

SK Telecom (SKT) - PDN Reactivation by DBR Private Extension

Technical Document

Copyright

© Ericsson AB 2019. All rights reserved. No part of this document may be reproduced in any form without the written permission of the copyright owner.

Disclaimer

The contents of this document are subject to revision without notice due to continued progress in methodology, design and manufacturing. Ericsson shall have no liability for any error or damage of any kind resulting from the use of this document.



Contents

1	Overview	1
2	Functionality	2
2.1	Support of the PDN Reactivation Private Extension IE	2
2.2	Message-Triggered PGW Blocking	2
2.3	Deactivation Triggered by the PDN Reactivation Private Extension IE	3
2.4	Detach Triggered by the PDN Reactivation Private Extension IE	5
3	Toolbox Tool	7
3.1	manage_blocked_gw	7
4	Network Impact	9
4.1	Capacity and Performance	9
4.2	Operation	9
4.3	Interface	9
4.4	Compatible Network Elements	10
5	Compliance	11





1 Overview

This document describes the Customer-Specific Function (CSF) of PDN Reactivation triggered by the PDN Reactivation Private Extension IE in a Delete Bearer Request message received by the MME.

This document covers the following sections:

- Functionality
- Toolbox Tool
- Network Impact
- Compliance

2 Functionality

The MME is now enhanced to support the PDN Reactivation Private Extension IE in a Delete Bearer Request message over the S11 interface. This Private Extension IE requires the MME to block the corresponding PGW and reactivate the related bearers or reattach the corresponding subscribers according to different scenarios.

When the MME receives a Delete Bearer Request message with the PDN Reactivation Private Extension IE and without the Cause IE, the corresponding PGW should be blocked by the MME, and the MME sends a Deactivate EPS Bearer Context Request message with the #39 Reactivation Requested ESM Cause IE or a Detach Request message with the Reattach Requested Detach Type IE to the UE to achieve PDN reactivation.

2.1 Support of the PDN Reactivation Private Extension IE

The MME is now enhanced to support the PDN Reactivation Private Extension IE in a Delete Bearer Request message. This Private Extension IE is supported if the following conditions are met:

- No Cause IE is included in a Delete Bearer Request message sent by the SGW.
- This Private Extension IE is correctly coded as depicted in [Figure 1](#).
- The Enterprise ID is 5806 (SKT) and the IE value is 0x10 or 0x11.

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Type = 255 (decimal)							
2 to 3	Length = 3							
4	Spare				Instance = 15			
5 to 6	Enterprise ID = 5806 (decimal)							
7 to (n+4)	Proprietary value: 0x10 or 0x11							

Figure 1 PDN Reactivation Private Extension IE

2.2 Message-Triggered PGW Blocking

This feature introduces a message-triggered PGW blocking mechanism. If the PDN Reactivation Private Extension IE in a Delete Bearer Request message is supported by the MME, when the MME receives the message, the corresponding PGW is set to blocked. See below for details.



When the MME receives a Delete Bearer Request message with the PDN Reactivation Private Extension IE and without the Cause IE, the following applies:

- If the status of the corresponding PGW is not blocked, GwStatus and GwRole are set to blocked and pgw respectively.
- If the status of the corresponding PGW is blocked and GwRole is set to sgw, GwStatus is kept as blocked and GwRole is set to bothSgwPgw.
- If the status of the corresponding PGW is blocked and GwRole is not set to sgw, GwStatus is kept as blocked and GwRole remains unchanged.

The manage_blocked_gw CLI command is introduced to show the change of blocked gateway status. For more information, see [Section 3 Toolbox Tool](#). Such a blocked PGW can be unblocked by using the delete_gw_blocking CLI command.

For more information on gateway blocking, see [Gateway Blacklisting](#).

2.3 Deactivation Triggered by the PDN Reactivation Private Extension IE

This feature introduces a new trigger for deactivation. The Deactivation procedure is performed if the MME receives a Delete Bearer Request message with the PDN Reactivation Private Extension IE and without the Cause IE from the SGW, and either of the following conditions is met:

- It's not the last default bearer.
- The UE supports EMM-Registered without PDN connection.

For more information on Deactivation procedures, see [LTE Session Management](#).

The Deactivation procedure triggered by the PDN Reactivation Private Extension IE is shown in [Figure 2](#) and described as follows.

