SGW Relocation 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
First introduced.	2021.01.0

Feature Description

This feature supports following procedures:

- S1 based SGW Relocation

- X2 based SGW Relocation
- TAU SGW Relocation
- 5G to 4G SGW Relocation

This feature also supports ePCO Indication flag at the PDN level, if it receives this indication in CS Request during Initial attach or PDN connection or SGW relocation.

SGW triggers a Modify Bearer Request to PGW in the following scenario:

- The source MME supports ePCO and the target MME does not support it.
- The target MME supports ePCO and the source MME does not support it.

Note When 4G SGW relocation Create Session Request message receives 5GS Interworking Indication (5GSIWKI), then set SGW relocation type as 5G.

How it Works

This section describes how this feature works.

Call Flows

This section describes the key call flows for SGW relocation feature.

X2 Handover SGW Relocation to cnSGW-C Call Flow

This section describes the X2 handover SGW relocation to cnSGW-C call flow.

Figure 1: X2 Handover SGW Relocation to cnSGW-C Call Flow

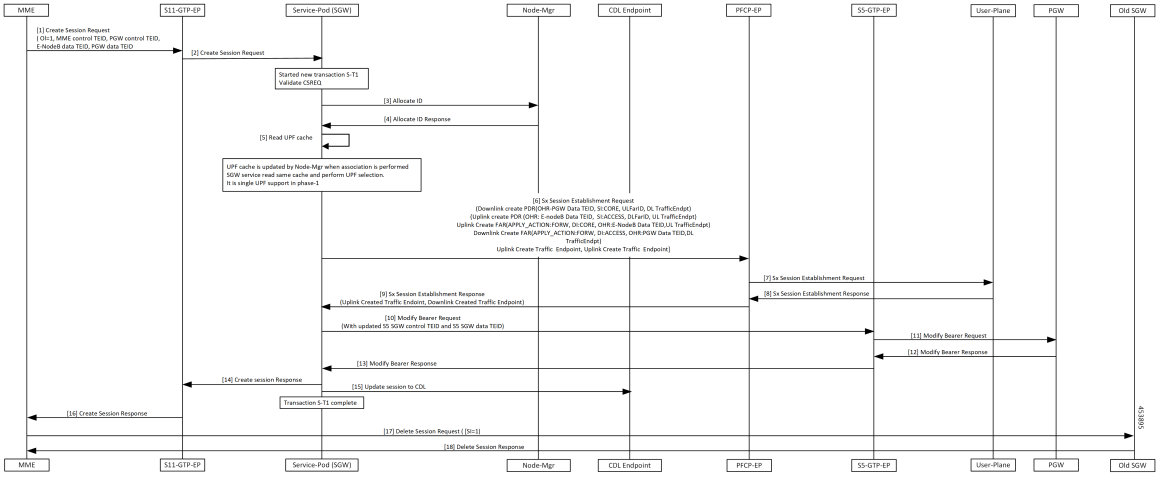

Table 3: X2 Handover SGW Relocation to cnSGW-C Call Flow Description

Step	Description
1	MME sends Create Session Request message to GTPC-EP ingress with the following: • OI flag set • MME Control TEID • PGW Control TEID • eNodeB Data TEID • PGW Data TEID Establishes new transaction at GTPC-EP ingress.
2	SGW service POD receives Create Session Request.
3	SGW service POD Create a new transaction S-T1.
4	Validate Create Session Req.
5	NodeMgr allocates TEID. SGW service POD reads the UPF cache and performs UPF selection.
6	PFCP-EP receives Sx Session Establishment Request from SGW service POD with the uplink and downlink Create PDRs/FARs (Apply Action as Forward)/CTEs.
7	PFCP-EP forwards Sx Session Establishment Request to UPF.
8	PFCP-EP receives Sx Session Establishment Response from UPF with Created CTEs.
9	SGW service POD receives Sx Session Establishment Response from PFCP-EP.
10	Modify Bearer Request with updated S5 SGW Control TEID and S5 SGW Data TEID sent from the SGW service POD to GTPC-EP.
11	PGW receives Modify Bearer Request message from GTPC-EP.
12	GTCP-EP receives Modify Bearer Response from PGW.
13	SGW service POD receives Modify Bearer Response from GTPC-EP.
14	SGW service POD forwards Create Session Response to GTPC-EP ingress.
15	Updated session at CDL. Transaction S-T1 completed.
16	GTPC-EP ingress forwards Create Session Response to MME.
17	MME sends Delete Session Request with SI=1 to old SGW and receives Delete Session Response. Call cleared in old SGW.

S1 Handover SGW Relocation to cnSGW-C Call Flow

This section describes the S1 handover SGW Relocation to cnSGW-C call flow.

