**SA WG2 Meeting #162S2-2405267**

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**Source: CableLabs, Comcast, KDDI**

**Title: New Solution for KI#1.3 for Session Management for DualSteer based on enhancement of the ATSSS MA PDU procedures**

**Document for: Approval**

**Agenda Item: 19.13**

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

*Abstract of the contribution: This pCR proposes a new solution for KI#1.3 on Session Management for DualSteer using MA PDU procedures.*

# 1 Discussion

This paper proposes a new solution for session management for KI#1.3.

This solution applies to the following scenario:

* Two NR/5GC accesses in two different PLMNs (including two VPLMNs or a VPLMN and the HPLMN) with each access being NR TN or NR NTN

It applies to both DualSteer (DS) device capable of non-simultaneous data transmission over the two networks and DS device capable of simultaneous data transmission over the two networks.

The proposal attempts to leverage the multi-access (MA) PDU session procedures defined for ATSSS for DualSteer. The actual PDU Session Establishment Procedures follows the ones defined in TS 23.502 clause 4.3.2.2.1 and 4.3.2.2.2. The only change is the DS device sending a DualSteer capability indication to the network and the network responding with a container IE (specific for DualSteer or leveraging ATSSS container) that includes the DualSteer parameters for the DS device for traffic steering and traffic switching.

This solution has no impacts to the registration procedure as defined in TS 23.502 clause 4.2.2.2.2 except for indicating the DualSteer support by the network within the Registration accept message indicating support for DualSteer feature using the 5GS network feature support informational element. Within this IE, the network should indicate whether it supports ATSSS, DualSteer or both. If it supports both, it should also indicate what the network prefers – ATSSS or DualSteer. The individual registrations across both the 3GPP access networks are independent and the DualSteer policies and rules are applied considering the network availability.

# 2. Proposal

It is proposed to adopt the following text in TR 23.700-54.

\*\*\* Start of 1st change (all new text) \*\*\*

### 6.1.X Solution #X: Session Management Solution for DualSteer using MA PDU Procedures

#### 6.1.X.1 Introduction

The proposed solution leverages the multi-access (MA) PDU session, currently defined for ATSSS, as a PDU session that provides a PDU connectivity service, which can use one access network at a time, or simultaneously one 3GPP access network and one non-3GPP access network. The MA PDU session is extended to a PDU session that provides a PDU connectivity service, which can use one access network at a time, or simultaneously one 3GPP access network and one non-3GPP access network or simultaneously two 3GPP access networks.

In case of DualSteer, an DS session can be established when the DS device is registered to the same PLMN over the two 3GPP access networks or registered to different PLMNs over the two 3GPP access networks. A DS device can initiate DS session establishment when the DS device is registered to a PLMN over either of the 3GPP access networks. Therefore, at any given time, the DS session can have user-plane resources established on both 3GPP access networks, or on a single 3GPP access only.

##### 6.1.X.1.1 DS connectivity service activation for DualSteer

Activating DS connectivity service for DualSteer refers to the establishment of user-plane resources on two 3GPP accesses:

1. if the DS device is registered over both 3GPP access networks in the same PLMN, the DS device initiates the UE-requested PDU session establishment procedure over a selected access. Over which access to initiate this UE-requested PDU session establishment procedure is DS device implementation specific.
2. if the DS device is registered over both 3GPP access networks in different PLMNs, the DS device initiates the UE-requested PDU session establishment procedure over each 3GPP access sequentially. Over which access to first initiate the UE-requested PDU session establishment procedure is DS device implementation specific.
3. if the DS device is registered to a PLMN over only one access, either 3GPP access, the DS device initiates the UE-requested PDU session establishment procedure over this access. When the DS device at a later point in time registers over the other 3GPP access, either in the same PLMN or in a different PLMN, it initiates the UE-requested PDU session establishment procedure with the same DS session ID over the other access in order to establish user plane resources on the other access for the DS session.

#### 6.1.X.2 Description

Figure 6.1.X.2-1 shows the high-level architecture envisioned for different PLMN scenario (HPLMN and VPLMN) where the two PLMN networks are operated by different service providers. The solution leverages the current procedures defined for Home-Routed (HR) roaming. The solution assumes that a business agreement exists between the two operators (HPLMN and VPLMN) to carry out the DualSteer procedures with access to both 3GPP networks simultaneously.

