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**Source: Huawei, HiSilicon**

**Title: KI#1, evaluations and conclusions**

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*Abstract: This contribution introduces evaluations on solutions of KI#1 and proposes a way forward for conclusions.*

# 1. Introduction/Discussion

1. **For solutions that address the scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server**, the following table provides a comparison for such solutions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Principle | What it solves | System impacts | Pros/Cons | Solution |
| Trigger Primary authentication and authorization towards AAA server using UDM indication | Determine the primary authentication and authorization towards AAA server based on UDM indication  Obtain the external UE ID, which is used during primary authentication and authorization towards AAA server  Select the AUSF that supports interacting with AAA server | Impacts on AUSF, UDM and AMF | Pros: well support of the scenario that UDM is involved in primary authentication and authorization  Cons: | Sol#4, #8 |
| Trigger Primary authentication and authorization towards AAA server using local policy and UE indication | Determine the primary authentication and authorization towards AAA server based on local policy and UE indication  Obtain the external UE ID, which is used during primary authentication and authorization towards AAA server  Select the AUSF that supports interacting with AAA server | Impacts on AUSF and AMF | Pros: well support of the scenario that UDM is not involved in primary authentication and authorization  Cons: | Sol#4, #8, #10 |
| UDM provides the subscription data for mobility management and session management | AMF or SMF obtain the subscription data from UDM using SUPI | No | Pros: reuse current mechanism  Cons: | Sol#4, #8, #44 |
| UDM provides the subscription data for mobility management and session management | AMF or SMF obtain the subscription data from UDM using SI-SUPI | Impacts on UDM/AMF/SMF | Pros:  Cons: need some changes in the existing mechanism | Sol#10 |
| AAA-P/AUSF provides the subscription data for mobility management and session management | AMF or SMF obtain the subscription data from AAA-P/AUSF using SUPI | Impacts on AAA-P/AMF/SMF | Pros: applicable in case no UDM is deployed at SNPN  Cons: | Sol#4, #8 |
| AAA server provides the subscription data for mobility management and session management to UDM (via AUSF) | AAA server provides the subscription data for mobility management and session management to UDM (via AUSF) | Impacts on AUSF, UDM | Pros:  Cons: | Sol#10, #44 |

Solution #4, #8, #10 and #44 address the scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server. This scenario is applicable when the Subscription Owner (SO) implements AAA infrastructure separate from the SNPN to store the UE identities and credentials (and potentially the service subscription data).

Moreover, this scenario is applicable at onboarding and remote provisioning for SNPN case where the primary authentication and authorization towards a DCS, separate entity from O-SNPN or SO-SNPN, is required during UE initial registration at the O-SNPN.

**Observation 1: the scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server can occur when Subscription Owner (SO) implements AAA infrastructure or when the SNPN provides onboarding and remote provisioning service.**

**Proposal 1: Support scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server.**

There are mainly two aspects that require to be addressed for the scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server:

- Primary authentication and authorization towards AAA server

- Retrieval of the subscription data for mobility management and session management

To address the Primary authentication and authorization towards AAA server, the AUSF that supports interacting with AAA server needs to be selected and the external UE ID used to identify UE towards AAA server needs to be obtained.

- If the UDM is not involved in this primary authentication and authorization, AMF determines the primary authentication and authorization towards AAA server based on local policy and UE indication, derives the external UE ID using SUPI/SUCI or requests the UE to provide the external UE ID, as well as selects the AUSF that supports interacting with AAA server. This can give well support for the case where UDM is not deployed.

- If the UDM is involved in this primary authentication and authorization, the AUSF determines the primary authentication and authorization towards AAA server based on UDM indication, derives the external UE ID using SUPI or requests the UE to provide the external UE ID via AMF. If the first selected AUSF does not support interacting with AAA server, then the AMF needs to select the AUSF that supports interacting with AAA server based on the received UDM indication. This can give well support for the case where UDM is used, for example to provide the pro-configured subscription data for mobility management and session management.

The exact procedures of primary authentication and authorization towards AAA server needs to be defined by SA3. This is captured as NOTE in the solutions.

**Observation 2: In scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server, the UDM may or may not be involved in the primary authentication and authorization towards the AAA-S, this is up to SNPN deployment.**

**Observation 3: There may exist AUSF supporting** **interaction with AAA server and AUSF not supporting** **interaction with AAA server at the same time in a SNPN.**

**Observation 4: The SUPI provided by UE in registration request can be generated based on external UE ID or has no relation with the external UE ID.**

**Observation 5: The** **primary authentication and authorization towards AAA server has SA3 impacts.**

**Proposal 2: The primary authentication and authorization towards the AAA-S is used during UE initial registration with the SNPN, the AUSF that supports interacting with AAA server needs to be selected and the external UE ID used to identify UE towards AAA server needs to be obtained. Based on SNPN deployment, the UDM may or may not be involved in this primary authentication and authorization.**

To address the Retrieval of the subscription data for mobility management and session management, the AMF or SMF needs to get the subscription data using a data key.

