**3GPP TSG-WG SA2 Meeting #163 *S2-2407086***

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**Source: Huawei, HiSilicon**

**Title: KI#1.4, Update Sol#1.15 to solve the EN about session management procedure**

**Document for: Approval**

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*Abstract: An EN related to session management is solved by further including the procedures of establishing PDU session for DualSteer traffic steering and the session management procedures to perform DualSteer traffic switching.*

# 1. Introduction/Discussion

There is an EN in solution#1.15:

Editor's note: The corresponding solution for Session Management is to be described.

The solution is further updated to provide corresponding description about how to establish PDU sessions according to the policies from HPLMN to achieve DualSteer traffic steering and DualSteer traffic switching respectively. The principles and assumptions for the session management are listed.

In addition, the solution is also further updated to clarify that the policy for Secondary SUPI registration does not have any impact on PLMN/RAT selection. Moreover, the policy for DualSteer traffic steering can also be a new UE policy without impacts on URSP rule.

# 2. Text Proposal

It is proposed to capture the following changes vs. TR 23.700-54.

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

## 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 |
| #1.1 | X | X | X | X |
| #1.2 | X | X | X | X |
| #1.3 | X | X | X | X |
| #1.4 | X | X | X | X |
| #1.5 | X | X | X | X |
| #1.6 | X | X |  | X |
| #1.7 | X |  |  |  |
| #1.8 | X | X |  |  |
| #1.9 | X | X |  |  |
| #1.10 |  | X |  |  |
| #1.11 |  |  | X |  |
| #1.12 |  |  | X |  |
| #1.13 |  |  | X | X |
| #1.14 | X |  | X |  |
| #1.15 |  |  | X | X |
| #1.16 |  |  |  | X |
| #1.17 | X | X |  | X |
| #1.18 | X |  |  | X |
| #1.19 |  |  | 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 |
| #2.9 | X |  |
| #2.10 | X |  |
| #2.11 | X |  |
| #2.12 |  | X |
| #2.13 |  | X |

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

### 6.1.15 Solution #1.15: DualSteer policy content and provisioning

#### 6.1.15.1 Description

##### 6.1.15.1.1 General Principle of Policy for DualSteer

This solution mainly addresses the Key Issue #1.4 about policy enhancement for DualSteer. In particular, the policy from the HPLMN includes the policies provided to the UE of DualSteer Device and the policies provided to the NF within the network. The policies provided to the UE of DualSteer cover following aspects:

- how to guide the DualSteer Device to activate the secondary SUPI in order to select an additional PLMN/PNI-NPN or an additional 3GPP access network within the same PLMN;

- how to determine the 3GPP access network to be used for the new service;

- how to determine to switch the service between two connected 3GPP access networks.

Some of the policies provided to the UE of DualSteer Device might apply only to single Dual-USIM DualSteer UE case or two separate Single-USIM DualSteer Ues case.

In order to have clearer understanding of the solution, the definitions of some terms are provided below:

 **Dual-USIM DualSteer UE**: A UE of a DualSteer device that can connect to two 3GPP access networks using a different USIM for each 3GPP access network, and is only capable of non-simultaneous data transmission, i.e. where all traffic is sent on only one 3GPP access network at any given time.

 **Single-USIM DualSteer UE:** A UE part of a DualSteer device that connects to a single 3GPP access network. The combination of two single-USIM DualSteer Ues as part of a DualSteer device allows the DualSteer device to transmit data simultaneously over two 3GPP access networks.

 **Primary 3GPP access:** the 3GPP access network connected by the UE of DualSteer Device using the Primary SUPI.

 **Secondary 3GPP access:** the 3GPP access network connected by the UE of DualSteer Device using the Secondary SUPI.

 **Primary SUPI:** the SUPI whose subscription includes DualSteer subscription indicating that it is the Primary one to support DualSteer.

 **Secondary SUPI:** the SUPI whose subscription includes DualSteer subscription indicating that it is the Secondary one to supplement the Primary SUPI to support DualSteer.

According to SA1 requirements, it is assumed that there is no restriction regarding registration for the primary SUPI, and HPLMN policies regarding registration only apply to the secondary SUPI.

In addition, the network should be provided with enough information to be able enforce these policies.

Therefore, considering the above aspects and device capabilities, the general principles are listed below:

**Policy for registration of Secondary SUPI:**

Policy for registration of Secondary SUPI is used to guide the UE of a DualSteer Device to perform the Registration Procedure with the Secondary SUPI in some certain conditions for different purposes (e.g. for backup) based on operator policy.

The DualSteer device can be provided with a combination of the following policies related to the registration of the Secondary SUPI:

- No restriction (UE of secondary SUPI can always attempt registration).

- Only when primary SUPI is not registered.

- Only when primary 3GPP access is below a certain SINR/RSRP/RSSI threshold (similar to the mechanism defined in clause 23.6 in TS 36.300 [24]).

- Location dependent (only attempt to register when in a specific area e.g. TAI(s), countries or PLMN(s)).

NOTE 1: This policy is provided by HPLMN to guide the DualSteer Device when to trigger the Secondary SUPI to perform the registration. PLMN/RAT selection is per existing mechanism. The policy does not have any impact on PLMN/RAT selection.

