**3GPP SA WG2 Meeting #162 S2-2404265**

**Changsha, April 15 – April 19, 2024**

**Source: Ericsson**

**Title:** **KI#1.x: New solution for Supporting dual-steer connection based on ATSSS**

**Document for: Approval**

**Agenda Item:** **19.13**

**Work Item / Release: FS\_MASSS / Rel-19**

*Abstract of the contribution: This proposal presents a solution for connecting a DualSteer device to 5GS, where registration, session management, policy, and subscription information is taken into account.*

# Introduction

This CR proposes a solution for KI#1.1, KI#1.2, KI#1.3 and KI#1.4

# 2. Text Proposal

It is proposed to introduce the following changes in TR 23.700-54

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

# 6 Solutions

## 6.0 Mapping of Solutions to Key Issues

Table 6.0-1: Mapping of DualSteer Solutions to Key Issues

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Key Issues for DualSteer | | | |
| Solution# | <Key Issue #1.1> | <Key Issue #1.2> | <Key Issue #1.3> | <Key Issue #1.4> |
| #X |  |  |  |  |
| #1.Y | x | x | x | x |
|  |  |  |  |  |
|  |  |  |  |  |

Table 6.0-2: Mapping of ATSSS\_Ph4 Solutions to Key Issues

|  |  |  |
| --- | --- | --- |
|  | Key Issues for ATSSS\_Ph4 | |
| Solution# | <Key Issue #2.1> | <Key Issue #2.2> |
| #2.1 | **X** |  |
| #2.2 |  | **X** |
| #2.3 | **X** |  |
| #2.4 | **X** |  |
| #2.5 | **X** |  |
| #2.6 |  | **X** |
| #2.7 |  | **X** |
| #2.8 |  | **X** |

\* \* \* Next Change (all new text) \* \* \* \*

## 6.1.Y Solution # 1.Y: Supporting dual-steer connection re-using certain ATSSS functionality

### 6.1.Y.1 Overall Description

#### 6.1.Y.1.1 Introduction

The proposed solution is based on the following principles:

- The impact to AMF is either none or minimal. This enables the DS functionality when only the HPLMN supports the DS functionality and the VPLMN can either remain unchanged or need to make minimal enhancements to the AMF. This solution describes two alternatives:

o Alt1: No AMF impact: this alternative is based on SMF redirection and needs homogeneous deployment of SMFs that support DS for a DNN/ S-NSSAI.

o Alt2: Limited AMF impact: this alternative enables non-homogeneous deployment of SMFs that support DS.

- Either of two SUPIs can be used by the UE to first register or request the PDU session establishment.

Editor's note: How the DS device becomes aware of what SUPIs can be used for DS functionality is FFS.

- The solution considerers the DS device to act as either one or two UEs towards the network but does not discuss the UE architecture. The requirements on the DS device are listed in the impact section.

- The traffic switching and steering is based on using a common SMF and UPF. Traffic splitting is not supported.

- UPF treats the DS PDU session in a similar manner as an MA PDU session. However, establishment and management of the DS PDU Session is different than that of the MA PDU session.

- The solution applies to a DS device that support simultaneous transmission.

Editor's note: How to support DS devices that do not support simultaneous transmission is FFS.

NOTE: How the UE decides to register to a second 3GPP access network and how the UE selects this 3GPP access network is assumed to be addressed by other solutions.

#### 6.1.Y.1.2 Architectures

This solution is based on providing a common anchor (UPF) and SMF inside the 5GC for the DS traffic from both 3GPP access networks. Non-roaming and roaming architectures are shown below.



Figure 6.1.Y.1.2-1 Non-roaming dual steering architecture



Figure 6.1.Y.1.2-2 Dual steering architecture with roaming in one access



Figure 6.1.Y.1.2-3 Dual steering architecture with roaming in both accesses with common VPLMN



Figure 6.1.Y.1.2-4 Dual steering architecture with roaming in both accesses with two different VPLMNs

#### 6.1.Y.1.3 Registration

**Alt 1: No AMF impact:**  It has no impact on the registration procedure.

**Alt 2: Limited AMF impact:**  The AMF may indicate (visited) network’s support for DS PDU session in the initial Registration Accept message to UE.

#### 6.1.Y.1.4 Policy

**URSP Rules:** To support establishment of DS PDU session, the URSP rules are extended. Specifically, the Access Type preference in Route Selection Descriptor is extended to include a Dual Steering indication.

