSGW sends the Sx Modify Request for PDN2 to the PFCP-EP. |
| 34 | The PFCP-EP sends the Sx Modify Response for PDN3 to the cnSGW. |
| 35 | The cnSGW sends the Create Bearer Response for PDN3 to the S5-GTP-EP. |
| 36 | The S5-GTP-EP sends the Create Bearer Response for PDN3 to the PGW. |

## Graceful Stop the Existing PDN Procedure Call Flow

This section describes the Graceful Stop the Existing PDN Procedure call flow.

***Figure 2: Graceful Stop the Existing PDN Procedure Call Flow***

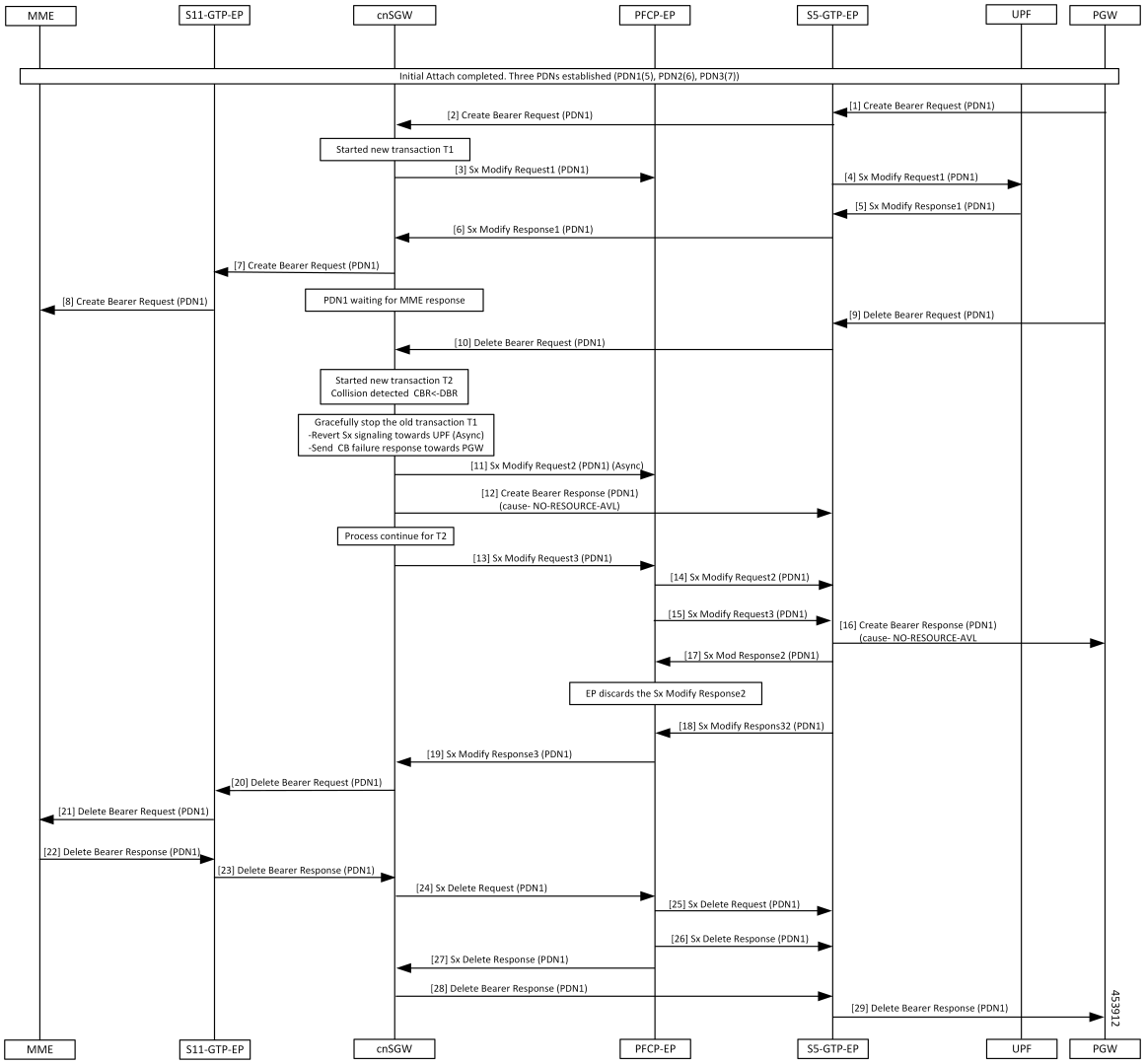



***Table 4: Graceful Stop the Existing PDN Procedure Call Flow Description***

| Step | Description |
|---|---|
| 1 | The Initial Attach process is completed with the already established three PDNs.<br>The PGW sends the Create Bearer Request to the S5-GTPC-EP. |
| 2 | The S5-GTCP-EP forwards the Create Bearer Request for PDN1 to the cnSGW. |
| 3 | The cnSGW forwards the Sx Modify Request for PDN1 to the PFCP-EP.<br>The cnSGW waits for the Sx Modify Response for PDN1. |
| 4 | The PFCP-EP sends the Sx Modify Request for PDN1 to the UPF. |
| 5 | The UPF sends the Sx Modify Response for PDN1 to the PFCP-EP. |

| Step | Description |
|---|---|
| 6 | The PFCP-EP sends the Sx Modify Response for PDN1 to the cnSGW. |
| 7 | The cnSGW sends the Create Bearer Request for PDN1 to the S11-GTPC-EP. |
| 8 | The S11-GTPC-EP forwards the Create Bearer Request for PDN1 to the MME. |
| 9 | The PGW sends the Delete Bearer Request for PDN1 to the S5-GTPC-EP. |
| 10 | The S5-GTPC-EP forwards the Delete Bearer Request for PDN1 to the cnSGW.<br>The cnSGW waits for the MME response and the cnSGW receives the Delete Bearer Request for PDN1.<br>When collision is detected for PDN1, stop the old transaction T1 for PDN1. |
| 11 | The cnSGW sends the Sx Modify Request (async) to the PFCP-EP. |
| 12 | The cnSGWcnSGW sends the Create Bearer Response with cause No-Resource-Available for PDN1 to the S5-GTPC-EP. |
| 13 | The cnSGW sends the Sx Modify Request for DBR to the PFCP-EP. |
| 14 | The PFCP-EP forwards the Sx Modify Request for CBR to the UPF. |
| 15 | The PFCP-EP forwards the Sx Modify Request for DBR to the UPF. |
| 16 | The S5-GTPC-EP sends the Create Bearer Response with cause No. |
| 17 | The UPF sends the Sx Modify Response for CBR to the PFCP-EP.<br>The PFCP-EP discards this response. |
| 18 | The UPF sends the Sx Modify Response for DBR to the PFCP-EP. |
| 19 | The PFCP-EP forwards the Sx Modify Response for DBR to the cnSGW. |
| 20 | The cnSGW sends the Delete Bearer Request for PDN1 to the S11-GTPC-EP. |
| 21 | The S11-GTPc-EP forwards the Delete Bearer Request for PDN1 to the MME. |
| 22 | The MME sends the Delete Bearer Response for PDN1 to the S11-GTPC-EP. |
| 23 | The S11-GTCP-EP forwards the Delete Bearer Response for PDN1 to the cnSGW. |
| 24 | The cnSGW sends the Sx Delete Request for PDN1 to the PFCP-EP. |
| 25 | The PFCP-EP forwards the Sx Delete Request for PDN1 to the UPF. |
| 26 | The UPF sends the Sx Delete Response for PDN1 to the PFCP-EP. |
| 27 | The PFCP-EP forwards the Sx Delete Response for PDN1 to the cnSGW. |
| 28 | The cnSGW sends the Delete Bearer Response for PDN1 to the S5-GTPC-EP. |
| 29 | The S5-GTPC-EP forwards the Delete Bearer Response for PDN1 to the PGW. |

# Inter MME Handover with Multi-PDN Handling (With PGW Interaction) Call Flow

This section describes the Inter MME Handover with Multi-PDN Handling (With PGW Interaction) call flow.