Inter-PLMN

Interfaces

N9

N16

N8

AMF

H-SMF

PCF

UDM

H-UPF

The H-UPF can be a PSA UPF or the H-UPF may route to a PSA UPF in HPLMN

Data Network

3GPP Access

N11

N7

N3

N2

N1

N8

N4

N10

N6

V-SMF

V-UPF

AMF

N11

3GPP Access

3GPP

DualSteer

Device

N4

N3

N2

Uu

Uu

N1

**VPLMN**

**HPLMN**

Figure 6.1.X.2-1: DualSteer Session between DualSteer Device and (PSA) UPF across different PLMNs (HPLMN and VPLMN)

Figure 6.1.X.2-2 shows the high-level architecture envisioned for different PLMN scenario (two VPLMNs) where the HPLMN and the two VPLMN networks are operated by different service providers. The solution leverages the current procedures defined for Home-Routed (HR) roaming. The solution assumes that a business agreement exists between the operators (HPLMN and VPLMN(s)) to carry out the DualSteer procedures with access to both 3GPP networks simultaneously.

H-SMF

PCF

UDM

H-UPF

The H-UPF can be a PSA UPF or the H-UPF may route to a PSA UPF

Data Network

N7

N4

N10

N6

V-SMF

V-UPF

AMF

N11

3GPP Access

**3GPP**

**DualSteer Device**

N4

N3

N2

Uu

N1

**VPLMN 2**

**HPLMN**

N8

N16

N9

V-SMF

V-UPF

AMF

N11

3GPP Access

N4

N3

N2

Uu

N1

**VPLMN 1**

N9

N8

N16

Inter-PLMN

Interfaces

Figure 6.1.X.2-2: DualSteer Session between DualSteer Device and (PSA) UPF across different PLMNs (two VPLMNs)

#### 6.1.X.3 Procedures

#### This section defines the device Requested PDU Session Establishment Procedure for DS device with access to two 3GPP networks using different PLMN (HPLMN and VPLMN).

In case of different PLMN (HPLMN and VPLMN), the PDU Session Establishment procedure is initiated by the DS device across both 3GPP access networks sequentially. Over which access to first initiate the PDU session establishment procedure is DS device implementation specific.

Below procedure (as an example) assumes the DS device first selects the HPLMN access to initiate the PDU session establishment procedure. This procedure on the HPLMN is based on TS 23.502 clause 4.3.2.2.1 (steps 1 to 21). The PDU session establishment procedure on the VPLMN is based on TS 23.502 clause 4.3.2.2.2 (steps 22 to 45). If the DS device first selects the VPLMN access to initiate the UE-requested PDU session establishment procedure, the overall procedure remains the same, with steps 22 to 45 being performed before step 1 to 21. The procedure assumes that the DS device has already registered with the AMFs in both 3GPP networks, thus unless the DS device is Emergency Registered, the AMFs have already retrieved the user subscription data from the UDM. Below are few aspects that differ from the procedures in TS 23.502 clause 4.3.2.2.1 and 4.3.2.2.2.

