June 2023

AVOIDING GENERATION OF A GTP-U ERROR INDICATION DURING A NETWORK INITIATED SESSION OR A BEARER DELETION

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ABSTRACT

Techniques described herein prevent a General Packet Radio Service (GPRS) Tunneling Protocol (GTP-U) error indication from being generated from the user plane during a network-initiated session or bearer deletion, which saves overall network and radio resources and reduces the operating expenditures for the operator. In addition, techniques described herein eliminate additional Packet Forwarding Control Protocol (PFCP) signaling between the control plane and the user plane nodes, which increases the reliability and provides faster communication of messages over the Sx/N4 interfaces.

DETAILED DESCRIPTION

In Control and User Plane Separation (CUPS) architecture, when there is a network-initiated session or bearer deletion, the control plane (CP) sends a Delete Bearer Request toward the access side to detach the session/bearer. Also, in the case of session deletion, the CP sends a Packet Forwarding Control Protocol (PFCP) Session Deletion Request message and a PFCP Session Modification Request message for bearer deletion to the user plane (UP). When the UP receives the respective message, it deletes the session/bearer context from its database. In this scenario, if the UP deletes the session/bearer context and the request to detach the session/bearer has not yet reached the eNodeB and the user equipment (UE), there is a possibility that uplink data sent from the UE on the session/bearer context will be deleted.

When the uplink data packet reaches the UP, since the UP has already deleted the session/bearer, the UP generates a General Packet Radio Service (GPRS) Tunneling Protocol (GTP-U) error indication and sends the GTP-U error indication toward the access side to the eNodeB and the UE. Thus, the generation of the GTP-U error indication message wastes radio resources and may also lead to network congestion during bulk deletion of

sessions, which can happen in the network in certain scenarios (e.g., GTP-C path failure, the operator wanting to moving CP into maintenance mode, etc.)

Techniques described herein introduce a new information element (IE), a Delayed Delete [Type = 399] IE. This IE will be sent from the CP to the UP as part of PFCP Session Modification Request used for bearer deletion and as part of PFCP Session Deletion Request for session deletion. The IE will contain a Delayed Delete Timer Value Field that contains the time period in seconds the UP should wait to clear the corresponding bearer/session context from its database.

According to techniques described herein, when the IE is received in a PFCP Session Modification Request used for bearer deletion or as part of a PFCP Session Deletion Request for session deletion, the UP will mark the bearer/session context for delayed deletion and start the timer based on a received Delayed Delete Timer Value. Once the timer expires, the UP clears the corresponding bearer/session. Since the bearer/session context won't be cleared from the UP immediately, any uplink data packet received for the corresponding packet will not generate any GTP-U error indication message from the UP. Instead, the UP would silently drop any data packets received for the bearer/session that are marked for delayed deletion.

The recommended Delayed Delete timer value from the CP is equal to (the configured number of GTP retransmissions) x (the configured retransmission timeout). This would guarantee that deletion at the UP happens only after the GTP Delete Bearer Request procedure is completed. In the scenario in which the CP receives the Delete Bearer Response for session deletion before the delayed timer expires at the UP, the CP may allocate the same CP-SEID for a new PFCP session and send it in a PFCP Session Establishment Request. In this case, the UP will clear the session marked for delayed delete immediately on receiving the PFCP Session Establishment request since that session is already cleared from access side nodes and no data packet can be received for it.

Delayed Delete IE

Figure 1, below, illustrates the Delayed Delete IE and illustrates how the Delayed Delete IE is encoded. The Delayed Delete IE indicates whether the CP function has decided to use the delayed delete feature for bearer/session deletion.

	Bits							
Octets	8	7	6	5	4	3	2	1
1 to 2	Type = 399 (decimal)							
3 to 4	Length = n							
5	Delayed Delete Timer Value							
k to (n+4)	These octet(s) is/are present only if explicitly specified							

Figure 1: Example Delayed Delete Information Element

As illustrated in Figure 1, the Delayed Delete Timer Value field contains the time period in seconds the UP should wait to clear the corresponding bearer/session context from its database. The Delayed Delete Timer Value field is encoded as an Unsigned32 binary integer value.

Figure 2, below, is a table illustrating an example change in information elements in a PFCP Session Modification Request.

Information elements	P	Condition / Comment	Appl.				IE Type
			Sxa	Sxb	Sxc	N4	
Delayed Delete	C	This IE shall be present if the CP function has sent this PFCP Session Modification Request to delete an EPS bearer and it decides to use the delayed delete feature. This IE shall be used in conjunction with Remove traffic Endpoint IE, assuming the UP has indicated support for PDI optimization.	X	X	X	X	Delayed Delete

Figure 2: Example Table Illustrating a PFCP Session Modification Request

Figure 3, below, is a table illustrating an example change in information elements in a PFCP Session Deletion Request.

Information elements	P	Condition / Comment	Appl.				IE Type
			Sxa	Sxb	Sxc	N4	
Delayed Delete	C	This IE shall be present if the CP function decides to use the delayed delete feature to delete a PFCP session.	X	X	X	X	Delayed Delete

Figure 3: Example Table Illustrating a PFCP Session Deletion Request

Flow Charts

Figure 4, below, is a flow chart illustrating the conventional method for performing an Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network-Initiated Detach.