***Figure 3: Inter MME Handover with Multi-PDN Handling (With PGW Interaction) Call Flow***

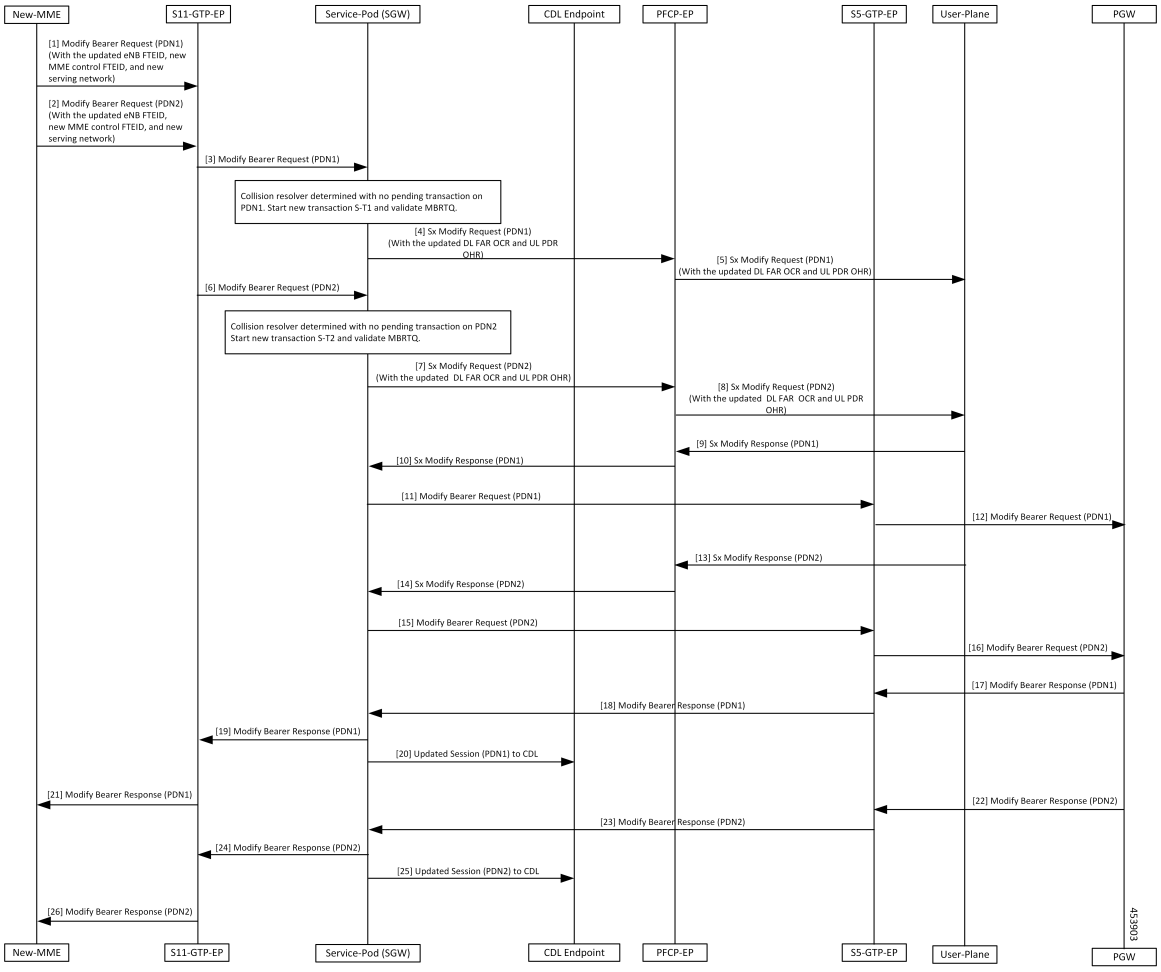



***Table 5: Inter MME Handover with Multi-PDN Handling (With PGW Interaction) Call Flow Description***

| Step | Description |
|---|---|
| 1 | The New-MME sends the Modify Bearer Request for (PDN1) with the updated eNodeB FTEID, new MME control FTEID, and new serving network to the S11-GTP-EP. |
| 2 | The New-MME sends the Modify Bearer Request for (PDN2) with the updated eNodeB FTEID, new MME control FTEID, and new serving network to the S11-GTP-EP. |
| 3 | The S11-GTP-EP sends the Modify Bearer Request (PDN1) to the cnSGW-C. |
| 4 | The cnSGW-C sends the Sx Modify Request (PDN1) with the updated DL FAR OCR and UL PDR OHR to the PFCP-EP. |
| 5 | The PFCP-EP forwards the Sx Modify Request for (PDN1) to the User-Plane. |

| Step | Description |
|---|---|
| 6 | The S11-GTP-EP sends the Modify Bearer Request (PDN2). |
| 7 | The Service-Pod (SGW) sends Sx Modify Request (PDN2) with updated DL FAR OCR and UL PDR OHR to the PFCP-EP. |
| 8 | The PFCP-EP forwards the Sx Modify Request (PDN2) to User-Plane. |
| 9 | The User-Plane sends the Sx Modify Response (PDN1) to the PFCP-EP. |
| 10 | The PFPC-EP forwards the Sx Modify Response (PDN1) to the Service-Pod (SGW). |
| 11 | The Service-Pod (SGW) sends the Modify Bearer Request (PDN1) with updated serving network information to the S5-GTP-EP. |
| 12 | The S5-GTP-EP forwards the Modify Bearer Request (PDN1) to the PGW. |
| 13 | The User-Plane sends the Sx Modify Response (PDN2) to the PFCP-EP. |
| 14 | The PFCP-EP forwards the Sx Modify Response (PDN2) to the Service-Pod (SGW). |
| 15 | The Service-Pod (SGW) sends the Modify Bearer Request (PDN2) with the updated serving network information to S5-GTP-EP. |
| 16 | The S5-GTP-EP sends the Modify Bearer Request (PDN2) to the PGW. |
| 17 | The PGW sends the Modify Bearer Response (PDN1) to the S5-GTP-EP. |
| 18 | The S5-GPT-EP forwards the Modify Bearer Response (PDN1) to the Service-Pod (SGW). |
| 19 | The Service-Pod (SGW) forwards the Modify Bearer Response (PDN1) to the S11-GTP-EP. |
| 20 | The Service-Pod (SGW) updates the PDN1 session sent to the CDL Endpoint. |
| 21 | The S11-GTP-EP sends the Modify Bearer Response (PDN1) to the New-MME. |
| 22 | The PGW sends the Modify Bearer Response for (PDN2) to the S5-GTP-EP. |
| 23 | The S5-GPT-EP forwards the Modify Bearer Response (PDN2) to the Service-Pod (SGW). |
| 24 | The Service-Pod (SGW) forwards the Modify Bearer Response (PDN2) to the S11-GTP-EP. |
| 25 | The Service-Pod (SGW) marks Inter-MME as completed (PDN2) and updates PDN2 session sent to the CDL Endpoint. |
| 26 | The S11-GTP-EP sends the Modify Bearer Response (PDN2) to New-MME. |

## Multi PDN Call X2 Handover SGW Relocation to cnSGW-C Call Flow

This section describes the Multi PDN Call X2 Handover SGW Relocation to cnSGW-C call flow.