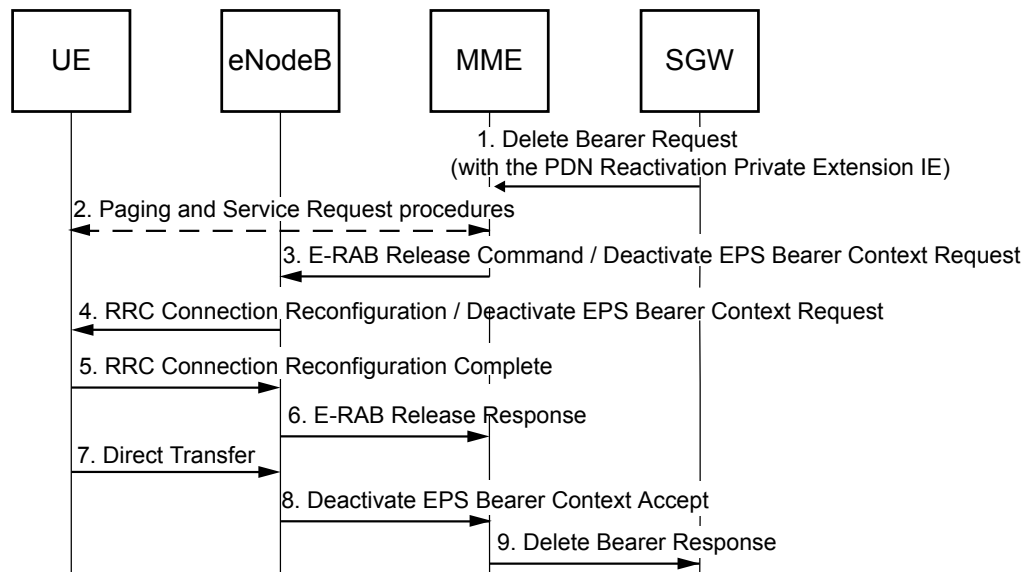


Figure 2 Deactivation Procedure Triggered by the PDN Reactivation Private Extension IE

The following steps describe the Deactivation procedure triggered by the PDN Reactivation Private Extension IE:

Steps

1. The SGW sends a Delete Bearer Request message to the MME. If this message includes the PDN Reactivation Private Extension IE and does not include the Cause IE, the corresponding PGW is set to blocked.
2. If the UE is in the ECM-IDLE state, Paging and Service Request procedures are performed.
3. The MME initiates the deactivation of bearers by sending an E-RAB Release Command message to the eNodeB. This message includes the Deactivate EPS Bearer Context Request message with the #39 Reactivation Requested ESM Cause IE. As a result, if there are additional bearers that must be deactivated, one Downlink NAS transport message including the Deactivate EPS Bearer Context Request message is sent for each of them.

A timer is started to supervise the response of the Deactivate EPS Bearer Context Request message. If the timer expires, the Deactivate EPS Bearer Context Request message is resent. If no answer is received after four retransmissions, the bearer is marked as failed in the MME, but will still be deactivated.

4. The eNodeB releases the corresponding bearers, and sends an RRC Connection Reconfiguration message including the Deactivate EPS Bearer Context Request message to the UE.



5. The UE releases the bearers and acknowledges this by sending an RRC Connection Reconfiguration Complete message to the eNodeB.
6. The eNodeB sends an E-RAB Release Response message to the MME to acknowledge the release.
7. The UE sends a Direct Transfer message to the eNodeB.
8. The eNodeB sends a Deactivate EPS Bearer Context Accept message including the identity of the deactivated bearer to the MME. One Deactivate EPS Bearer Context Accept message is sent for each deactivated bearer.
9. The MME deletes the bearer context related to the deactivated EPS bearer, and acknowledges the bearer deactivation by sending a Delete Bearer Response message including the EPS bearer identities to the SGW.

2.4 Detach Triggered by the PDN Reactivation Private Extension IE

This feature introduces a new trigger for detach. The Detach procedure is performed if the MME receives a Delete Bearer Request message with the PDN Reactivation Private Extension IE and without the Cause IE from the SGW, and it's the last default bearer and the UE does not support EMM-Registered without PDN connection. For more information on Detach procedures, see [LTE Mobility Management](#).

The Detach procedure triggered by the PDN Reactivation Private Extension IE is shown in [Figure 3](#) and is described as follows.

