PGW Restart Notification in S4-SGSN

This chapter describes the PGW Restart Notification in S4-SGSN.

Feature Description

The purpose of enabling PGW Restart Notification (PRN) in S4-SGSN is to provide a simple and optimized solution for handling the signaling overload on the SGSN when a PGW failure occurs. Until release 10, the SGW used to send Delete Bearer Request for every PDN connection activated through the failed PGW. This results in signaling overload on the SGSN. From 3GPP Release 10 specifications onwards it is possible for a SGW to indicate a PGW failure through a single PRN message to the SGSN.

When the SGW detects that a peer PGW has restarted or it is not reachable, it deletes all the PDN connections associated with that peer node and releases all the internal resources associated with those PDN connections.

The SGW sends a PGW Restart Notification only to the SGSNs that have configured advertisement of PGW restart notification in echo request/response messages. When the S4-SGSN receives this message, according to the control plane IP address of the restarted PGW and the control plane IP address of the SGW on the S4 interface included in the message, the S4-SGSN deletes all PDN connections associated with the SGW and the restarted PGW. The SGSN also releases any internal resources associated with those PDN connections.

The S4-SGSN sends a PGW Restart Notification Acknowledge message in response to the PGW Restart Notification message sent by the SGW.

Overview

Listed below is an overview of the PRN feature in the S4-SGSN:

- When the PGW Restart Notification is enabled at the S4-SGSN, the PRN bit in Node Features IE in Echo Request message is set. This indicates to the SGW that the S4-SGSN supports PGW Restart Notification message (PRN).

- The SGW sends the PRN message to the S4-SGSN in case of PGW node restart or if a path failure occurs. In case of PGW node restart the PRN arrives without any cause, but if a path failure has occurred the PRN is received with cause "PGW not responding".
- The S4-SGSN on receiving the PRN, deletes all PDN connections associated with the SGW and the restarted PGW. It also releases the internal resources associated with those PDN connections.
- The S4-SGSN prioritizes the PDN connections to be restored based on subscribed APN restoration priority (if received from the HSS). A locally configured value as default restoration priority shall be used for a user's PDN connection if it is not received from the HSS. Restoration priority value received in subscription record from HSS value has more priority over locally configured default value.
- If the S4-SGSN wants to restore the PDN connections, it does so by using the "reactivation requested" cause if restoration priority value is available irrespective of whether UE is in CONNECTED or IDLE state.
- Deactivation is performed with cause "regular deactivation" if the UE is in CONNECTED state and restoration priority is not available. If the UE is in IDLE state and restoration priority value is not available, then local deactivation is done.

How it Works

Listed below is a detailed description of how the PGW restart notification feature in S4-SGSN works:

1. The PRN support should be enabled through the **gtpc** command in egtp-service configuration mode.
2. If PRN is received and support for PRN is not configured then the S4-SGSN sends PRN Acknowledge message with EGTP_CAUSE_SERVICE_DENIED cause code.
3. If PRN is received and support for PRN is configured then S4-SGSN responds with PRN Acknowledge message with cause code EGTP_CAUSE_REQ_ACCEPTED.
4. When PRN is enabled at the S4-SGSN, the PRN bit in Node Features IE in Echo Request message is set. This indicates to the SGW that the S4-SGSN supports PGW Restart Notification message.
5. The SGW sends the PRN to the S4-SGSN in case of PGW node restart or path failure. In case of PGW node restart, PRN arrives without any cause. In case of path failure, PRN is received with cause specified as "PGW not responding". The behavior of S4-SGSN on receiving PRN is same in both scenarios.
6. When a PRN is received, the PDN connections are deleted based on SGW and PGW address received in PRN message.
7. The S4-SGSN restores the PDN connections by sending Deactivate Request to UE using sm cause "reactivation required".
8. Restoration will be done only when the restoration priority is received from the HSS subscription for that PDN or when the default apn-restoration priority is configured locally under the apn-profile.

