S-GW Restoration Support

This chapter describes the S-GW Restoration support feature.

- Feature Description, on page 1
- How it Works, on page 2
- Configuring S-GW Restoration Support, on page 3
- Monitoring and Troubleshooting S-GW Restoration Support, on page 4

Feature Description

S-GW Restoration helps in handling the S-GW failure in the EPC network. It allows affected PDNs that fail due to S-GW to be restored by selecting another S-GW to serve the affected PDNs. This avoids unnecessary flooding of signaling for PDN cleanup.

The P-GW maintains the sessions in case path failure is detected or if S-GW restart is detected during recovery IE on GTP-C signaling. The P-GW will ensure that any dropped packets in this scenario are not charged. The P-GW also rejects any bearer additions or modification requests received for the PDN connection maintained after the S-GW failure detection. This occurs until the PDN is restored.

Once the session has been restored by the MME and the P-GW receives a Modify Bearer Request from the restarted S-GW or a different S-GW, then the P-GW continues forwarding any received downlink data and start charging them.

When a subscriber is in S-GW restoration phase, all RARs (expect for Session Termination) reject the PCEF. The P-GW rejects all internal updates which can trigger CCR-U towards the PCRF. The P-GW triggers a CCR-U with AN-GW changes for the PDNs that are restored if the S-GW has changed on restoration.

The MME/S4-SGSN is locally configured to know that the P-GW in the same PLMN supports the S-GW restoration feature. When this feature is enabled at the P-GW, it supports it for all S-GWs/MMEs.

Important Only MME/S4-SGSN triggered S-GW restoration procedure will be supported.

S-GW restoration detection based on GTP-U path failure shall not be considered for this release. GTP-C path failure detection should be enabled for enabling this feature.

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The P-GW Restart Notification may also be used to signal that the peer P-GW has failed and not restarted. In this case, the P-GW Restart Notification contains a cause value: P-GW not responding. While sending the PRN, the S-GW includes the cause with this new cause value depending on the echo response.

Relationships to Other Features

GTP-C path failure detection should be enabled for enabling this feature.

How it Works

Changes at P-GW

If a path failure is detected at the Demux, then the path failure notification is sent to all session managers at the P-GW. Next, the session manager cleans up the ongoing transactions. Once all the transactions are deleted, the sessmgr-egtpc deletes the tunnels by adding them into the pacing queue.

The P-GW will not delete the session immediately after detecting path failure with the S-GW restoration in place. The P-GW discards downlink packets received for a maintained PDN connection and stop charging for maintained PDN connections after an S-GW failure that has not been restored.

The MME/S4-SGSN controls the pace of the S-GW relocations to avoid core network node overload. The MME/S4-SGSN prioritizes the S-GW relocation for UEs engaged in a Service Request for RAU/TAU procedures over UEs which are not engaged in any mobility product procedure and do not have a signaling connection to MME/S4-SGSN.

If a session is marked for S-GW restoration and if a new request results in context replacement, then the existing session is aborted followed by a new request indication event.

Changes at the E-GTPC

When the Demux informs the eGTP-C about the path failure, abort all active procedures. The abort procedure indicates to the P-GW if S-GW restoration is enabled to for the session. Add all the session in the queue and start the session hold timer for S-GW. The MME restores these sessions by relocating sessions to the new or the same S-GW. When the MBReq is received at the P-GW and if the session is marked with S-GW restoration, then the S-GW flag is reset. At this point, the session hold timer expires and S-GW restoration is removed.

Changes at the MME and SGSN

When the MME and SGSN detects path failure towards the S-GW and the MME supports S-GW restoration, then MME relocates sessions from the failed S-GW to another S-GW.

S-GW restoration is supported in MME from Release 21.3 onwards. However, for SGSN, S-GW restoration is not supported.

Demux Failure Detection

The EGTPIN manager detects a path failure and informs all session managers about the failure. Then, the session manager gets the path failure notification and S-GW restoration is enabled so it will stop all ongoing transactions. The Sessmgr-egtpc informs the P-GW-drv about the path failure. The P-GW deletes the session.

