**3GPP TSG-SA/WG2 Meeting #138E *S2-200xxxx***

**Elbonia, 20 – 24 April, 2020**

**Source: ZTE**

**Title: Solution to KI1,2,4,5: Proactive Slice Quota Management in AMF**

**Document for: Agreement**

**Agenda Item: 8.8**

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

***Abstract of the contribution:*** *This contribution* *proposes a new solution to resolve the key issue#1, key issue#2, key issue #4 and key issue #5.*

# 1 Introduction

This contribution proposes a proactive solution to resolve the slice quota management in key issue #1,#2,#4 and #5. In this solution Slice Quota Management (SQM) is introduced to manage the quota per network slice. The AMF retrieve the local slice quota from the SQM and enforce the slice quota in the AMF. This solution also addresses the slice quota management for roaming case.

# 2 Proposal

It is proposed to agree the following changes in TR 23.700-40.

\*\*\*\*\*\*\*\*\*\*\*\*\* Start Changes \*\*\*\*\*\*\*\*\*\*\*\*\*

## 6.0 Mapping of Solutions to Key Issues

Table 6.0-1: Mapping of Solutions to Key Issues

|  |  |  |
| --- | --- | --- |
| Solution#'s | Solution Titles | Key Issue#'s |
| 1 | PCF measurement based Network Slice SLA control for Maximum Number of UEs parameter | 1 |
| 2 | Max number of UEs per Network Slice control at registration | 1 |
| 3 | AMF/NSSF based counting of UEs in a Network Slice | 1 |
| 4 | NWDAF enhancements for supporting of network slice quota on the maximum number of UEs | 1 |
| 5 | NWDAF enhancements for supporting of network slice quota on the maximum number of PDU Sessions | 2 |
| 6 | PCF-based counting of PDU Sessions in a Network Slice | 2 |
| 7 | Support of Network Slice SLA for Maximum Number of PDU sessions parameter | 2 |
| 8 | AMF and O&M based solution | 1, 2 & 4 |
| 9 | Monitoring multiple quotas of number of UEs/PDU Sessions per S-NSSAI at NWDAF | 1, 2 & 4 |
| 10 | Max number of PDU Sessions per Network Slice control via NSQ function | 2 |
| 11 | Handling maximum number of sessions using NF status | 2 |
| x | **Proactive Slice Quota Enforcement in AMF** | 1,2,4&5 |

\*\*\*\*\*\*\*\*\*\*\*\*\* Next Changes \*\*\*\*\*\*\*\*\*\*\*\*\*

## 6.x Solution #x: Proactive Slice Quota Enforcement in AMF

### 6.x.1 Introduction

This solution addresses the key issue #1, key issue #2, key issue #4 and key issue #5.

### 6.x.2 High-level Description

This solution the AMF is the local enforcement point for the following slice quotas:

- maximum number of UEs in the network slice(KI#1)

- maximum number of PDU Sessions in the network slice(KI#2).

- maximum data rate per network slice(KI#5).

The Slice Quota Management (SQM) is a new function to manage the slice quota within the PLMN. During the first UE registration in the network slice(S-NSSAI), the AMF proactively retrieves the allowed value of local slice quota(s) of the S-NSSAI from the SQM and then enforces the local slice quota(s) as follows:

- (KI#1)For maximum number of UEs in the network slice the AMF ensures the number of UE in the network slice does not exceed the allowed value in the quota for the network slice. When new UE is registered in the network slice(i.e. the S-NSSAI is within the Allowed NSSAI) the AMF adds the number of UE. When the UE is deregistered or the UE context is transferred to another AMF, the AMF reduce the number of UE in the network slice.

- (KI#2)For maximum number of PDU Sessions in the network slice the AMF ensures the number of PDU session in the network slice does not exceed the allowed value in the quota for the network slice. When new PDU Session is established in the network slice or new PDU session context of the network slice is transferred from another AMF, the AMF adds the number of PDU session in the network slice. When the PDU session is released or the PDU session context is transferred to another AMF, the AMF reduce the number of PDU Session in the network slice.

- (KI#5)For maximum data rate per network slice, the AMF sums the Slice-MBR of all UEs in Connected mode which have established PDU Session in the network slice and ensures the total data rate does not exceed the allowed value in the quota for the network slice. When the first PDU session of the UE in the network slice is established or the first PDU session context of the network slice is transferred from another AMF, the AMF adds the Slice-MBR of the network slice. When the last PDU session of the UE in the network slice is released or the last PDU session context of the network slice is transferred to another AMF, the AMF reduces the Slice-MBR of the network slice.