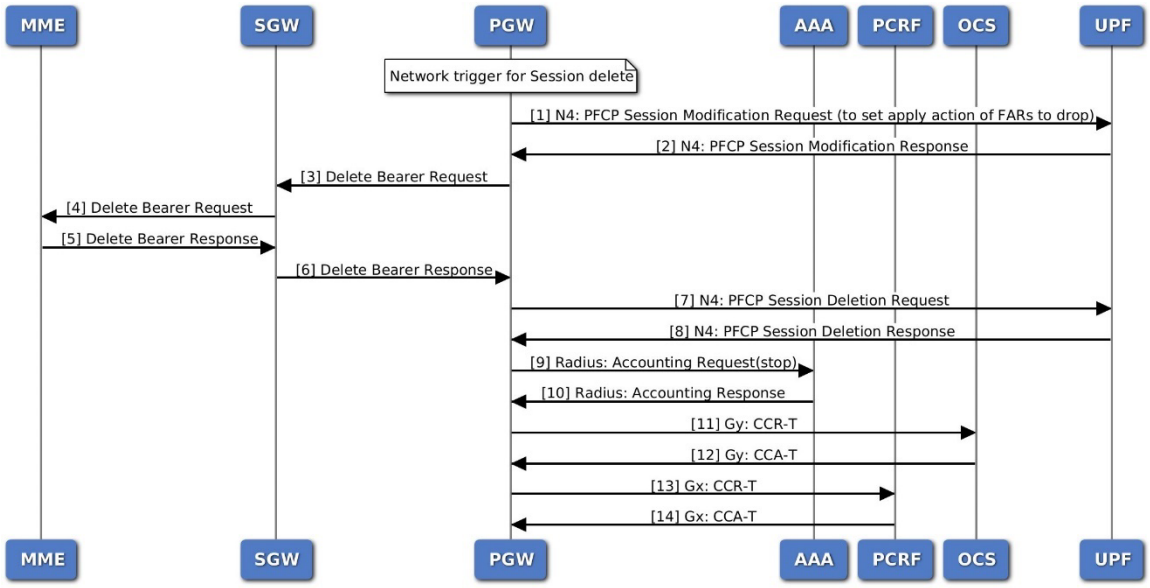

Figure 4: Example Method for the Conventional E-UTRAN Network-Initiated Detach

Figure 5, below, is a flow chart illustrating a method for performing an E-UTRAN Network-Initiated Detach according to techniques presented herein.

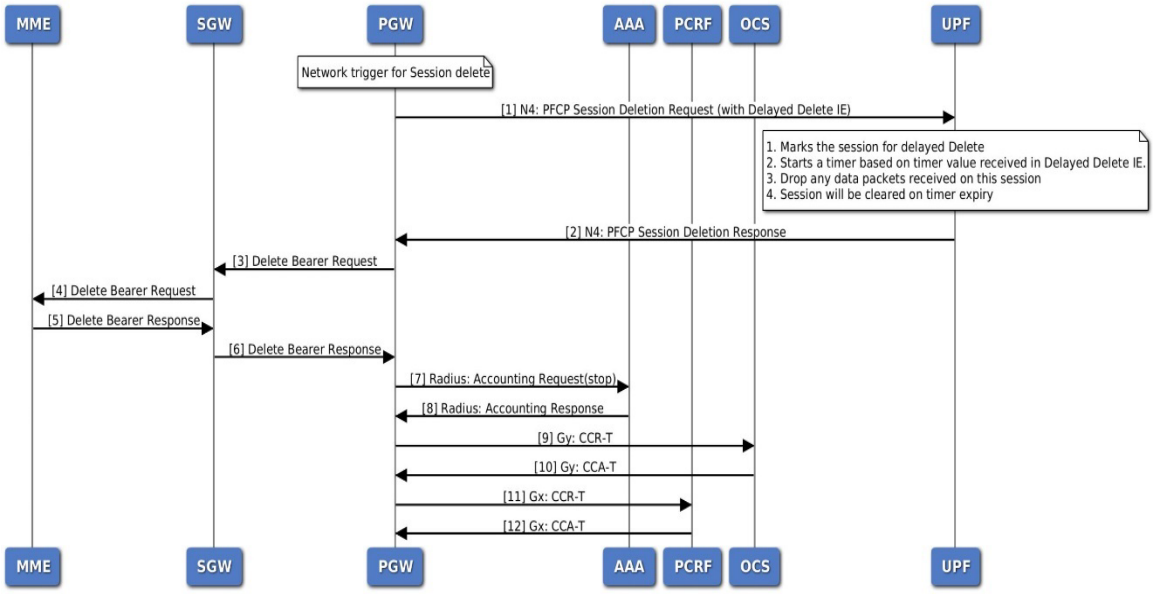

Figure 5: Example Method for an E-UTRAN Network-Initiated Detach

In summary, techniques described herein aim to fill the gap in the existing Third Generation Partnership Project (3GPP) architecture with regard to network-initiated session or bearer deletion call flows in CUPS architecture. Techniques described herein prevent a GTP-U error indication from being generated from the UP during a network-initiated session or bearer deletion, which saves overall network and radio resources and reduces the operating expenditures for the operator. In addition, techniques described herein eliminate additional PFCP signaling required to achieve the same result. The reduced PFCP traffic between the CP and the UP nodes increases the reliability and provides faster communication of messages over the Sx/N4 interfaces.