***Figure 4: Multi PDN Call X2 Handover SGW Relocation to cnSGW-C Call Flow***

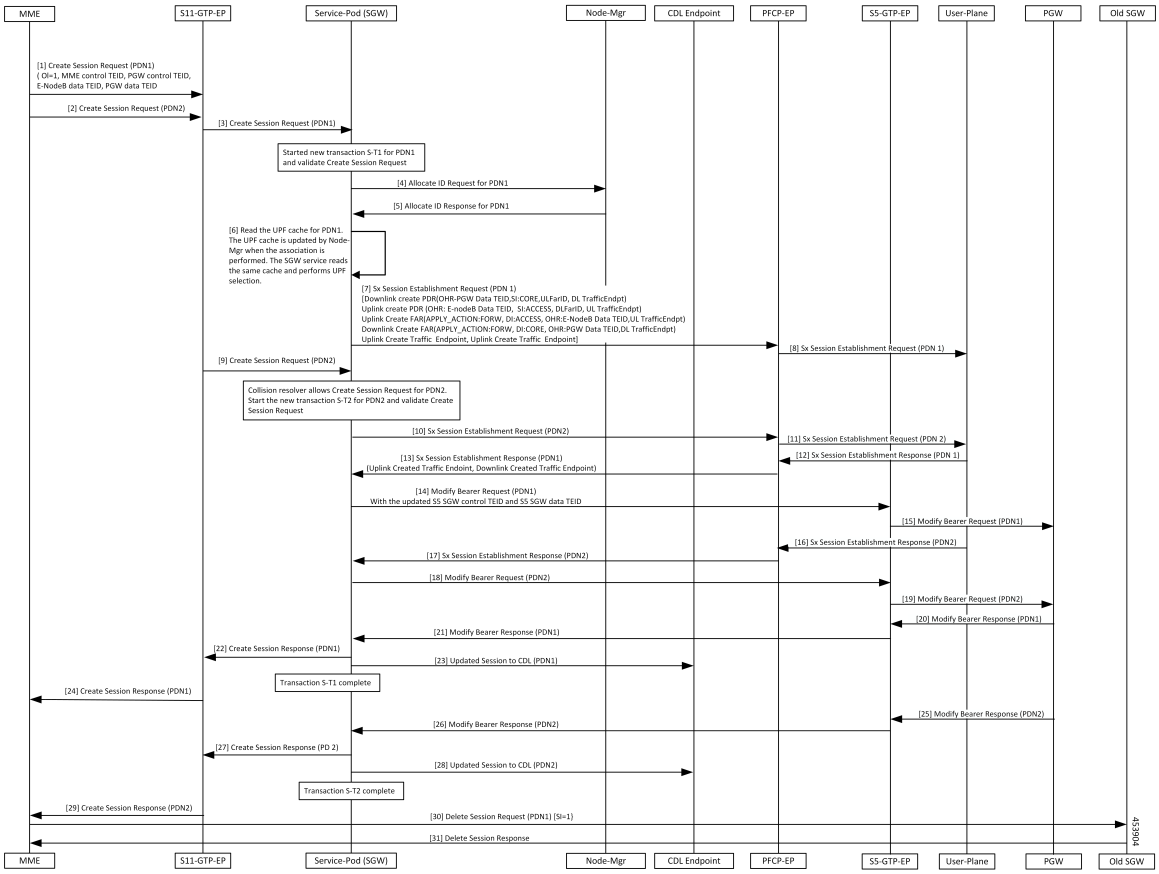



***Table 6: Multi PDN call X2 Handover SGW Relocation to cnSGW-C Call Flow Description***

| Step | Description |
|---|---|
| 1 | The MME sends the Create Session Request for (PDN1) with (OI = 1, MME Control TEID, PGW Control TEID, eNodeB Data TEID, PGW Data TEID) to the S11-GTP-EP. |
| 2 | The MME sends the Create Session Request (PDN2) to the S11-GTP-EP. |
| 3 | The S11-GTP-EP forwards the Create Session Request (PDN1) to the Service-Pod (SGW). |
| 4 | The Service-Pod (SGW) requests for ID allocation (PDN1) to the Node-Mgr. |
| 5 | The Node-Mgr responds with the Allocate Id Response (PDN1). |
| 6 | The Service-Pod (SGW) performs the UPF selection. |
| 7 | The Service-Pod (SGW) sends the Sx Session Establishment Request (PDN1) to the PFCP-EP. |
| 8 | The PFCP-EP forwards the Sx Session Establishment Request (PDN1) to the User-Plane. |
| 9 | The S11-GTP-EP sends the Create Session Request (PDN2) to the Service-Pod (SGW). |

| Step | Description |
|---|---|
| 10 | The Service-Pod (SGW) sends the Sx Session Establishment Request (PDN2) to PFCP-EP. |
| 11 | The PFCP-EP forwards the Sx Session Establishment Request (PDN2) to the User-Plane. |
| 12 | The User-Plane sends the Sx Session Establishment Response (PDN1) to the PFCP-EP. |
| 13 | The PFCP-EP sends the Sx Session Establishment Response (PDN1) to the Service-Pod (SGW). |
| 14 | The Service-Pod (SGW) sends the Modify Bearer Request (PDN1) with the updated S5 SGW Control TEID and S5 SGW Data TEID to S5-GTP-EP. |
| 15 | The S5-GTP-EP forwards the Modify Bearer Request (PDN1) to the PGW. |
| 16 | The User-Plane sends the Sx Session Establishment Response (PDN2) to the PFCP-EP. |
| 17 | The PFCP-EP forwards the Sx Session Establishment Response (PDN2) to the Service-Pod (SGW). |
| 18 | The Service-Pod (SGW) sends the Modify Bearer Request (PDN2) with the updated S5 SGW Control TEID and S5 SGW Data TEID to the S5-GTP-EP. |
| 19 | The S5-GTP-EP forwards the Modify Bearer Request (PDN2) to the PGW. |
| 20 | The PGW sends the Modify Bearer Response (PDN1) to the S5-GTP-EP. |
| 21 | The S5-GTP-EP forwards the Modify Bearer Response (PDN1) to the Service-Pod (SGW). |
| 22 | The Service-Pod (SGW) sends the Create Session Response (PDN1) to the S11-GTP-EP. |
| 23 | The Service-Pod (SGW) updates the PDN1 session to the CDL Endpoint. |
| 24 | The S11-GTP-EP forwards the Create Session Response (PDN1) to the MME. |
| 25 | The PGW sends the Modify Bearer Response (PDN2) to the S5-GTP-EP. |
| 26 | The S5-GTP-EP forwards the Modify Bearer Response (PDN2) to the Service-Pod (SGW). |
| 27 | The Service-Pod (SGW) sends the Create Session Response (PDN2) to the S11-GTP-EP. |
| 28 | The Service-Pod (SGW) updates the PDN2 session to the CDL Endpoint. |
| 29 | The S11-GTP-EP forwards the Create Session Response (PDN2) to the MME. |
| 30 | The MME sends the Delete Session Request (PDN1) [SI=1] to the Old SGW. |
| 31 | The Old SGW responds with the Delete Session Response to the MME. |

## Multi-PDN S1 Handover SGW Relocation to Service-Pod (SGW) Call Fow

This section describes the Multi-PDN S1 Handover SGW Relocation to Service-Pod (SGW) call flow.

