

LTE to Wi-Fi (S2bGTP) Seamless Handover

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Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	• P-GW • SAEGW
Applicable Platform(s)	• ASR 5500 • VPC - DI • VPC - SI
Feature Default	Disabled - Configuration Required
Related Changes in This Release	Not Applicable
Related Documentation	• *Command Line Interface Reference* • *P-GW Administration Guide* • *SAEGW Administration Guide* • *Statistics and Counters Reference*

Revision History



Important Revision history details are not provided for features introduced before release 21.2 and N5.1.

Revision Details	Release
With this release, support has been added for seamless handover of subscribers from LTE to Wi-Fi (S2bGTP).	21.8
First introduced.	Pre 21.2

Feature Description

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, an enhancement is introduced, in Release 21.8, that holds both the tunnels (LTE and Wi-Fi) and sends the Delete Bearer Request on LTE tunnel only when uplink data is seen on the Wi-Fi tunnel or on expiry of the configured handover timer (when there is no uplink data), whichever is earlier. As long as the LTE tunnel is active, uplink and downlink data is exchanged on the LTE tunnel. When handover is complete, uplink and downlink data is exchanged on the Wi-Fi tunnel. This prevents packet loss.

With this enhancement, the following benefits can be 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.
- When there are two tunnels (LTE and Wi-Fi) established for the same subscriber, GTP-U error indication and GTP-U path failure on the LTE or Wi-Fi tunnel (default or dedicated bearer) are handled properly during the transition period.

How It Works

The LTE to Wi-Fi (S2bGTP) Seamless Handover works as explained in the following sections.

LTE to Wi-Fi Handoff

The LTE to Wi-Fi handoff occurs as follows:

1. The P-GW delays sending the DBR to the S-GW until:

- CSR expiry is sent to the ePDG (default behavior).
- Uplink data is sent on the Wi-Fi tunnel.
- Handover timer has expired. If timer expires, the ePDG does not send the Modify Bearer Request (MBR) to notify handoff completion.

2. After CSR for LTE to Wi-Fi handoff is received, Control Plane GTPv2 (GTP-C) messages from LTE access are not handled at the P-GW. These messages are blocked at the EGTPC.
3. LTE tunnel carries GTP-U traffic during the transition period. Transition period is defined as time between CSR (for LTE to Wi-Fi handoff is received) and handover completion. MBR for handoff completion is not expected in this scenario.
4. In case of multiple outstanding CCR-Us being supported, all requests before the handoff request are dropped. This is done at IMSA.
5. During the transition period:
   - If Modify Bearer Command (MBC) is received in Wi-Fi, it is rejected with Service-Denied message.
   - If Delete Bearer Command for dedicated bearer is received in LTE, it is discarded.
   - If PCRF sends RAR for policy change, it is processed after handover is complete.
   - New tunnel (that is, Wi-Fi) does not carry any GTP-U traffic. Any GTP-U traffic that is received on the Wi-Fi during the transition period is dropped or ignored. Similarly, any downlink traffic that is received on the Wi-Fi is sent on an older tunnel (that is, LTE tunnel) until DBR is sent on the Wi-Fi tunnel. This is true even when CSR is sent on the Wi-Fi tunnel. Any uplink traffic that is received on the Wi-Fi tunnel before timer expiry triggers the handover completion, and from then on all traffic is forwarded only through the Wi-Fi tunnel.
   - Any pending transactions on LTE access are discarded. For example, if CBR or UBR is sent for LTE access and handoff 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.
   - 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”.
   - GTP-U or GTP-C path failure over LTE leads to call drop for LTE access while the Wi-Fi call continues.
   - GTP-U or GTP-C path failure over Wi-Fi leads to call drop. Both tunnels are cleared.
   - If the user moves back to LTE (that is, back to back 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, back to back 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 reason as context replacement and call is processed like a new call over LTE.

Session Recovery and ICSR

During the transition period, old access is considered as stable state and Full Checkpoint is triggered once handover is complete from LTE to Wi-Fi (S2bGTP). This is done for both Session Recovery and ICSR.

Configuring LTE to Wi-Fi Seamless Handover

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

Configuring LTE to Wi-Fi Handover Timer

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
      { 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*: 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 or on receipt of uplink data on the Wi-Fi tunnel.

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 First Uplink Data on S2b tunnel – Specifies the number of handovers due to uplink packets.

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

Bulk Statistics

The following statistics are included in support of this feature.

APN Schema

The following bulk statistics are added for APN in the APN schema in support of the LTE to Wi-Fi Seamless Handover feature.

Bulk Statistics	Description
apn-handoverstat-ltetos2bgtpsucc-timerexpiry	Number of LTE to S2bGTP handover succeeded on Timer Expiry.
apn-handoverstat-ltetos2bgtpsucc-uplnkdata	Number of LTE to S2bGTP handover succeeded on Uplink Data on the S2b tunnel.

P-GW Schema

The following bulk statistics are added for P-GW in the P-GW schema in support of the LTE to Wi-Fi Seamless Handover feature.

Bulk Statistics	Description
handoverstat-ltetos2bgtpsucc-timerexpiry	Handover Statistics - Number of LTE to GTP S2b successful handovers on Timer Expiry.
handoverstat-ltetos2bgtpsucc-uplnkdata	Handover Statistics - Number of LTE to GTP S2b successful handovers on Uplink Data on S2b tunnel.

SAEGW Schema

The following bulk statistics are added for SAEGW in the SAEGW schema in support of the LTE to Wi-Fi Seamless Handover feature.

Bulk Statistics	Description
pgw-handoverstat-ltetos2bgtpsucc-timerexpiry	P-GW Handover Statistics - Number of LTE to GTP S2b successful handover on Timer Expiry.

Bulk Statistics	Description
pgw-handoverstat-ltetos2bgtpsucc-uplnkdata	P-GW Handover Statistics - Number of LTE to GTP S2b successful handover on Uplink Data on S2b tunnel.