

LTE - Wi-Fi Seamless Handover in CUPS

- Revision History, on page 1
- Feature Description, on page 1
- How It Works, on page 2
- Configuring LTE and Wi-Fi Seamless Handover, on page 3
- Monitoring and Troubleshooting, on page 4

Revision History

Note Revision history details are not provided for features introduced before release 21.24.

Revision Details	Release
First introduced	Pre 21.24

Feature Description

Seamless handovers between LTE and Wi-Fi (S2a/S2b), for UEs that need continuity with their ongoing data session, is supported in the CUPS architecture.

When handover is initiated from LTE to Wi-Fi, the Delete Bearer Request (DBR) is sent over the LTE tunnel immediately when the Create Session Response (CSR) is sent on the Wi-Fi tunnel. This causes some packet loss because of the IPSec tunnel establishment delay at the ePDG. To address the issue of packet loss, a Delete Bearer Request is sent on LTE tunnel only on expiry of the configured handover timer. If the LTE tunnel is active, uplink and downlink data are exchanged on the LTE tunnel. When handover is complete, uplink and downlink data is exchanged on the Wi-Fi tunnel. This prevents packet loss. During Wi-Fi to LTE handover, if the Modify Bearer Request is received with HI=1, it initiates a tunnel switch from Wi-Fi to LTE as per the specification.

With this feature, the following benefits are seen:

- Minimum packet loss during LTE to Wi-Fi (S2bGTP) handover and making the handover seamless (that is, MAKE before BREAK).

- LTE procedures are handled gracefully over the LTE tunnel when both tunnels are established with the P-GW.
- Wi-Fi procedures are handled gracefully over the Wi-Fi tunnel when both tunnels are established with the P-GW.

Important

- In an LTE to Wi-Fi or Wi-Fi to LTE handover, a tunnel identifier is allocated for new access traffic type for experiencing seamless handover.

How It Works

LTE - Wi-Fi Handover

- Before HO is started:
  - In case of multiple outstanding CCR-Us being supported, all requests before the hand-off requests are dropped.
  - Any pending transactions on LTE access are discarded. For example, if CBR or UBR is sent for LTE access and hand-off is initiated before completion of CBR or UBR transaction, then CBR or UBR is ignored at the P-GW. PCRF is not notified about failure.
- During the transition period:
  - If PCRF sends RAR for policy change, it is processed after handover is complete.
  - If ASR is received, then call drop occurs and both tunnels go down.
  - If session-release occurs from PCRF, then call is dropped and CSR is sent with cause as “no-resources”.
  - If the user moves back to LTE (that is, recurring handoff from LTE to Wi-Fi to LTE) with HO-Ind set to 1 (after guard timer), then the HO is processed successfully and user session is moved to LTE again.
  - If the user moves back to LTE (that is, recurring handoff from LTE to Wi-Fi to LTE) with HO-Ind set to 0, then it leads to context replacement. Old call is cleared on Wi-Fi access with the reason "Context Replacement", and the call is processed like a new call over LTE.
  - If Modify Bearer Command (MBC) is received in LTE (New access), it is rejected with Service-Denied message.
  - If Modify Bearer Command (MBC) is received in Wi-Fi (Old access), it is discarded.
  - If Delete Bearer Command (DBC) is received in LTE (New access) during the HO in progress, session is terminated.
  - In case of Sx Path Failure during an ongoing handover, on-going transactions are aborted, resulting in tearing down the call locally.
  - GTPC S5/S11 path failure

- During LTE to Wi-Fi HO, if path failure occurs on an older tunnel, then the call is cleared. If path failure occurs on a newer tunnel, it result in tearing the call .
- During the Wi-Fi to LTE HO, when path failure happens on an older tunnel, the older tunnel is cleared and the new tunnel call continues. This is possible only if the MBReq is pending from MME. In all other states, the call is teared down locally.
- WIFI to LTE (Collapsed call) HO, call continuation is not possible. Path failure on an older tunnel only results in tearing down the call locally.
- During the HO, if path failure occurs on a Newer tunnel, it will result in tearing down the call.

ICSR and Session Recovery

- At Control Plane, during transition, the most recent is considered as the stable state and a full checkpoint is triggered once handover is complete from LTE to Wi-Fi (S2BGTP) or vice-versa. This is applicable to Session Recovery and ICSR. User Plane has individual session recovery and ICSR check pointing on every message received.
- During handover failure, that is, when CP and UP are out of sync, the CP session is recovered on the most recently accessed state and UP is recovered in the new transition state. This behavior is applicable during UP failure.

Limitations

The LTE - Wi-Fi Seamless Handover feature does not support LTE to eHRPD and Wi-Fi to eHRPD handover and hand back.

Standards Compliance

The LTE – Wi-Fi Seamless Handover feature is compliant with the following standards:

- 3GPP TS 23.214
- 3GPP TS 29.244
- 3GPP TS 23.401
- 3GPP TS 23.402

Configuring LTE and Wi-Fi Seamless Handover

The following section provides information about the CLI commands available to enable or disable the feature.

Use the following CLI commands to configure LTE to Wi-Fi handover timer.

```
configure
  context context_name
    apn apn_name
      lte-s2bgtp-first-uplink timeout_value
```

```
{ default | no } lte-s2bgtp-first-uplink
end
```

NOTES:

- **default**: Enables the LTE to Wi-Fi handover completion to occur when the Create Session Response is sent on the Wi-Fi tunnel.
- **no**: Disables the feature and handover completion occurs on Create Session Response.
- **lte-s2bgtp-first-uplink** *timeout_value*: Configures LTE to S2bGTP handover completion timeout in multiples of 100 milliseconds. The valid range is from 100 to 3000. The recommended configuration is 1000 milliseconds.
- By default, the LTE to Wi-Fi handover completion happens when Create Session Response is sent on the Wi-Fi tunnel. However, after handover timeout is configured, the handover is delayed until timeout.
- Triggering handover based on first uplink data packet is not supported because the User Plane and Control Plane nodes are separated in the CUPS architecture.

Monitoring and Troubleshooting

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

Show Command(s) and/or Outputs

This section provides information regarding show commands and/or their outputs in support of this feature.

show apn statistics name <*name*>

The output of this CLI command has been enhanced to display the following new fields for the APN:

- LTE-to-S2bGTP handover Succeeded on Timer Expiry – Specifies the number of handovers due to timer expiry.

NOTES:

The new fields, introduced as part of this feature, are also displayed for the following CLI commands:

- **show pgw-service statistics name** *service_name* **verbose**
- **show pgw-service statistics name all verbose**
- **show saegw-service statistics all function pgw verbose**