***Figure 5: Multi-PDN S1 Handover SGW Relocation to Service-Pod (SGW) Call Flow***

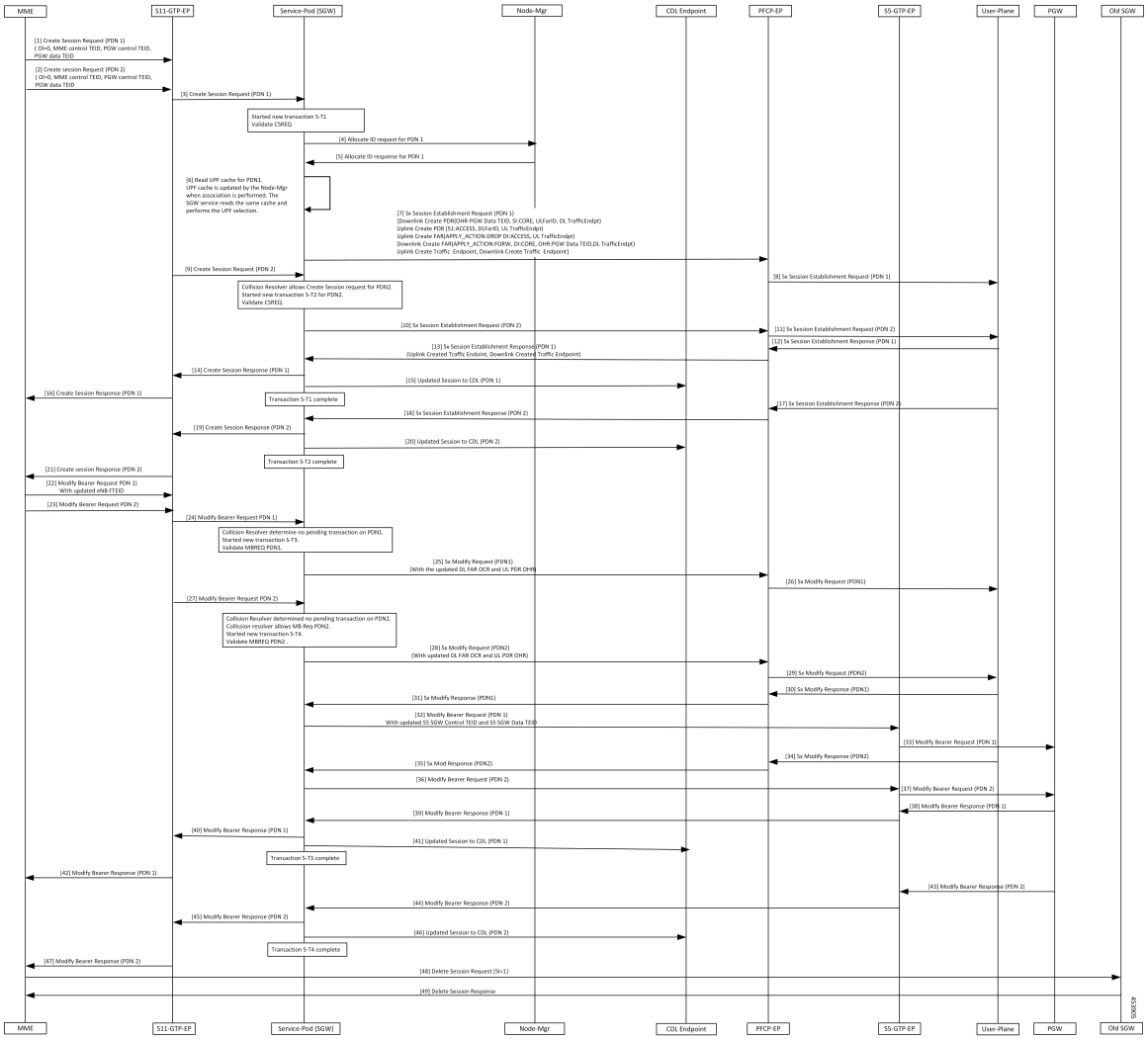



***Table 7: Multi-PDN S1 Handover SGW Relocation to Service-Pod (SGW) Call Flow Description***

| Step | Description |
|---|---|
| 1 | The MME sends a Create Session Request (PDN1) with (OI = 0, MME Control TEID, PGW Control TEID, and PGW Data TEID) to the S11-GTP-EP. |
| 2 | The MME sends the Create Session Request (PDN2) with (OI = 0, MME Control TEID, PGW Control TEID, and PGW Data TEID) to the S11-GTP-EP. |
| 3 | The S11-GTP-EP sends the Create Session Request (PDN1) to the Service-Pod (SGW). |
| 4 | The Service-Pod (SGW) requests ID allocation (PDN1) to the Node-Mgr. |
| 5 | The Node-Mgr responds with the Allocate ID Response (PDN1) to the Service-Pod (SGW). |
| 6 | The Service-Pod (SGW) performs the UPF selection. |

| Step | Description |
|---|---|
| 7 | The Service-Pod (SGW) triggers the Sx Session Establishment Request (PDN1) to the PFCP-EP. |
| 8 | The PFCP-EP forwards a Sx Session Establishment Request (PDN1) to the User-Plane. |
| 9 | The Service-Pod (SGW) receives the Create Session Request (PDN2) from the S11-GTP-EP. |
| 10 | The Service-Pod (SGW) sends a Sx Session Establishment Request (PDN2) to the PFCP-EP. |
| 11 | The PFCP-EP forwards the Sx Session Establishment Request (PDN2) to the User-Plane. |
| 12 | The User-Plane responds with the Sx Session Establishment Response (PDN1) to the PFCP-EP. |
| 13 | The PFCP-EP forwards the Sx Session Establishment Response (PDN1) to the Service-Pod (SGW). |
| 14 | The Service-Pod (SGW) sends the Create Session Response (PDN1) to the S11-GTP-EP. |
| 15 | The Service-Pod (SGW) updates the PDN1 session to the CDL Endpoint. |
| 16 | The S11-GTP-EP forwards the Create Session Response (PDN1) to the MME. |
| 17 | The User-Plane responds with the Sx Session Establishment Response (PDN2) to the PFCP-EP. |
| 18 | The PFCP-EP forwards the Sx Session Establishment Response (PDN2) to the Service-Pod (SGW). |
| 19 | The Service-Pod (SGW) sends the Create Session Response (PDN2) to the S11-GTP-EP. |
| 20 | The Service-Pod (SGW) updates the PDN2 session to the CDL Endpoint. |
| 21 | The S11-GTP-EP forwards the Create Session Response (PDN2) to the MME. |
| 22 | The MME sends a Modify Bearer Request (PDN1) to the S11-GTP-EP. |
| 23 | The MME sends the Modify Bearer Request (PDN2) to the S11-GTP-EP. |
| 24 | The S11-GTP-EP forwards the Modify Bearer Request (PDN1) to the Service-Pod (SGW). |
| 25 | The Service-Pod (SGW) sends a Sx Modify Request (PDN1) to the PFCP-EP. |
| 26 | The PFCP-EP forwards the Sx Modify Request (PDN1) to the User-Plane. |
| 27 | The S11-GTP-EP sends the Modify Bearer Request (PDN2) to the Service-Pod (SGW). |
| 28 | The Service-Pod (SGW) sends a Sx Modify Request (PDN2) with the updated DL FAR OCR and UL PDR OHR to the PFCP-EP. |
| 29 | The PFCP-EP forwards the Sx Modify Request (PDN2) to the User-Plane. |
| 30 | The User-Plane responds with the Sx Modify Response (PDN1) to the PFCP-EP. |
| 31 | The PFCP-EP forwards the Sx Modify Response (PDN1) to the Service-Pod (SGW). |
| 32 | The Service-Pod (SGW) sends the Modify Bearer Request (PDN1) with the updated S5 SGW Control TEID and S5 SGW Data TEID to the S5-GTP-EP. |
| 33 | The S5-GTP-EP forwards the Modify Bearer Request (PDN1) to the PGW. |

| Step | Description |
|---|---|
| 34 | The User-Plane sends the Sx Modify Response (PDN2) to the PFCP-EP. |
| 35 | The PFCP-EP forwards the Sx Modify Response (PDN2) to the Service-Pod (SGW). |
| 36 | The Service-Pod (SGW) sends the Modify Bearer Request (PDN2) to the S5-GTP-EP. |
| 37 | The S5-GTP-EP forwards the Modify Bearer Request (PDN2) to the PGW. |
| 38 | The PGW responds with the Modify Bearer Response (PDN1) to the S5-GTP-EP. |
| 39 | The S5-GTP-EP forwards the Modify Bearer Response (PDN1) to the Service-Pod (SGW). |
| 40 | The Service-Pod (SGW) sends the Modify Bearer Response (PDN1) to the S11-GTP-EP. |
| 41 | The Service-Pod (SGW) updates the PDN1 session to the CDL Endpoint. |
| 42 | The S11-GTP-EP forwards the Modify Bearer Response (PDN1) to the MME. |
| 43 | The PGW responds with the Modify Bearer Response (PDN2) to the S11-GTP-EP. |
| 44 | The S5-GTP-EP forwards the Modify Bearer Response (PDN2) to the Service-Pod (SGW). |
| 45 | The Service-Pod (SGW) sends the Modify Bearer Response (PDN2) to the S11-GTP-EP. |
| 46 | The Service-Pod (SGW) updates the PDN2 session to the CDL Endpoint. |
| 47 | The S11-GTP-EP forwards the Modify Bearer Response (PDN2) to the MME. |
| 48 | The MME triggers the Delete Session Request [SI=1] to Old SGW. |
| 49 | The Old SGW deletes the session and responds with the Delete Session Response. |

## Multiple CBR for Same PDN Call Flow

This section describes the Multiple CBR for Same PDN call flow.

