

# Error Indication and GTPU Path Failure Detection


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## 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

The User Plane (UP) function notifies an Error Indication message for a GTPU peer to the sender when a GTP-PDU is received with a TEID that does not exist. This ensures that there are no stale sessions or bearers and maintains consistency in the network.

Error Indication and GTPU Path Failure between CP and UP nodes are supported over SxA, SxB and SxAB. For the neighbor nodes, it is supported over the S1u/S5u interfaces.

Behavior variations of local-purge or signal-peer for error indication and GTPU path failure are considered in this implementation.

- When Error Indication is received, the UP communicates the TEID and GTPU-peer information with the CP to ensure deletion or modification of the GTPU-peer.
- On receiving GTPU packet with non-existing TEID, the UP generates and sends Error Indication with TEID and GTPU peer entries.
- The deletion of a session or a bearer is decided based on the path failure detection at CP or UP.

- GTPU path failure is detected using GTPU echo messages between UP nodes, and between the UP and CP nodes.

As per 3GPP TS 29.244, the following is implemented in this feature:

- The PFCP Session Report Request is sent over the Sxa and Sxb interface by the UP function to report information related to an PFCP session to the CP function.
- The PFCP Session Report Response is sent over the Sxa and Sxb interface by the CP function to the UP function as a response to the PFCP Session Report Request.
- Error Indication Report IE must be present if the Report Type indicates an Error Indication Report.
- Remote F-TEID is sent in the Error Indication Report to identify the remote F-TEID of the GTP-U bearer for which an Error Indication has been received at the UP function.
- The PFCP Node Report Request is sent over the Sxa and Sxb interface by the UP function to report information to the CP function that is not specific to an PFCP session.
- The PFCP Node Report Response is sent over the Sxa, Sxb; Sxc and N4 interface by the CP function to the UP function as a response to the PFCP Node Report Request.
- UPPath Failure Report will be present if the Node Report Type indicates a User Plane Path Failure Report.
- Remote GTP-U Peer includes the IP address of the remote GTP-U peer towards which a UP path failure has been detected.

# How It Works

## Error Indication Support

### Error Indication Handling at CP

CP on receiving a PFCP Session Report Request triggered by Error Indication received on UP from a neighboring UP, responds with PFCP Session Report Response and sends a PFCP Session Modification Request towards UP to delete PDR, a FAR for dedicated bearer identified for removal or a PFCP Session Deletion Request to delete the session.

- The session or bearer will be locally purged on PGW-C on reception of PFCP Session Deletion Response or PFCP Session Modification Response from UP respectively.
- For SAEGW-C, signaling over EGTP is based on **local purge** and **page-ue** configuration for S1u.
- For SGW-C, signaling over EGTP on CP is based on **local purge** and **page-ue** configuration for S1u and local-purge and signal peer on S5u.

### Error Indication Handling on UP

UP on receiving Error Indication initiates a PFCP Session Report Request with Error Indication Report that includes remote FTEID containing TEID and GTPU Peer address.

- For PGW-U, Error Indication messages is sent or received over S5u.

- For SAEGW-U, Error Indication message is sent or received over S1u.
- For SGW-U, Error Indication message is sent and received over S1u and S5u.

