**SA WG2 Meeting #155S2-2303655**

**Athens, Greece, Feb 20 – 24, 2023 (revision of S2-2302828)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.501** | **CR** | **4160**  | **rev** | **1** | **Current version:** | **18.0.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  | Delivery of Traffic Influence information for Home Routed-Session Breakout (HR-SBO) support |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell, Huawei, HSilicon |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | EDGE\_Ph2 |  | ***Date:*** | 2023-02-04 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | It was agreed (TR 23.700-48 conclusions) to support Home Routed Session Breakout (HR-SBO) in Rel-18 to enable local traffic routing in VPLMN for Home Routed PDU Session.  |
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| ***Summary of change:*** | AF influence on traffic routing may apply in the case of Home Routed deployments with Session Breakout (HR SBO) as defined in TS 23.548. In that case when an AF belonging to the V-PLMN (or with an offloading SLA with the V PLMN) desires to provide Traffic Influence policies it may invoke at the V-NEF the API defined in clause 5.6.7 and provide the information listed in Table 5.6.7-1 below but the corresponding Traffic Influence information is provided directly from V-NEF to V-SMF bypassing the PCF. This is further defined in TS 23.548 clause 6.7.2. The rest of the clause 5.6.7.1 does not address how information related with AF influence on traffic routing may be provided to the SMF in the case of Home Routed deployments. |
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| ***Consequences if not approved:*** | HR-SBO is not supported |
|  |  |
| ***Clauses affected:*** | 5.6.7.1 ; 5.6.7.2 ; 7.2.8 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | 23.502 CR 3909 |
| ***affected:*** |  | **x** |  Test specifications |  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | The solution works as follows* Nnef traffic influence information is provided directly from V-AF to V-SMF Traffic Influence information is provided directly from V-AF to V-SMF (via V-NEF/UDR) bypassing the PCF(s).
* V-SMF needs to subscribe to Nnef\_TrafficInfluenceDelivery to receive Traffic Influence information for HR-SBO related with a HPLMN DNN and slice
* In order to have proper QoS for the offloaded flows; the V-AF may also invoke Nnef\_AFsessionWithQoS in order to have proper QoS for the offloaded flows; The H-PCF based on operator policies determines QoS information sent in PCC rules by H-PCF to H-SMF. The H-SMF determines the correspondingto Qos flows controlled over the N16 interface to V-SMF (per TS 23.502 [2] clauses 4.3.2.3 and 4.3.3.3

This is per existing R17 QoS mechanismsand means that QoS is controlled at a single point i.e. the H-PCF |

*FIRST CHANGE*

#### 5.6.7.1 General

The content of this clause applies to non-roaming and to LBO deployments i.e. to cases where the involved entities (AF, PCF, SMF, UPF) belong to the Serving PLMN or AF belongs to a third party with which the Serving PLMN has an SLA agreement.

AF influence on traffic routing may apply in the case of Home Routed deployments with Session Breakout (HR SBO) as defined in TS 23.548 [130]. In that case when an AF belonging to the V-PLMN (or with an offloading SLA with the V PLMN) desires to provide Traffic Influence policies it may invoke at the V-NEF the API defined in this clause and provide the information listed in Table 5.6.7-1 below but the corresponding Traffic Influence information is provided directly from V-NEF to V-SMF bypassing the PCF. This is further defined in TS 23.548 [130] clause 6.7.2. and the rest of the clause 5.6.7.1 does not address how information related with AF influence on traffic routing may be provided to the SMF in the case of HR SBO.

PCF shall not apply AF requests to influence traffic routing to PDU Sessions established in Home Routed mode.

An AF may send requests to influence SMF routeing decisions for traffic of PDU Session. The AF requests may influence UPF (re)selection and (I-)SMF (re)selection and allow routeing user traffic to a local access to a Data Network (identified by a DNAI).

The AF may issue requests on behalf of applications not owned by the PLMN serving the UE.

If the operator does not allow an AF to access the network directly, the AF shall use the NEF to interact with the 5GC, as described in clause 6.2.10.

The AF may be in charge of the (re)selection or relocation of the applications within the local part of the DN (as defined in TS 23.548 [130]). Such functionality is not defined. For this purpose, the AF may request to get notified about events related with PDU Sessions.