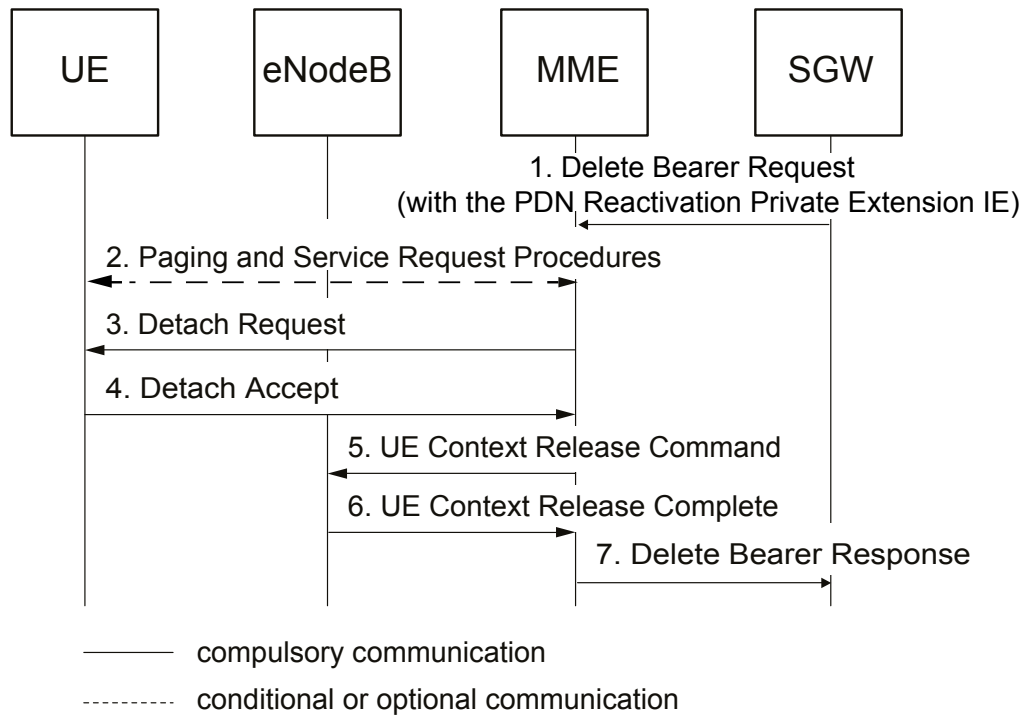


Figure 3 Detach Procedure Triggered by the PDN Reactivation Private Extension IE

The following steps describe the Detach procedure triggered by the PDN Reactivation Private Extension IE.

Steps

1. The SGW sends a Delete Bearer Request message to the MME. If this message includes the PDN Reactivation Private Extension IE and does not include the Cause IE, the corresponding PGW is set to blocked.
2. If the UE is in the ECM-IDLE state, Paging and Service Request procedures are performed.
3. The MME informs the UE that it is being detached by sending a Detach Request message. The Detach Request message includes the Reattach Requested Detach Type IE.
4. The UE sends a Detach Accept message to the MME.
5. The MME releases the connection for the UE by sending a UE Context Release Command message to the eNodeB with the Cause IE set to Detach.
6. The eNodeB acknowledges the request by sending a UE Context Release Complete message to the MME.
7. The MME sends a Delete Bearer Response message to the SGW.



3 Toolbox Tool

3.1 manage_blocked_gw

The `manage_blocked_gw` CLI command compares the current blocked gateway list with the blocked gateway list in the LastActivated or a specific Software Configuration (SC) to show the change of blocked gateway status.

`manage_blocked_gw [-sc <ScName>] [-h]`

Syntax

- help | -h** This option displays extensive command information.
- ScName | -sc** This option is used to compare the current blocked gateway list with the blocked gateway list in the LastActivated or a specific SC. If the `ScName` parameter is not configured, the SGSN-MME compares the current blocked gateway list with the blocked gateway list in the LastActivated SC. `ScName` can be obtained from the output of the `listSCs` CLI command. The two blocked gateway lists are also displayed in the output.

Example

This example compares the current blocked gateway list with the blocked gateway list in the LastActivated SC to show the change of blocked gateway status. In this example, the name of the LastActivated SC is `vob_tecscas_test1`.