**Policy for DualSteer traffic steering:**

The policy for DualSteer traffic steering is used by the UE of DualSteer Device to determine the 3GPP access to be used to transmit the new matching traffic. Once the 3GPP access has been determined, the traffic will be transmitted via that 3GPP access and the policy of DualSteer traffic steering for such matching traffic will not be considered. Whether the ongoing traffic will be moved to the other 3GPP access will be determined by the policy for DualSteer traffic switching.

Considering the capability of the DualSteer Device in single Dual-USIM DualSteer UE case and the DualSteer Device in two separate Single-USIM DualSteer Ues case is different for traffic steering, some policies provisioned to the DualSteer Device cannot be provided to the DualSteer Device with single Dual-USIM DualSteer UE case.

Therefore, following are the policies for DualSteer traffic steering which is applicable to individual new matching traffic:

- Steer to existing activated access (either Primary 3GPP access or Secondary 3GPP access). If neither SUPI is active, trigger to activate UP on Primary 3GPP access.

- Steer to Primary 3GPP access regardless of other traffic (applicable to two separate Single-USIM DualSteer Ues only).

- Steer to Secondary 3GPP access regardless of other traffic (applicable to two separate Single-USIM DualSteer Ues only).

NOTE 1: Additional optional policies can be further considered to improve the flexibility of DualSteer.

When the PCF generates the policy for DualSteer traffic steering, the PCF shall determine whether simultaneous transmission is allowed or not based on operator policy and the DualSteer Device capability (whether simultaneous transmission is supported or not) if provided by the DualSteer Device. If the PCF determines that simultaneous transmission is not allowed, the PCF shall ensure that the DualSteer traffic steering policy for all services are coordinated so that all services are transferred over the same single 3GPP access.

**Policies for DualSteer traffic switching:**

The policies for DualSteer traffic switching are used by the UE of DualSteer Device to determine following aspects:

1) Whether the traffic of partial services can be switched to the other 3GPP access or the traffic of all services shall be moved so that only single 3GPP access will be used to transmit all traffic at one time.

 This policy is used by the DualSteer Device to determine a general principle for the DualSteer traffic switching which considers the DualSteer Device capability and operator policy. For example, the policy that the traffic of some services only can be switched is only provided to the DualSteer Device in two separate Single-USIM DualSteer UEs case.

2) Whether and when the matching traffic can be switched to the other 3GPP access.

 This policy is used by the UE of DualSteer Device to determine DualSteer traffic switching actions (i.e. whether and when the matching traffic should be moved to the other 3GPP access) based on the policy and principle mentioned in 1).

 This policy will further help the UE of DualSteer Device to group the traffic with the same DualSteer traffic switching actions into the same PDU Session so that the traffic with the same DualSteer traffic switching action can be switched together to the other 3GPP access by switching the PDU Session from the source 3GPP access to the target 3GPP access. In this case, service level switching can be achieved.

Therefore, based on the above consideration, the policies for DualSteer traffic switching are:

1. DualSteer simultaneous transmission policy for DualSteer Device:

- no restriction (only be applicable to two separate Single-USIM DualSteer Ues case);

- always use single 3GPP access for all traffic (i.e. non-simultaneous transmission).

2. DualSteer traffic switching policy for the matching traffic:

- based on DualSteer simultaneous transmission policy, switch to Primary 3GPP access whenever it becomes available;

- based on DualSteer simultaneous transmission policy, switch to Secondary 3GPP access whenever it becomes available;

- based on DualSteer simultaneous transmission policy, switch to the other 3GPP access if the current 3GPP access status meets the condition of DualSteer traffic switching;

- based on DualSteer simultaneous transmission policy, switch to the other 3GPP access whenever necessary.

NOTE 2: Policy for DualSteer traffic switching can be set properly to optimize the performance of DualSteer traffic switching (e.g. the condition of DualSteer traffic switching can be “the performance of current 3GPP access cannot fulfil the QoS requirement”).

When the DualSteer traffic switching policy is not present:

- for SSC mode 1, the traffic will never be moved to the other 3GPP access via DualSteer traffic switching mechanism;

- for SSC mode 2 or 3, the traffic can be moved to the other 3GPP access by disconnecting the current UP and establishing the new UP over the other 3GPP access.

When the PCF generates the policy for DualSteer traffic switching, the PCF shall determine whether simultaneous transmission is allowed or not based on operator policy and the DualSteer Device capability (whether simultaneous transmission is allowed or not) if provided by the DualSteer Device. If simultaneous transmission is not allowed, the PCF shall set the DualSteer simultaneous transmission policy for DualSteer Device to "always use single 3GPP access for all traffic" and shall ensure that the DualSteer traffic switching policy for all services shall be coordinated so that all services are transferred over the same single 3GPP access.

##### 6.1.15.1.2 Proposed solution of policy handling

**Policy for registration of Secondary SUPI:**

This is a new information of UE policy provisioned to UE. The UE Configuration Update procedure as specified in clause 4.2.4 of TS 23.502 [4] is re-used to provision this policy to UE.