In the case of AF instance change, the AF may send request of AF relocation information.

The AF requests are sent to the PCF via N5 (in the case of requests targeting specific on-going PDU Sessions of individual UE(s), for an AF allowed to interact directly with the 5GC NFs) or via the NEF. The AF requests that target existing or future PDU Sessions of multiple UE(s) or of any UE are sent via the NEF and may target multiple PCF(s), as described in clause 6.3.7.2. The PCF(s) transform(s) the AF requests into policies that apply to PDU Sessions. When the AF has subscribed to UP path management event notifications from SMF(s) (including notifications on how to reach a GPSI over N6), such notifications are sent either directly to the AF or via an NEF (without involving the PCF). For AF interacting with PCF directly or via NEF, the AF requests may contain the information as described in the Table 5.6.7-1:

Table 5.6.7-1: Information element contained in AF request

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| --- | --- | --- | --- |
| Information Name | Applicable for PCF or NEF (NOTE 1) | Applicable for NEF only | Category |
| Traffic Description | Defines the target traffic to be influenced, represented by the combination of DNN and optionally S-NSSAI, and application identifier or traffic filtering information.  | The target traffic can be represented by AF-Service-Identifier, instead of combination of DNN and optionally S-NSSAI.  | Mandatory |
| Potential Locations of Applications | Indicates potential locations of applications, represented by a list of DNAI(s). | The potential locations of applications can be represented by AF-Service-Identifier. | Conditional(NOTE 2) |
| Target UE Identifier(s) | Indicates the UE(s) that the request is targeting, i.e. one or a list of individual UE(s), a group of UE represented by Internal Group Identifier (NOTE 3), or any UE accessing the combination of DNN, S-NSSAI and DNAI(s). | GPSI can be applied to identify the individual UE, or External Group Identifier can be applied to identify a group of UE. | Mandatory |
| Spatial Validity Condition | Indicates that the request applies only to the traffic of UE(s) located in the specified location, represented by areas of validity. | The specified location can be represented by geographical area. | Optional |
| AF transaction identifier | The AF transaction identifier refers to the AF request. | N/A | Mandatory |
| N6 Traffic Routing requirements | Routing profile ID and/or N6 traffic routing information corresponding to each DNAI and an optional indication of traffic correlation (NOTE 4). | N/A | Optional(NOTE 2) |
| Application Relocation Possibility | Indicates whether an application can be relocated once a location of the application is selected by the 5GC. | N/A | Optional |
| UE IP address preservation indication | Indicates UE IP address should be preserved. | N/A | Optional |
| Temporal Validity Condition | Time interval(s) or duration(s). | N/A | Optional |
| Information on AF subscription to corresponding SMF events | Indicates whether the AF subscribes to change of UP path of the PDU Session and the parameters of this subscription. | N/A | Optional |
| Information for EAS IP Replacement in 5GC | Indicates the Source EAS identifier and Target EAS identifier, (i.e. IP addresses and port numbers of the source and target EAS). | N/A | Optional |
| User Plane Latency Requirement | Indicates the user plane latency requirements | N/A | Optional |
| Information on AF change | N/A | Indicates the AF instance relocation and relocation information. | Optional |
| Indication for EAS Relocation | Indicates the EAS relocation of the application(s) | N/A | Optional |
| Indication for Simultaneous Connectivity over the source and target PSA at Edge Relocation | Indicates that simultaneous connectivity over the source and target PSA should be maintained at edge relocation and provides guidance to determine when the connectivity over the source PSA can be removed. | N/A | Optional |
| EAS Correlation indication | Indicates selecting a common EAS for the application identified by the Traffic Description for the set of UEs. |  | Optional |
| NOTE 1: When the AF request targets existing or future PDU Sessions of multiple UE(s) or of any UE and is sent via the NEF, as described in clause 6.3.7.2, the information is stored in the UDR by the NEF and notified to the PCF by the UDR.NOTE 2: The potential locations of applications and N6 traffic routing requirements may be absent only if the request is for subscription to notifications about UP path management events only.NOTE 3: Internal Group ID can only be used by an AF controlled by the operator and only towards PCF.NOTE 4: The indication of traffic correlation can be used for 5G VN groups as described in clause 5.29. |

