**3GPP TSG-SA2 Meeting #143-E *S2-210096***

**Elbonia, February 24 – March 09, 2021**

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| *CR-Form-v11.2* |
| **CHANGE REQUEST** |
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|  | **23.502** | **CR** |  **2464** | **rev** | **-** | **Current version:** | **16.7.1** |  |
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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** |
|  |
| ***Title:***  | Update AM, SM and UE Policy control procedures to add NWDAF interaction |
|  |  |
| ***Source to WG:*** | Spirent, Ericsson |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | eNA\_ph2 |  | ***Date:*** | 2021-01-30 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* *Rel-17 (Release 17)* |
|  |  |
| ***Reason for change:*** | Update Policy control procedures to add interaction with NWDAF as input for policy decisions |
|  |  |
| ***Summary of change:*** | Extend clause 4.16 to include PCF/NWDAF interactions for requesting and providing analytics as input for a policy decision |
|  |  |
| ***Consequences if not approved:*** | Will be missing procedures updates that are required per additional features in Rel 17.  |
|  |  |
| ***Clauses affected:*** | 4.15.3.1, 5.2.2.3, 5.2.8.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS/TR 23.288 CR xxx |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |   |

\* \* \* \* First Change \* \* \* \*

## 4.16 Procedures and flows for Policy Framework

### 4.16.1 AM Policy Association Establishment

#### 4.16.1.1 General

There are three cases considered for AM Policy Association Establishment:

1. UE initial registration with the network.

2. The AMF re-allocation with PCF change in handover procedure and registration procedure.

3. EPS to 5GS mobility when there is no existing AM Policy Association between AMF and PCF for this UE.

#### 4.16.1.2 AM Policy Association Establishment with new Selected PCF



Figure 4.16.1.2-1: AM Policy Association Establishment with new Selected PCF

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the role of the V-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF.

1. Based on local policies, the AMF decides to establish AM Policy Association with the (V-)PCF then steps 2 to 3 are performed under the conditions described below.

2. [Conditional] If the AMF has not yet obtained Access and Mobility policy for the UE or if the Access and Mobility policy in the AMF are no longer valid, the AMF requests the PCF to apply operator policies for the UE from the PCF. The AMF sends Npcf\_AMPolicyControl\_Create to the (V-)PCF to establish an AM policy control association with the (V-)PCF. The request includes the following information: SUPI, Internal Group (see clause 5.9.7 of TS 23.501 [2]), subscription notification indication and, if available, Service Area Restrictions, RFSP index, Subscribed UE-AMBR, the Allowed NSSAI, GPSI which are retrieved from the UDM during the update location procedure, and may include Access Type and RAT Type, PEI, ULI, UE time zone, and Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]).

3. The (V)-PCF responds to the Npcf\_AMPolicyControl\_Create service operation. The (V)-PCF provides Access and mobility related policy information (e.g. Service Area Restrictions) as defined in clause 6.5 of TS 23.503 [20]. In addition, (V)-PCF can provide Policy Control Request Trigger of AM Policy Association to AMF. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.2.3.

 The AMF is implicitly subscribed in the (V-)PCF to be notified of changes in the policies.

4. [Conditional] The AMF deploys the Access and mobility related policy information which includes storing the Service Area Restrictions and Policy Control Request Trigger of AM Policy Association, provisioning Service Area Restrictions to the UE and provisioning the RFSP index, the UE-AMBR and Service Area Restrictions to the NG-RAN as defined in TS 23.501 [2].

#### 4.16.1.3 Void

\* \* \* \* Next Change \* \* \* \*

### 4.16.2 AM Policy Association Modification

#### 4.16.2.0 General

There are three cases considered for AM Policy Association Modification:

- Case A: A Policy Control Request Trigger condition is met: the procedure is initiated by the AMF.

- Case B: PCF local decision or trigger from other peers of the PCF (i.e. UDR): the procedure is initiated by the PCF.

- Case C: AM Policy Association Modification with the old PCF during AMF relocation: the procedure is initiated by the AMF.

- Case D: PCF policy decision triggered by analytics received from the NWDAF. The procedure is initiated by the PCF.

#### 4.16.2.1 AM Policy Association Modification initiated by the AMF

##### 4.16.2.1.1 AM Policy Association Modification initiated by the AMF without AMF relocation

This procedure is applicable to Case A.



Figure 4.16.2.1.1-1: AM Policy Association Modification initiated by the AMF

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the role of the V-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF.

1. When a Policy Control Request Trigger condition is met the AMF updates AM Policy Association and provides information on the conditions that have changed to the PCF by invoking Npcf\_AMPolicyControl\_Update.

2. The (V-)PCF stores the information received in step 1 and makes the policy decision. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.2.3.