**Policy for DualSteer traffic steering:**

Option 1: A new UE policy can be introduced to specify policy for DualSteer traffic steering. In this case, the UE Configuration Update procedure as specified in clause 4.2.4 of TS 23.502 [4] is re-used to provision this policy to UE. Following is the example of the new UE policy.

Table 6.1.15.1.2-1: Access Selection Rule

| Information name | Description | Category | PCF permitted to modify in a UE context | Scope |
| --- | --- | --- | --- | --- |
| Rule Precedence | Determines the order the ASP rule is enforced in the UE. | Mandatory | Yes | UE context |
| **Traffic descriptor** | *This part defines the traffic descriptors for the policy* |  |  |  |
| Application identifiers | Application identifier(s)  | Optional | Yes | UE context |
| IP descriptors | IP 3 tuple(s) (destination IP address or Ipv6 network prefix, destination port number, protocol ID of the protocol above IP) | Optional | Yes | UE context |
| Non-IP descriptors | Descriptor(s) for non-IP traffic | Optional | Yes | UE context |
| …… |  |  |  |  |
| **3GPP access for DualSteer traffic steering** | One single value of following 3GPP access:1. Existing activated 3GPP access, otherwise Primary 3GPP access.2. Prefer Primary 3GPP access.3. Prefer Secondary 3GPP access.4. List of ordered PLMN and/or RAT. | Mandatory | Yes | UE context |

Option 2: The URSP rule can be enhanced to include the policy for DualSteer traffic steering. It is assumed that such URSP rules supporting DualSteer traffic steering can be provisioned to the DualSteer Device via either Primary 3GPP access or Secondary 3GPP access. The UE of the DualSteer Device can evaluate the URSP to determine whether the new matching traffic is transmitted via current 3GPP access or the other 3GPP access. If the new matching traffic is determined to be transmitted via the other 3GPP access, the traffic will be transferred across UEs within the DualSteer Device (in two separate Single-USIM DualSteer Ues case) based on implementation. Following is the example of the enhanced URSP rules.

Table 6.1.15.1.2-2: Route Selection Descriptor

| Information name | Description | Category | PCF permitted to modify in URSP | Scope |
| --- | --- | --- | --- | --- |
| Route Selection Descriptor Precedence  | Determines the order in which the Route Selection Descriptors are to be applied.  | Mandatory | Yes | UE context |
| **Route selection components** | *This part defines the route selection components* | Mandatory |  |  |
| … | … | … | … | … |
|  |  |  |  |  |
| 3GPP access for DualSteer traffic steering  | One single value of following 3GPP access:1. Existing activated 3GPP access, otherwise Primary 3GPP access.2. Prefer Primary 3GPP access.3. Prefer Secondary 3GPP access.4. List of ordered PLMN and/or RAT. | Optional | Yes | UE context |

The different values of 3GPP access for DualSteer traffic steering are used to support different steering polices:

- Value 1 - Existing activated 3GPP access, otherwise Primary 3GPP access: steering the new service to the existing activated 3GPP access, if no activated 3GPP access, use the Primary 3GPP access to transmit the new service.

- Value 2 - Prefer Primary 3GPP access: try to steering the new service to the Primary 3GPP access. Otherwise, use the Secondary 3GPP access to transmit the new service.

- Value 3 - Prefer Secondary 3GPP access: try to steering the new service to the Secondary 3GPP access. Otherwise, use the Primary 3GPP access to transmit the new service.

- Value 4 - List of ordered PLMN and/or RAT: select the 3GPP access network which match the PLMN and/or RAT in the list of ordered.

The value of the 3GPP access included in the URSP is determined based on the DualSteer subscription and DualSteer Device capability. For example, if the DualSteer Device is in single Dual-USIM DualSteer UE case, the second and third value would not be included in the URSP rule.

The UE Configuration Update procedure as specified in clause 4.2.4 of TS 23.502 [4] is re-used to provision this policy to UE.

**Policies for DualSteer traffic switching:**

DualSteer simultaneous transmission policy for DualSteer Device is a new information of UE policy. The UE Configuration Update procedure as specified in clause 4.2.4 of TS 23.502 [4] is re-used to provision this policy to the DualSteer Device.

Table 6.1.15.1.2-3: DualSteer simultaneous transmission policy

| Information name | Description | Category | PCF permitted to modify in a UE context | Scope |
| --- | --- | --- | --- | --- |
| **DualSteer simultaneous transmission policy** | One single value of following:1. no restriction (only be applicable to two separate Single-USIM DualSteer UEs case);
2. always use single 3GPP access for all traffic (i.e. non-simultaneous transmission).
 | Mandatory | Yes | UE context |

For the DualSteer traffic switching policies used by the UE of DualSteer Device for the matching traffic, the URSP rule can be enhanced to include such policy. It is assumed that such URSP rules supporting DualSteer traffic switching can be provisioned to the DualSteer Device via either Primary 3GPP access or Secondary 3GPP access or both of them. Each UE can evaluate the URSP to determine whether the matching traffic can be moved to the other 3GPP access via DualSteer traffic switching with the same condition.