For each information element mentioned above in the AF request, the detailed description is as follows:

1) Information to identify the traffic. The traffic can be identified in the AF request by

- Either a DNN and possibly slicing information (S-NSSAI) or an AF-Service-Identifier

- When the AF provides an AF-Service-Identifier i.e. an identifier of the service on behalf of which the AF is issuing the request, the 5G Core maps this identifier into a target DNN and slicing information (S-NSSAI)

- When the NEF processes the AF request the AF-Service-Identifier may be used to authorize the AF request.

- An application identifier or traffic filtering information (e.g. IP 5 Tuple). The application identifier refers to an application handling UP traffic and is used by the UPF to detect the traffic of the application

 When the AF request is for influencing SMF routing decisions, the information is to identify the traffic to be routed.

 When the AF request is for subscription to notifications about UP path management events, the information is to identify the traffic that the events relate to.

2) Information about the N6 traffic routing requirements for traffic identified as defined in 1). This includes:

- Information about the N6 traffic routing requirements that is provided per DNAI: for each DNAI, the N6 traffic routing requirements may contain a routing profile ID and/or N6 traffic routing information.

- An optional indication of traffic correlation, when the information in 4) identifies a group of UEs. This implies the targeted PDU Sessions should be correlated by a common DNAI in the user plane for the traffic identified in 1). If this indication is provided by the AF, the 5GC should select a common DNAI for the target PDU Sessions from the list of DNAI(s) specified in 3).

NOTE 1: The N6 traffic routing requirements are related to the mechanism enabling traffic steering in the local access to the DN. The routing profile ID refers to a pre-agreed policy between the AF and the 5GC. This policy may refer to different steering policy ID(s) sent to SMF and e.g. based on time of the day etc.

NOTE 2: The mechanisms enabling traffic steering in the local access to the DN are not defined.

3) Potential locations of applications towards which the traffic routing should apply. The potential location of application is expressed as a list of DNAI(s). If the AF interacts with the PCF via the NEF, the NEF may map the AF-Service-Identifier information to a list of DNAI(s). The DNAI(s) may be used for UPF (re)selection and (I‑)SMF (re)selection.

4) Information on the set of target UE(s). This may correspond to:

- Individual UEs (i.e. one or a list of UEs) identified using GPSI, or an IP address/Prefix or a MAC address.

- Groups of UEs identified by an External Group Identifier as defined in TS 23.682 [36] when the AF interacts via the NEF, or Internal-Group Identifier (see clause 5.9.7) when the AF interacts directly with the PCF.

- Any UE accessing the combination of DNN, S-NSSAI and DNAI(s).

 When the PDU Session type is IPv4 or IPv6 or IPv4v6, and the AF provides an IP address and/or an IP Prefix, or when the PDU Session type is Ethernet and the AF provides a MAC address, this allows the PCF to identify the PDU Session for which this request applies and the AF request applies only to that specific PDU Session of the UE. In this case, additional information such as the UE identity may also be provided to help the PCF to identify the correct PDU Session.

 Otherwise the request targets multiple UE(s) and shall apply to any existing or future PDU Sessions that match the parameters in the AF request.

 When the AF request targets an individual or a list of UE(s) and GPSI is provided within the AF request, the GPSI is mapped to SUPI according to the subscription information received from UDM.

 When the AF request targets any UE or a group of UE, the AF request is likely to influence multiple PDU Sessions possibly served by multiple SMFs and PCFs.

 When the AF request targets a group of UE it provides one or several group identifiers in its request. The group identifiers provided by the AF are mapped to Internal-Group identifiers. Members of the group have this Group Identifier in their subscription. The Internal-Group Identifier is stored in UDM, retrieved by SMF from UDM and passed by SMF to PCF at PDU Session set-up. The PCF can then map the AF requests with user subscription and determine whether an AF request targeting a Group of users applies to a PDU Session.

 When the AF request is for influencing SMF routing decisions, the information is to identify UE(s) whose traffic is to be routed.

 When the AF request is for subscription to notifications about UP path management events, the information is to identify UE(s) whose traffic the events relate to.