Figure 2: S1 Handover SGW Relocation to cnSGW-C Call Flow

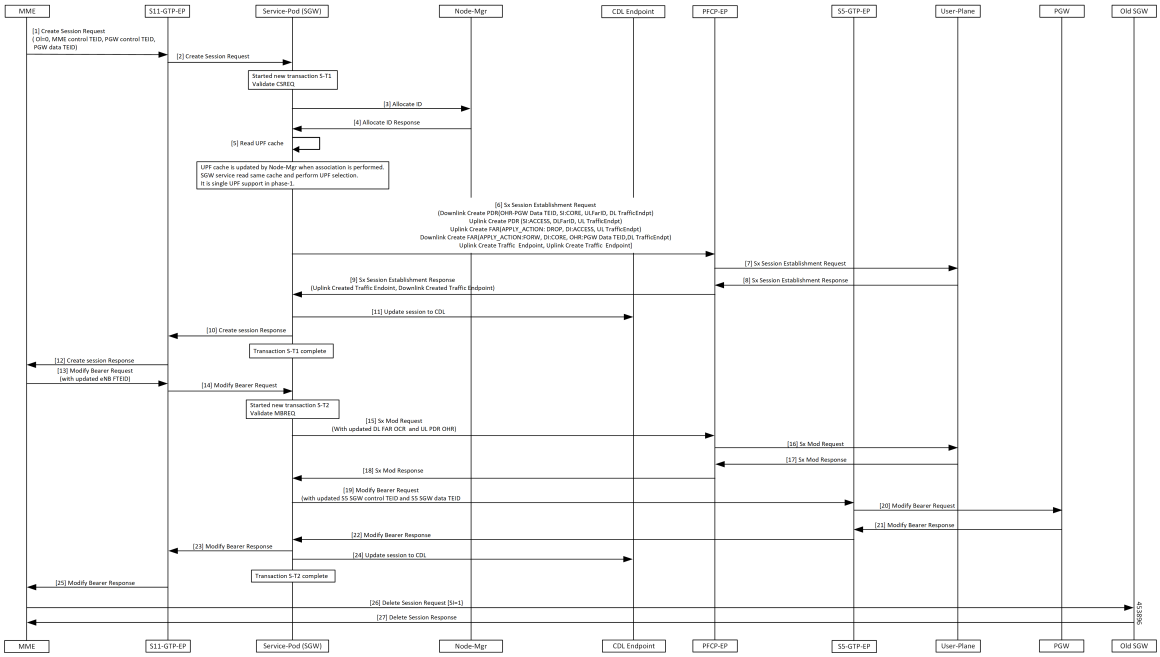

Table 4: S1 Handover SGW Relocation to cnSGW-C Call Flow Description

Step	Description
1	MME sends Create Session Request message to GTPC-EP ingress with the following: • OI flag unset • MME Control TEID • PGW Control TEID • PGW Data TEID Establishes new transaction at GTPC-EP ingress.
2	SGW service POD receives Create Session Request.
3	Create a new transaction S-T1.
4	Validate Create Session Req.
5	NodeMgr allocates TEID. SGW service reads the UPF cache and performs UPF selection.
6	PFCP-EP receives Sx Session Establishment Request from SGW service POD with the following: • Uplink and downlink Create PDRs/FARs (Apply Action as Forward)/CTEs

Step	Description
7	PFCP-EP forwards Sx Session Establishment Request to UPF
8	PFCP-EP receives Sx Session Establishment Response from UPF with Created CTEs.
9	SGW service POD receives Sx Session Establishment Response from PFCP-EP.
10	SGW service POD forwards Create Session Response to GTPC-EP ingress.
11	Updated session at CDL. Transaction S-T1 completed.
12	GTPC-EP ingress forwards Create Session Response to MME.
13	GTPC-EP ingress receives Modify Bearer Req with updated eNodB FTEID from MME.
14	GTPC-EP ingress forwards Modify Bearer Req to SGW service POD. Creates new transaction-T2.
15	PFCP-EP receives Sx Mod Req from SGW service POD with the updated downlink FAR and uplink PDR.
16	PFCP-EP forwards Sx Mod Req to UPF.
17	PFCP-EP receives Sx Mod Response from UPF.
18	SGW receives Sx Mod Response from PFCP-EP.
19	SGW service POD sends Modify Bearer Request with updated S5 SGW Control TEID and S5 SGW Data TEID to GTPC-EP.
20	GTPC-EP forwards Modify Bearer Request to PGW.
21	GTPC-EP receives Modify Bearer Response from PGW.
22	SGW service POD receives Modify Bearer Response from GTPC-EP.
23	GTPC-EP ingress receives Modify Bearer Response from SGW service POD.
24	Session updated at CDL. Transaction S-T2 completed.
25	GTPC-EP ingress forwards Modify Bearer Response to MME.
26	MME sends Delete Session Request with SI=1 to old SGW and receives Delete Session Response. Call cleared in old SGW.

TAU X2 Handover SGW Relocation to cnSGW-C Call Flow

This section describes the TAU X2 handover SGW telocation to cnSGW-C call flow.