- If the UDM is not involved, AMF or SMF can use the SUPI/External UE ID to request the individual/common subscription data from AUSF/AAA server. This can give well support for the case where UDM is not deployed.

- If the UDM is involved, AMF or SMF can use the data key to request the individual/common subscription data from the UDM. The subscription data in UDM may be pre-configured or dynamically provisioned by AAA-S on demand. The data key could be either a SUPI or a SI-SUPI. This can give well support for the case where UDM is used. However when SI-SUPI is used as the data key (sol#10), it requires additional enhancement at the UDM or AAA-S for support of the SI-SUPI generation.

**Observation 6: It is essential to retrieve the subscription data for mobility management and session management. Using SI-SUPI rather than SUPI as the data key to retrieve the subscription data from the UDM has additional impacts.**

**Proposal 3: The AMF or SMF can retrieve the individual subscription data (using SUPI) or common subscription data (using external UE ID) from the UDM or AUSF/AAA-S to complete the registration and session management procedures respectively. When the UDM is involved, the subscription data in UDM may be pre-configured or dynamically provisioned by AAA-S on demand.**

1. **For solutions that address the mobility scenario,** the following table provides a comparison for such solutions:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Principle | What it solves | System impacts | Pros/Cons | Solution |
| Consider Inter-PLMN like interworking | Considering the Inter-PLMN like interworking, use the PDU Session Establishment procedure with Existing PDU Session indication to address the session continuity for “Home Routed” PDU sessions | No | Pros:  Cons: no support of session continuity for “LBO” PDU session, only consider the Inter-PLMN like interworking | Sol#1, #2, #41 |
| Consider both the Inter-PLMN like interworking and N3IWF based interworking | Considering all mobility cases to address the session continuity for “Home Routed” or “Local Breakout” the PDU sessions, use the PDU Session Establishment procedure with Existing PDU Session indication or use the Handover of a PDU Session procedure between 3GPP and untrusted non-3GPP access Procedure, or use the PDU Session Establishment procedure with Initial Request indication | Target network needs to determine a mobility indication considering the Inter-PLMN like interworking or N3IWF based interworking | Pros: comprehensive consideration for different mobility cases and support session continuity for “Home Routed” or “Local Breakout” the PDU sessions  Cons: needs a mobility indication | Sol#41 |

To address the mobility scenario of KI#1, it should consider all possible mobility cases, for example:

- Whether there is Xn interface or N14 interface between two networks

- Where the PDU session anchors, Home SP or Source network. When the PDU session anchors at source network, which interworking way is supported between source network and target network. When the PDU session anchors at Home SP, which interworking way is supported between target network and Home SP network.

To achieve the service continuity, the exact procedures to handover the PDU session should consider the real deployment situation among the source network, the target network and the Home SP:

- In the case that there are neither common AMF (i.e., Xn interface) nor N14 interface between the source network and target network, in order to support handover for PDU sessions anchored at Home SP#:

- in the case of Inter-PLMN like interworking between target network and Home SP, the UE performs the handover of the PDU session using PDU Session Establishment procedure with Existing PDU Session indication as defined in TS 23.502 [6] clause 4.3.2.2.2

- in the case of usage of N3IWF for interworking between target network and Home SP, the UE performs the handover of the PDU session using Handover of a PDU Session procedure between 3GPP and untrusted non-3GPP access Procedure as defined in TS 23.502 [6] clause 4.9.2.3 or 4.9.2.4 that follows the PDU Session Establishment procedure at the target network as defined TS 23.502 [6] clause 4.3.2.2.1

- In the case that there are neither common AMF nor N14 interface between the source network and target network, in order to support handover for PDU sessions anchored at SNPN#1

- in the case of Inter-PLMN like interworking between the source network and the target network, the UE performs the handover of the PDU session using PDU Session Establishment procedure with Existing PDU Session indication as defined in TS 23.502 [6] clause 4.3.2.2.2

- in the case of usage of N3IWF for interworking between the source network and the target network, the UE performs the handover of the PDU session using Handover of a PDU Session procedure between 3GPP and untrusted non-3GPP access Procedure as defined in TS 23.502 [6] clause 4.9.2.1 or 4.9.2.2 that follows the PDU Session Establishment procedure at the target network as defined TS 23.502 [6] clause 4.3.2.2.1