3. The (V-)PCF responds to the AMF of the updated Access and Mobility related policy control information as defined in clause 6.5 of TS 23.503 [20] and the updated Policy Control Request Trigger parameters.

4. The AMF deploys the access and mobility control policy, which includes storing the Service Area Restrictions and Policy Control Request Trigger of AM Policy Association, provisioning the Service Area Restrictions to the UE and provisioning the RFSP index, UE-AMBR and Service Area Restrictions to the NG-RAN as defined in TS 23.501 [2].

##### 4.16.2.1.2 AM Policy Association Modification with old PCF during AMF relocation

This procedure is applicable to Case C. In this case, AMF relocation is performed without PCF change in handover procedure and registration procedure.



Figure 4.16.2.1.2-1: AM Policy Association Modification with the old PCF during AMF relocation

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the role of the V-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF.:

1. [Conditional] When the old AMF and the new AMF belong to the same PLMN, the old AMF transfers to the new AMF about the AM Policy Association information including policy control request trigger(s) and the PCF ID. For the roaming case, the new AMF receives V-PCF ID.

2. Based on local policies, the new AMF decides to establish UE Context with the (V-)PCF and contacts the (V‑)PCF identified by the PCF ID received in step 1.

3. The new AMF sends Npcf\_AMPolicyControl\_Update to the (V-)PCF to update the AM policy association with the (V-)PCF. The request may include the following information: policy control request trigger which has been met, Subscribed Service Area Restrictions (if updated), subscribed RFSP index (if updated) which are retrieved from the UDM during the update location procedure, and may include access type and RAT, PEI, ULI, UE time zone, service network. The (V-)PCF updates the stored information provided by the old AMF with the information provided by the new AMF. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.2.3.

4. The (V-)PCF may update the policy decision based on the information provided by the new AMF.

5. The AMF deploys the access and mobility control policy, which includes storing the Service Area Restrictions, provisioning Service Area Restrictions to the UE and provisioning the RFSP index, UE-AMBR and Service Area Restrictions to the NG-RAN.

#### 4.16.2.2 AM Policy Association Modification initiated by the PCF

This procedure is applicable to AM Policy Association modification due to Case B.



Figure 4.16.2.2-1: AM Policy Association Modification initiated by the PCF

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the role of the V-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF.

NOTE: The V-PCF stores the access and mobility control policy information provided to the AMF.

1. [Conditional] PCF determines locally that the new status of the UE context requires new policies, in case that the PCF determination is triggered by analytics is described in clause 4.16.2.3.

2. The (V-)PCF makes a policy decision. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.2.3.

3. The (V-)PCF sends Npcf\_AMPolicyControl\_UpdateNotify including AM Policy Association ID associated with the SUPI defined in TS 29.507 [32], Service Area Restrictions, UE-AMBR or RFSP index.

4. The AMF deploys the Access and mobility related policy information, which includes storing the Service Area Restrictions and Policy Control Request Trigger of AM Policy Association, provisioning of the Service Area Restrictions to the UE and provisioning the RFSP index, UE-AMBR and Service Area Restrictions to the NG-RAN.

\* \* \* \* Next Change - adding new subclause \* \* \* \*

#### 4.16.2.3 AM Policy Association Modification initiated by the PCF per NWDAF provided analytics.

The following Analytics IDs are relevant for AM Policy decisions: "Load level information", "Service Experience", "Abnormal behaviour", "UE Communication", "User Data Congestion" and "Data Dispersion".

The following procedure is applicable to AM Policy Association modification due to Case D.



Figure 4.16.2.3-1: AM Policy Association Modification initiated by PCF per interaction with NWDAF

This procedure applies to non-roaming scenarios.

NOTE: In this release NWDAF is not supporting roaming scenario.

1. Triggered by a policy decision e.g. to enable determination of the RFSP index value, UE-AMBR value or Service Area Restrictions, the PCF subscribes to analytics information from the NWDAF. The type of requested analytics (i.e. Analytics Id) can include the following: User Data Congestion Data Dispersion, Service Experience, UE Communication, Abnormal behaviour, Load Level information, and is described in TS 23.503 [20] clause 6.1.1.3.
2. The NWDAF obtains the relevant parameters as described in TS 23.288 [50] and performs the requested analytics provides a response to the PCF.

3. The NWDAF provides analytics to the PCF.

4. Based provided analytics the PCF makes a policy decision. The PCF may also decide to subscribe to new AnalyticsId, as in step 1.

5. The PCF sends Npcf\_AMPolicyControl\_UpdateNotify including AM Policy Association ID associated with the SUPI defined in TS 29.507 [32]. The policy update may include Service Area Restrictions, UE-AMBR or RFSP index value. The actions that the PCF takes based on the Analytics received are described in clause 6.1.1.3 in TS 23.503 [20].