The policy for DualSteer traffic switching is stored in the PDU Session context similarly to DNN, S-NSSAI, SSC mode, etc. When new traffic is established, the rule for reusing an existing PDU Session (see clause 6.6.2 of TS 23.503 [5]) will also take in account the policy for DualSteer traffic switching, i.e. it will only reuse an existing PDU Session if that PDU Session has the same policy for DualSteer traffic switching as the matching URSP rule for the new traffic. Otherwise, a new PDU Session will be established for the new traffic. This allows to switch all traffic of a given PDU Session simultaneously as they share the same trigger conditions for switching. If the parameter of "DualSteer traffic switching actions" is not present in the URSP, it means that the DualSteer traffic switching mechanism is not enabled for this service.

Table 6.1.15.1.2-4: Route Selection Descriptor

| Information name | Description | Category | PCF permitted to modify in URSP | Scope |
| --- | --- | --- | --- | --- |
| Route Selection Descriptor Precedence | Determines the order in which the Route Selection Descriptors are to be applied. | Mandatory | Yes | UE context |
| **Route selection components** | *This part defines the route selection components.* | Mandatory |  |  |
| … | … | … | … | … |
| DualSteer traffic switching actions | One single value of following actions:1. switch to Primary 3GPP access whenever it becomes available.2. switch to Secondary 3GPP access whenever it becomes available.3. switch to the other 3GPP access if the current access status meets the condition of DualSteer traffic switching.4. switch to the other 3GPP access whenever necessary. | Optional | Yes | UE context |

The different values of DualSteer traffic switching actions are used to support different switching triggers:

- Value 1 - Switch to Primary 3GPP access whenever it becomes available: switch the services of the PDU session to the Primary 3GPP access whenever it becomes available.

- Value 2 - Switch to Secondary 3GPP access whenever it becomes available: switch the services of the PDU session to the Secondary 3GPP access whenever it becomes available.

- Value 3 - Switch to the other 3GPP access if the current access status meets the condition of DualSteer traffic switching: when the status of current 3GPP access meets the condition of DualSteer traffic switching, switch the services of the PDU session to the other 3GPP access.

- Value 4 - Switch to the other 3GPP access whenever necessary: some services need not have specific conditions to trigger the switching. However, in some cases such as when the DualSteer Device is in single UE case, some services are triggered to be switched to the other 3GPP access network. The leftover services are also triggered to switched to the other 3GPP network. In this case, the DualSteer traffic switching actions corresponding to these services can use the action.

When the conditions of the 3GPP accesses change (e.g. one 3GPP access becomes available/registered, one 3GPP access becomes unavailable), the value of the DualSteer traffic switching action associated to the PDU Sessions of the DualSteer device are evaluated, and taking in account the DualSteer simultaneous transmission policy for the DualSteer device, none, some, or all PDU Sessions are moved from one 3GPP access to another.

NFs (e.g. SMF) in the network are provided with corresponding information allowing them to enforce these policies. The detailed parameters and call flows depends on solutions for KI#1.3.

##### 6.1.15.1.3 Session management corresponding to the policy handling

This clause describes the assumptions and principles of session management solution corresponding to the policy handing, which are listed below:

**Assumption 1**: For services that can be switched using DualSteer traffic switching from one 3GPP access using one UE/SUPI of the DualSteer device to the other 3GPP access using another UE/SUPI of the DualSteer device, but require to keep the same IP address (i.e. SSC mode 1), the data service transmitted is switched from one PDU Session of one UE (named source PDU session) to a new PDU Session of another UE (named target PDU session), these two UEs belonging to the same DualSteer device. In that case, the IP address used for data service transmission is not change to minimize service interruption during the switching. For other SSC modes, there is no need for 5GC to keep the same IP address for the target PDU session, and therefore, the DualSteer traffic switching feature is not used for these traffics.

Based on Assumption 1, SMF will reuse the same IP address for target PDU Session of target UE. The N4 session can be reused and correlated with target PDU Session of target UE. SSC mode 1 is assigned to the PDU Session.

**Assumption 2**: The two associated PDU Sessions (source PDU Session of source UE and target PDU Session of target UE) have same parameters (DNN and S-NSSAI, SSC mode, etc).

Based on Assumption 2, URSP should be complementary for the two UEs within the DualSteer device, so that the same data service can be mapped to same parameters during the switching.

**Assumption 3**: The same SMF/H-SMF manages the both PDU Sessions (before and after the switching) from the two UEs of the DualSteer device.

Based on Assumption 3, SMF selection needs to be enhanced to enable the AMF to select the same SMF/H-SMF. The SMF is aware of which two PDU Sessions (i.e., source PDU session and target PDU session) are related for the switching.

**Assumption 4:** PDU Session level switch (i.e., DualSteer traffic switching feature) is performed. All data services transmitted via the PDU Session with the same IP address share the same DualSteer traffic switching policy and therefore they are switched from the source PDU session of source UE to the target PDU session of the target UE together.

**Assumption 5:** Not all data services are required/allowed to use DualSteer traffic switching feature. In other words, DualSteer traffic switching policy applies to per data service level.