- in the case of no interworking between the source network and the target network, the UE re-establish the PDU session using PDU Session Establishment procedure with Initial Request indication as defined in TS 23.502 [6] clause 4.3.2.2.1

- In the case that there are common AMF and/or N14 interface between the source network and target network, mechanism defined in TS 23.502 [6] clause 4.9.1 is re-used

**Observation 7: Between two networks, there may have no interworking, or use the N3IWF for interworking, or use the Inter-PLMN like interworking, and there may or may not exist Xn interface or N14 interface.**

**Observation 8: The PDU session may anchor at source network or Home SP network during UE mobility. The exact procedures to handover the PDU session should consider the real deployment situation among the source network, the target network and the Home SP.**

**Proposal 4: Mobility scenarios should support the following cases**

**1) a UE moving from SNPN#1 to SNPN#2 with PDU session anchored in the Home SP#1 and vice versa;**

**2) a UE moving from SNPN#1 to SNPN#2 with PDU session anchored in the SNPN#1 and vice versa**

**3) a UE moving between SNPN#1 and Home SP#1 with PDU session anchored in the Home SP#1.**

**4) a UE moving between SNPN#1 and Home SP#1 with PDU session anchored in the SNPN#1.**

**Proposal 5: Support the mobility indication provided by target network to UE to indicate which be the mobility procedure to be used for session mobility of a PDU session, i.e. those for inter-PLMN like interworking, usage of N3IWF located in the network where the PDU session is anchored and no interconnection between source and target network.**

1. **For solutions that address the simultaneous data services from both V-SNPN and Home SP (PLMN or SNPN) of KI#2 for UE with a single subscription**, the following table provides a comparison for such solutions::

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Principle | What it solves | System impacts | Pros/Cons | Solution |
| Access to V-SNPN services | Use the Local Breakout PDU session for access to V-SNPN services | No | Pros: reuse current mechanism  Cons: | Sol#1, #2, #50 |
| Access to Home SP network services | Use the “Home Routed” PDU session for access to Home SP network services | No | Pros: reuse current mechanism  Cons: | Sol#1, #2, #50 |
| Access to Home SP network services taking UE subscription, UE capability (SR or DR), local policy and agreements between V-SNPN and Home SP | Use the “Home Routed” PDU session for access to Home SP network services, e.g., for SR UE  Use the non-roaming PDU session for access to Home SP network services by a secondary 3GPP registration at Home SP network, e.g., for DR UE | The network determines which way to use for the UE to access Home SP network services | Pros: efficient utilization of network resource by taking all aspects into consideration  Cons: | Sol#50 |

Interim conclusions for KI#2 include that when UE only has single subscription, the data service from both V-SNPN and Home SP (PLMN or Home SNPN), as well as service continuity is to be evaluated by KI#1. To address the data service from V-SNPN for UE with single subscription, all solutions propose to re-use the “Local Breakout” PDU session i.e., PDU session anchored at the V-SNPN for access to V-SNPN services.

**Proposal 6: For UE with single subscription, use the PDU session anchored at the V-SNPN for access to V-SNPN services.**

To address the data service from Home SP, all solutions propose to re-use the “Home Routed” PDU session, i.e., PDU session anchored at the Home SP. Solution 50 further considers the following case: when the UE is capable of dual radio and the V-SNPN does not allow/prefer the UE to access Home SP network services using V-SNPN resources, then the UE can select the PLMN cell and perform another secondary registration at the Home SP using the Home SP credential/subscription, following this secondary registration, the UE can use the non-roaming PDU session for access to Home SP network services.

**Observation 9: Access to Home SP services using“Home Routed” PDU session has dependency on V-SNPN support, e.g., V-SNPN RAN/V-SMF/V-UPF, the V-SNPN may not allow/able to use the“Home Routed” PDU session based on network policies/deployments/configurations.**

**Proposal 7: For DR UE, use the non-roaming PDU session for access to Home SP network services, which follows a secondary 3GPP registration at Home SP network via the cell of the Home SP.**

# 2. Text Proposal

It is proposed to capture the following changes vs. TR 23.700-07 V0.5.0.

\* \* \* \* First change \* \* \* \*

## 7.1 Key Issue #1: Enhancements to Support SNPN along with credentials owned by an entity separate from the SNPN

Editor's note: This clause may provide a general evaluation and comparison of the solutions per Key Issue #1.