*Figure 6: Multiple CBR for Same PDN Call Flow*

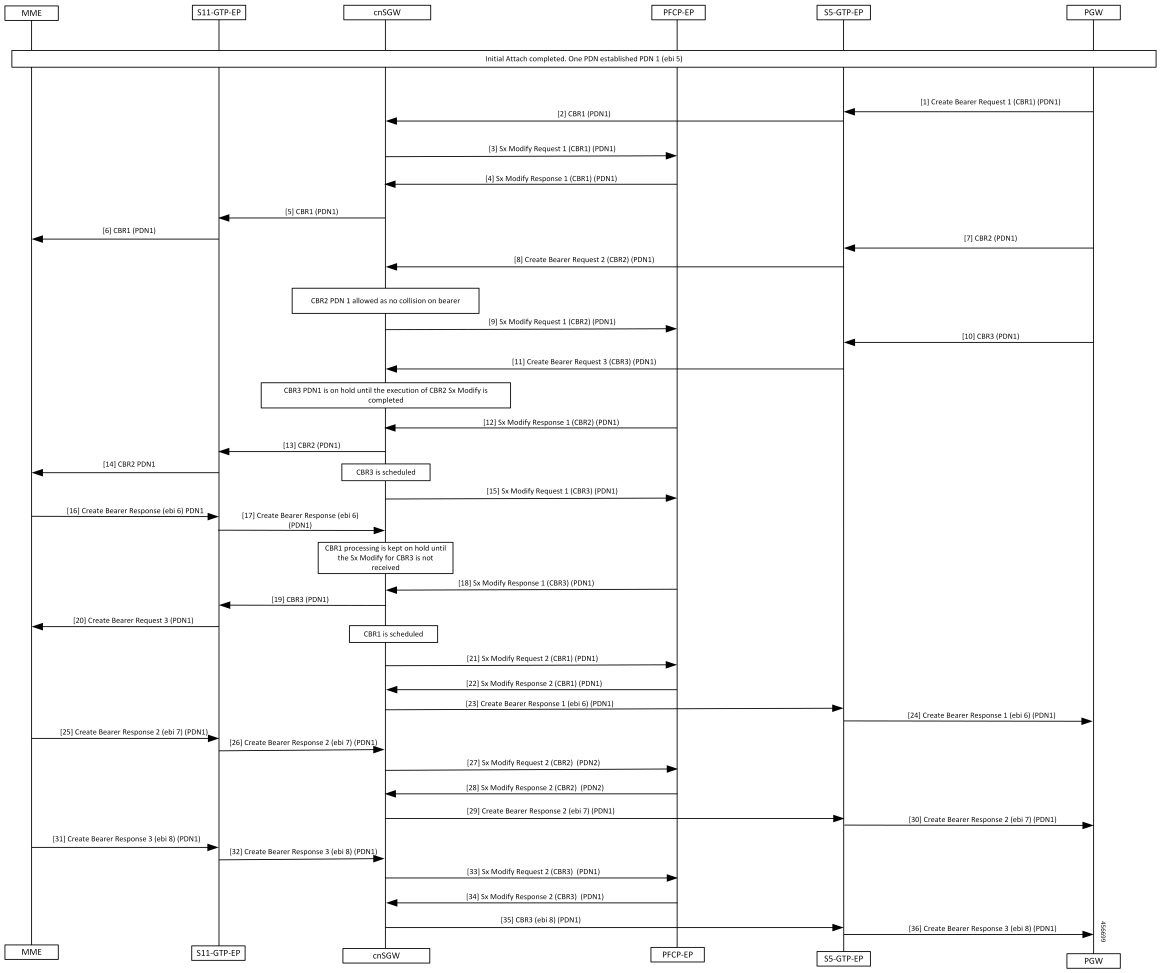



*Table 8: Multiple CBR for Same PDN Call Flow Description*

| Step | Description |
|---|---|
| 1 | Initial Attach completed. One PDN has established PDN1 (ebi 5).<br>The PGW sends the Create Bearer Request 1 for PDN1 to the S5-GTP-EP. |
| 2 | The S5-GTP-EP forwards the Create Bearer Request 1 for PDN1 to the cnSGW. |
| 3 | The cnSGW sends the Sx Modify Request 1 for PDN1 to the PFCP-EP. |
| 4 | The cnSGW receives the Sx Modify Response 1 for PDN1 from the PFCP-EP. |
| 5 | The cnSGW sends the Create Bearer Request 1 for PDN1 to the S11-GTP-EP. |
| 6 | The S11-GTP-EP sends the Create Bearer Request 1 for PDN1 to the MME. |
| 7 | The PGW sends the Create Bearer Request 2 to the S5-GTP-EP. |

| Step | Description |
|---|---|
| 8 | The S5-GTP-EP sends the Create Bearer Request 2 to the cnSGW. |
| 9 | The cnSGW sends the Sx Modify Request 1 (Create Bearer Request 2) for PDN1 to the PFCP-EP. |
| 10 | The PGW sends the Create Bearer Request 3 for PDN1 to the S5-GTP-EP. |
| 11 | The S5-GTP-EP sends the Create Bearer Request 3 for PDN1 to the cnSGW |
| 12 | The PFCP-EP sends the Sx Modify Response 1 (CBR2) for PDN1 to the cnSGW. |
| 13 | The cnSGW sends the Create Bearer Request 2 for PDN1 to the S11-GTP-EP. |
| 14 | The S11-GTP-EP sends the Create Bearer Request 2 for PDN1 to the MME. |
| 15 | The cnSGW sends the Sx Modify Request 1(CBR3) for PDN1 to the PFPC-EP. |
| 16 | The MME sends the Create Bearer Response 1 (ebi6) for PDN1 to the S11-GTP-EP. |
| 17 | The S11-GTP-EP sends the Create Bearer Response 1 (ebi6) for PDN1 to the cnSGW. |
| 18 | The cnSGW receives the Sx Modify Response 1 (CBR3) for PDN1 to the PFPC-EP. |
| 19, 20 | The cnSGW sends the Create Bearer Request 3 to the S11-GTP-EP. |
| 20 | The S11-GTP-EP sends the Create Bearer Request 3 to the MME. |
| 21 | The cnSGW sends the Sx Modify Request 2(CBR1) for PDN1 to the PFPC-EP. |
| 22 | The cnSGW receives the Sx Modify Response 2 (CBR1) for PDN1 to the PFPC-EP. |
| 23 | The cnSGW sends the Create Bearer Response 1 (ebi 6) for PDN1 to the S5-GTP-EP. |
| 24 | The S5-GTP-EP sends the Create Bearer Response 1 (ebi 6) for PDN1 to the PGW. |
| 25 | The MME sends the Create Bearer Response 2 (ebi 7) for PDN1 sent from MME to cnSGW. |
| 26 | The S11-GTP-EP sends the Create Bearer Response 2 (ebi 7) for PDN1 sent from MME to the cnSGW. |
| 27 | The cnSGW sends the Sx Modify Request 2 (CBR2) for PDN1 to PFCP-EP. |
| 28 | The PFCP-EP sends the Sx Modify Response 2 (CBR2) for PDN1 to the cnSGW. |
| 29 | The cnSGW sends the Create Bearer Response 2 (ebi 7) for PDN1 to the S5-GTP-EP. |
| 30 | The S5-GTP-EP sends the Create Bearer Response 2 (ebi 7) for PDN1 to the PGW. |
| 31 | The MME sends the Create Bearer Response 3 (ebi 8) for PDN1 to the S11-GTP-EP. |
| 32 | The S11-GTP-EP sends the Create Bearer Response 3 (ebi 8) for PDN1 to the cnSGW. |
| 33 | The cnSGW sends the Sx Modify Request 2 (CBR3) for PDN1 to the PFPC-EP. |
| 34 | The PFCP-EP send the Sx Modify Response 2 (CBR3) for PDN1 to the cnSGW. |

| Step | Description |
|---|---|
| 35 | The cnSGW sends the Create Bearer Response 3 (ebi 8) for PDN1 to the S5-GTP-EP. |
| 36 | The S5-GTP-EP sends the Create Bearer Response 3 (ebi 8) for PDN1 to the PGW. |

## Collision Resolver Discard Handling Call Flow

This section describes the Collision Resolver Discard Handling call flow.