Figure 3: TAU X2 Handover SGW Relocation to cnSGW-C Call Flow

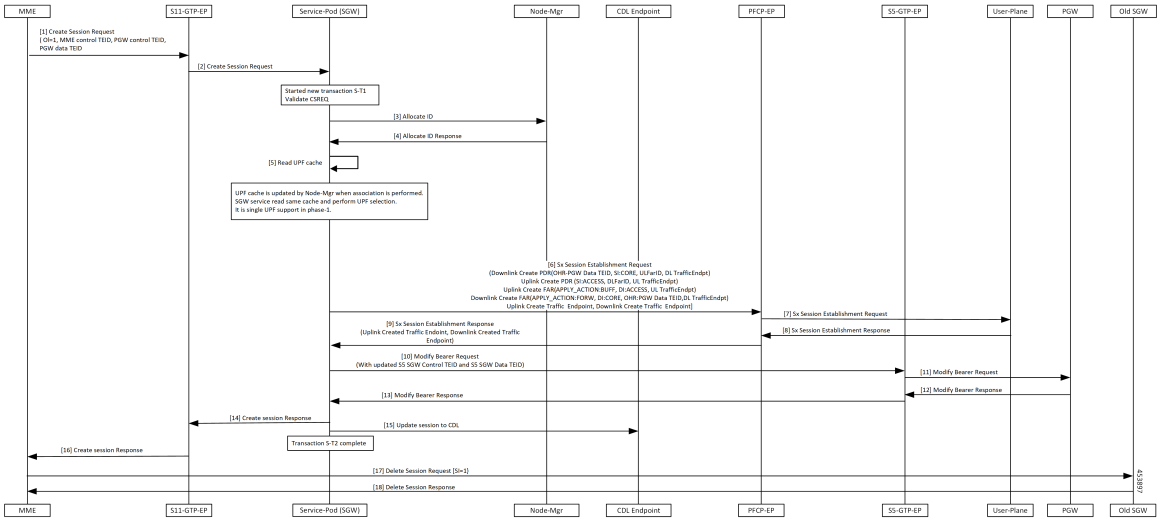

Table 5: TAU X2 Handover SGW Relocation to cnSGW-C Call Flow Description

Step	Description
1	MME sends Create session Req to GTPC-EP ingress with the following: • OI flag set • MME Control TEID • PGW Control TEID • PGW Data TEID Establishes new transaction at GTPC-EP ingress.
2	GTPC-EP ingress forwards Create Session req to SGW service POD.
3	SGW service POD receives Create Session Req. Create a new transaction S-T1.
4	Validate CSReq. NodeMgr performs TEID allocation.
5	SGW service reads UPF Cache and performs UPF selection.
6	PFCP-EP receives Sx Session Establishment Req from SGW service POD with the following: • Uplink and downlink Create PDRs/FARs(ApplyAction as Forward for the uplink FAR)/CTEs.
7	PFCP-EP forwards Sx Session Establishment Req to UPF.
8	PFCP-EP receives Sx Session Establishment Response from UPF.
9	SGW service POD receives Sx Session Establishment Response from PFCP-EP.

Step	Description
10	SGW service POD sends Modify Bearer Req with updated S5 SGW Control TEID and S5 SGW Data TEID to GTPC-EP.
11	GTPC-EP forwards Modify Bearer Request to PGW.
12	GTPC-EP receives Modify Bearer Response from PGW.
13	GTPC-EP forwards Modify Bearer Response to SGW service POD.
14	SGW service POD forwards Create Session Response to GTPC-EP ingress.
15	Session updated at CDL. Transaction S-T1 completed.
16	GTPC-EP ingress forwards Create Session Response to MME.
17	MME sends Delete Session Request with SI=1 sent to old SGW and receives Delete Session Response. Call cleared in old SGW.

X2 Handover SGW Relocation to CN-SGW (Multi PDN) Call Flow

This section describes the X2 handover SGW relocation to CN-SGW (Multi PDN) to cnSGW-C call flow.