 When the AF request is for traffic forwarding in a PDU Session serving for TSC, the MAC address used by the PDU Session is determined by the AF to identify UE whose traffic is to be routed according to the previously stored binding relationship of the 5GS Bridge and the port number of the traffic forwarding information received from TSN network.

5) Indication of application relocation possibility. This indicates whether an application can be relocated once a location of the application is selected by the 5GC. If application relocation is not possible, the 5GC shall ensure that for the traffic related with an application, no DNAI change takes place once selected for this application.

6) Temporal validity condition. This is provided in the form of time interval(s) or duration(s) during which the AF request is to be applied.

 When the AF request is for influencing SMF routing decisions, the temporal validity condition indicates when the traffic routing is to apply.

 When the AF request is for subscription to notifications about UP path management events, the temporal validity condition indicates when the notifications are to be generated.

7) Spatial validity condition on the UE(s) location. This is provided in the form of validity area(s). If the AF interacts with the PCF via the NEF, it may provide geographical area (e.g. a civic address or shapes) and the NEF maps the information to areas of validity based on pre-configuration. The PCF in turn determines area(s) of interest based on validity area(s).

 When the AF request is for influencing SMF routing decisions, the spatial validity condition indicates that the request applies only to the traffic of UE(s) located in the specified location.

 When the AF request is for subscription to notifications about UP path management events, the spatial validity condition indicates that the subscription applies only to the traffic of UE(s) located in the specified location.

8) Information on AF subscription to corresponding SMF events.

 The AF may request to be subscribed to change of UP path associated with traffic identified in the bullet 1) above. The AF request contains:

- A type of subscription (subscription for Early and/or Late notifications).

 The AF subscription can be for Early notifications and/or Late notifications. In the case of a subscription for Early notifications, the SMF sends the notifications before the (new) UP path is configured. In the case of a subscription for Late notifications, the SMF sends the notification after the (new) UP path has been configured.

- Notification target address for receiving event notification.

- Optionally, an indication of "AF acknowledgment to be expected".

 The indication implies that the AF will provide a response to the notifications of UP path management events to the 5GC. The SMF may, according to this indication, determine to wait for a response from the AF before the SMF configures in the case of early notification, or activates in the case of late notification, the new UP path as described in clause 5.6.7.2.

 The AF subscription can also request to receive information associating the GPSI of the UE with the IP address(es) of the UE and/or with actual N6 traffic routing to be used to reach the UE on the PDU Session; in this case the corresponding information is sent by the SMF regardless of whether a DNAI applies to the PDU Session.

9) An AF transaction identifier referring to the AF request. This allows the AF to update or remove the AF request and to identify corresponding UP path management event notifications. The AF transaction identifier is generated by the AF.

 When the AF interacts with the PCF via the NEF, the NEF maps the AF transaction identifier to an AF transaction internal identifier, which is generated by the NEF and used within the 5GC to identify the information associated to the AF request. The NEF maintains the mapping between the AF transaction identifier and the AF transaction internal identifier. The relation between the two identifiers is implementation specific.

 When the AF interacts with the PCF directly, the AF transaction identifier provided by the AF is used as AF transaction internal identifier within the 5GC.

10) Indication of UE IP address preservation. This indicates UE IP address related to the traffic identified in bullet 1) should be preserved. If this indication is provided by the AF, the 5GC should preserve the UE IP address by preventing reselection of PSA UPF for the identified traffic once the PSA UPF is selected.

11) Information for EAS IP Replacement in 5GC. This indicates the Source EAS identifier and Target EAS identifier (i.e. IP addresses and port numbers of the source and target EAS) for a service subject to Edge Computing.

12) User Plane Latency Requirement. This includes AF requirements for User Plane latency. (see clause 6.3.6 of TS 23.548 [130]).

13) Information on AF change. The AF relocation information includes:

- AF Identifier: the identifier of the target AF instance.

NOTE 3: The AF relocation information is applicable for interaction with NEF only and it is not stored in UDR or transferred to PCF, even for the case AF directly interacts with PCF.

14) Indication for EAS relocation. This indicates the application(s) are to be relocated.