**PCC rules:** Considering that data splitting is not supported, the allowed steering modes are Active-Standby and Smallest Delay. For the Active-Standby mode, the Access type and connected PLMNs can be important. Therefore, the MA PDU session Control part of the PCC rules is enhanced as follows:

- A new field Access descriptor is added to PCC rules, which includes a 4-tuples (Access1-type, Access1-PLMN-ID, Access2-type, Access2-PLMN-ID), identifying Access1 and Access2. The access type may be one of the following: T-NR, GEO, LEO, LTE, non-3GPP, other.

- The fields charging/monitoring key for Non-3GPP access is extended to include charging/monitoring key for Access2.

**Table 6.1.Y.1.4-1: Enhancement on the PCC rule for Dual Steering**

|  |  |
| --- | --- |
| **Information Name** | **Description** |
| MA PDU Session Control |  |
| Application descriptors | Identifies the application traffic (NOTE1) |
| Access descriptor | Identifies the access type and PLMN via a 4-tuples as follows: (Access1-type, Access1-PLMN-ID, Access2-type, Access2-PLMN-ID) (NOTE2) |
| Steering Functionality | Indicates the applicable traffic steering functionality:  Values "MPTCP functionality", "ATSSS-LL functionality", "MPQUIC functionality" |
| Steering Mode | “Shortest delay” or “Active-Standby” (NOTE 3) |
| Steering Mode Indicator | N/A for DS |
| Threshold Values | N/A for DS |
| Transport Mode | (NOTE1) |
| Charging key for Non-3GPP access/Access2 | (NOTE1) |
| Monitoring key for Non-3GPP access/ Access 2 |  |
| NOTE1: similar to how it is defined for MA PDU session in clause 6.3.1 of TS 23.503 [5].  NOTE2: The access type can be one of {T-NR, GEO, LEO, LTE, non-3GPP, other}  NOTE3: As an example, the Active Standby mode is described as “Active: Access1, Standby: Access2”, where Access1 and Access2 can be identified by the Access Descriptor. | |

The PCF should subscribe to changes of RAT, Access Type, and PLMN to SMF for both SUPI1 and SUPI2 and it may update the PCC rules based on the notifications.

Editor's note: Further description on how to handle a single SM policy association related to two SUPIs, is FFS.

**ATSSS Rules:** To enforce DS policies in the UL direction, the ATSSS rules are re-used to provide policies for DualSteer traffic steering and switching and enhanced with a new Access Descriptor parameter to differentiate from ATSSS rules used with MA PDU Session. This is the same 4-tuple as described in Table 6.1.Y.1.4-1 and guides the DS device to identify which one of the accesses is Access1 and which one is Access2.

Editor's note: Whether this is referred to as ATSSS rules or a new type of rule is define (DS rules) is FFS

**Table 6.1.Y.1.4-2: ATSSS rule structure to support DS**

|  |  |
| --- | --- |
| Information name | Description |
| **Rule identifier** | NOTE1 |
| Rule Precedence | NOTE1 |
| **Traffic Descriptor** | NOTE1 |
| Application descriptors | NOTE1 |
| IP descriptors | NOTE1 |
| Non-IP descriptors | NOTE1 |
| **Access descriptor** | **NOTE2** |
| **Access Selection Descriptor** | NOTE1 |
| Steering Mode | **NOTE2** |
| Steering Functionality | NOTE1 |
| Transport Mode | NOTE1 |
| NOTE1: the same clause 5.32.8 of TS 23.501.  NOTE2: The same as in Table 6.1.Y.1.4-1 | |

**N4 Rules:** The same mechanism for MA PDU session can be implemented for DS PDU session, i.e., the SMF generates two FARs that direct the traffic to the two accesses and one MAR that points to one of the FARs depending on whether the Active path is chosen for downlink traffic or the standby one (in the Active-Standby mode).

#### 6.1.Y.1.5 Subscription and UE context data in UDM/UDR

The connection between the two SUPIs is maintained in UDM. For this purpose, **a new field, DS SUPI,** is added in the Session Management Subscription Data for both SUPI1 (containing SUPI2) and SUPI2 (containing SUPI1). In addition, for alternative 2, the same field is also added to the Access and Mobility Subscription Data for both SUPIs.

A new parameter, **DS Correlation ID,** which is used to connect two PDU session requests is added to SMF registration information and UE context in SMF data in UDM/UDR.

How these new parameters are used is described on the procedures below.