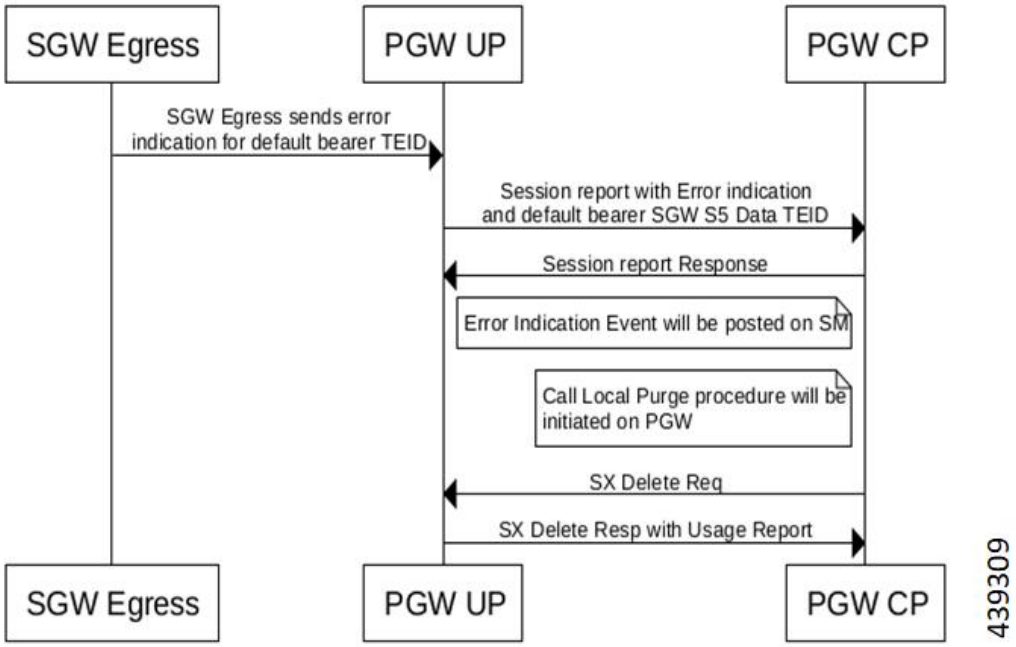
## Error Indication Generation on UP

UP generates Error Indication with TEID and GTPU Peer Address towards a peer when a data packet is received with TEID for which a session or bearer does not exist.

## Error Indication Call Flows

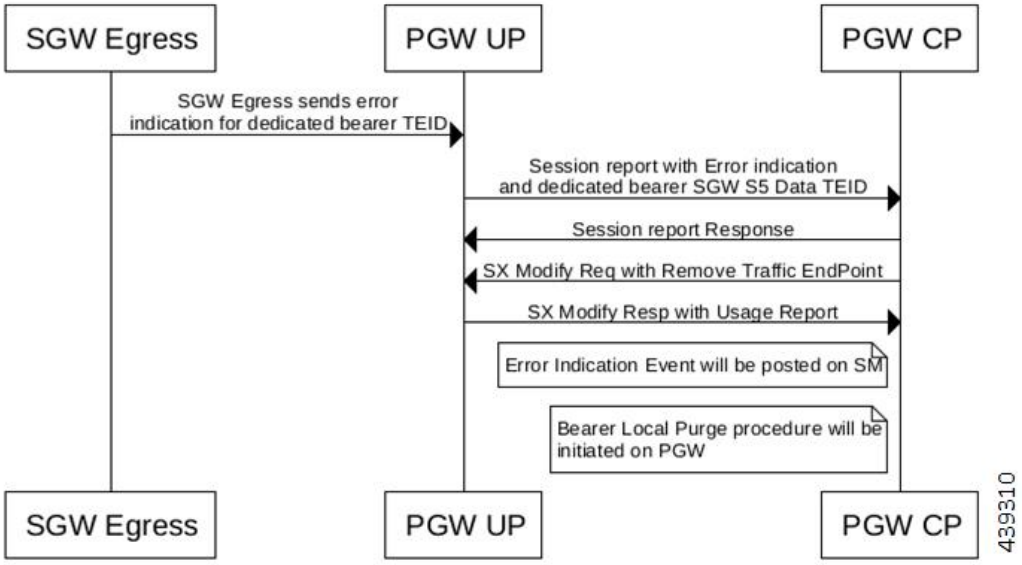
### P-GW Default Bearer Error Indication Handling

The following call flow illustrates P-GW default bearer error indication handling with local purge.



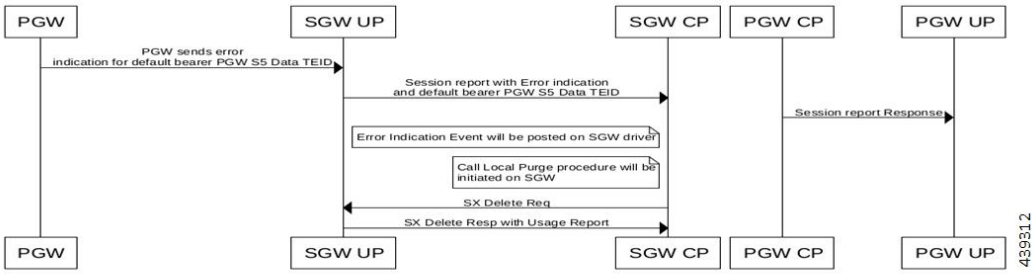

### P-GW Dedicated Bearer Error Indication Handling

The following call flow illustrates P-GW dedicated bearer error indication handling with local purge.