### 7.1.X Evaluations for scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server

This clause provides evaluations for the solutions that address the scenario where the SNPN offers connectivity for UE(s) with credentials owned by separate entity offering AAA Server (AAA-S), among these solutions:

- Sol#4 proposes that

- In the case that SNPN UDM does not provide any subscription data the primary authentication and authorization towards the AAA-S is triggered by AMF based on local policy and UE indication, the AMF selects the AAA-P that supports the primary authentication and authorization towards the AAA-S. The AMF derives the external UE ID from the SUCI/SUPI or receives the external UE ID from UE. The AMF selects the AAA-P that supports the primary authentication and authorization towards the AAA-S. The AMF obtains the access and mobility subscription data from AAA-P/AAA-S to complete the registration procedures, the SMF obtains the session management subscription data from AAA-P/AAA-S to complete the session management procedures. This is applicable when UDM is not involved in the primary authentication and authorization towards the AAA-S, e.g., the UDM is not deploy in the SNPN.

- In the case that SNPN UDM provides access and mobility subscription data, session management subscription data, the primary authentication and authorization towards the AAA-S is triggered by the UDM indication in subscription data. The AMF may re-select a AAA-P that supports the primary authentication and authorization towards the AAA-S based on the UDM indication. The AAA-P derives the external UE ID from the SUPI or receives the external UE ID from UE via AMF. The AMF obtains the access and mobility subscription data from UDM to complete the registration procedures, the SMF obtains the session management subscription data from UDM to complete the session management procedures. This is applicable when UDM is involved in the primary authentication and authorization towards the AAA-S.

- Sol#8 proposes the similar mechanism as the Sol#4’s case that SNPN UDM provides subscription data for the UE, where CdP (Credentials Provider) replaces the AAA-S, and AAA-P is implemented by enhanced AUSF that supports delegation of authentication server role to the CdP via new NF supporting protocol interworking with CdP.

- Sol#10 proposes the similar mechanism as the Sol#4’s case that the primary authentication and authorization towards the AAA-S is triggered by AMF based on local policy and UE indication where the AMF derives the external UE ID from the SUCI/SUPI and uses this for the security procedures. In addition, the subscription data is pre-configured at UDM or dynamically provisioned at UDM on-demand. The AMF or SMF can obtain the UE subscription data from UDM using a UE Subscription Identifier (SI-SUPI), which can be generated by UDM/UDR or be provided by the AAA server. The SI-SUPI is new key for subscription data retrieval and has impacts on the procedural level.

- Sol#44 proposes that the similar mechanism as the Sol#4’s case that the primary authentication and authorization towards the AAA-S is triggered by AMF based on local policy and UE indication. In addition, the AAA Server can interact with SNPN UDM, supporting to provision the UE subscription data e.g., session management subscription data, access and mobility subscription data at UDM during registration procedure once the primary authentication and authorization at AAA-S succeeds. The direct interaction between AAA server and UDM has impacts on the system level.

### 7.1.Y Evaluations for mobility scenarios

This clause provides evaluations for the solutions that address the mobility scenario, among the solutions below described:

- Sol#1 and Sol#2 supports mobility scenario based on roaming architecture (i.e., Inter-PLMN like interworking) between the source/target network and the Home SP, making use the PDU Session Establishment procedure with Existing PDU Session indication as defined in TS 23.502 [6] clause 4.3.2.2 to address the session continuity for the PDU sessions anchored in the home SP (SNPN or PLMN). This only addresses the session continuity for “Home Routed” PDU sessions and only considers the Inter-PLMN like interworking for mobility cases.

Editor’s note: Evaluate solution #41 when solution and impact is clear.

### 7.1.Z Evaluations for simultaneous data service from both V-SNPN and Home SP (PLMN or SNPN)

This clause provides evaluations for the solutions that address the simultaneous data services from both V-SNPN and Home SP (PLMN or SNPN) of KI#2, among these solutions:

- Sol#1 or #2 propose to support the Local Breakout PDU sessions and Home routed PDU sessions to address the simultaneous data services from both V-SNPN and Home SP (PLMN or SNPN).

Editor’s note: Evaluate solution #50 when solution and impact is clear.

\* \* \* \* Second change \* \* \* \*

## 8.1 Key Issue #1: Enhancements to Support SNPN along with credentials owned by an entity separate from the SNPN

Editor's note: This clause will capture conclusions for Key Issue #1.

### 8.1.Y Conclusions for mobility scenarios

The mobility procedures are based on:

- In the case that there are common AMF and/or N14 interface between the source network and target network, mechanism defined in TS 23.502 [6] clause 4.9.1 is re-used to address UE mobility.

\* \* \* \* End of changes \* \* \* \*