Indirect Forwarding Tunnel

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Revision History

Revision Details	Release
First introduced	2021.02.0

Feature Description

The UPF supports Indirect Forwarding Tunnel (IDFT) procedures for creation and deletion, which are applicable for Pure-S and Collapsed calls with dedicated bearers. This feature is applicable for IDFT support with S-GW Relocation.

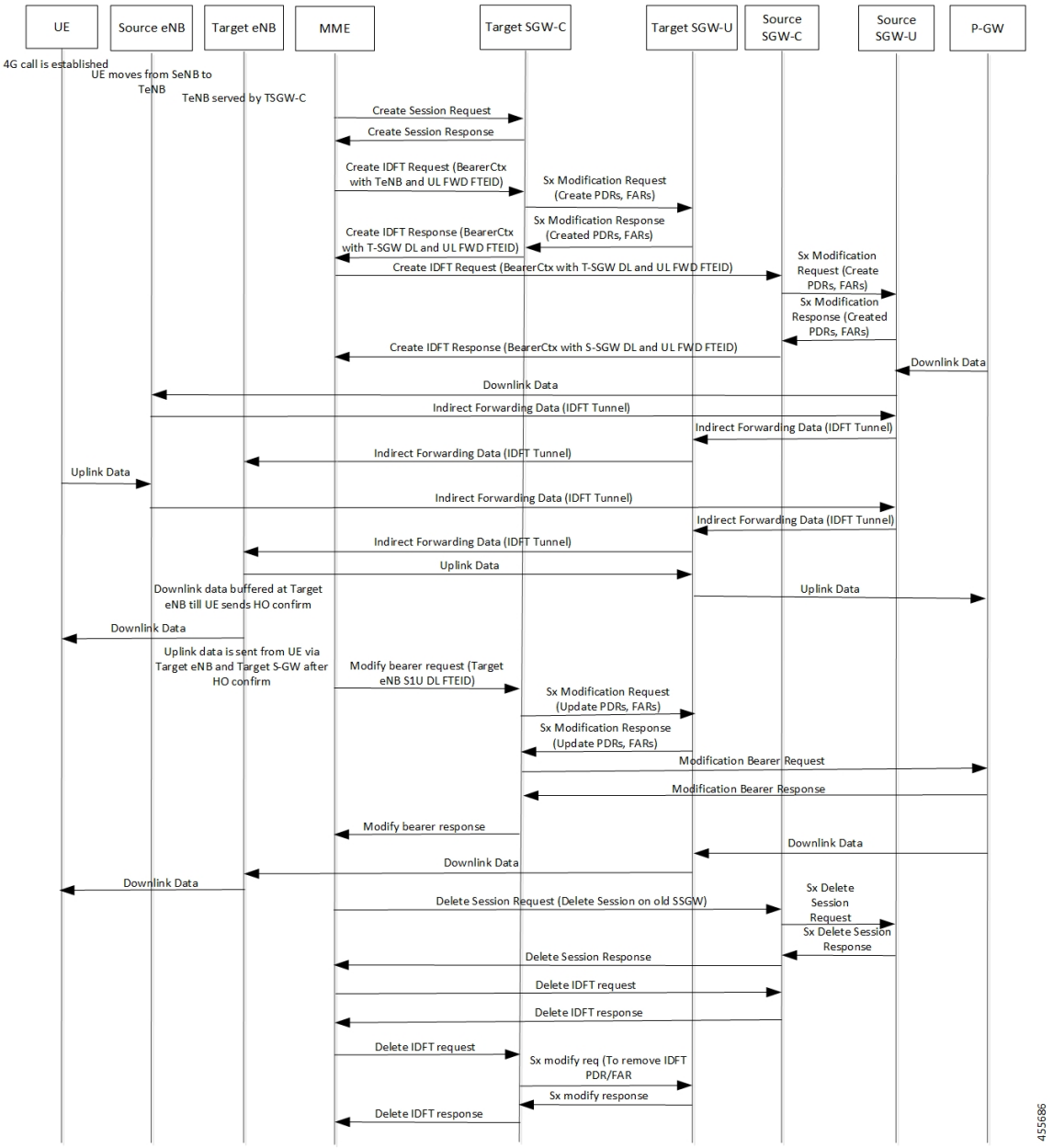
Note The IDFT in UPF is a CLI-controlled feature. By default, the IDFT feature in UPF is disabled.

