**3GPP TSG-SA/WG2 Meeting #140E *S2-2004957***

**19August -02 September 2020, Electronic meeting**

**Source: Ericsson**

**Title: KI #1, KI#2, KI#5, Sol #12:** Updates to extend the solution

**Document for: Agreement**

**Agenda Item: 8.3**

**Work Item / Release: FS\_enh\_EC / Rel-17**

***Abstract of the contribution:*** *This contribution* *extends Solution #12: DNS-triggered re-anchoring, proposing a generic solution for PDU session re-anchoring that addresses the Key Issue #1: Discovery of Edge Application Server (EAS), Key Issue #2: Edge Relocation and Key Issue #5: Activating the traffic routing towards Local Data Network per AF request. The UE is Edge Computing Service agnostic.*

# 1 Introduction

This contribution proposes a generic solution for PDU session re-anchoring, extending the Solution #12: DNS-triggered re-anchoring proposed for Key Issue #1: Discovery of Edge Application Server to address the SSC Mode 2 re-anchoring and re-anchoring based on AF request. Besides, the solution addresses also Key Issue #2: Edge Relocation and Key Issue #5: Activating the traffic routing towards Local Data Network per AF request for the scenarios when the PDU session is SSC Mode 2 or 3 and re-anchoring with SMF re-selection is needed. The UE is Edge Computing Service agnostic.

The corrections proposed in pCR S2-2004958 are also included in this pCR, and if this pCR is approved, the pCR S2-2004958 could be discarded.

# 2 Proposal

It is proposed to have the following changes in TR 23.748:

**\* \* \* \* 1st Change \* \* \* \***

# 6.0 Mapping of Solutions to Key Issues

Table 6.0-1: Mapping of Solutions to Key Issues

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Solutions | Key Issues | | | |
| 1 | 2 | 3 | 5 |
| #12 PDU Session re-anchoring | X | X |  | X |

**\* \* \* \* 2nd Change \* \* \* \***

## 6.12 Solution #12: PDU session re-anchoring

### 6.12.1 Solution description

This solution addresses the Key Issue #1: Discovery of Edge Application Server (EAS), Key Issue #2: Edge Relocation and Key Issue #5: Activating the traffic routing towards Local Data Network per AF request. The UE is Edge Computing Service agnostic.

The proposed solution supports the “Distributed Anchor Point” connectivity model. It is assumed that at PDU session establishment the SMF selects a central PSA, but local PSA is available to the SMF, and re-anchoring is used to transition to the “Distributed Anchor Point” model.

The proposed solution also supports the “Session breakout” connectivity model. In this case, re-anchoring involves moving the anchor(s) to the control of another SMF if the PDU session is SSC mode 2 or 3.

Re-anchoring could happen based on different triggers, e.g.:

1. The UE issues a DNS query related to an EC service. The SMF will get information from LDNSR that a local PSA is needed.

Note 1: The placement of LDNSR will decide the exact procedure.

2. Application AF initiates a traffic influence request to PCF (through the NEF in the case of external AF), upon which the PCF initiates a routing request for the PDU session to the SMF. Based on the requested target DNAI the SMF initiates re-anchoring.

3. UE mobility cases which imply re-anchoring.

1. and 2. above are related to KI#1 and 3, is related to KI#2

The following re-anchoring scenarios can be differentiated:

a Support of KI#1, Re-anchoring without change of SMF where the SMF has full control over the re-anchoring. This is the case when the re-anchoring can be done using one of the following existing 5GC procedures for PSA change:

- SSC mode 3 with IPv6 Multi-homed PDU Session (clause 4.3.5.3 of TS 23.502 [3]).

- SSC mode 3 with multiple PDU Sessions (clause 4.3.5.2 of TS 23.502 [3]), without SMF Reallocation.

b Re-anchoring with re-selection of SMF where the SMF may have or may not have full control over the selected re-anchored DNAI.

In b, old SMF sends “use SMF (set) for next PDU session” or “use DNAI for next PDU session” indication to the AMF in the Namf\_Communication\_N1N2MessageTransfer message. The AMF uses this information when selecting an SMF for the new PDU session

Example use cases of re-anchoring where AMF does re-selection of SMF (the existing or new SMF) that could use the described functionality is listed below

1 KI#1, The selected DNAI is supported by SMF but only SSC mode 2 is supported.

2 KI#2, there is a better DNAI because the UE has moved and DNAI is supported by SMF, a new DNAI is selected by SMF

3 KI#5, Selected DNAI is outside the SMF service area. PDU session is SSC#2 or SSC#3.

4 KI#2 and KI#5, due to mobility, the current DNAI is not valid and a new DNAI is needed and the new UE location is outside the SMF service area. PDU session is SSC#2 or SSC#3.