15) Indication for Simultaneous Connectivity over source and target PSA at Edge Relocation (see clause 6.3.4 of TS 23.548 [130]). Indicates that source and target PSA should coexist for some time at PSA relocation, and may influence the establishment of a temporary N9 forwarding tunnel between the source UL CL and target UL CL. It may also provide guidance for the time interval after the described traffic ceases when the connectivity over the source PSA may be removed.

16) EAS Correlation indication. Indicates selecting a common EAS for the application identified by the Traffic Description accessed by the set of UEs, the set of UEs contains UEs that the AF request aims at.

An AF may send requests to influence SMF routeing decisions, for event subscription or for both.

The AF may request to be subscribed to notifications about UP path management events, i.e. a UP path change occurs for the PDU Session. The corresponding notification about a UP path change sent by the SMF to the AF may indicate the DNAI and /or the N6 traffic routing information that has changed as described in clause 4.3.6.3 of TS 23.502 [3]. It may include the AF transaction internal identifier, the type of notification (i.e. early notification or late notification), the Identity of the source and/or target DNAI, the IP address/prefix of the UE or the MAC address used by the UE, the GPSI and the N6 traffic routing information related to the 5GC UP.

NOTE 4: The change from the UP path status where no DNAI applies to a status where a DNAI applies indicates the activation of this AF request; the change from the UP path status where a DNAI applies to a status where no DNAI applies indicates the de-activation of this AF request.

 In the case of IP PDU Session Type, the IP address/prefix of the UE together with N6 traffic routing information indicates to the AF how to reach over the User Plane the UE identified by its GPSI. N6 traffic routing information indicates any tunnelling that may be used over N6. The nature of this information depends on the deployment.

NOTE 5: N6 traffic routing information can e.g. correspond to the identifier of a VPN or to explicit tunnelling information such as a tunnelling protocol identifier together with a Tunnel identifier.

NOTE 6: In the case of Unstructured PDU Session type the nature of the N6 traffic routing information related to the 5GC UP is described in clause 5.6.10.3.

 In the case of Ethernet PDU Session Type, the MAC address of the UE together with N6 traffic routing information indicates to the AF how to reach over the User Plane the UE identified by its GPSI. The UE MAC address (es) is reported by the UPF as described in clause 5.8.2.12. The N6 traffic routing information can be, e.g. a VLAN ID or the identifier of a VPN or a tunnel identifier at the UPF.

When notifications about UP path management events are sent to the AF via the NEF, if required, the NEF maps the UE identify information, e.g. SUPI, to the GPSI and the AF transaction internal identifier to the AF transaction identifier before sending the notifications to the AF.

The PCF, based on information received from the AF, operator's policy, optionally service experience analytics per UP path received from NWDAF, etc., authorizes the request received from the AF and determines for each DNAI, a traffic steering policy ID (derived from the routing profile ID provided by the AF) and/or the N6 traffic routing information (as provided by the AF) to be sent to the SMF as part of the PCC rules. The traffic steering policy IDs are configured in the SMF or in the UPF. The traffic steering policy IDs are related to the mechanism enabling traffic steering to the DN.

The DNAIs are related to the information considered by the SMF for UPF selection and (I‑)SMF (re)selection, e.g. for diverting (locally) some traffic matching traffic filters provided by the PCF.

The PCF acknowledges a request targeting an individual PDU Session to the AF or to the NEF.

For PDU Session that corresponds to the AF request, the PCF provides the SMF with a PCC rule that is generated based on the AF request, Local routing indication from the PDU Session policy control subscription information and taking into account UE location presence in area of interest (i.e. Presence Reporting Area). The PCC rule contains the information to identify the traffic, information about the DNAI(s) towards which the traffic routing should apply and optionally, an indication of traffic correlation and/or an indication of application relocation possibility and/or indication of UE IP address preservation and/or an EAS Correlation indication. The PCC rule also contains per DNAI a traffic steering policy ID and/or N6 traffic routing information, if the N6 traffic routing information is explicitly provided in the AF request. If EAS Correlation\_indication or indication of traffic correlation is included in the AF request, a traffic correlation ID will be included in PCC rule. The PCF may also provide in the PCC rule information to subscribe the AF (or the NEF) to SMF events (UP path changes) corresponding to the AF request in which case it provides the information on AF subscription to corresponding SMF events received in the AF request. This is done by providing policies at PDU Session set-up or by initiating a PDU Session Modification procedure. When initiating a PDU Session set-up or PDU Session Modification procedure, the PCF considers the latest known UE location to determine the PCC rules provided to the SMF. The PCF evaluates the temporal validity condition of the AF request and informs the SMF to activate or deactivate the corresponding PCC rules according to the evaluation result. When policies specific to the PDU Session and policies general to multiple PDU Sessions exist, the PCF gives precedence to the PDU Session specific policies over the general policies. The PCF authorizes the AF request of User Plane Latency Requirements. If the PCF determines that the requirements can't be authorized, the PCF rejects the AF request.

