**SA WG2 Meeting #13S2-20xxxxx**

(**revision of S2-2001477, merge of S2-2000934 and S2-2000809**)

**Source: Apple, CATT**

**Title: Solution for Key Issue #2: Deactivated PDU Session release for efficient PDU Session quota management**

**Document for: Approval**

**Agenda Item: 8.8**

**Work Item / Release: FS\_eNS\_Ph2 / Rel-17**

*Abstract: This contribution proposes a solution of how to handle the scenario when maximum quota has been reached and a new PDU Session is trying to be established.*

# 1. Introduction

This solution is for Key Issue 2 – Support of network slice related quota on maximum number of PDU sessions.

*START of CHANGE*

## 6.X Solution #X: Deactivated PDU Session release for efficient PDU Session quota management

### 6.X.1 Introduction

This solution is for *Key Issue 2 – Support of network slice related quota on maximum number of PDU sessions*.

This solution is on top of "Solution #10: Max number of PDU Sessions per Network Slice control via NSQ function" which proposes the base functionality for PDU Session count management.

### 6.X.2 Functional Description

Figure 6.X.2-1 shows the addition of the NSQM to the reference architecture:



Figure 6.X.2-1 – Addition of NSQM to the reference architecture

NOTE: Some network functions are excluded from the figure for easier reference.

### 6.X.3 Procedures

#### 6.X.3.1 Deactivated PDU Session release for efficient PDU Session quota management

The SMF deactivates the UP connection of the PDU Session by releasing the data radio bearer and N3 tunnel. The scenarios that the SMF triggers the operation are described in step 1 in clause 4.3.7 in TS 23.502, as follows:

*The SMF determines that the UP connection of the PDU Session can be deactivated in following cases:*

*- During handover procedure, if all the QoS Flows of a PDU Session are rejected by the target NG-RAN (as described in clause 4.9.1), or if a PDU Session is failed to setup indicated by the AMF (see step 7 of clause 4.9.1.3.3). SMF proceeds with step 2 and step 3, the steps 5 to 9 are skipped;*

*- The UPF detects that the PDU Session has no data transfer for a specified Inactivity period as described in clause 4.4.2.2;*

*- For a LADN PDU Session, the AMF notifies to the SMF that the UE moved out of the LADN service area; or*

*- The AMF notifies to the SMF that the UE moved out of the Allowed Area.*

As shown in Figure 6.X.3.1, UE1, UE2 and UE3 establish the PDU Session with the same S-NSSAI separately. UP connection of the PDU Session of UE1 is deactivated, i.e. the data radio bearer and N3 tunnel is released. UP connections of the PDU Sessions of UE2 and UE3 are activated.



Figure 6.X.3.1-1: Status of UP connection of PDU Session associated with the same S-NSSAI

When UE4 requests to establish the PDU Session associated with the same S-NSSAI (e.g. triggered by an application), AMF initiates the SM Policy Association establishment to NSQ function. If NSQ function detects that the PDU Session COUNT of the S-NSSAI reaches the maximum number, NSQ lets AMF know the list of deactivated PDU sessions along with the corresponding UE identities.



Figure: 6.X.3.1-2 Deactivated PDU Session release for efficient PDU Session quota management

**Pre-Conditions:**

- The NSQM subscribes to the SMF to keep track of the number of active and deactive PDU sessions established for a S-NSSAI.

**Procedures:**

1. The UE initiates a PDU Session Establishment Request with S-NSSAI

2. The AMF receives the PDU Session Establishment and checks the S-NSSAI if any of the slices have the quota limitation. In case any slice has the quota limitation enabled, the AMF retrieves the address of the NSQM from the NRF.

3. The NRF provides the addresss of the NSQM to the AMF.

4. The AMF queries the available quota for the Established PDU sessions count from the NSQM for the S-NSSAI by sending a Nnsqm\_PDUCount\_AvailabilityCheck\_Request message.

5. NSQM checks if quota available for new PDU session to be established for the S-NSSAI.

6. The NSQM has no quota available to accept a new PDU session to the S-NSSAI. The NSQM sends a cause code with appropriate reject cause value. Additionally, the NSQM also sends the list of deactivated PDU sessions along with corresponding UE identities.

7. Since the establishment of a new PDU session is more important than maintaining resources for an inactive and deactivated PDU session, the AMF may optionally take a decision to release a deactivated PDU session as per TS 23.502 clause 4.3.4.

NOTE: It is up to AMF implementation how to select the PDU session to be released. For e.g. a PDU session for which user plane resources have been deactive for more than ‘x’ minutes.

8. PDU Session establishment procedure continues for UE ‘a’

9. The AMF informs the NSQM to increment the count for the established Active PDU sessions for UE “a” and decrement the count for the deactive PDU sessions for UE “x” in Nnsqm\_PDUCount\_Modification\_Request message.

10. The NSQM acknowledges the modification of the updated counts.

11. The AMF sends the PDU Session Establishment Accept message to UE “a”.

Editor’s Note: Roaming impacts need to be studied.

### 6.X.4 Impacts on existing entities and interfaces

- A new network function to be added for maintaining the quota for the maximum number of PDU sessions established per network slice, as well as count of the number of active & deactivate PDU sessions.

- AMF <--> NSQM communication should be defined.

*End of CHANGES*