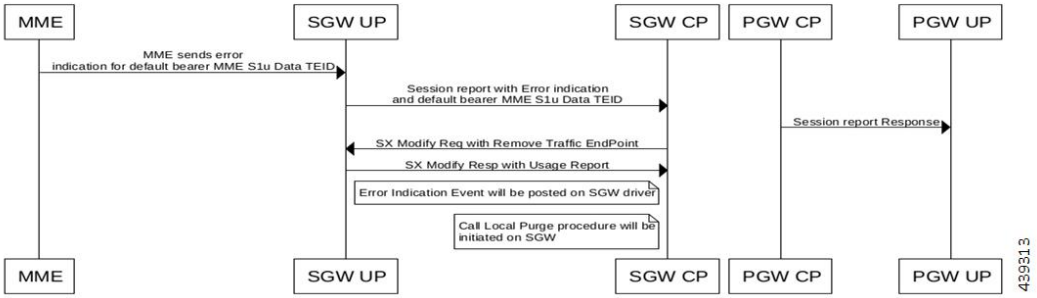

### S-GW Default Bearer Indication Handling

The following call flow illustrates S-GW dedicated bearer error indication handling with S5u local purge.



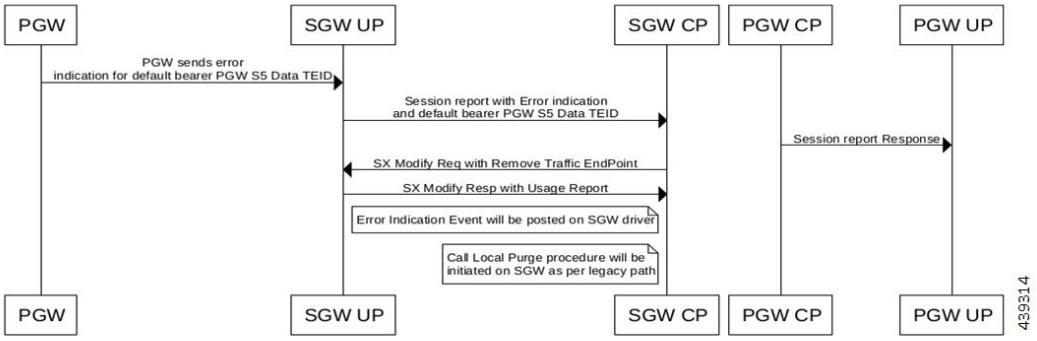

### S-GW Dedicated Bearer Indication Handling

The following call flow illustrates S-GW dedicated bearer error indication handling with S1u local purge.



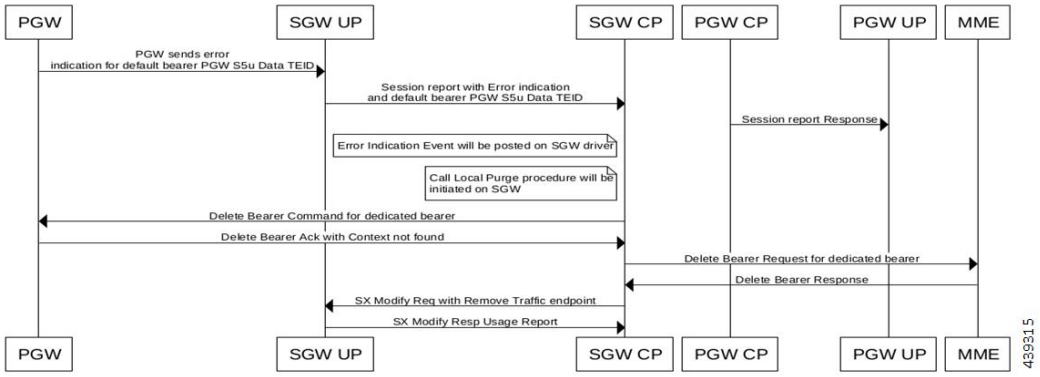

### S-GW Dedicated Bearer Indication Handling

The following call flow illustrates S-GW dedicated bearer error indication handling with S5u local purge.