The spatial validity condition is resolved at the PCF. In order to do that, the PCF subscribes to the SMF to receive notifications about change of UE location in an area of interest (i.e. Presence Reporting Area). The subscribed area of interest may be the same as spatial validity condition, or may be a subset of the spatial validity condition (e.g. a list of TAs) based on the latest known UE location. When the SMF detects that UE entered the area of interest subscribed by the PCF, the SMF notifies the PCF and the PCF provides to the SMF the PCC rules described above by triggering a PDU Session Modification. When the SMF becomes aware that the UE left the area subscribed by the PCF, the SMF notifies the PCF and the PCF provides updated PCC rules by triggering a PDU Session Modification. SMF notifications to the PCF about UE location in or out of the subscribed area of interest are triggered by UE location change notifications received from the AMF or by UE location information received during a Service Request or Handover procedure.

When the PCC rules are activated, the SMF may, based on local policies, take the information in the PCC rules and, optionally, the Service Experience analytics and/or DN Performance analytics per UP path (including UPF and/or DNAI and/or AS instance) as defined in clause 6.4.3 and clause 6.14.3, respectively, of TS 23.288 [86] into account to:

- (re)select UP paths (including DNAI(s)) for PDU Sessions. The SMF is responsible for handling the mapping between the UE location (TAI / Cell-Id) and DNAI(s) associated with UPF and applications and the selection of the UPF(s) that serve a PDU Session. This is described in clause 6.3.3. If the PDU Session is of IP type and if Indication of UE IP address preservation is included in the PCC rules, the SMF should preserve the UE IP address, by not reselecting the related PSA UPF once the PSA UPF is selected, for the traffic identified in the PCC rule. If the user plane latency requirement is included in the PCC rules, the SMF chooses the PSA UPF that satisfies the user plane latency requirement. If the PCC rules are related to a 5G VN group served by the SMF and if the PCC rule includes an indication of traffic correlation, the SMF should select a common DNAI for the PDU Sessions of the 5G VN group, see clause 5.29.

- configure traffic steering at UPF, including activating mechanisms for traffic multi-homing or enforcement of an UL Classifier (UL CL). Such mechanisms are defined in clause 5.6.4. This may include that the SMF is providing the UPF with packet handling instructions (i.e. PDRs and FARs) for steering traffic to the local access to the DN. The packet handling instructions are generated by the SMF using the traffic steering policy ID and/or the N6 traffic routing information in the PCC rules corresponding to the applied DNAI. In the case of UP path reselection, the SMF may configure the source UPF to forward traffic to the UL CL/BP so that the traffic is steered towards the target UPF.

- if Information on AF subscription to corresponding SMF events has been provided in the PCC rule, inform the AF of the (re)selection of the UP path (UP path change). If the information includes an indication of "AF acknowledgment to be expected", the SMF may decide to wait for a response from the AF before it activates the new UP path, as described in clause 5.6.7.2.

When an I-SMF is inserted for a PDU Session, the I-SMF insertion, relocation or removal to a PDU session shall be transparent (i.e. not aware) to the PCF and to the AF. The processing of the AF influence on traffic routing is described in clause 5.34 and detail procedure is described in clause 4.23.6 of TS 23.502 [3].