Based on Assumption 4 and Assumption 5, the data services of this DualSteer device with different policies for DualSteer switching can be grouped into different PDU Sessions, although they are associated otherwise with the same characteristics (DNN, S-NSSAI, SSC mode, etc).

URSP is enhanced to include a new component "DualSteer traffic switching actions" within Route Selection Descriptors. If there is "DualSteer traffic switching actions" in the Route Selection Descriptors, it means those data services are allowed to be switched via DualSteer traffic switching mechanism. Moreover, when there is new service, the URSP is evaluated to determine whether an existing PDU session can be reused for the new services or a new PDU session shall be established. In this way, all traffics transmitted in the same PDU session share the same policy for the DualSteer traffic switching. When the UE of DualSteer Device requests to establish the PDU Session, it sets Request Type to "DualSteer Request for session switching".

If the "DualSteer traffic switching actions" does not exist in the Route Selection Descriptors, it means that this service is not intended to use DualSteer traffic switching feature. Therefore, this new service is transmitted via a PDU session without DualSteer traffic switching feature.

**Assumption 6:** Whether the DualSteer switching feature can be performed also depends on the network capability (e.g., AMF and SMF needs to support the switch) and DualSteer device’s SM subscription/policy.

Based on Assumption 6, the network needs to authorize whether the PDU Session with the Request Type of “DualSteer Request for session switching” can be switched, and needs to notify the decision to the DualSteer device. For example, "DualSteer allowed indication" is provided to the UE of the DualSteer device indicating that the PDU Session can be switched between UEs of the DualSteer device based on the policies provided to the DualSteer device.

**Assumption 7:** An IP address can only be used by one PDU Session.

Based on Assumption 7, after the switching, SMF triggers to release the source PDU Session.

**Assumption 8:** A PDU Session that is marked as DualSteer allowed between UE1 and UE2 of the DualSteer device, can be further handed over from the 3GPP access to the non-3GPP access within one UE using the existing mechanism specified in clause 4.9.2.2 of TS 23.502. However, based on SA1 requirements, it would need to be handed over back to the 3GPP access of that UE before being switched to the 3GPP access of the other UE based on the policies provided by the network.

This solution supports the following cases (see the procedure for more details):

- the solution can apply to different types of DualSteer devices, i.e., a single Dual-USIM DualSteer UE case and two separate Single-USIM DualSteer UEs case.

- the solution can apply to all scenarios, e.g., different PLMNs (e.g., one is HPLMN and another is VPLMN with HR, both are VPLMN with HR), same PLMN (e.g., one is NR RAT, and another is NTN RAT).

- the solution supports efficiently per service DualSteer traffic switching based on HPLMN policies.

The session management procedure is specified in clause 6.1.15.2.3.

#### 6.1.15.2 Procedures

##### 6.1.15.2.1 General

Clause 6.1.15.2.2 describes the procedure about how the policies for DualSteer are provisioned to the DualSteer Device, while clause 6.1.15.2.3 describes the procedure about how the DualSteer Device establishes the PDU session for DualSteer traffic steering and how to perform session management procedure to achieve DualSteer traffic switching.

##### 6.1.15.2.2 Procedure of provisioning polocies for DualSteer



Figure 6.1.15.2-1: Procedure of policy provisioning

1. UE of DualSteer Device performs Registration procedure with Primary SUPI. During the procedure, policies mentioned in clause 6.1.15.1 are generated by PCF based on operator policy. In particular, the policies provisioned to the UE of the DualSteer Device also consider the DualSteer Device capability.

 The detailed call flows and the corresponding parameters in each message depends on solutions for KI#1.1 and KI#1.2.

2. When the UE of the DualSteer Device performs Registration procedure successfully and is authorized to perform DualSteer traffic steering and DualSteer traffic switching, the UCU procedure is triggered to provision the policies for DualSteer to UE as specified in clause 4.2.4 in TS 23.502 [4].

3. Based on the policies for registration of Secondary SUPI, the DualSteer Device activates the Secondary SUPI and performs Registration procedure. During the procedure, policies mentioned in clause 6.1.15.1 may be generated or updated by PCF based on operator policy. In particular, the policies provisioned to the UE of the DualSteer Device also consider the DualSteer Device capability.

 The detailed call flows and the corresponding parameters in each message depends on solutions for KI#1.1 and KI#1.2.

4. When the UE of the DualSteer Device performs Registration procedure successfully and is authorized to perform DualSteer traffic steering and DualSteer traffic switching, the UCU procedure may be triggered to provision the policies for DualSteer to UE as specified in clause 4.2.4 of TS 23.502 [4].

##### 6.1.15.2.3 Procedure of session management for DualSteer

The PDU Session handling for DualSteer Device can be divided into two parts. One is the PDU Session Establishment for source UE of the DualSteer device (UE1), and the other one is the procedure of PDU Session Switching from the source UE to the target UE of the DualSteer device (UE2).

**Principle for PDU Session Establishment**

The DualSteer traffic steering policies are evaluated in the DualSteer Device to decide which 3GPP access (or which UE/SUPI) is used to transmit the new service (existing activated access, Primary 3GPP access, Secondary 3GPP access), with the assumption that the DualSteer Device knows the registration status of two UEs/SUPIs. The details of DualSteer traffic steering policies refer to the Solution #1.15.