***Figure 7: Collision Resolver Discard Handling Call Flow***

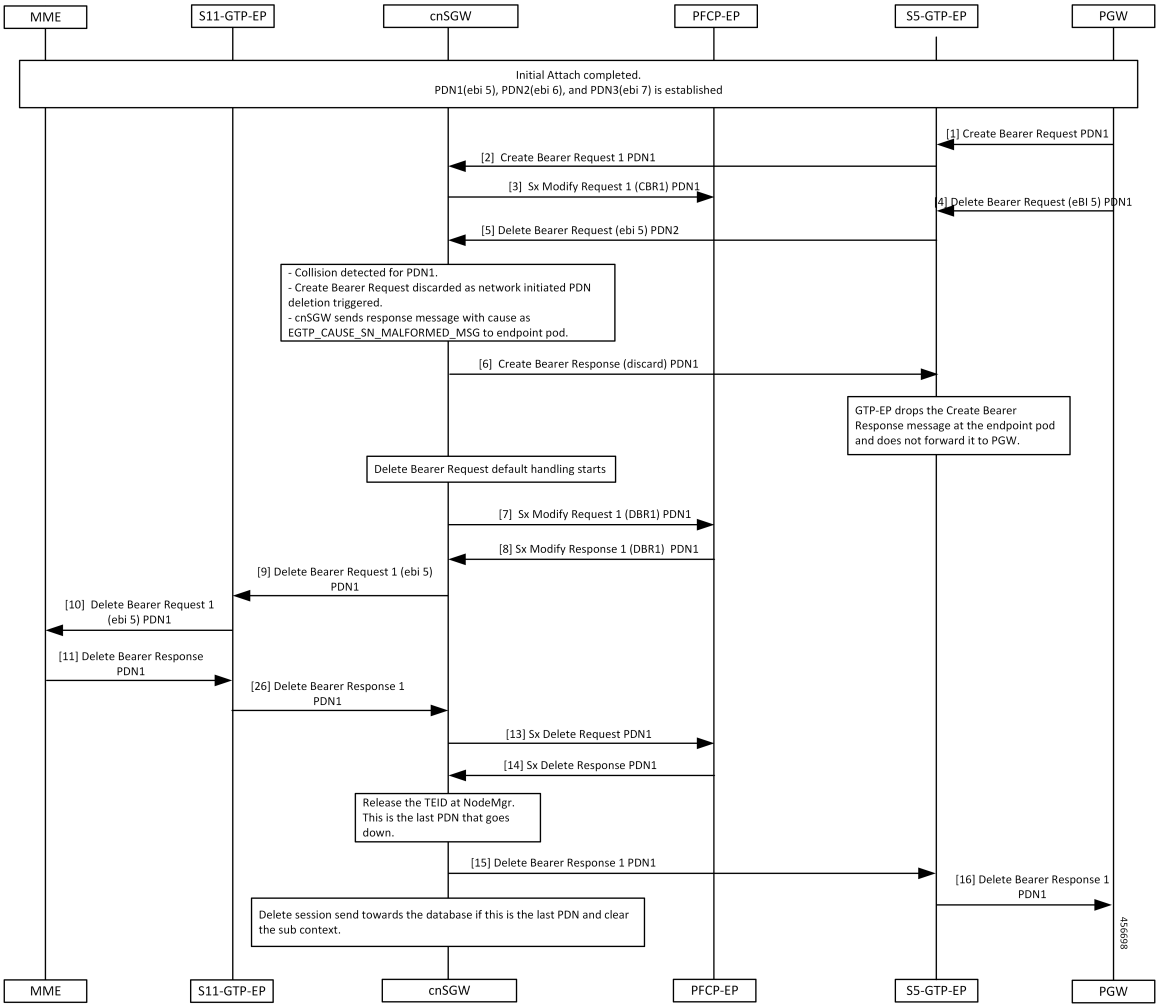



***Table 9: Collision Resolver Discard Handling Call Flow Description***

| Step | Description |
|---|---|
| 1 | Initial Attach procedure is completed.<br>The PDN1(ebi 5), PDN2(ebi 6), and PDN3(ebi 7) is established.<br>The PGW sends the Create Bearer Request for PDN1 to the S5-GTP-EP. |

| Step | Description |
|---|---|
| 2 | The PFCP-EP sends the Create Bearer Request 1 for PDN1 to the cnSGW. |
| 3 | The cnSGW sends the Sx Modify Request 1 for PDN1 to the PFCP-EP. |
| 4, 5 | The PGW sends the Delete Bearer Request (ebi5) for PDN1 to the cnSGW. |
| 6 | Collision detected for PDN1.<br>The Create Bearer Request is discarded as network initiated PDN deletion request is triggered.<br>The cnSGW sends a response message with the cause as EGTP_CAUSE_SN_MALFORMED_MSG to the endpoint pod.<br>The cnSGW sends Create Bearer Response (discard 1) for PDN1 to the S5-GTP-EP. |
| 7 | The cnSGW sends the Sx Modify Request 1 (DBR1) for PDN1 to the PFPC-EP. |
| 8 | The cnSGW receives the Sx Modify Response 1 (DBR1) for PDN1 from the PFPC-EP. |
| 9 | The cnSGW sends the Delete Bearer Request 1 to the S11-GTP-EP. |
| 10 | The S11-GTP-EP sends the Delete Bearer Request 1 to the MME. |
| 11 | The MME sends the Delete Bearer Response 1 to the S11-GTP-EP. |
| 12 | The S11-GTP-EP sends the Delete Bearer Response 1 to the cnSGW. |
| 13 | The cnSGW sends the Sx Delete Request for PDN1 to the PFCP-EP. |
| 14 | The PFPC-EP sends the Sx Delete Response for PDN1 to the cnSGW. |
| 15 | The cnSGW sends the Delete Bearer Response 1 for PDN1 to the PGW. |
| 16 | The S5-GTP-EP sends the Delete Bearer Response for PDN1 to the PGW. |

## Suspend Handling Call Flow

This section describes the Suspend Handling call flow.