Figure 4: X2 Handover SGW Relocation to CN-SGW (Multi PDN) Call Flow

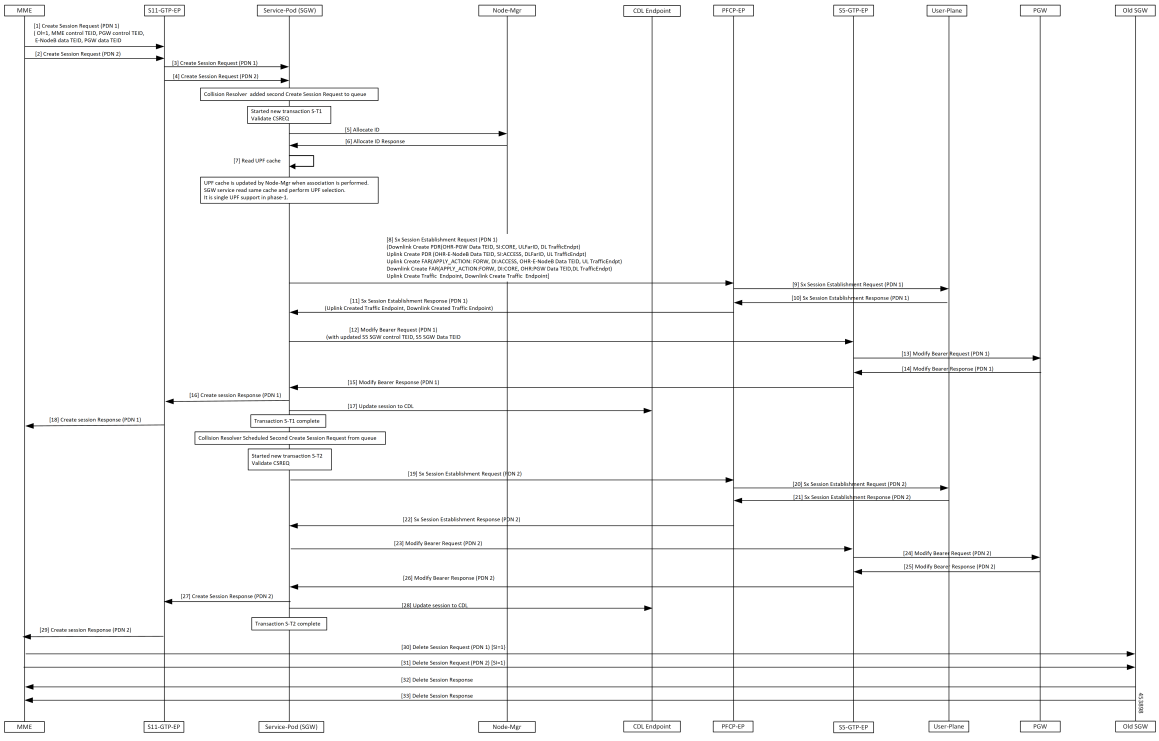

Table 6: X2 Handover SGW Relocation to CN-SGW (Multi PDN) Call Flow Description

Step	Description
1, 2	MME sends Create Session Req for both PDNs to GTPC-EP ingress with the following: • OI flag set • MME Control TEID • PGW Control TEID • eNodeB Data TEID • PGW Data TEID Establishes new transactions at GTPC-EP ingress.
3, 4	SGW service POD receives Create Session Req for both PDNs from PFCP-EP ingress. Collision resolver added Create Session Req for PDN 2 in queue.
5	Create a new transaction S-T1 for Create Session Req for PDN1 Validate CSReq.
6	NodeMgr allocates TEID.
7	SGW service POD reads UPF Cache and performs UPF selection.
8	PFCP-EP receives Sx Session Establishment Req from SGW service POD for PDN 1 with the following: • Uplink and downlink Create PDRs/FARs(ApplyAction as Forward)/CTEs.
9	PFCP-EP forwards Sx Session Establishment Req for PDN 1 to UPF.
10	UPF sends Sx Session Establishment Response for PDN 1 to PFCP-EP with Created CTEs.
11	PFCP-EP forwards Sx Session Establishment Response for PDN 1 to SGW service POD.
12	SGW service POD sends Modify Bearer Req for PDN 1 to GTPC-EP with the following: • Updated S5 SGW Control TEID • S5 SGW Data TEID
13	GTPC-EP forwards Modify Bearer Req for PDN 1 to PGW.
14	PGW sends Modify Bearer Response for PDN 1 to GTPC-EP.
15	GTPC-EP forwards Modify Bearer Response for PDN 1 to SGW service POD.
16	SGW service forwards Create Session Response for PDN 1 to GTPC-EP ingress.
17	Session updated at CDL. Transaction S-T1 completed. Collision resolver schedules Create Session Req for PDN 2 from queue.

Step	Description
18	GTPC-EP ingress forwards Create Session Response for PDN 1 to MME.
19 - 27	Repeat steps from 8 to 16 for PDN2.
28	Session updated at CDL. Transaction S-T2 completed.
29	GTPC-EP ingress forwards Create Session Response for PDN 2 to MME.
30 - 33	MME sends Delete Session Request for both PDNs with SI=1 to old SGW and receives Delete Session Response. Call cleared in old SGW.

S1 Handover SGW Relocation to CN-SGW (Multi PDN) Call Flow

This section describes the S1 handover SGW relocation to CN-SGW (Multi PDN) to CN-SGW call flow.

