Technical Disclosure Commons

Defensive Publications Series

October 08, 2019

SYSTEMS AND METHODS TO OPTIMIZE THE SIGNALING BETWEEN UPF AND SMF DURING HANDOFF AND EPS-INTERNETWORKING

Ajay Singh Meena

Navneet Priya

Raghunadha Reddy

SYSTEMS AND METHODS TO OPTIMIZE THE SIGNALING BETWEEN UPF AND SMF DURING HANDOFF AND EPS-INTERNETWORKING

AUTHORS:
Ajay Singh Meena
Navneet Priya
Raghunadha Reddy

ABSTRACT

Systems and methods are described herein for optimizing the signaling between a User Plane Function (UPF) and a Session Management Function (SMF) during Handoff (HO) and Evolved Packet System (EPS)-Interworking cases. The systems and methods may be employed to intimate "End-Marker" notification from a UPF to a Source Radio Access Network (Source-RAN) of a respective 4G/5G Access-Network. This is achieved by introducing Send End Marker Packets (SNDEM) flags in "Remove FAR" as part of an N4 Session Modification Request.

The solution described herein is applicable where a SMF has selected the same or different UPF to interact with a target RAN (T-RAN) based on slice information provided by Network Slice Selection Function (NSSF).

DETAILED DESCRIPTION

Conventionally, at the time of N2 handoff in 5G, the Session Management Function (SMF) and User Plane Function (UPF) signaling over N4 interface includes the following four iterations to complete the process:

In the first iteration, the flows are created for the target gNB (t-gNB).

In the second iteration, the flows are created for Indirect Data Forwarding Tunnel (IDFT).

In the third iteration, SMF sends the End Marker flag to the UPF to enable the UPF to send the End Marker packet towards the source gNB (s-gNB).

In the fourth (final) iteration, the flows are deleted for s-gNB and IDFT.

The solution described herein proposes to suppress/optimize the message sequence to achieve the above functionality.

As described in 3GPP TS 29.244, N2 HO has two phases: a Preparation Phase and an Execution Phase.

In an example implementation of the solution, the Preparation Phase call flow is the same as it is defined in 3GPP TS 23.502 sec 4.9.1.3.2. This phase involves two iterations of N4 interaction: establishing the uplink (UL) flows for T-RAN and IDFT flows, if direct forwarding tunnel is not available.

Reference is now made to 3GPP Specification 23.502 sec 4.9.1.3.3, and in particular, the call flow during the Execution Phase shown in Figure 4.9.1.3.3-1.

For handoff to be completed during the Execution Phase, the SMF and the UPF currently have two iterations, as shown at steps 10a/10b and steps 13a/13b in Figure 4.9.1.3.3-1. In steps 10a/10b, the SMF sends End Marker flag to the UPF. In steps 13a/13b, the SMF removes the flows installed during the Preparation Phase.

Currently, the “Remove FAR” IE (Information Element) does not contain the End Marker Notification in N4 Session Modification Request., and more generally, “Remove FAR" does not carry End Marker Notification. Rather, SNDEM is defined only in the Update Forwarding parameters in Update FAR IE of Packet Forwarding Control Protocol (PFCP) Session Modification Request.

The solution presented herein proposes techniques to optimize the above signaling between the SMF and the UPF, reducing the four total iterations (two iterations in the preparation phase and two in the execution phase) to three during Handoff and EPS-Interworking. In the Execution Phase, two sequence flows are merged into one iteration.

1) Send the End Marker notification along with Remove FAR in the 3rd iteration itself at step10a/10b while sending the PFCP Session Modification message on N4 to delete the flows for source-gNB, thereby eliminating the need of step13a/13b.

2) Add the End Marker flag in the Remove FAR IE of PFCP Session Modification Request. SMF is to send PFCP Session Modification Request containing Remove PDR (Packet Detection Rule) and Remove FAR.

This saves processing time and resources at the SMF and the UPF. This is important at UPF side, since, as a data node, it handles the data and handoffs.

The proposed solution may be employed for regular PFCP Session Release or any N2 Handoff, 5GS EPS-Interworking to intimate End Marker Notification to gNB and EUTRAN.

The flow defined in the 3GPP Specification 23.502, mentioned above, is a generic one which includes the UPF chaining. The flow includes steps 9a/9b to switch the downlink (DL) flows with t-gNB info (TEID & IP Addr) at s-UPF and includes steps 10a/10b to send the End Marker to the PDU Session Anchor UPF. The flow also includes steps 13a/13b, at which it deletes the old flows of s-gNB, and in steps 15a/15b, deletes the IDFT tunnel.

The solution described herein is applicable when the UPF chaining is not present or UPFs are collocated. In this case, in single session Modification itself, SMF can send END_MARKER flags along with removal of flows for s-gNB. At this point, the GPRS Tunnelling Protocol for User Plane (GTPU) tunnel between s-gNB and UPF is still active, and UPF can send END Marker flag before clearing the flow(s) for s-gNB.

With respect to time at the s-gNB between End Marker receipt and the delete flow action, the steps 14a/14b in the call flow are triggered upon the expiry of the timer which was started at step 6a, as defined in the step 14a.

As per the 3GPP Specification 23.502, the flow cleanup that SMF triggers in step 13a/13b is being performed at UPF level.

With the solution described herein, the same is achieved in the proposed steps10a/10b presented above.