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### 6.12.2 Procedures

#### 6.12.2.1 EAS Discovery triggered re-anchoring without change of SMF, KI#1

Procedure for KI#1. The trigger for re-anchoring is uses the discovery (DNS) for EC server by UE. The PDU Session is SSC#3. The SMF supports Edge PSAs. LDNSR is shown as part of SMF.

This is shown in Figure 6.12.2.2.1-1 below.



Figure 6.12.2..1-1 Re-anchoring without change of SMF during Edge Application Server Discovery using DNS component in SMF

EC AS-FQDN is known by the system and when in a DNS Query is what will trigger a re-anchoring

1. The EC service is identified by a FQDN, the AS-FQDN. The application in the UE does a DNS discovery request to discover the EAS. The DNS request is (at least for EC FQDNS) forwarded by central PSA (UPF1) to the SMF.

2. The SMF checks whether the received FQDN is an AS-FQDN. If yes, then it buffers the DNS request. That decision could either be based on SLA information locally configured in SMF, or on the PCCs received from PCF for the PDU Session.

NOTE 1: Steps 1 and 2 assume DNS query triggering the procedure. DNS query may reach SMF as in Step 1, but it can also reach an external LDNSR that notifies in turn the SMF about the DNAI to use. Other alternatives are also possible, e.g., the MNO uses a DPI engine (e.g., at the UPF) to differentiate traffic of specific applications. Discovery of certain applications for certain users will then trigger procedure. Such traffic differentiation can be based in DPI as an example on the TLS client hello Server Name Indication (SNI), on destination IP ranges published or provided by the Application provider, etc.

3. SMF shall select a UPF/PSA closest to the user. If latest UE Location is not available, SMF gets UE location from AMF by invoking Namf\_EventExposure service with OneTime Report type (as in TS 29.518, ch 5.3.1).

4. If early DNS handling, DNS respond with the AS address, which will cause the UE to connect to the AS via the existing PSA (and once new PDU session is established, the UE should trigger a new DNS query, see solution #24, or other solution for KI#2, and executed in steps 7 and 8)

5. SMF initiates Change of PDU Session Anchor to the PSA selected in step 3 using one of the following methods:

- SSC mode 3 with IPv6 Multi-homed PDU Session (clause 4.3.5.3 of TS 23.502 [3])

- SSC mode 3 with multiple PDU Sessions (clause 4.3.5.2 of TS 23.502 [3])

Usage reporting for the relevant EC flows is activated to track activity.

NOTE 2: Further re-anchoring (to a central UPF) may be triggered if EC application terminates.

NOTE 3: As for all use of SSC modes 2 and 3, all IP traffic on the PDU session is affected since IP address is changed from old PSA (in this case central PSA) to new PSA (in this case local PSA).

6. If late DNS handling, the SMF either:

- Drops the DNS query, by which the UE needs to re-send the DNS query based on timeout

- Re-directs the DNS query to a local MNO DNS Server by referral to this DNS server

7. The UE sends again the DNS query (after expiration timer at the UE or after receiving the redirect message). The DNS query goes through the Local PSA to the DNS resolver provided at the session establishment of the new session, and it is resolved to an Edge AS as described in Solution 6.10.

8. DNS response includes an EAS that is closest to PSA (with DNS state of the art many **Authoritative (DNS)** Name servers already today return different responses based on the perceived topological location of the user (see e.g. solution #10 for DNS based EAS discovery with distributed anchor).

9. The Application Traffic then starts towards the selected Edge AS.

NOTE 4: The assumption is that PDU session setup is complete before the new DNS request is sent in step 7. DNS retransmission timers at UE (DNS client) are implementation dependent. Typical retransmission timer value recommendations in RFC 1536 is 4 seconds and increases exponentially.

#### 6.12.2.2 AF triggered re-anchoring without change of SMF, KI#1

Similar procedure as 6.12.2.1 but AF influence on traffic routing triggers the procedure instead of DNS, and when UE initiates a new PDU session for SSC mode 3, a solution to KI#2 may need to be used to move the session if the UE already has a connection to the AS/AF, since this connection was what could have triggered the AF influence routing.

#### 6.12.2.3 Re-anchoring with AMF re-selecting the same SMF, KI#1

This procedure applies for session re-anchoring using SSC mode 2, but where the SMF is still in control of the UPF/PSA that supports the DNAI.

This procedure is similar as 6.12.2.1, but in step 5, the SMF sends a “use SMF (Set) for next PDU session” indication to the AMF and may send as well a EC dynamic context to AMF e.g. included in the Namf\_Communication\_N1N2MessageTransfer message for SSC mode #2.. Where by the AMF selects a SMF (in the SMF set).