For more flexible switching handling the PDU Session with same parameters (DNN and S-NSSAI, SSC mode, etc) can be further divided into two categories, i.e., PDU sessions with DualSteer traffic switching feature and the PDU Session without DualSteer traffic switching feature.

Once the 3GPP access has been determined (i.e., the UE/SUPI has been selected), the URSP rule of the selected UE/SUPI is evaluated to determine whether to reuse an established PDU Session or to establish a new PDU Session based on the DualSteer traffic switching actions and other existing information elements (e.g., DNN, S-NSSAI) in the RSD. If the "DualSteer traffic switching actions" is present in the Route Selection Descriptors, it means that this new service can be switched via DualSteer traffic switching mechanism. Therefore, this new service shall be transmitted via a PDU session which is allowed to use DualSteer traffic switching mechanism with the corresponding "DualSteer traffic switching actions".

If the "DualSteer traffic switching actions" does not exist in the Route Selection Descriptors, it means that this service does not use DualSteer traffic switching feature. Therefore, this new service is transmitted via PDU session without DualSteer traffic switching feature.

If only one UE/SUPI in the DualSteer device is registered, PDU Sessions are only established by the registered UE/SUPI. The DualSteer traffic switching can only be performed after the other UE/SUPI in the DualSteer device has registered to the network.

**Principle for PDU Session Switching**

DualSteer simultaneous transmission policy for DualSteer Device:

- no restriction (only be applicable to two separate Single-USIM DualSteer UEs case)

- always use single 3GPP access for all traffic (i.e., non-simultaneous data transmission)

When the triggers for DualSteer traffic switching, the DualSteer traffic switching policy is evaluated in the DualSteer Device for each PDU session.

If "no restriction" is present, each PDU session supporting the DualSteer traffic switching feature is switched based on the DualSteer traffic switching actions associated to the PDU session.

If "always use single 3GPP access for all traffic", only one 3GPP access can be used for data transmission. Therefore, all PDU sessions are moved or re-established according to the policy, or none is moved.

DualSteer Device determines to perform DualSteer traffic switching based on the DualSteer traffic switching policies specified in clause 6.1.15 and the current conditions of the DualSteer device (e.g., Primary/Secondary 3GPP access is available or not, current/other 3GPP access status).

There are two options considering how AMF selects the same SMF, and how the SMF correlates the two PDU sessions.

- In Option#1, the association is based on PDU Session ID#1 and SUPI of UE1.

- In Option#2, the association is based on Session correlation ID allocated by SMF.

**Enforcement of policy for non-simultaneous transmission**

If the HPLMN determines that the simultaneous transmission is not allowed based on operator policy (e.g. due to subscription or DualSteer Device capability), the HPLMN shall provision policy within the network to ensure that only one 3GPP access is used by the DualSteer Device for data transmission. In this solution, the UDM is enhanced to enforce such policy as follow:

- If the simultaneous transmission is not allowed, when there is a new PDU Session established by the target UE/SUPI over the target 3GPP access, the UDM shall instruct the SMF(s) to deactivate/release the PDU Session(s) established by the source UE/SUPI (if any).

###### 6.1.15.2.3.1 PDU Session Establishment procedure for DualSteer traffic steering

Figure 6.1.15.2.3.1 shows the PDU Session Establishment procedure for DualSteer traffic steering.



Figure 6.1.15.2.3.1-1: PDU Session establishment procedure

0. UDM stores the linked SUPIs of UE1 and UE2, using the solution on KI#1.1.

1. UE1 and UE2 registers to network, using the solution on KI#1.2. UE1 can be the primary UE, and UE2 can be the secondary UE. AMF1 is the UE1’s serving AMF, and AMF2 is the UE2’s serving AMF. During the registration, it assumes that the AMF1 knows that the UE1 is authorized to use DualSteer and the AMF2 knows that the UE2 is authorized to use DualSteer, and the DualSteer device knows that UE1 and UE2 are authorized to use DualSteer.

2. UE1 request to establish PDU Session ID#1, with Request Type indicating "DualSteer Request for session switching". Based on the "DualSteer Request for session switching", AMF1 selects SMF supporting DualSteer.

 Before step 2, based on the DualSteer policy for traffic steering received during step 1, it assumes that UE1 is selected to transmit the service data, and then the URSP of UE1 is evaluated. The details of DualSteer policy for traffic steering are specified in clause 6.1.15.

 The URSP is enhanced to include a new component "DualSteer traffic switching actions" within Route Selection Descriptors. If the "DualSteer traffic switching actions" exists in the Route Selection Descriptors, the UE1 determines to use the PDU session with DualSteer traffic switching feature to transmit the traffic of the service. The UE1 determines whether an existing PDU session can be reused for the new service or a new PDU session shall be established by taking into account the value of DualSteer traffic switching actions. If the UE1 determines to establish a new PDU session with DualSteer traffic switching feature for the new service, the UE1 sets Request Type indicating "DualSteer Request for session switching". If the "DualSteer traffic switching actions" does not exist in the Route Selection Descriptors, then the UE1 establishes the PDU Session without DualSteer traffic switching feature, and the data services over this PDU session cannot be switched to the target 3GPP access of target UE via DualSteer traffic switching mechanism.