*NEXT CHANGE (2)*

#### 5.6.7.2 Enhancement of UP path management based on the coordination with AFs

In order to avoid or minimize service interruption during PSA relocation for a PDU session of SSC mode 3, or a PDU session with UL CL or branch point, according to the indication of "AF acknowledgment to be expected" on AF subscription to corresponding SMF events (DNAI change) (that may be provided in PCC rules received from the PCF as defined in clause 5.6.7.1 except in HR-SBO case or that may be provided directly by V-NEF to V-SMF as defined in TS 23.548 [130] clause 6.7.2 in case of HR-SBO) or according to local configuration (e.g. DN-related policies) the SMF may wait for a response from the AF after sending a notification (an early notification or a late notification) to the AF. In the case of late notification, based on the indication of "AF acknowledgment to be expected" on AF subscription, the SMF may send the notification before activating the UP path towards a new DNAI (possibly through a new PSA).

NOTE 1: Before the UP path toward the new DNAI is activated, application traffic data (if any exists) is still routed toward the old DNAI.

The notification sent from the SMF to the AF indicates UP path management events (DNAI change) as described in clause 5.6.7.1. The AF can confirm the DNAI change indicated in the notification with the SMF by sending a positive response to the notification to the SMF or reject the DNAI change by sending a negative response.

NOTE 2: The AF can determine whether application relocation is needed according to the notification of DNAI change. If not, the AF can send a positive response to the SMF immediately; otherwise, the AF sends the positive response after application relocation is completed or a negative response if the AF determines that the application relocation cannot be completed on time (e.g. due to temporary congestion). The AF decision and behaviours on application relocation are not defined. However, the new DNAI may be associated with a new AF. In such cases, the SMF and the old AF cancel earlier subscribed UP path management event notifications, and the new AF subscribes to receive UP path management event notifications from the SMF.

The AF can include N6 traffic routing information related to the target DNAI in a positive response sent to the SMF. The SMF configures the N6 traffic routing information from the AF response to the PSA on the UP path.

The AF can include the EAS relocation Indication to indicate the application(s) to be relocated.

In the case of early notification, based on the indication of "AF acknowledgment to be expected" on AF subscription, the SMF does not configure the UP path towards the new DNAI until it receives a positive AF response as specified in clause 4.3.6.3 of TS 23.502 [3].

In the case of late notification, based on the indication of "AF acknowledgment to be expected" on AF subscription, the SMF does not activate the UP path towards the new DNAI until it receives a positive AF response as specified in clause 4.3.5 of TS 23.502 [3].

NOTE 3: After the UP path toward the new DNAI is activated, data is routed toward the new DNAI.

If the SMF receives a negative response at any time, the SMF keeps using the original DNAI and may cancel related PSA relocation or addition. The SMF may perform DNAI reselection afterwards if needed.

The SMF can assume according to local policy a negative response if a response is expected and but not received from the AF within a certain time window.

When Early/Late Notification happens, the SMF notifies AF about the target DNAI and may indicate capability of supporting EAS IP replacement in 5GC.When EAS relocation is performed, the AF sends an/a early/late notification response to the SMF after the EAS relocation is completed, which may include the Information for EAS IP Replacement in 5GC. The SMF may instruct the local PSA with the EAS IP address replacement using "Outer Header Creation" as defined in clause 5.8.2.11.6 and "Outer Header Removal" as defined in clause 5.8.2.11.3. If local PSA relocation is required, the SMF may request the target local PSA to buffer uplink traffic as described in clause 6.3.5 of TS 23.548 [130].

*NEXT CHANGE (3)*

### 7.2.8 NEF Services

The following NF services are specified for NEF:

Table 7.2.8-1: NF Services provided by NEF

| Service Name | Description | Reference in TS 23.502 [3] or other TS |
| --- | --- | --- |
| Nnef\_EventExposure | Provides support for event exposure. | 5.2.6.2 |
| Nnef\_PFDManagement | Provides support for PFDs management. | 5.2.6.3 |
| Nnef\_ParameterProvision | Provides support to provision information which can be used for the UE in 5GS. | 5.2.6.4 |
| Nnef\_Trigger | Provides support for device triggering. | 5.2.6.5 |
| Nnef\_BDTPNegotiation | Provides support for background data transfer policy negotiation and optionally notification for the renegotiation. | 5.2.6.6 |
| Nnef\_TrafficInfluence | Provide the ability to influence traffic routing. | 5.2.6.7 |
| Nnef\_ChargeableParty | Requests to become the chargeable party for a data session for a UE. | 5.2.6.8 |
| Nnef\_AFsessionWithQoS | Requests the network to provide a specific QoS for an AS session. | 5.2.6.9 |
| Nnef\_MSISDN-less\_MO\_SMS | Used by the NEF to send MSISDN-less MO SM to the AF. | 5.2.6.10 |
| Nnef\_ServiceParameter | Provides support to provision service specific information. | 5.2.6.11 |
| Nnef\_APISupportCapability | Provides support for awareness on availability or expected level of a service API. | 5.2.6.12 |
| Nnef\_NIDDConfiguration | Used for configuring necessary information for data delivery via the NIDD API. | 5.2.6.13 |
| Nnef\_NIDD | Used for NEF anchored MO and MT unstructured data transport. | 5.2.6.14 |
| Nnef\_SMContext | Provides the capability to create, update or release the SMF-NEF Connection. | 5.2.6.15 |
| Nnef\_AnalyticsExposure | Provides support for exposure of network analytics. | 5.2.6.16 |
| Nnef\_UCMFProvisioning | Provides the ability to configure the UCMF with dictionary entries consisting of UE manufacturer-assigned UE Radio Capability IDs, the corresponding UE radio capabilities, the corresponding UE Radio Capability for Paging and the (list of) associated IMEI/TAC value(s) via the NEF. The UE radio capabilities the NEF provides for a UE radio Capability ID can be in TS 36.331 [51] format, TS 38.331 [28] format or both formats. Also used for deletion (e.g. as no longer used) or update (e.g. to add or remove a (list of) IMEI/TAC value(s) associated to an entry) of dictionary entries in the UCMF. | 5.2.6.17 |
| Nnef\_ECRestriction | Provides support for queuing status of enhanced coverage restriction, or enable/disable enhanced coverage restriction per individual UEs. | 5.2.6.18 |
| Nnef\_ApplyPolicy | Provides the capability to apply a previously negotiated Background Data Transfer Policy to a UE or a group of UEs. | 5.2.6.19 |
| Nnef\_Location | Provides the capability to deliver UE location to AF. | 5.2.6.21 |
| Nnef\_AMInfluence | Provides the ability to influence access and mobility management related policies for one or multiple UEs. | 5.2.6.22 |
| Nnef\_AMPolicyAuthorization | Provides the ability to provide inputs that can be used by the PCF for deciding access and mobility management related policies. | 5.2.6.23 |
| Nnef\_AKMA | AKMA Application Key derivation service. | TS 33.535 [124] |
| Nnef\_Authentication | This service enables the consumer to authenticate and authorize the Service Level Device Identity as described in TS 23.256 [136]. | TS 23.256 [136] |
| Nnef\_TimeSynchronization | Provides the ability to support for (g)PTP or 5G access stratum based time synchronization service. | 5.2.6.25 |
| Nnef\_EASDeployment | EAS deployment service. | 5.2.6.26 |
| Nnef\_UEId | UE Identifier service, which supports to retrieve AF specific UE Identifier based on UE address. | 5.2.6.27 |
| Nnef\_MBSTMGI | Allows AF to request allocation/deallocation of TMGI(s) for MBS Session. | TS 23.247 [129] |
| Nnef\_MBSSession | Allows AF to create, update and delete MBS Session. | TS 23.247 [129] |
| Nnef\_ASTI | Provides the ability to influence 5G access stratum based time distribution configuration. | 5.2.6.28 |
| Nnef\_SMService | Used for SBI-based MO SM transmit through NEF for MSISDN-less MO SMS. | 5.2.6.29 |
| Nnef\_PDTQPolicyNegotiation | Provides support for negotiation for Planned Data Transfer with QoS requirements policy and optionally notification for the renegotiation. | 5.2.6.30 |
| Nnef\_ TrafficInfluenceData | Used in HR SBO as defined in TS 23.548 [74] to get AF Traffic Influence configuration from the V- V-NEF. | 5.2.6.X |

*NEXT CHANGE (4)*

*END OF CHANGES*