Figure 5: S1 Handover SGW Relocation to CN-SGW (Multi PDN) Call Flow

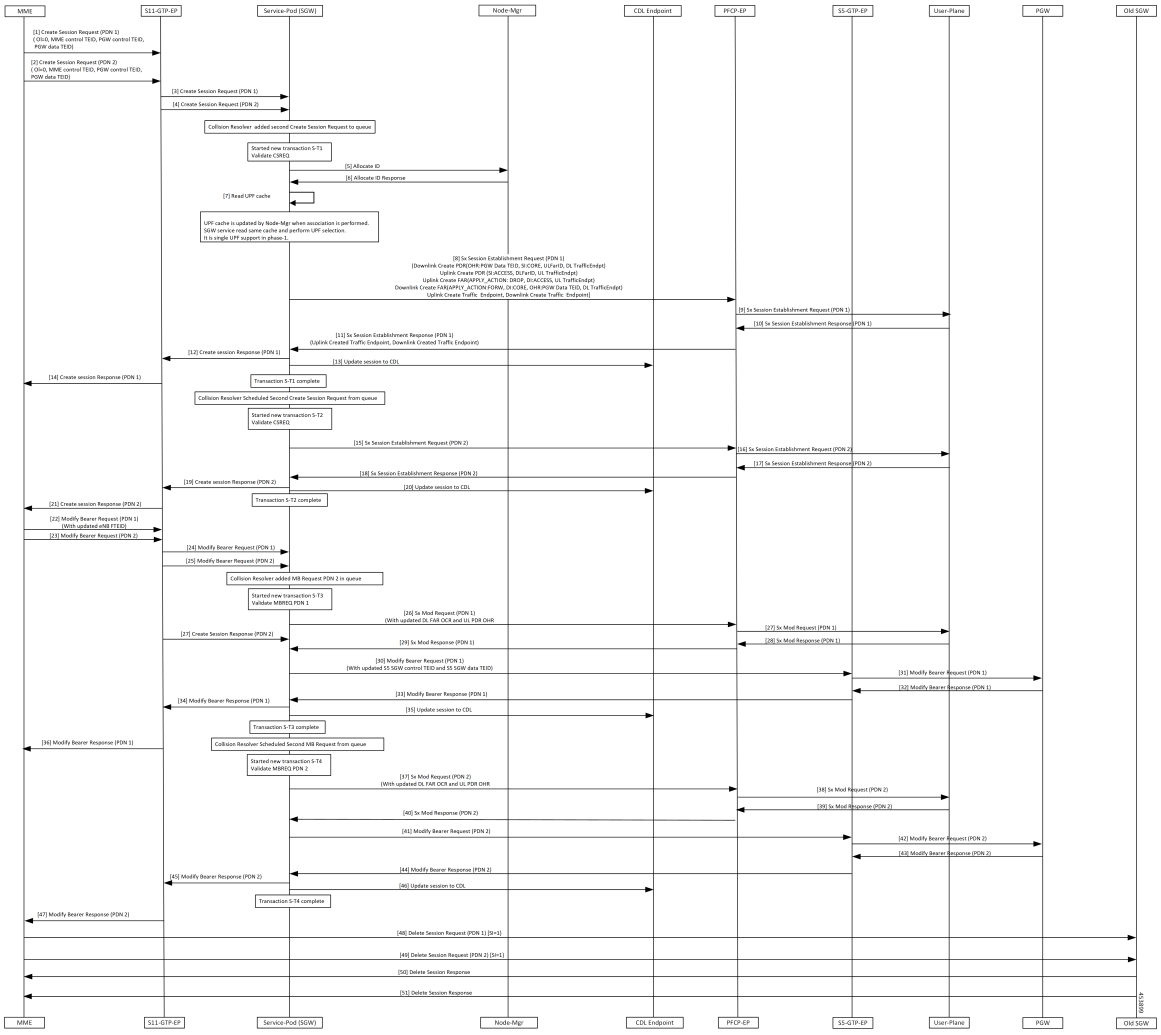

Table 7: S1 Handover SGW Relocation to CN-SGW (Multi PDN) Call Flow Description

Step	Description
1, 2	GTCP-EP ingress receives Create Session Req for both the PDNs with the following: • Ol flag unset • MME control TEID • PGW control TEID • PGW Data TEID Establishes new transaction at GTPC-EP ingress.
3, 4	SGW service POD receives Create Session Req for both the PDNs from GTPC-EP ingress. Collision resolver added Create Session Req for PDN 2 in queue. Create a new transaction S-T1.
5	Validate CSReq.
6	NodeMgr allocates TEID.
7	SGW service reads UPF Cache and performs UPF selection.
8	PFCP-EP receives Sx Session Establishment Req from SGW service POD for PDN 1 with the following: • Uplink and downlink Create PDRs/FARs/CTEs.
9	PFCP-EP forwards Sx Session Establishment Req for PDN 1 to UPF.
10	PFCP-PE receives Sx Session Establishment Response for PDN 1 from UPF with Created CTEs.
11	SGW service POD receives Sx Session Establishment Response for PDN 1 from PFCP-EP.
12	SGW service POD forwards Create Session Response for PDN 1 to GTPC-EP ingress.
13	Session updated at CDL. Transaction S-T1 completed. Collision resolver scheduled Create Session Req for PDN 2 from queue.
14	GTPC-EP ingress forwards Create Session Response for PDN 1 to MME.
15–21	Repeat steps 11–14 for PDN2(S-T2).
22, 23	GTPC-EP ingress receives Modify Bearer Req for both the PDNs with updated eNodB FTEID from MME.
24, 25	GTPC-EP ingress forwards Modify Bearer Req to both PDNs to SGW service POD. Collision resolver added Modify Bearer Req for PDN 2 in the queue. Create a new transaction S-T3.

Step	Description
26	PFCP-EP receives Sx Session Modification Req for PDN 1 from SGW service POD with the updated downlink FAR and uplink PDR.
27	PFCP-EP forwards Sx Session Modification Req for PDN 1 to UPF.
28	UPF sends Sx Session Modification Response for PDN 1 to PFCP-EP.
29	SGW service POD receives Sx Modify Response for PDN 1 from PFCP-EP.
30	GTPC-EP receives Modify Bearer Req for PDN 1 from SGW service POD with the following: • Updated S5 SGW Control TEID and S5 SGW Data TEID.
31	GTPC-EP forwards Modify Bearer Req for PDN 1 to PGW.
32	GTPC-EP receives Modify Bearer Response for PDN 1 from PGW.
33	GTPC-EP forwards Modify Bearer Response for PDN 1 to SGW service POD.
34	SGW service POD forwards Modify Bearer Response for PDN 1 to GTPC-EP ingress.
35	Session updated at CDL.
36	GTPC-EP ingress forwards Modify Bearer Response for PDN 1 to MME.
37	SGW service POD sends Modify Bearer Req for PDN 2 to PFCP-EP. Transaction S-T3 completed. Collision resolver schedules Modify Bearer Req to PDN 2.
38–40	Repeat steps 27,28, 29 for PDN 2.
41	SGW service POD sends Modify Bearer request for PDN 2 to GTPC-EP.
42–47	Repeat steps 31–36 for PDN 2.
48, 49	MME sends Delete Session Request for both the PDNs with SI=1 sent to old SGW.
50	MME receives Delete Session Response. Call cleared in old SGW.

X2 Handover SGW Relocation with Bearer Context Marked for Removal Call Flow

This section describes the X2 handover SGW relocation with bearer context marked for removal call flow.