How It Works

Call Flow

The following call flow illustrates the IDFT support with S-GW Relocation.

Figure 1: IDFT Support with S-GW Relocation



The above call flow describes the IDFT tunnels establishment and deletion with S-GW relocation and without MME change.

If IDFT tunnels are not deleted by MME, then S-GW initiates the local delete of IDFT tunnels.

This feature supports the following scenarios for the Pure-S and Collapse calls:

- S-GW relocation with same MME
- S-GW relocation with same MME and different eNodeB
- S-GW relocation with different MME

- S1-based eNodeB Handoff
- EUTRAN to UTRAN Handoff
- EUTRAN to UTRAN Handoff with S-GW relocation
- UTRAN to EUTRAN Handoff
- UTRAN to EUTRAN Handoff with S-GW relocation
- Tracking Area Update (TAU) with S-GW change and indirect data forwarding
- Radio Access Bearer (RAB) during Active IDFT
- Sx transaction timeout during IDFT setup or removal
- Pending Sx transaction (event from PCRF or OCS) and IDFT request comes in
- Create Bearer Request (CBR) during Active IDFT
- Update Bearer Request (UBR) during Active IDFT
- Delete Bearer Request (DBR) during Active IDFT
- Modify Bearer Request (MBR) behavior on other PDN during Active IDFT
- Source MME path failure
- Target MME path failure
- MME path failure with NTSR enabled
- eGTP-C S5 path failure
- eGTP-C S5 path failure with P-GW restart notification enabled
- Sx path failure (clean IDFT and calls)
- Abort session (clear sub all, local abort, and so on.)
- CBR, UBR on other PDN during Active IDFT
- DBR on other PDN/bearer during Active IDFT
- S1-u path failure for target eNodeB
- S1-u path failure for source eNodeB
- S-GW path failure for source S-GW
- S-GW path failure for target S-GW
- S1-u error indication on the default bearer while Active IDFT
- S1-u error indication on the dedicated bearer while Active IDFT
- S1-u error indication from the target S-GW to source S-GW bearer
- S1-u error indication from the target eNodeB to target S-GW bearer
- Sending End Marker when tearing down IDFT tunnel after failure
- If SMF ICSR/SR leads to the cleanup of IDFTs, the UPF also cleans the IDFT PDRs/FARs

5G to 4G Handover with IDFT

In compliance with 3GPP TS 23.502 v15.5.1, the 5G to 4G handover with IDFT is supported in UPF. Refer the "5GS to EPS handover using N26 interface" section in the 3GPP specification for details about call/datapath flow for IDFT.

This functionality isn't CLI-controlled in UPF.

4G to 5G Handover with IDFT

In compliance with 3GPP TS 23.502 v15.5.1, the 4G to 5G handover with IDFT is supported in UPF. Refer the "EPS to 5GS handover using N26 interface" (preparation and execution phase) section in the 3GPP specification for details about the call flow.

This functionality isn't CLI-controlled in UPF.

Supported Functionality

The IDFT feature supports the following functionality:

- Create IDFT request for Collapsed, Pure-S, combination of Collapsed and Pure-S multi-PDN calls with multiple bearers.
- Data transfer on downlink and uplink IDFT bearers.
- Deletion of IDFT request from MME. Also, timer-based deletion of IDFT bearer after expiration of a default value of 100 seconds, if the MME does not send an IDFT request for deletion.
- Deletion of IDFT PDN, including Clear/Delete subscribers from MME/P-GW, when normal PDN goes down.
- IDFT creation of Sx Failure Handling for Pure-S and Collapsed PDN.

Important Transport GTP-U address capability is assumed to be same across eNodeB and S-GW.

Limitations

The IDFT feature has the following limitations:

- Message interaction and collision during IDFT PDN establishment or deletion with any other procedure is not supported.
- S11/S5 and Sx Path Failure Handling on non-IDFT PDN is not supported when IDFT PDN is Active.
- Deletion of partial dedicated bearers in IDFT connected-state is not supported.

Configuring Indirect Forwarding Tunnel

This section describes the CLI commands available in support of IDFT feature.