3. AMF1 sends SUPI of UE1, PDU Session ID#1 and "DualSteer Request for session switching" to SMF. Based on the "DualSteer Request for session switching". If the UE1 is not authorized for perform DualSteer, the AMF shall reject the PDU session.

4. SMF retrieves, SM subscription data from UDM.

In order to enable the network to correlate the PDU session established by UE2 in the potential DualSteer traffic switching procedure with this PDU session and select the same SMF during the switching procedure, correlation information for the PDU session to be switched is needed and is sent by the SMF to the UDM. The correlation information includes PDU Session ID#1, SMF ID and an indication indicating that the PDU Session ID#1 is allowed to support DualSteer traffic switching to the UDM.

5. Based on the association between the SUPI of UE1 and the SUPI of UE2 in the subscription, UDM sends the PDU Session ID#1, SUPI of UE1 and SMF ID to the AMF2, if this PDU Session ID#1 is used for DualSteer traffic switching.

AMF2 stores the PDU Session ID#1, SUPI of UE1 and SMF ID.

If the UE1 is not authorized to perform DualSteer (e.g. based on subscription or if SUPI1 and SUPI2 are not used by the same DualSteer Device), UDM does not perform this step.

NOTE: Step 5 can be performed separately when UE2 registers to the network.

6. Remaining steps are performed to complete the establishment of PDU Session ID#1, including N3 and N4 establishment. The UPF is the Anchor UPF. SMF may establish SM Policy Association with PCF to get the PCC Rules for PDU Session ID#1 of UE1.

NOTE 1: The PCC Rules are defined in existing specification. There are no new impacts to PCC Rules.

7. If the SMF decides to accept the "DualSteer Request for session switching", the SMF sends a DualSteer allowed indication to AMF1.

8. AMF1 sends the DualSteer allowed indication to UE1.

After the PDU Session ID#1 of UE1 is established, the DualSteer device transmits the corresponding data services over the PDU Session ID#1 of UE1.

Apart from using the PDU session #1 of UE1 as correlation information to identify the PDU session for potential DualSteer traffic switching, SMF can also generate a Session correlation ID for network to identify the PDU session to be switched. For this alternative, the procedure of 6.1.15.2.2 can be used with following modifications and clarifications:

- In step 4, SMF allocates Session correlation ID#1 for the PDU Session ID#1 of UE1, if PDU Session ID#1 is requested for DualSteer. The Session correlation ID shall be unique. SMF sends the Session correlation ID#1 and SMF ID to UDM. SMF stores the association of Session correlation ID#1 and PDU Session ID#1 of UE1.

- In step 5, UDM sends the Session correlation ID#1 and SMF ID to AMF2. AMF2 stores the Session correlation ID#1 and SMF ID.

- In step 7, the SMF sends a DualSteer allowed indication and Session correlation ID#1 to AMF1.

- In step 8, the AMF1 sends the DualSteer allowed indication and Session correlation ID#1 to UE1.

###### 6.1.15.2.3.2 PDU Session Switching procedure for DualSteer traffic switching

Figure 6.1.15.2.3.2 shows the PDU Session Switching procedure for DualSteer traffic switching where the PDU Session is switched from UE1 to UE2 of the DualSteer Device.



Figure 6.1.15.2.3-1: PDU Session Switching procedure

0. After the PDU Session establishment of UE1, PDU Session ID#1 of UE1 is shared from UE1 to UE2 within the device based on the device implementation.

1. When DualSteer device decides the session switch based on the DualSteer traffic switching policies as the specified in clause 6.1.15 and the current conditions of this DualSteer device (e.g., Primary/Secondary 3GPP access is available or not, current/other 3GPP access status), DualSteer device requests the session switching from PDU Session ID#1 of UE1 to PDU Session ID#2 of UE2. In particular, UE2 sends NAS message to AMF2, includes PDU Session ID#2, PDU Session ID#1 of UE1, session switch indication, and PDU Session establishment request. The PDU Session ID#2 of UE2 has the same parameters (e.g., DNN and S-NSSAI) with the PDU Session ID#1 of UE1.

 Based on DualSteer allowed indication received during the establishment of PDU Session ID#1, the DualSteer device knows that the PDU Session ID#1 is allowed to be switched between UEs.

2. AMF2 may select the SMF based on the information if received from UDM (step 5 of Figure 6.1.X.2.2). If AMF2 does not receive the information for SMF selection, the AMF2 sends the request to UDM to obtain the the SMF ID for PDU Session ID#1 of UE1.

If the UE2 is not authorized to perform DualSteer, the AMF shall reject the PDU session.

3. AMF2 sends SUPI of UE2, PDU Session ID#2, PDU Session ID#1 of UE1, SUPI of UE1, session switch indication, and PDU Session establishment request.

4. If the SMF receives the session switch indication from AMF2 and the PDU session is allowed for DualSteer based on SM subscription data, the SMF determines that UE IP address and N4 session associated with PDU Session ID#1 of UE1 can be reused for PDU Session ID#2 of UE2.