### S-GW Dedicated Bearer Indication Handling

The following call flow illustrates S-GW dedicated bearer error indication handling with S5u signal peer.




# GTPU Path Failure Support

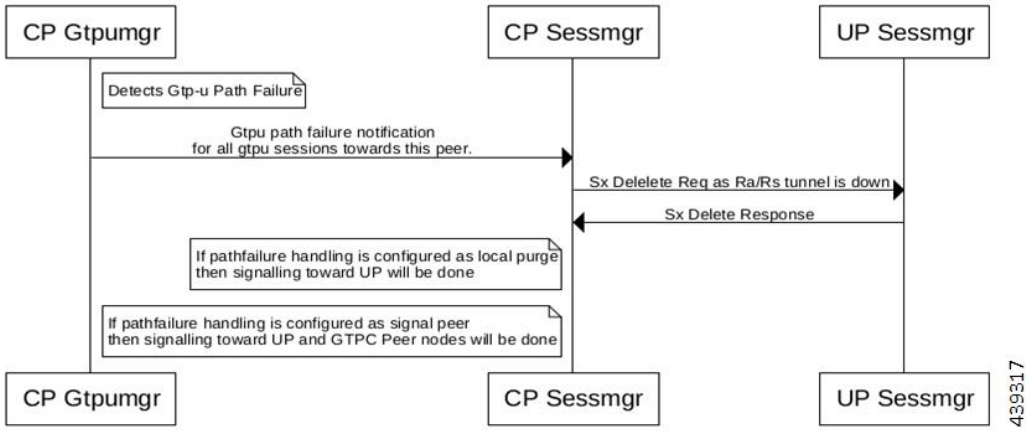
## GTPU Path Failure Support at CP

GTPU Echo Requests is initiated and sent periodically as per the configured interval on CP. GTPU Echo Response is sent for the GTPU Echo Request received from UP over the GTPU tunnel.

If Response is not received for the GTPU Echo Request, CP retries Echo Requests based on configured retransmission timeout and maximum retries. When retries are exhausted, CP initiates PFCP Session Deletion Request to delete the PFCP session.

On receiving the PFCP Node Report Request from UP, CP will send PFCP Node Report Response and initiate PFCP Session Deletion Request towards UP. Billing records will be generated when usage reports are received in PFCP Session Deletion Response.

The following call flow illustrates GTPU Path Failure handling at CP.




## GTPU Path Failure Support at UP

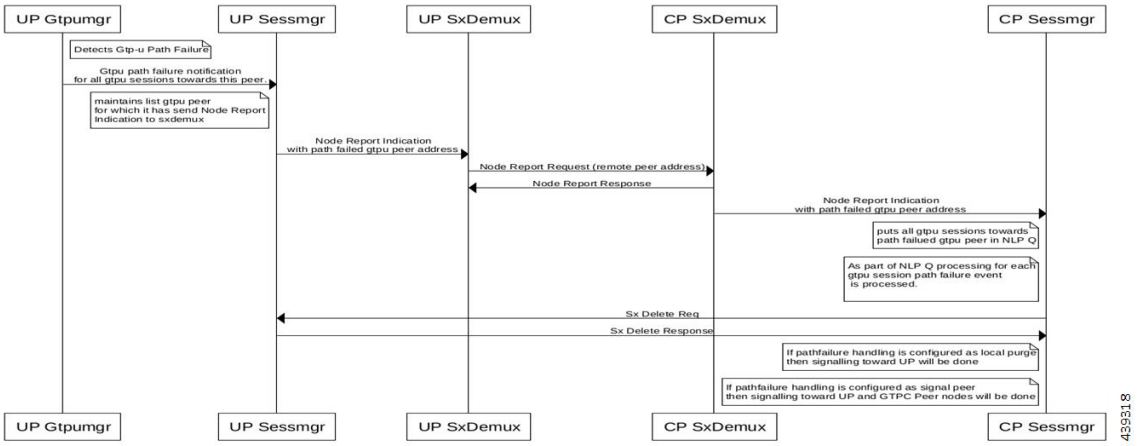
GTPU Echo Requests is initiated and sent periodically as per the configured interval on UP. GTPU Echo Response is sent for the GTPU Echo Request received from CP over GTPU tunnel.