#### 6.1.Y.1.6 Session management

This solution is based on creating a DS PDU session that is anchored in a common UPF and managed by a common SMF. To achieve this:

- Two separate PDU session Establishment requests are sent by the UE (one for each SUPI).

- In the PDU session Establishment requests, UEs provides a new parameter (DS Correlation ID) to enable identifying which two PDU session requests correspond to the same DS PDU session.

- Both AMFs select the same (H-)SMF. To achieve these two alternatives are presented:

o Alt1: No AMF impact: Selection of common SMF is done via HTTP redirect, request by the SMF.

1. Alt2: Limited AMF impact: Selection of common SMF is done via DS Correlation ID matching by AMF.

### 6.1.Y.2 Procedures

#### 6.1.Y.2.1 Session management

Based on the impact on AMF two alternatives are considered for creating DS PDU session.

Note: in this section we consider two separate UDMs to manage the subscription data of SUPI1 and SUPI2, however, since both UDMs belong to the HPLMN, it can be assumed that the subscription data of both SUPIs are managed in a single UDM.

**Alt1: No AMF impact:**



Figure 6.1.Y.2.1-1 Dual steering PDU Session Establishment: Alt1

1. UE1 registers to 5GC through AMF1 using SUPI1 and receives DS URSP rules.

2. UE1 sends PDU Session Establishment request with Request Type initial request, using SUPI1 and includes in the N1 SM container a new parameter, **DS Correlation ID**. The DS Correlation ID is generated by the DS device and should uniquely identify the DS PDU Session across both UEs.

3. The AMF selects the SMF1 according to the current specifications. Here, homogenous implementation of the DS is assumed for all SMFs that support the requested DNN/S-NSSAI. Therefore, AMF does not take into consideration the capability of SMF to support DS.

4. AMF sends a Nsmf\_PDUSession\_CreateSMContext request to the SMF1.

5 SMF1 retrieves the SM subscription data from UDM which includes a new parameter**, DS SUPI** containing SUPI2. SMF associates the DS PDU session to both SUPI1 and SUPI2.

6. SMF1 establishes a SM Policy Association and, in addition to SUPI1, includes the DS SUPI (SUPI2) in the request. The PCF associates the SM policy association to both SUPI1 and SUPI2. The PCF provides the PCC rules for DS PDU session.

7. The SMF1 establishes an N4 session with the UPF. SMF generates N4 rules similarly as for a MA PDU Session.

8. SMF Registers the PDU Session with UDM. In addition, it includes the **DS Correlation ID** as new parameter in the registration request.

9: If the DS device is not already registered with SUPI2 through a second access, it registers in this step and receives DS URSP rules.

Editor's note: How step 9 is triggered is assumed to be addressed by other solutions.

10. This step is the same as step 2 with a new parameter in SM container, Existing DS PDU, which indicates that the PDU session for SUPI1 has been already created. The DualSteer device sends the same DS Correlation ID and the same DNN/ S-NSSAI as in step 2.

11. AMF2 selects an SMF (SMF2) based on current mechanisms.

12. AMF sends a Nsmf\_PDUSession\_CreateSMContext request to the SMF2. In this step, SMF2 checks if there exist a PDU Session corresponding to SUPI2 and the DS Correlation ID. If yes, then steps 13-16 are skipped (SMF2 and SMF1 are the same).

13. SMF2 obtains the subscription data for SUPI2, which includes **DS SUPI** (containing SUPI1).

14. SMF2 uses SUPI1 to get the list of PDU Sessions from UDM and then using **DS Correlation ID** obtains the SMF ID of SMF1.

15. SMF sends a redirection response to AMF and provides SMF1 ID. In case of home-routed roaming scenarios, the H-SMF sends a redirection response to V-SMF and provides SMF1 ID.

Editor's note: Redirect from a NF consumer is described in TS 29.500 [X]. It is FFS whether there are any impacts to this mechanism to support redirect in this DS scenario.

16. Similar to step 4 but for SUPI2.

17. Similar to step 5 but for SUPI2.

18. SMF triggers SM policy association update request to update the policy information for the PDU Session and includes **DS SUPI** (SUPI1). PCF may modify the PCC rules based on the access type and PLMN of the SUPI2.

19. SMF modifies the N4 rules so that an additional N3/N9 tunnel is established between the second access and the UPF.

20. The same as steps 11-21 of figure 4.3.2.2.1-1 of TS 23.502 [4], with the difference that in step 16c the SMF includes DS Correlation ID in the registration of the PDU session as in step 8.