*Figure 8: Suspend Handling Call Flow*

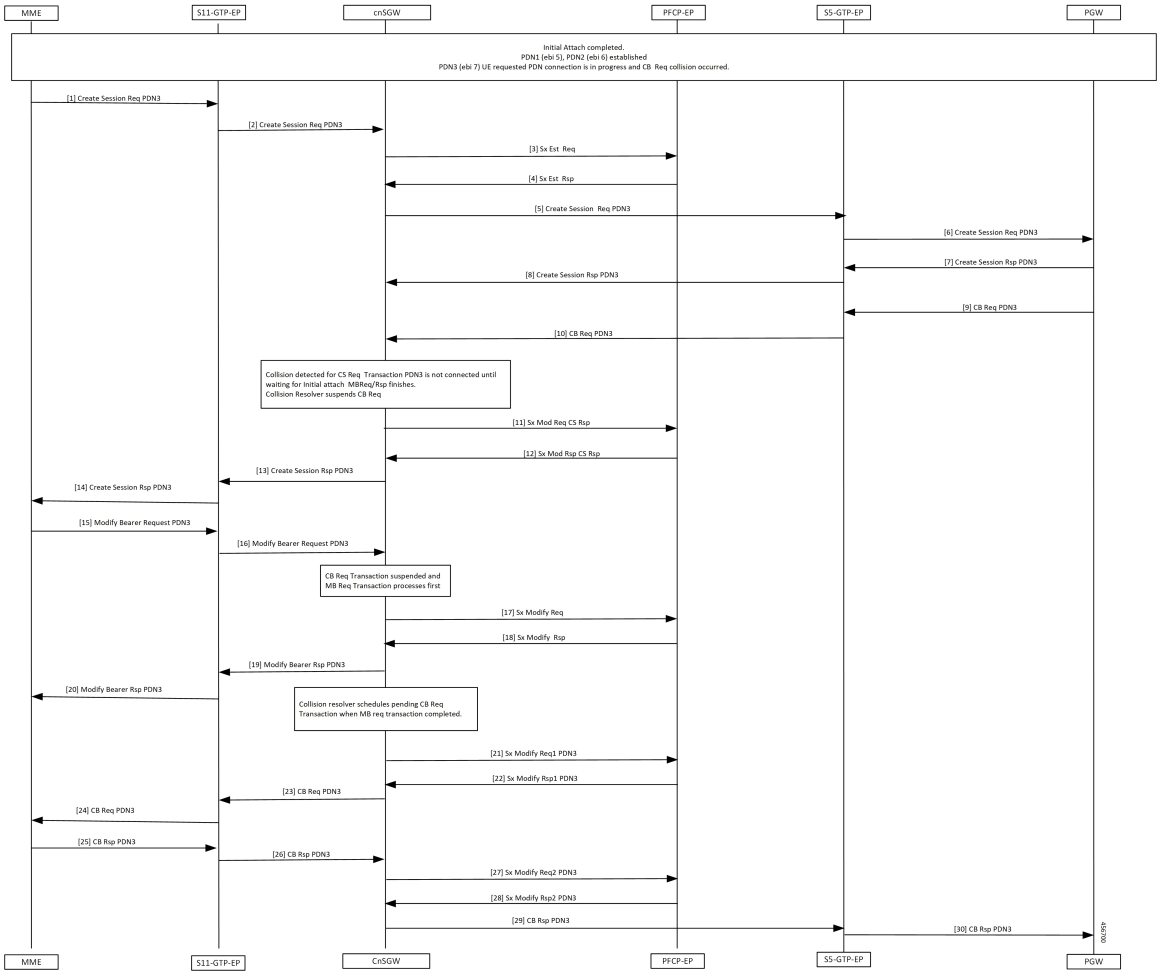



*Table 10: Suspend Handling Call Flow Description*

| Step | Description |
|---|---|
| 1 | Initial Attach process is completed.<br>The PDN1 (ebi 5) and PDN2 (ebi 6) is established.<br>PDN3 (ebi 7) UE requested that PDN connection is in progress. The Create Bearer Request collision occurred.<br>The MME sends Create Session Req for PDN3 to S11-GTP-EP. |
| 2 | The S11-GTP-EP sends the Create Session Request for PDN3 to the cnSGW. |
| 3 | The cnSGW sends the Sx Establishment Request to the PFCP-EP. |
| 4 | The PFCP-EP sends the Sx Establishment Response to the cnSGW. |
| 5 | The cnSGW sends the Create Session Request for PDN3 to the PGW. |

| Step | Description |
|---|---|
| 6 | The S5-GTP-EP sends the Create Session Request for PDN3 to the PGW. |
| 7 | The PGW sends the Create Session Rsppnse for PDN3 to the S5-GTP-EP. |
| 8 | The S5-GTP-EP sends the Create Session Response for PDN3 to the cnSGW. |
| 9 | The PGW sends the Create Bearer Request for PDN3 to the S5-GTP-EP. |
| 10 | The S5-GTP-EP sends the Create Bearer Request for PDN3 to the cnSGW. |
| 11 | Collision that is detected for Create Session Request transaction for PDN3 gets connected when waiting for the initial attach Modify Bearer Request or Response is complete.<br>Collision Resolver suspends Create Bearer Request.<br>The cnSGW sends Sx Modify Request and Create Session Request to the PFCP-EP. |
| 12 | The PFCP-EP sends the Sx Modify Response and Create Session Response to cnSGW. |
| 13 | The cnSGW sends the Create Session Response for PDN3 sent to the S11-GTP-EP. |
| 14 | The S11-GTP-EP sends the Create Session Response for PDN3 sent to the MME. |
| 15 | The MME sends the Modify Bearer Request for PDN3 to the S11-GTP-EP. |
| 16 | The S11-GTP-EP sends the Modify Bearer Request for PDN3 to the cnSGW. |
| 17 | The cnSGW sends the Modify Bearer Request for PDN3 to the PFCP-EP. |
| 18 | The PFCP-EP sends the Sx Modify Response to the cnSGW. |
| 19 | The cnSGW sends the Modify Bearer Response for PDN3 to the S11-GTP-EP. |
| 20 | The S11-GTP-EP sends the Modify Bearer Response for PDN3 to the MME. |
| 21 | The cnSGW sends Sx Modify Request 1 for PDN3 to the PFCP-EP. |
| 22 | The PFPC-EP sends the Sx Modify Response 1 for PDN3 to the PFPC-EP. |
| 23 | The cnSGW sends the Create Bearer Request for PDN3 sent to the S11-GTP-EP. |
| 24 | The S11-GTP-EP sends the Create Bearer Request for PDN3 sent to the MME. |
| 25 | The MME sends the Create Bearer Response for PDN3 to the S11-GTP-EP. |
| 26 | The S11-GTP-EP sends the Create Bearer Response for PDN3 to the cnSGW. |
| 27 | The cnSGW sends Sx Modify Request 2 for PDN3 to the PFCP-EP. |
| 28 | The PFCP-EP sends the Sx Modify Response 2 for PDN3 to the cnSGW. |
| 29 | The cnSGW sends the Create Bearer Response for PDN3 to the PGW. |
| 30 | The S5-GTP-EP sends the Create Bearer Response for PDN3 to the PGW. |

# Abort Handling of Low-Priority Procedure Call Flow

This section describes the Abort Handling of Low-Priority Procedure call flow.