If Response is not received for the GTPU Echo Request, UP retries Echo Requests based on configured retransmission timeout and maximum retries. When retries are exhausted, UP shall initiate PFCP Node

Report Request including (Node ID, Node Report Type, User Plane Path Failure Report including Remote GTP-U Peer).

If UP receives PFCP Node Report Response and PFCP Session Deletion Request to delete the session, it responds to the deletion request with usage reports.

The following call flow illustrates GTPU Path Failure support at UP




## Limitations

In this release, the Error Indication and GTPU Path failure feature has the following limitations:

- UP on receiving following messages/packets with Extension Headers will respond with Supported Extension Headers Notification indicating neighboring UPs that extension headers are not supported.
  - Error Indication
  - GTPU Echo Requests
  - GTPU Echo Response
  - GTP-PDU

# Configuring Error Indication and GTPU Path Failure on Control Plane

## Configuring Error Indication on CP

Use following commands to control the behavior of CP towards EGTP peers based on GTPU error indication received on a GTPU interface (s1u/s5u).

```
configure
  context context_name
    sgw-service service_name
```

```
      gtpu-error-ind { s1u { local-purge | page-ue }| s5u { local-purge
| signal-peer } }
      end
```

**NOTES**:

- **gtpu-error-ind**: Configures the actions to be taken upon receiving a GTP-U error indication from P-GW.
- **s1u**: Specifies the action to take when a GTP-U error indication is received from P-GW over the S1u interface.
- **s5u**: Specifies the action to take when a GTP-U error indication is received from P-GW over the S5u interface.
- **local-purge**: The S-GW clears the affected bearer (or PDN if error-indication is received on default bearer) locally without informing peer.
- **page-ue**: The S-GW moves the complete UE state to S1-Idle and starts paging for this UE.
- **signal-peer**: Clears the affected bearers or PDNs and initiates control signals towards the peer MME and P-GW.

**Note** The **extension-header source-udp-port** CLI option is not supported for GTP-U service on User Plane.

# Configuring GTPU Path Failure on CP

Use following commands to control the behavior of CP towards EGTP peers based on GTPU path failure detected on GTPU interface (s1u/s5u).

```
configure
  context context_name
    sgw-service service_name
      path-failure { s1u | s5u }{ local-purge | signal-peer }
      end
```

**NOTES**:

- **path-failure**: Configures the action to take upon the occurrence of a path failure between the S-GW and the MME or P-GW.
- **s1u**: Specifies the action to take when a GTP-U error indication is received from P-GW over the S1u interface.
- **s5u**: Specifies the action to take when a GTP-U error indication is received from P-GW over the S5u interface.
- **local-purge**: The S-GW clears the affected bearer (or PDN if error-indication is received on default bearer) locally without informing peer.
- **signal-peer**: Clears the affected bearers or PDNs and initiates control signals towards the peer MME and P-GW.

# Limitations

The following CLI options are not supported in this release:

- **In GTP-U service on UP: extension-header source-udp-port**
- **In SG-W service on CP:**

  **gtpu-error-ind s4u**

  **gtpu-error-ind s11u**

  **gtpu-error-ind s12**

  **path-failure s4u**

  **path-failure s11u**

  **path-failure s12**

When Sx Session Modification Response for Error Indication or GTP-U Path Failure is pending from User Plane and Collapsed to Pure-P Handover request is received, Modify Bearer Request for Handover is processed once Sx Session Modification Response which was delayed is received. Following configuration is recommended for working of above case for handover to be successfully completed.

```
configure
   context egress context_name
      ims-auth-service service_name
         policy-control
            max-outstanding-ccr-u 2
            end
```