Limitations

The PRN feature in S4-SGSN supports either IPv4 or IPv6 but not both at the same time.

Standards Compliance

The PRN feature in S4-SGSN complies with the following standards:

- 3GPP TS 23.007 version 11
- 3GPP TS 29.274 version 11

Configuring PGW Restart Notification in S4-SGSN

The following commands are used to configure the PGW restart notification support in the S4-SGSN:

Configure Node IE For PRN Advertisement

The following CLI command configures advertisement of PGW Restart Notification in echo request/response messages. This is an existing CLI command under the EGTP Service Configuration mode which has to be configured in order to inform SGW that S4-SGSN supports receiving PRN. The command option **node-feature pgw-restart-notification** has to be configured in order to inform SGW that S4-SGSN supports receiving PRN.

```
configure
    context context_name
        egtp_service service_name
            gtpc { bind { ipv4-address ipv4_address [ ipv6-address ipv6_address
] | ipv6-address ipv6_address [ ipv4-address ipv4_address ] } | echo-interval
 seconds [ dynamic [ smooth-factor multiplier ] ] | echo-retransmission-timeout
 seconds | ip qos-dscp { forwarding_type } | max-retransmissions num |
node-feature pgw-restart-notification | path-failure detection-policy
echo | private-extension overcharge-protection | retransmission-timeout
 seconds }
            exit
```

Configure Default APN Restoration Priority

The following CLI command configures APN restoration priority for an APN profile:

```
configure
    apn-profile profile_name
            apn-restoration priority priority_value
            exit
```

Notes:

- The PGW Restart Notification (PRN) message is sent by the S-GW when it detects a peer P-GW has re-started. The S4-SGSN on receiving the PRN message, uses the default apn-restoration priority value, if priority value is not available in HSS Subscription to prioritize the affected PDN connections for restoration. To restore PDN it is mandatory to get priority value from HSS in subscription record or default value must be configured under apn-profile.
- The priority value is an integer value from 1 through 16. Where "1" is the highest priority and "16" is the lowest priority.

Verifying the PRN Configuration in S4-SGSN

Execute the command **show egtp-service all** to verify the PRN support configuration in S4-SGSN:

```
show egtp-service all
```

The output of this command displays if the PRN support has been configured:

```
.
.
.
GTPC Node Feature

PGW Restart Notification
                                                        : Enabled
.
.
```

Monitoring and Troubleshooting PRN support in S4-SGSN

This section provides information on the show commands and disconnect reasons available to support this feature.

PGW Restart Notification Show Command(s) and/or Outputs

This section provides information regarding show commands and/or their outputs in support of the PRN feature in S4-SGSN:

show s4-sgsn statistics

The following PDP Deletion Statistics have been added to the **show s4-sgsn statistics** command:

- PDP Deletion Statistics
- 3G S4 PDPs Deleted due to PGW Restart Notification
- 2G S4 PDPs Deleted due to PGW Restart Notification

show egtpc statistics

The following PGW Restart Notification statistics have been added to **show egtpc statistics** :

- PGW Restart Notification Request
- Total RX
- Initial RX
- Retrans RX
- PGW Restart Notification Ack
- Total TX
- Initial TX
- Accepted
- Denied
- Discarded

Notes:

- When APN Restoration priority value is available, either through local configuration or through subscription received from HSS, then the SGSN sends Deactivation Request with SM Cause "Reactivation Required" towards MS after PGW Restart Notification Request from SGW.
- When APN Restoration priority value is not available and the subscriber is in Idle/Standby state, the SGSN deletes the affected bearers locally and does not trigger Paging Request towards the MS to send Deactivation Request.

- When APN Restoration priority value is not available and the subscriber is in Connected/Ready state, the SGSN will send Deactivation Request.

show session disconnect-reasons verbose

The following disconnect reason is used to track both PGW Restart or path failure and SGW path failure:

- sgsn-gtpc-path-failure(267)

show session disconnect-reasons verbose