Editor's note: For KI#5, this solution depends on the solution 6.x in which the Slice-MBR is available in the AMF.

NOTE x: This solution doesn’t assume the AMF has to know the information whether the PDU Session is activated or deactivated.

In roaming case, during the first UE registration for a given HPLMN, the AMF retrieves the allowed value of local slice quota of the S-NSSAI from the SQM in the home PLMN and then enforces the local slice quota at the VPLMN according to the corresponding mapped S-NSSAI in the home PLMN.

When the AMF detects the local quota of network slice is overflown it notifies the SQM(KI#4). The SQM may provide new fresh quota for this network slice. In case of no more quota available, the AMF acts as follows:

- If the maximum number of UEs in the network slice exceeds the quota, AMF shall reject any further UE registration in the network slice by adding the S-NSSAI in the rejected NSSAI and the cause value is set to “S-NSSAI is not available in the current registration area”. When the UE moves outside of the registration area the UE initiates a registration procedure and can request the S-NSSAI again. When the AMF receives further quota of this slice the AMF then adds the S-NSSAI in the Allowed NSSAI and initiates UE Configuration Update procedure to the UE.

- If maximum number of PDU Sessions in the network slice exceeds the quota, the AMF shall reject any further PDU session establishment request with the S-NSSAI and send a back off timer to the UE so the UE will not send PDU Session establishment request with same S-NSSAI before the timer expires.

- If maximum data rate per network slice exceeds the quota, the AMF shall reject any further PDU session establishment request with the S-NSSAI and send a back off timer to the UE so the UE will not send PDU Session establishment request with same S-NSSAI before the timer expires. The AMF shall reject any further service request to activate the PDU session in the network slice.

The slice quota in SQM can be preconfigured by OAM, or can be provisioned by the Application Function. The SQM may also request the AMF to report the remaining quota for the network slice. The report can be once or periodically.

The SQM may be deployed together with the NSSF, NRF, or OAM or deployed as standalone function.

### 6.x.3 Procedures

Editor's note: This clause describes high-level procedures and information flows for the solution.



Figure 6.x.3-1: A high-level procedure of the solution

1. The AF may send AF request to SQM to provision the quota of network slice. The AF request may be sent via NEF if the AF is third party AF and the NEF performs authorization.

2. During the first UE registration in the network slice (i.e. the S-NSSAI is within the allowed NSSAI) and AMF knows the S-NSSAI is subject to quota management, the AMF sends quota request to the SQM to retrieve the quota of network slice. The quota request message may include the capacity information of the AMF, AMF identifier and S-NSSAI, etc.

 For roaming case the AMF determines the mapped S-NSSAI of the S-NSSAI in the allowed NSSAI is subject to quota management, the AMF sends quota request to the hSQM in home PLMN via vSQM to retrieve the quota of network slice.

 The AMF may be configured whether the S-NSSAI is subject to quota management, or receives such information from the NSSF.

3. Based on service layer agreement and AMF capability, the SQM determines the quota information of the network slice for the AMF and returns the quota information to the AMF.

 In case of AMF Set, the SQM determines the quota information per AMF set.

The SQM also subscribe the notification event when the quota is overflown or report the remaining quota periodically.

4. The AMF enforce the quota information as described in clause 6.x.2.

5. In case of quota information is overflown or periodical timer expires, the AMF notifies the SQM.

6. Optional, the SQM sends further notification to AF.

7. Optional, the AF may determine to sends AF request to add more quota information to the SQM.

8. The SQM sends notification response to the AMF.

9. The SQM may send quota update request to the AMF to refresh quota information.

10. The AMF stores and reviews the new quota information to apply the latest quota enforcement. The AMF sends quota update response to the SQM and may include the remaining local quota for the network slice.

### 6.x.4 Impacts on services, entities and interfaces

Editor's note: This clause describes impacts to existing entities and interfaces.

**AMF:**

- Interacts with the SQM to retrieve the local slice quota information.

- Local slice quota enforcement

**New SQM function**

- manage the slice quota per PLMN.

- determine the local slice quota for each AMF/AMF set.

### 6.x.5 Evaluation

Editor's note: This clause provides an evaluation of the solution.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End Changes \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*