`manage_blocked_gw.pl`

```
LastActivated(vob_tecscas_test1) blocked gateway:
=====
GwAddress      GwName          GwRole
-----
10.10.10.1      topon.eth1.pgw.gtt.com    sgw
10.10.10.2      topon.eth1.pgw.gtt.com    pgw
10.10.10.3      topon.eth1.pgw.gtt.com    pgw
=====

Current blocked gateway:
=====
GwAddress      GwName          GwRole
-----
10.10.10.2      topon.eth1.pgw.gtt.com    pgw
10.10.10.3      topon.eth1.pgw.gtt.com    bothSgwPgw
10.10.10.4      topon.eth0.sgw.ericsson.com  pgw
=====

Changed blocked gateway:
=====
GwAddress      GwName          GwRole
-----
(D)10.10.10.1    topon.eth1.pgw.gtt.com    sgw
(M)10.10.10.3    topon.eth1.pgw.gtt.com    bothSgwPgw
(A)10.10.10.4    topon.eth0.sgw.ericsson.com  pgw
=====
```



NOTE: The gateway blocking information has been updated!
If you compare the current SC with the LastActivated SC, it's recommended to checkpoint the currently active configuration data!

This example compares the current blocked gateway list with the blocked gateway list in the vob_tecscas_test2 SC to show the change of blocked gateway status.

manage_blocked_gw.pl -sc vob_tecscas_test2

```
vob_tecscas_test2 configured blocked gateway:
=====
GwAddress      GwName      GwRole
-----
10.10.10.1     topon.eth1.pgw.gtt.com    sgw
10.10.10.2     topon.eth1.pgw.gtt.com    pgw
10.10.10.3     topon.eth1.pgw.gtt.com    pgw
=====

Current blocked gateway:
=====
GwAddress      GwName      GwRole
-----
10.10.10.2     topon.eth1.pgw.gtt.com    pgw
10.10.10.3     topon.eth1.pgw.gtt.com    bothSgwPgw
10.10.10.4     topon.eth0.sgw.ericsson.com pgw
=====

Changed blocked gateway:
=====
GwAddress      GwName      GwRole
-----
(D)10.10.10.1   topon.eth1.pgw.gtt.com    sgw
(M)10.10.10.3   topon.eth1.pgw.gtt.com    bothSgwPgw
(A)10.10.10.4   topon.eth0.sgw.ericsson.com pgw
=====
```

NOTE: The gateway blocking information has been updated!
If you compare the current SC with the LastActivated SC, it's recommended to checkpoint the currently active configuration data!

Note: The ScName can be obtained through the listSCs CLI command. See the following example.

listSCs

```
vob_tecscas (99A-99-99),< No valid date >,InstalledCompleted (LastBooted)
mkviiilwg, 2019-01-04 08:31:26, CheckpointCompleted (Permanent)
test, 2019-01-04 08:35:11, CheckpointActive (Next,LastActivated)
```

In this example, vob_tecscas is ReleaseName.mkviiilwg and test are CheckpointName. The ScName is named ReleaseName_CheckpointName.



4 Network Impact

Access Type:	LTE
Hardware Platform:	All
Licensed Feature:	Gateway Blacklisting
Introduced in:	1.26

The MME is now enhanced to support the PDN Reactivation Private Extension IE in a Delete Bearer Request message over the S11 interface. This Private Extension IE requires the MME to block the corresponding PGW and reactivate the related bearers or reattach the corresponding subscribers according to different scenarios. As a result, this feature introduces a new PGW blocking mechanism, and a new trigger for deactivation and detach to achieve PDN reactivation.

4.1 Capacity and Performance

No impact.

4.2 Operation

The feature introduces the following EBM sub-cause codes:

- SGW_INITIATED_DELETE_BEARER_REQUEST_GTPV2_PE_16_AND_BLOCK_PGW
- SGW_INITIATED_DELETE_BEARER_REQUEST_GTPV2_PE_17_AND_BLOCK_PGW

For more information, see SGSN-MME Operational Delta.

4.3 Interface

The MME now supports the PDN Reactivation Private Extension IE in a Delete Bearer Request message over the S11 interface.



4.4 Compatible Network Elements

This feature requires support in the SGW.



5 Compliance

For compliance information on 3GPP interfaces, see SoC with 3GPP TS 29.274.