#### 6.12.2.4 Re-anchoring with AMF re-selecting different SMF, KI#5

The procedure is shown in Figure 6.12.2.2.4-1 below. The pre-requisite is that SMF1 has local logic and may have additional configuration (for example, local policies) to control this new functionality, including the information provided to AMF. As an example, these policies determine for each event, whether DNAI identifies a specific DN access, or whether that is a generic identifier for the closest PSA to the UE’s current location, as well as what is the additional information that needs to be provided. That additional information is from now on referred to as the EC dynamic context



Figure 6.12.2.2.3-1 Re-anchoring with re-selection of SMF

0. PDU Session establishment. The UE PDU session is established.

1. SMF1 receives a trigger related to the UE PDU session. The trigger may be one of the triggers in the examples listed in Clause 6.12.1 The details related to different triggers (DNS query or AF traffic routing request) are similar to the procedures in 6.12.2.1 and 6.12.2.2

2. SMF1 decides on re-anchoring for this PDU session. That decision could either be based on SLA information locally configured in SMF, or on the PCCs received from PCF for the PDU Session. SMF1 determines that SSC mode 2 or SSC mode 3 with SMF reallocation is to be used, i.e., e.g. one of the scenarios listed in Clause 6.12.1.

3. SMF1 initiates a Change PDU Session Anchor using one of the following methods:

- SSC mode 3 with multiple PDU Sessions (clause 4.3.5.2 of TS 23.502 [3]) with SMF Reallocation request, or

- SSC mode 2 with different PDU Sessions (clause 4.3.5.1 of TS 23.502 [3]).

4. In both cases in step 3, SMF1 may send a “use DNAI for next PDU session” indication to the AMF e.g. in the N1 SM Information to the UE via the AMF by invoking the Namf\_Communication\_N1N2MessageTransfer message for SSC mode #2 or SSC mode #3 session re-establishment. The local configuration plus any additional input specific for the related applications (see step 0 and pre-requisites) is used to determine the information provided: The EC dynamic context that SMF1 may convey towards AMF may include:

- DNAI(s) for the local PSA(s)

- Traffic filters (for session breakout scenarios)

- N6 routing information

- DNS configuration (e.g., DNS server to use by the UE in the new PDU session)

- Subscribed AF information (in the case when PCF may not have the information)

- Related local policies.

AMF stores the information received in this EC dynamic context as it will need to be passed to new SMF when UE sends the new PDU Session Establishment request according to SSC mode 2 or 3

NOTE 1: Some of the information may be possible to determine again by new SMF based on local configuration or from the PCF. What needs to be provided is what depends on local configuration specific to the old SMF or information that SMF has received/created dynamically for the PDU session (see pre-requisites)

NOTE 2: SMF1 may also send the above information to AMF by invoking a Nsmf\_EventExposure service operation

5. AMF selects new SMF2 for the next PDU session establishment requested by the same UE. If AMF received the “use DNAI for next PDU session” indication from SMF1 in Step 4, then the AMF will use the DNAI received when selecting the new SMF (that can be done e.g. with assistance by NRF as proposed in solution #50).

6. AMF conveys the stored EC dynamic context information to the newly selected SMF2 in the Nsmf\_PDUSession\_CreateSMContext Request.

7. Based on the information received from the AMF, SMF2 will select and setup UPF(s)2 (including the local PSA(s) if needed) for this PDU session and perform additional actions if needed (e.g., setting MNO DNS for the PDU session or notifying the indicated AF).

NOTE 3: Usage reporting for the relevant EC flows may be activated to track activity. Further re-anchoring (to a central UPF) may be triggered if EC application terminates.

### 6.12.3 Impacts on services, entities and interfaces

- SMF:

KI#1, The additional logic needed to support DNS triggered/AF triggered re-anchoring according to the descriptions in 6.12.2.1 and 6.12.2.2.

KI #1, The re-anchoring decision and procedures including conveying the “SMF (set) for next PDU session” as well as the EC dynamic context to AMF as described in 6.12.2.3.

KI #5 and KI#2, The re-anchoring decision and procedures including conveying the “DNAI for next PDU session” as well as the EC dynamic context to AMF as described in 6.12.2.4.

NOTE: the coordination of DNS and the PSA of the PDU Session is performed by a new function LDNSR in other solutions for KI#1. This solution impacts that function and the impact on the 5GC NFs is conditioned by the decisions taken for all solutions in relation to LDNSR.

- AMF:

- KI#1, using SMF (set) information received from former SMF in the selection of the new SMF.

- KI#5 & KI#2, using DNAI information received from former SMF in the selection of the new SMF and conveying the DNAI,

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