**Alt2: Limited AMF impact:**



Figure 6.1.Y.2.1-2 Dual steering PDU Session Establishment: Alt2

1. UE1 registers to 5GC through AMF1 using SUPI1 and receives DS URSP rules.

2. UE1 sends a PDU Session Establishment Request of type initial request and includes the DS Correlation ID in the MM part of the NAS message, as well as in the SM container.

3. AMF selects an SMF that supports the DS functionality.

5. UE2 sends a PDU Session Establishment Request of type Existing PDU Session and includes the DS Correlation ID in the MM part of the NAS message, as well as in the SM container. There is no need for Existing DS PDU parameter since existing PDU session is chosen for the request type.

6. AMF2 uses the DS SUPI filed in the Access and Mobility Subscription data to discover SUPI1 and gets the UE context in SMF data for SUPI1 from UDM and selects SMF1 based on DS Correlation ID.

7. The SMF redirection steps (steps 12-15) are skipped since AMF2 selects SMF1 directly.

Editor's note: Description of additional procedures is FFS

#### 6.1.Y.2.2 Interworking with EPS:

To enable interworking with EPS the same mechanism as in Figure 6.1.Y.2.1-1 are followed with the following differences:

In case the DS device first establishes a PDU Session for SUPI1 in a 3GPP access network in 5GS:

- In addition to registering the PDU Session for SUPI1 in step 8 of Figure 6.1.Y.2.1-1, SMF1+PGW-C1 registers the PDU Session for SUPI2 in HSS.

- In Step 11 of Figure 6.1.Y.2.1-1, when the UE requests a PDN Connection for SUPI2, the MME selects SMF1+PGW-C1 directly according to current specification since the PDU Session is registered for SUPI2 with the same DNN/APN. Therefore, the SMF redirection steps in Alt1 (steps 12-15) are skipped.

In case the DS device first establishes a PDN Connection for SUPI1 (IMSI) in a 3GPP access network in EPS:

- The UE provides the PDU Session ID (as per legacy) and the DS Correlation ID in the PCO in the Attach Request or PDN Connection Establishment request.

- The SMF1+PGW-C1 provides the DN Correlation ID with the Nudm\_UECM registration in

- In case of Alt 1 (see 6.1.Y.2.1):

- In Step 11 of Figure 6.1.Y.2.1-1, when the UE requests a PDN Connection for SUPI2, the MME selects SMF1+PGW-C1 directly according to current specification since the PDU Session is registered for SUPI2 with the same DNN/APN. Therefore, the SMF redirection steps in Alt1 (steps 12-15) are skipped.

- In case of Alt 2 (see 6.1.Y.2.2):

- When the SMF+PGW-C1 establishes the PDN connection successfully, in addition to registering the PDN Connection for SUPI1, SMF1+PGW-C1 also registers the PDN Connection for SUPI2 in HSS.

- In Step 11 of Figure 6.1.Y.2.1-1, when the UE requests a PDU Session for SUPI2, the AMF selects SMF1+PGW-C1 directly according to current specification since the PDU Session is registered for SUPI2 with the same DNN/APN. Therefore, the SMF redirection steps in Alt1 (steps 12-15) are skipped.

In both cases the SMF verifies that at least one PDU Session is in 5GS and rejects the session establishment otherwise.

### 6.1.Y.4 Impacts

DS device: Registering with two separate SUPIs; supporting steering and switching across two PDU session associated with two SUPIs; providing a unique DS correlation ID in the N1 SM container in the PDU Session Establishment requests for both SUPIs.

AMF: No impact for Alt1. For Alt2: Selecting SMF with DS capability, Selecting SMF based on DS Correlation ID. Providing indication of support for DS PDU session in initial Registration Accept message.

N4 enhancements: Support for providing two SUPIs to UPF.

UPF: Existing support for MA PDU Sessions is re-used (e.g. the use of MAR pointing to two FARs). N4 enhancements as described above.SMF: Invoking HTTP redirect upon receiving a PDU Session Establishment request (Alt1). Creating N4 rules and ATSSS rules for DS PDU session, including N4 enhancements as described above.

UDM/UDR: Adding a new parameter, DS SUPI, to UE SM subscription data. Adding a new parameter to PDU Session context, DS Correlation ID.

PCF: Handle a SM policy association related to two SUPIs. Creating PCC rules with DualSteer information.

\* \* \* End of Change \* \* \* \*