Figure 6: X2 Handover SGW Relocation with Bearer Context Marked for Removal Call Flow

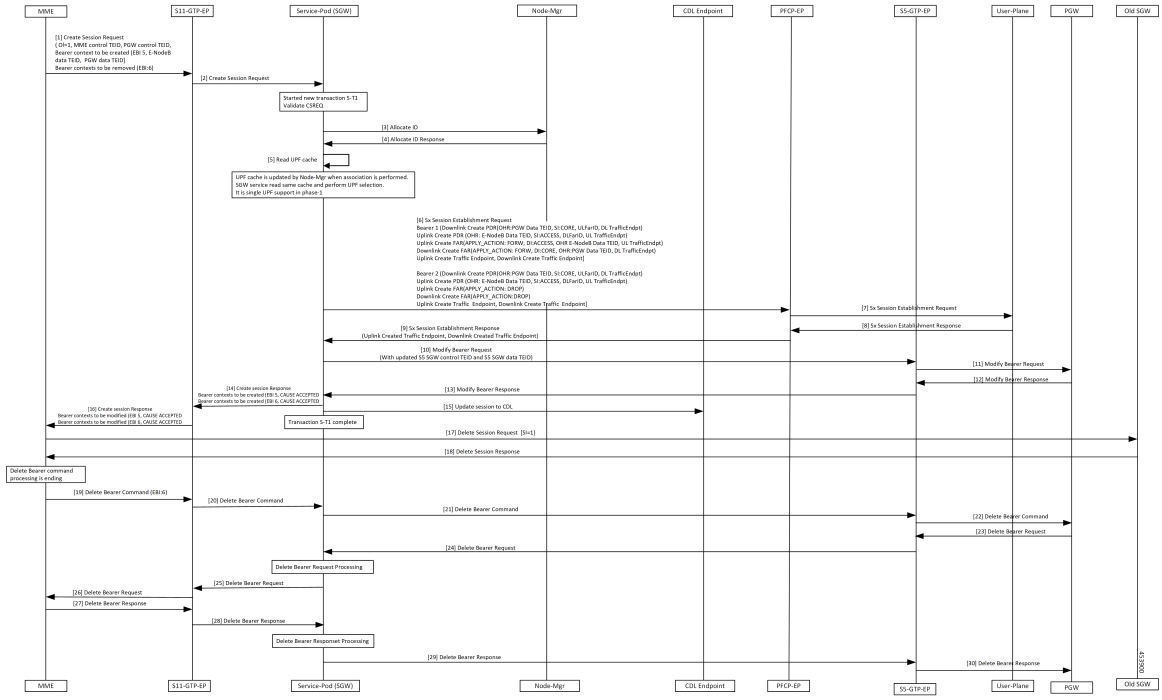

Table 8: X2 Handover SGW Relocation with Bearer Context Marked for Removal Call Flow Description

Step	Description
1	GTPC-EP ingress receives Create Session Req with the following: • OI flag set • MME Control TEID • PGW Control TEID • new Bearer Contexts to create (EBI:5, eNodeB Data TEID and PGW Data TEID) • Bearer context to delete (EBI: 6) Establishes new transaction at GTPC-EP.
2	GTPC-EP ingress forwards Create Session Req to SGW service POD.
3	SGW service POD receives Create Session Req. Create a new transaction S-T1.
4	Validate CSReq. NodeMgr allocates TEID.
5	SGW service POD reads UPF Cache and performs UPF selection.

Step	Description
6	PFCP-EP receives Sx Session Establishment Req from SGW service POD with the following: • Uplink and downlink Create PDRs/FARs (ApplyAction as Forward for EBI 5 and as Drop EBI 6)/CTEs.
7	PFCP-EP forwards Sx Session Establishment Req to UPF.
8	PFCP-EP receives Sx Session Establishment Response from UPF with Created CTEs.
9	SGW service POD receives Sx Session Establishment Response from PFCP-EP.
10	SGW service POD sends Modify Bearer Req with updated S5 SGW Control TEID and S5 SGW Data TEID to GTPC-EP.
11	GTPC-EP forwards Modify Bearer Request to PGW.
12	GTPC-EP receives Modify Bearer Response from PGW.
13	GTPC-EP forwards Modify Bearer Response to SGW service POD.
14	SGW service POD sends Create Session Response to GTPC-EP ingress with cause Accepted for both Bearer Contexts.
15	Session updated at CDL. Transaction S-T1 completed.
16	GTPC-EP ingress forwards Create Session Response to MME.
17	MME sends Delete Session Request with SI=1 sent to old SGW.
18	MME receives Delete Session Response. Call cleared in old SGW.
19	GTPC-EP ingress receives Delete Bearer Command for Bearer Context from MME to delete (EBI 6).
20	SGW service POD receives Delete Bearer Command from GTPC-EP ingress.
21	SGW service POD forwards Delete Bearer Command to GTPC-EP.
22	GTPC-EP forwards Delete Bearer Command to PGW.
23	PGW responds with Delete Bearer Request (EBI 6) to GTPC-EP.
24	GTPC-EP forwards Delete Bearer Request to SGW service POD.
25	SGW service POD processes Delete Bearer Request and sends to GTPC-EP.
26	GTPC-EP ingress forwards Delete Bearer request to MME.
27	MME responds with the Delete Bearer Response to GTPC-EP ingress.
28	GTPC-EP ingress forwards Delete Bearer Response to SGW service POD.
29	SGW service POD processes Delete Bearer Response and sends to GTPC-EP.

Step	Description
30	GTPC-EP forwards Delete Bearer Response to PGW.

S1 Handover SGW Relocation with Bearer Context Marked for Removal Call Flow

This section describes the S1 handover SGW relocation with bearer context marked for removal call flow.