5. Remaining steps are performed to complete the establishment of PDU Session ID#2. SMF may establish SM Policy Association with PCF to get the PCC Rules for PDU Session ID#2 of UE2.

NOTE 1: The PCC Rules are defined in existing specification. There are no new impacts to PCC Rules.

NOTE 2: The SM Policy Association for PDU Session ID#1 of UE1 and SM Policy Association of PDU Session ID#2 of UE2 are separated, and SMF does not need to select the same PCF. There is no impact on the SM Policy Association

 SMF triggers the N4 Session Modification procedure to update the N4 Session Context to replace the AN tunnel info with the AN tunnel info of RAN2. SMF sends the CN tunnel info of the UPF to the RAN2 via N2 SM Information.

 After step 5, PDU Session ID#2 of UE2 is established, the DualSteer device and UPF transmits the corresponding services via the PDU Session ID#2 of UE2.

 If simultaneous transmission is not allowed based on operator policy, the UDM shall inform the SMF(s) to deactivate/release the PDU Session(s) established by SUPI1/UE1 (if any) based on the UE context in SMF data of the associated SUPI subscription.

6. SMF triggers the PDU session release procedure to release the PDU Session ID#1 of UE1, including to release SM Policy Association with PCF for PDU Session ID#1 of UE1, and to deregister this PDU Session from the UDM. After the switching, the same IP is only used by the PDU Session ID#2 of UE2.

If the Session correlation ID is used in the PDU session establishment procedure as specified in clause 6.1.15.2.2, the procedure of 6.1.15.2.3 can be used with following modifications and clarifications:

- In step 1, the UE2 sends NAS message to AMF2, includes PDU Session ID#2, Session correlation ID#1, session switch indication, and PDU Session establishment request.

- In step 2, the AMF2 may send the request to UDM to obtain the the SMF ID for Session correlation ID#1.

- In step 3, the AMF2 sends SUPI of UE2, PDU Session ID#2, Session correlation ID#1, session switch indication, and PDU Session establishment request.

- In step 4, the SMF associates PDU Session ID#1 of UE1 and PDU Session ID#2 of UE2 based on Session correlation ID#1.

The procedures in Figure 6.1.15.2.2 and Figure 6.1.15.2.3 describe the non-roaming intra-PLMN scenario where both UE1 and UE2 are in the HPLMN, but the same procedure applies to the other scenarios, as follows:

* For the scenario that UE1 is in the HPLMN and UE2 is roaming, the PDU Session for UE2 is set up as HR roaming where the SMF is the H-SMF, and the UPF is the H-UPF. The message in step 3 in Figure 6.1.15.2.3 is sent to V-SMF and additionally includes H-SMF ID, and the V-SMF sends the information in the step 3 in Figure 6.1.15.2.3 to the H-SMF.
* For the scenario that UE1 is roaming and UE2 is in the HPLMN, the PDU Session for UE1 is set up as HR roaming where the SMF is the H-SMF, and the UPF is the H-UPF. The messages in both step 3 and step 7 in Figure 6.1.15.2.2 are transferred via V-SMF.
* For the scenario that both UE1 and UE2 are roaming, the PDU Sessions for UE1 and UE2 are set up as HR roaming where the SMF is the H-SMF, and UPF is the H-UPF. The messages in both step 3 and step 7 in Figure 6.1.15.2.2 are transferred via V-SMF1. The message in step 3 in Figure 6.1.15.2.3 is sent to V-SMF and additionally includes H-SMF ID, and the V-SMF sends the information in the step 3 in Figure 6.1.15.2.3 to the H-SMF.

#### 6.1.15.3 Impacts on services, entities and interfaces

**UE PCF:**

- generate and provision the policies for DualSteer to the UE of DualSteer Device by considering the operator's policy, DualSteer subscription and DualSteer Device capability.

**UE/DualSteer Device:**

- receive new UE policies or enhanced URSP from the network.

- Evaluate the policies for DualSteer to determine whether and when to activate the Registration of Secondary SUPI, how to steer the traffic of a new service and how to switch the traffic of service(s) from source 3GPP access to target 3GPP access if the conditions for DualSteer traffic switching are met.

- evaluate the URSP of the selected UE/SUPI, to determine whether to reuse an established PDU Session or to establish a new PDU Session based on the DualSteer traffic switching actions and other existing information elements (e.g., DNN, S-NSSAI) in the RSD.

- Request Type indicating "DualSteer Request for session switching" during the PDU Session establishment.

- request the session switch based on DualSteer traffic switching policy and the received DualSteer allowed indication from SMF.

**UDM:**

- send the PDU Session information to serving AMF of the linked SUPI.

- inform the SMF to deactivate/release the PDU session established by the source UE/SUPI when there is a new PDU Session established by the target UE/SUPI if the non-simultaneous transmission is not allowed.

**AMF:**

- select the SMF based on PDU Session information from UDM, and requests session switch to the SMF.

**SMF:**

- perform the session association and switch based on the request from AMF.

- trigger the source PDU session release after DualSteer traffic switching.

**SM PCF:**

- NO

**UPF:**

- NO

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