Enabling Indirect Forwarding Tunnel Feature

On SMF, use the following CLI commands to enable or disable the IDFT feature.

```
configure
  context context_name
    sgw-service service_name
      [ default | no ] egtp idft-support
      end
```

NOTES:

- **idft-support**: Enables/Disables the IDFT feature in UPF.
- By default, the IDFT feature is disabled and this CLI command is applicable on run-time change.

Verifying the Indirect Forwarding Tunnel Feature

show sgw-service name <service_name>

On SMF, the output of this CLI command has been enhanced to display if the IDFT feature is enabled or disabled.

- IDFT-Feature Support for CUPS: Enabled/Disabled

Monitoring and Troubleshooting

This section provides information regarding the CLI commands available in support of monitoring and troubleshooting the feature.

Show Commands Input and/or Outputs

This section provides information regarding show commands and their outputs in support of the feature.

show subscribers saegw-only full all

On UPF, use this command to see the IDFT Local and Remote TEID data. The following is a sample output:

```
Indirect Fwding   : Active
DL fwd local  addr: 209.165.201.28          DL fwd remote   addr: 209.165.201.27
DL fwd local  teid: [0x80028004]            DL fwd remote   teid: [0x2002d2e5]
UL fwd local  addr: 209.165.201.28          UL fwd remote   addr: 209.165.201.27
UL fwd local  teid: [0x8002a004]            UL fwd remote   teid: [0x20042bca]
```

show subscribers user-plane-only callid <call_id> pdr all

On UPF, use this command to see the PDRs created for IDFT. The following is a sample output:

Important IDFT PDRs will have ACCESS as the source and destination interface type.

```
+-----Source Interface:          (C) - Core            (A) - Access
|-----Type                       (P) - CP-function     (.) - Unknown
|
|+----Destination Interface:     (C) - Core            (A) - Access
||----Type                       (P) - CP-function     (.) - Unknown
||
||
||+---Rule-Type:                 (S) - Static          (P) - Predefined
|||---Type                       (D) - Dynamic         (.) - Unknown
|||
|||
vvv   PDR-ID    Associated FAR-ID    Associated URR-ID(s)    Associated QER-ID(s)
---   ------    -----------------    --------------------    --------------------
ACS   0x0001         0x8001              n/a                  0x80000001
CAS   0x0002         0x8002              n/a                  0x80000001
ACD   0x0003         0x0003           0x00000007              0x00000002
                                         n/a                  0x80000003
CAD   0x0004         0x0004           0x00000007              0x00000002
                                         n/a                  0x80000003
CAD   0x0005         0x0005           0x00000000              n/a
ACD   0x0006         0x0006           0x00000000              n/a
CAD   0x0007         0x0007           0x00000000              n/a
ACD   0x0008         0x0008           0x00000000              n/a
AAD   0x0009         0x0009           0x00000000              n/a
AAD   0x000A         0x000A           0x00000000              n/a
AAD   0x000B         0x000B           0x00000000              n/a
AAD   0x000C         0x000C           0x00000000              n/a

Total subscribers matching specified criteria: 1
```

Similarly, you can use the **show subscribers user-plane-only callid** *call_id* **far all** CLI command to see the FARs created for IDFT

show subscribers user-plane-only full all

Important Data statistics on IDFT PDRs are captured in the same way as existing PDR statistics. However, it is captured with a limitation – Statistics for DL and UL IDFT will be incremented in Pkts-Down and Bytes-Down category.

The following is sample output:

```
Static & Predef Rule Match stats:
Rule Name            Pkts-Down  Bytes-Down Pkts-Up    Bytes-Up   Hits       Match-Bypassed
  FP-Down(Pkts/Bytes)  FP-Up(Pkts/Bytes)
-------------------- ---------- ---------- ---------- ---------- ---------- --------------
  -------------------  -----------------
catchall                      0          0          3       1368          3              0
          0/0              0/0

Dynamic Rule Match stats:
PDR Id   Pkts-Down  Bytes-Down Pkts-Up    Bytes-Up   Hits       Match-Bypassed
FP-Down(Pkts/Bytes)    FP-Up(Pkts/Bytes)
-------- ---------- ---------- ---------- ---------- ---------- --------------
-------------------    -----------------
0x0004        2       856          0          0          2              0              0/0
                 0/0
0x000b        2       856          0          0          2              0              0/0
                 0/0
0x000c        2       168          0          0          2              0              0/0
                 0/0
```