Next, the eGTP-C starts the session hold timer. If the MME triggers the S-GW service restoration before the session hold up timer, then sessions from the old S-GW will move to the new S-GW. This ensures that no sessions are handed over and none are deleted.

Once the session hold timer expires, all the sessions with that peer are cleaned up. At this point, new sessions are not moved to the new S-GW.

Important If the S-GW goes down and comes back up in a very short interval, then the P-GW will not detect the path failure. In this case, S-GW restoration does not occur. If the old S-GW comes up again before the hold timer expires, then there is a chance that only some partial sessions move to the new S-GW. In this case, the eGTP-C does not need to delete the remaining sessions with that peer. The eGTP-C will stop the timer.

If the session manager detects the path failure, then it informs the Demux manager. The above, scenario still occurs in this case.

After detecting the path failure, the Demux will not send ECHO messages towards the S-GW. If the new session addition occurs or a new session is restored from the node, then the Demux sends the ECHO messages towards the peer.

Standards Compliance

The S-GW Restoration functionality complies with the following standards:

- 3GPP TS 23.007: Restoration procedures
- 3GPP TS 29.212: Policy and Charging Control over Gx reference point

Configuring S-GW Restoration Support

The session-hold timer is a configurable parameter. The operator can configure this parameter using the **egtpc sgw-restoration session-hold timeout seconds** CLI command.

The **sgw-restoration** keyword enables S-GW restoration functionality and configure session hold timeout on a P-GW service.

When the P-GW detects that the peer S-GW is down (detection is based on restart counter change or PATH failure due to an ECHO response failure), it moves all PDN sessions associated with the peer S-GW to the SGW-RESTORATION-STATE. Also the P-GW starts a timer with the value provided for session-hold timeout per peer S-GW. After timer expiry, the P-GW cleans up all the sessions which are in the SGW-RESTORATION-STATE.

Important By default, S-GW restoration support will not be enabled.

Sample Configuration

Use the following example to enable S-GW Restoration Support.

```
configure
   context context_name
      pgw-service service_name
         egtpc sgw-restoration session-hold timeout seconds
         { default | no } egtpc sgw-restoration session-hold
         end
```

Notes:

- **session-hold timeout** configures session hold timer for S-GW restoration.
- *seconds* must be an integer from 1 to 3600. Default: 0 (disabled).
- On S-GW failure indication, the P-GW checks if the S-GW restoration feature is enabled or not. If enabled, the P-GW maintains all the affected sessions for session-hold timeout. After session-hold timeout, the P-GW clears all the sessions which are not recovered yet.

Verifying the S-GW Configuration

To verify the S-GW Restoration configuration, use the following command:

show pgw-service all

The following fields have been added to display configuration information for S-GW restoration.

- EGTP SGW Restoration Handling
- Session Hold Timer
- Timeout

Monitoring and Troubleshooting S-GW Restoration Support

This section includes show commands in support of the S-GW Restoration.

S-GW Show Commands

This section provides information regarding show commands and/or their outputs in support of the S-GW Restoration.

show ims-authorization policy-control statistics

The following fields have been added to display the statistics introduced in support of S-GW Restoration Support.

- SGW Restoration
- RAR Reject
- Internal Updates Dropped
- Revalidation Timeout

- Pending Updates

show pgw-service statistics all

The following counters have been added to display S-GW Restoration Support.

- SGW Restoration Statistics
- PDNs Total
- In Restoration State
- Recovered
- Released
- Drops During SGW Restoration State
- Packets
- Bytes

show subscribers pgw-only full all

The following fields and counters have been added to display S-GW Restoration Support.

- Bearer State
- in packet dropped sgw restoration state
- in bytes dropped sgw restoration state
- out packet dropped sgw restoration state
- out bytes dropped sgw restoration state

show subscribers pgw-only full all