Figure 7: S1 Handover SGW Relocation with Bearer Context Marked for Removal Call Flow

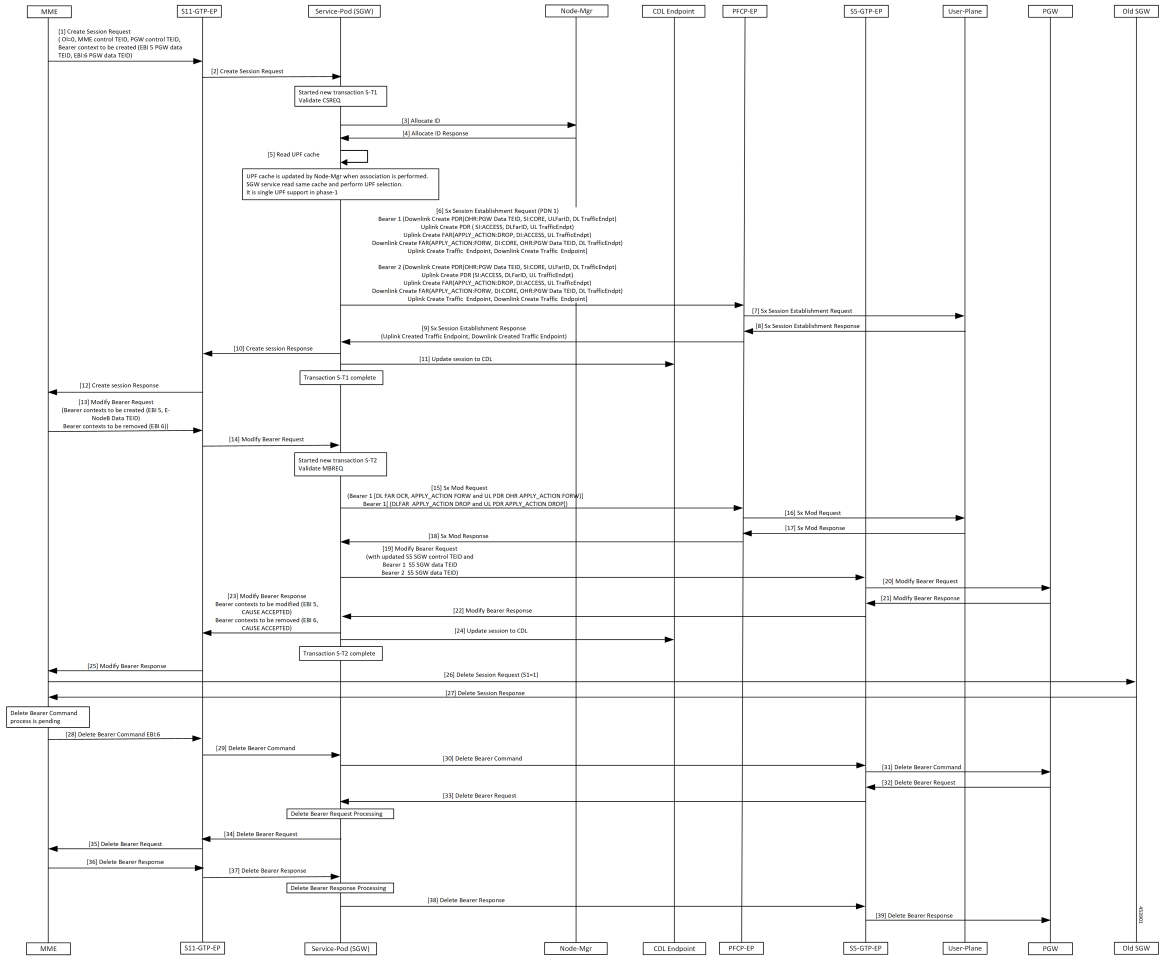

Table 9: S1 Handover SGW Relocation with Bearer Context Marked for Removal Call Flow Description

Step	Description
1	GTPC-EP ingress receives Create Session Request from MME with the following: • OI flag unset • MME Control TEID • PGW Control TEID • Bearer context to create (EBI:5, PGW Data TEID, EBI:6, PGW Data TEID) Establishes new transaction at GTPC-EP ingress.
2	GTPC-EP ingress forwards Create Session req to SGW service POD.
3	SGW service POD receives Create Session Req. Create a new transaction S-T1.
4	Validate CSReq. NodeMgr allocates TEID.
5	SGW service reads UPF cache and performs UPF selection.
6	PFCP-EP receives Sx Session Establishment Req from SGW service with the following: • Uplink and downlink Create PDRs/FARs(ApplyAction as Forward for EBI 5 and as Drop EBI 6)/CTEs.
7	PFCP-EP forwards Sx Session Establishment Req to UPF.
8	PFCP-EP receives Sx Session Establishment Response from UPF with Created CTEs.
9	SGW service receives Sx Session Establishment Response from PFCP-EP.
10	SGW forwards Sx Session Establishment Response to GTPC-EP ingress.
11	Session updated at CDL. Transaction S-T1 completed.
12	GTPC-EP ingress sends Create Session Response to MME.
13	GTPC-EP ingress receives Modify Bearer Req with the following: • Updated eNodeB FTEID with new Bearer Contexts (here EBI 5) and removed (here EBI 6).
14	GTPC-EP forwards Modify Bearer Req to SGW.
15	Create a new transaction S-T2. PFCP-EP receives Sx Session Modification Req from SGW service POD with the following: • Updated downlink FAR and uplink PDR (Apply Action as DROP for Bearer 2).
16	PFCP-EP forwards Sx Session Modification Req forwarded to UPF.