***Figure 9: Abort Handling of Low-Priority Procedure Call Flow***

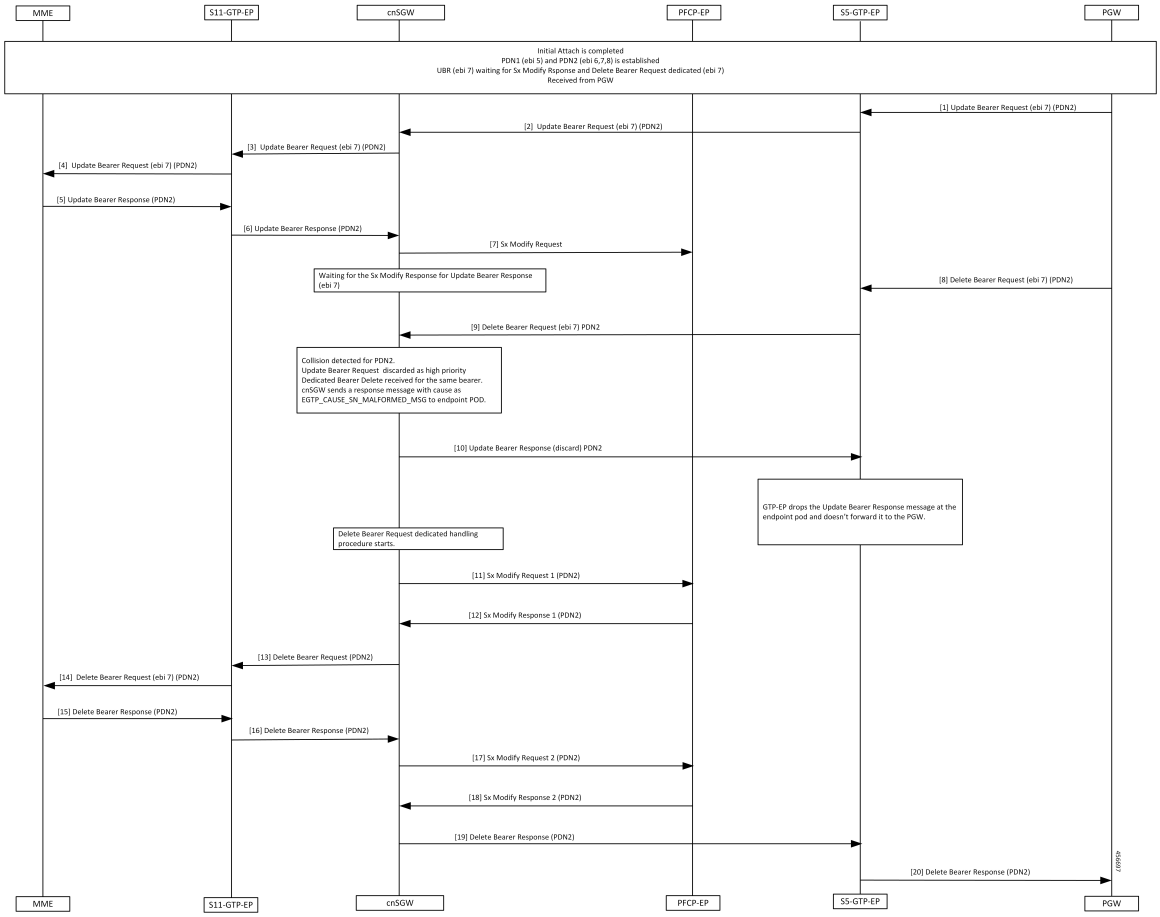



***Table 11: Abort Handling of Low-Priority Procedure Call Flow Description***

| Step | Description |
|---|---|
| 1 | Initial Attach procedure is completed.<br>The PDN1(ebi 5) and PDN2(ebi 6,7,8) is established.<br>The Update Bearer Request (ebi 7) is waiting for the Sx Modify Response and Dedicated Bearer Request dedicated (ebi 7) received from the PGW.<br>The PGW sends an Update Bearer Request (eBi 7) PDN2 to the S5-GTP-EP. |
| 2 | The PFCP-EP sends the Update Bearer Request (eBi 7) PDN2 to the cnSGW. |
| 3 | The cnSGW sends the Update Bearer Request (eBi 7) PDN2 to the S11-GTP-EP. |
| 4 | The S5-GTP-EP forwards the Update Bearer Request (eBi 7) PDN2 to the MME. |

| Step | Description |
|---|---|
| 5 | The MME sends an Update Bearer Response to the S11-GTP-EP. |
| 6 | The S11-GTP-EP sends a Update Bearer Response to the cnSGW. |
| 7 | The cnSGW sends Sx Modify Request to the PFCP-EP. |
| 8 | The PGW sends the Delete Bearer Request (eBi 7) for PDN2 to the S5-GTP-EP. |
| 9 | The S5-GTP-EP forwards Delete Bearer Request (eBi 7) for PDN2 to the cnSGW. |
| 10 | Collision is detected for PDN2.<br>The Update Bearer Request is discarded as high priority-dedicated bearer delete received for the same bearer.<br>The cnSGW sends a response message with cause as EGTP_CAUSE_SN_MALFORMED_MSG to endpoint POD.<br>The cnSGW sends Update Bearer Response (Discard) for PDN2 to the S5-GTP-EP. |
| 11 | The GTP-EP drops the Update Bearer Response message at endpoint pod and not forwarded to the PGW.<br>The cnSGW sends the Sx Modify Request 1 for PDN2 to the PFCP-EP. |
| 12 | The PFCP-EP sends the Sx Modify Response 1 for PDN2 to the cnSGW. |
| 13 | The cnSGW sends the Delete Bearer Request for PDN2 to the S11-GTP-EP. |
| 14 | The S11-GTP-EP sends the Delete Bearer Request (ebi 7) for PDN2 to the MME. |
| 15 | The MME sends the Delete Bearer Response for PDN2 to the S11-GTP-EP. |
| 16 | The S11-GTP-EP sends the Delete Bearer Response for PDN2 to the cnSGW. |
| 17 | The cnSGW sends the Sx Modify Request for PDN2 to the PFCP-EP. |
| 18 | The PFCP-EP sends Sx Modify Response for PDN2 to the cnSGW. |
| 19 | The cnSGW sends the Delete Bearer Response for PDN2 to the S5-GTP-EP. |
| 20 | The S5-GTP-EP sends the Delete Bearer Response for PDN2 to the PGW. |

## Double Delete Optimization Call Flow

This section describes the Double Delete Optimization call flow.

*Figure 10: Double Delete Optimization Call Flow*

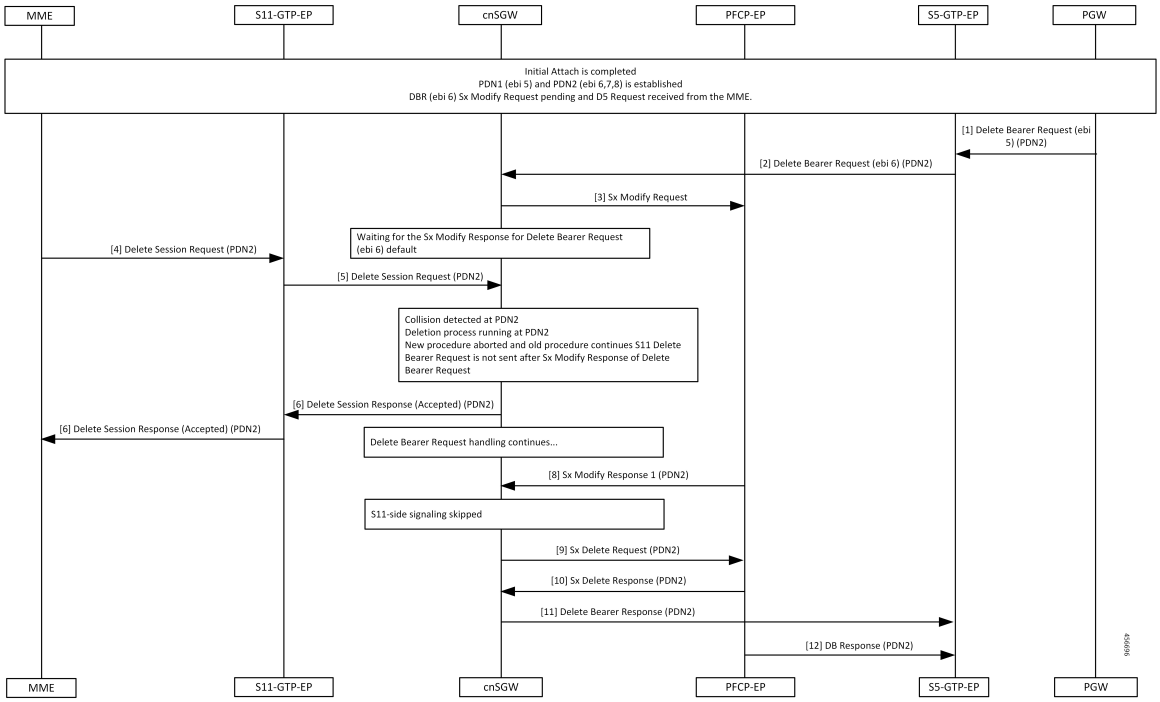



*Table 12: Double Delete Optimization Call Flow Description*

| Step | Description |
|---|---|
| 1 | Initial Attach procedure is completed.<br>The PDN1(ebi 5) and PDN2(ebi 6,7,8) is established.<br>The Delete Bearer Request (ebi 6) and Sx Modify Request is pending and the Delete Session Request is received from the MME.<br>The PGW sends the Delete Bearer Request (ebi 6) for PDN2 to the S5-GTP-EP. |
| 2 | The S5-GTP-EP forwards the Delete Bearer Request (ebi 6) for PDN2 to the cnSGW. |
| 3 | The cnSGW sends the Sx Modify Request to the PFCP-EP. |
| 4 | Waits for the Sx Modify Response for the Delete Bearer Request (ebi 6) default.<br>The MME sends the Delete Session Request for PDN2 to the S11-GTP-EP. |
| 5 | The S11-GTP-EP forwards the Delete Session Request for PDN2 to the cnSGW. |

| Step | Description |
|---|---|
| 6 | Collision detected at PDN2.<br>Deletion process running at PDN2.<br>New procedure aborted and old procedure continue.<br>The S11 Delete Bearer Request isn't send after an Sx Modify Response of the Delete Bearer Request.<br>The cnSGW sends Delete Session Response (Accepted) for PDN2 to the S11-GTP-EP. |
| 7 | The S11-GTP-EP forwards the Delete Session Response (Accepted) for PDN2 to the MME. |
| 8 | While the Delete Bearer Request handling continues, the PFCP-EP sends Sx Modify Response 1 for PDN2 to the cnSGW. |
| 9 | The cnSGW sends the Sx Delete Request for PDN2 to the PFCP-EP. |
| 10 | The PFCP-EP sends the Sx Delete Response for PDN2 to the cnSGW. |
| 11 | The cnSGW sends Delete Bearer Response for PDN2 to the S5-GTP-EP. |
| 12 | The S5-GTP-EP forwards the Delete Bearer Response for PDN2 to the PGW. |