* The DS device includes the DS Session ID and DS session request within the PDU Session Establishment Request message indicating the support for DualSteer feature using the DualSteer Indication and DualSteer supported steering functionality/modes using the DualSteer Capability IEs as proposed in Figure 6.1.X.3-1 to the AMF in Steps 1, 22.
* Based on the indication in Step 1 and 22, the AMF in both HPLMN and VPLMN select the same DualSteer capable H-SMF and forward the DS Session Request with the DualSteer Indication within the CreateSMcontext Request message to the H-SMF in step 3 and 27 (via V-SMF in step 24a).
* In step 2, the AMF performs the H-SMF selection, and in step 23, the AMF performs the V-SMF and H-SMF selection as specified in TS 23.501 clause 6.3.2 and TS 23.502 clause 4.3.2.2.3.3. In case of home routing, the AMF in the serving PLMN selects both an SMF in the Serving PLMN using the S-NSSAI of the Serving PLMN mapping to the S-NSSAIs of the HPLMN used for the DS Session, and additionally an SMF in the HPLMN using the S-NSSAI of the HPLMN used for the DS Session. The AMF may receive alternative H-SMFs from the NRF.
* In case of static IPv4 address and/or a static IPv6 prefix, a dedicated SMF may be deployed for the indicated combination of DNN and S-NSSAI and registered to the NRF or provided by the UDM as part of the subscription data. So, in this scenario, AMF selects a static H-SMF which can then route (internal routing in HPLMN) the messages to the same H-SMF hosting the DS session using the DS Session ID info sent in the Nsmf\_PDUSession\_Create Request from V-SMF to H-SMF.
* In case of dynamic IP addressing, the AMF in VPLMN based on the UE location and the DS session request, makes a DualSteer capable H-SMF selection (assuming the AMF has a 1:1 mapping info of TA to the DualSteer capable H-SMF serving the respective TA) to ensure the same H-SMF is selected in H-PLMN.
* Once the same H-SMF selection is ensured that manages the DS Sessions across both the networks, H-SMF can ensure the same H-UPF is selected for both DS Sessions based on the same DS Session ID used across both the networks in steps 8 and 31. H-UPF can correlate the two DS sessions using the same DS Session ID. The H-UPF will manage the state of each N4 session independently, maintaining context information, QoS parameters, and other session attributes. The H-UPF will monitor the network conditions and based on operator defined policies may steer traffic on either of the two 3GPP networks or switch traffic between the two 3GPP networks dynamically.
* In step 4 and 28, the H-SMF performs subscription retrieval for both SUPIs of DS device provisioned in the UDM in HPLMN network. The operator may have separate subscriptions for each SUPI associated with the same subscription profile.
* The H-SMF performs an SM Policy Association Establishment procedure to establish an SM Policy Association with the PCF in home network and is provided with the default PCC Rules for the DS Session. This association considers the DualSteer feature support and any associated polices in Steps 7b and 32. The PCF in H-PLMN will have the policies provisioned for both the SUPIs. Whether the PCF has unified policies that maps to both SUPIs or separate identical policies for both SUPIs that are associated with a common subscription profile is subject to operator implementation.
* The H-SMF includes the DS Session ID and the DualSteer response (indicating the support for DualSteer feature and the configured DualSteer rules) to the AMF in step 11 and step 35.
* The N2 PDU Session Request in step 12 and 36, the PDU Session Establishment Accept message in step 13 and the RRC Reconfiguration message in step 37 contain the DualSteer Container IE for the DS device from the SMF. This NAS container includes the information elements associated with DualSteer.

**NOTE:** The DualSteer container information element is a new information element to transfer parameters associated with DualSteer. The ATSSS container information element defined for ATSSS may be re-used for carrying the DualSteer parameters. The DualSteer and ATSSS (or a common) container information element will also include information on which amongst DualSteer and ATSSS is preferred, assuming both are supported by the DS device and the network. The DS NAS container is carried over the RRC messages without any impact to the access network.

* In step 26a/26b, UL N9 tunnel CN info is allocated by the H-SMF or H-UPF. After this, N9 tunnels between the H-UPF and V-UPF are established.
* The H-SMF selects the same DualSteer capable H-UPF and sends the DualSteer rules to the H-UPF for establishing the user plane resources in N4 session Establishment message in steps 10a and 33a.

Given that both SUPIs on each of the networks (HPLMN and VPLMN) are provisioned in the UDM in HPLMN, the HPLMN may associate the two SUPIs to a common subscription profile.

In case of different PLMN (two VPLMNs), the UE-requested PDU session establishment procedures are performed on both the VPLMNs as defined in TS 23.502 clause 4.3.2.2.2 (steps 22 to 45) with the same identified differences as mentioned above (for steps 22, 24b, 27, 32, 36 and 37).

**Figure 6.1.X.3-1 - DualSteer session establishment procedure with HPLMN and VPLMN**

#### 6.1.X.4 Impacts on services, entities and interfaces

**AMF:**

- Supports DualSteer capable SMF selection that can support session management across both 3GPP networks.

**SMF:**

- Supports DualSteer capable PSA UPF selection that can support session management across both 3GPP accesses.

- Indicates DualSteer feature support and sends the DualSteer container IE to the DS device via the AMF including the DualSteer parameters.

- Maps the PCC rules into DualSteer rules which are sent to DS device via the AMF.

**PCF:**

* Creates PCC rules based on the specified DualSteer steering functionality.

**UE:**

- Indicates DualSteer feature support as part of the DS session request to the SMF via the AMF.

\*\*\* End of 1st change \*\*\*