Step	Description
17	UPF sends Sx Modification Response to PFCP-EP
18	PFCP-EP forwards Sx Modification Response to SGW service POD.
19	SGW service POD sends Modify Bearer Req with updated S5 SGW Control TEID and S5 SGW Data TEID to GTPC-EP.
20	GTPC-EP forwards Modify Bearer Request to PGW.
21	GTPC-EP receives Modify Bearer Response from PGW.
22	GTPC-EP forwards Modify Bearer Response to SGW service POD.
23	SGW service POD forwards Create Session Response to GTPC-EP ingress with cause Accepted for both Bearer Contexts.
24	Session updated at CDL. Transaction S-T2 completed.
25	GTPC-EP ingress sends Modify Bearer Response to MME.
26	MME sends Delete Session Request with SI=1 to old SGW.
27	MME receives Delete Session Response. Call cleared in old SGW.
28	GTPC-EP ingress receives Delete Bearer Command from MME for BearerContext to delete (EBI 6).
29	SGW service POD receives Delete Bearer Command from GTPC-EP ingress.
30	SGW service POD forwards Delete Bearer Command to GTPC-EP.
31	GTPC-EP forwards Delete Bearer Command to PGW.
32	PGW responds with Delete Bearer Request (EBI 6) to GTPC-EP.
33	GTPC-EP sends Delete Bearer Request to SGW service POD.
34	SGW service POD processes Delete Bearer Request and sends to GTPC-EP ingress.
35	GTPC-EP ingress sends Delete Bearer request to MME.
36	MME responds with the Delete Bearer Response to GTPC-EP ingress.
37	GTPC-EP ingress receives Delete Bearer response and sends to SGW service POD.
38	SGW service POD processes Delete Bearer Response and forwards to GTPC-EP.
39	GTPC-EP forwards Delete Bearer Response to PGW.

Inter and Intra MME Handover and S1 SGW Relocation with Less Number of Bearer Context Call Flow

This section describes the inter and intra MME handover and S1 SGW relocation with less number of bearer context call flow.

Figure 8: Inter and Intra MME Handover and S1 SGW Relocation with Less Number of Bearer Context Call Flow

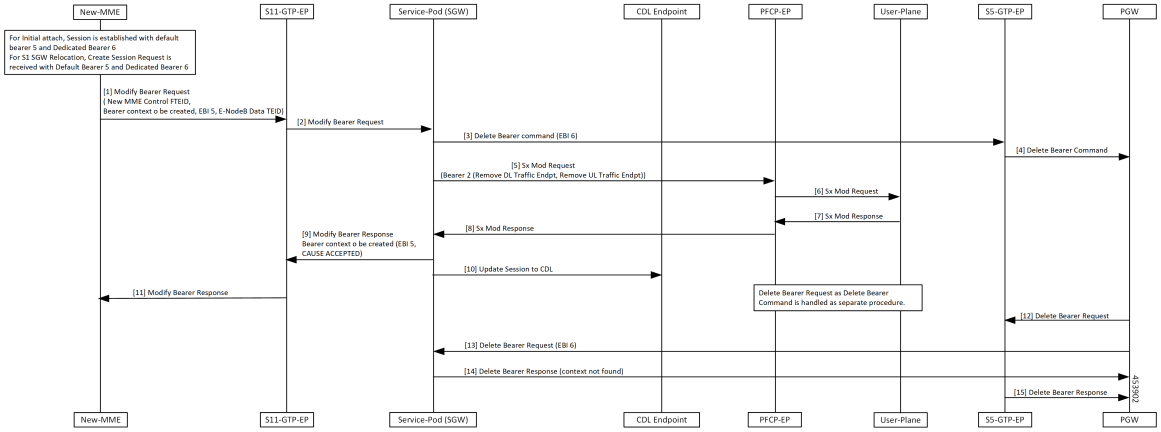

Table 10: Inter and Intra MME Handover and S1 SGW Relocation with Less Number of Bearer Context Call Flow Description

Step	Description
1	Established NEW MME session with the default bearer EBI 5 and dedicated bearer 6. New MME receives Create Session Request for S1 SGW Relocation with Default bearer EBI 5 and dedicated bearer 6. New MME sends Modify Bearer Request to GTPC-EP ingress with the following: • New MME Control TEID • New Bearer Contexts to create • EBI5 • eNodeB Data TEID
2	GTPC-EP ingress forwards Modify Bearer Request to SGW service POD.
3	SGW service POD sends Delete Bearer Command with EBI 6 to GTPC-EP.
4	GTPC-EP forwards Delete Bearer Command to PGW.
5	SGW service POD sends Sx Mod Req to PFCP-EP with Remove DL Traffic Endpoint and Remove UL Traffic Endpoint for Bearer 2.
6	PFCP-EP forwards Sx Mod Req to UPF.
7	UPF sends Sx Mod Response to PFCP-EP.
8	PFCP-EP forwards Sx Mod Response to SGW service POD.

Step	Description
9	SGW service POD sends Modify Bearer Response to GTPC-EP ingress with the following: • Bearer Contexts EBI 5 to modify with cause as *Accepted*
10	Updated session to CDL.
11	GTPC-EP ingress sends Modify Bearer Response to New MME.
12	PGW sends Delete Bearer Request to GTPC-EP.
13	SGW service POD receives Delete Bearer Request with EBI6 from PGW as Delete Bearer Command handled as separate procedure.
14	SGW service POD responds with Delete Bearer Response with cause as *Context Not Found* to GTPC-EP.
15	GTPC-EP forwards Delete Bearer Response to PGW.

Note

- Sx Modify Request message along with Remove DL traffic Endpoint and Remove UL traffic Endpoint is sent as don't confirm message in Legacy CUPS. Sx Modify for MBReq message follows Sx Modify Request and sent to UPF.
- UPF receives the following messages in cnSGW-C.
  - Single Sx Modify Request message for MB Request
  - Remove DL traffic Endpoint
  - Remove UL traffic Endpoint

SGW Relocation OAM Support

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