6. The AMF deploys and stores the updated Access and mobility related policy information.

### 4.16.3 AM Policy Association Termination

#### 4.16.3.1 General

The following case is considered for AM Policy Association Termination:

1. UE Deregistration from the network.

2. The mobility with change of AMF (e.g. new AMF is in different PLMN or new AMF in the same PLMN).

3. [Optional] 5GS to EPS mobility with N26 if the UE is not connected to the 5GC over a non-3GPP access in the same PLMN.

#### 4.16.3.2 AMF-initiated AM Policy Association Termination



Figure 4.16.3.2-1: AMF-initiated AM Policy Association Termination

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the role of the V-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF.

1. The AMF decides to terminate the AM Policy Association during Deregistration procedure or due to mobility with change of AMF and (V-)PCF in the registration procedure or handover procedure, then if a AM Policy Association was established with the (V-)PCF steps 2 to 3 are performed.

2. The AMF sends the Npcf\_AMPolicyControl\_Delete service operation including AM Policy Association ID to the (V-)PCF.

3. The (V-)PCF removes the policy context for the UE and replies to the AMF with an Acknowledgement including success or failure. In non-roaming case, the PCF unsubscribes to analytics from NWDAF if any.

4. The AMF removes the AM Policy Association for this UE, including the Access and Mobility Control Policy related to the UE. The AMF deletes the subscription to AMF detected events requested for that Policy Association.

#### 4.16.3.3 Void

### 4.16.4 SM Policy Association Establishment



Figure 4.16.4-1: SM Policy Association Establishment

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved. In the local breakout roaming case, the H-PCF is not involved. In the home routed roaming case, the V-PCF is not involved and the H-PCF interacts with the H-SMF.

This procedure is used in UE requests a PDU Session Establishment as explained in clause 4.3.2.2.1, for non-roaming and local breakout roaming. For home-routed roaming, as explained in clause 4.3.2.2.2.

For local breakout roaming, the interaction with HPLMN (e.g. step 3) is not used. In local breakout roaming, the V-PCF interacts with the UDR of the VPLMN.

1. The SMF determines that the PCC authorization is required and requests to establish an SM Policy Association with the PCF by invoking Npcf\_SMPolicyControl\_Create operation (see clause 5.2.5.4.2). The SMF includes the following information: SUPI, PDU Session id, PDU Session Type, S-NSSAI, NSI ID (if available), DNN, DNN Selection Mode, GPSI (if available), Access Type, RAT Type, AMF instance identifier and if available, the IPv4 address and/or IPv6 network prefix, PEI, User Location Information, UE Time Zone, Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]), Charging Characteristics, Session AMBR, default QoS information, Trace Requirements, Internal Group Identifier (see TS 23.501 [2], clause 5.9.7).

 The SMF provides Trace Requirements to the PCF when it has received Trace Requirements and it has selected a different PCF than the one received from the AMF.

 If the DNN Selection Mode indicates that the DNN is not explicitly subscribed, the PCF may use the local configuration instead of PDU Session policy control data in UDR.

2. If the PCF does not have the subscriber's subscription related information, it sends a request to the UDR by invoking Nudr\_DM\_Query (SUPI, DNN, S-NSSAI, Policy Data, PDU Session policy control data, Remaining allowed Usage data) service in order to receive the information related to the PDU Session. The PCF may request notifications from the UDR on changes in the subscription information by invoking Nudr\_DM\_Subscribe (Policy Data, SUPI, DNN, S-NSSAI, Notification Target Address (+ Notification Correlation Id), Event Reporting Information (continuous reporting), PDU Session policy control data, Remaining allowed Usage data) service.

3. If the PCF determines that the policy decision depends on the status of the policy counters available at the CHF and such reporting is not established for the subscriber, the PCF initiates an Initial Spending Limit Report Retrieval as defined in clause 4.16.8.2. If policy counter status reporting is already established for the subscriber, and the PCF determines that the status of additional policy counters are required, the PCF initiates an Intermediate Spending Limit Report Retrieval as defined in clause 4.16.8.3.

4. The PCF makes the authorization and the policy decision. The PCF may reject Npcf\_SMPolicyControl\_Create request when Validation condition is not satisfied. (see TS 23.503 [20], clause 6.1.2.4).

 PCF may invoke Nbsf\_Management\_Register service operation to create the binding information in BSF.

In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.5.3.

5. The PCF answers with a Npcf\_SMPolicyControl\_Create response; in its response the PCF may provide policy information defined in clause 5.2.5.4 (and in TS 23.503 [20]). The SMF enforces the decision. The SMF implicitly subscribes to changes in the policy decisions.

NOTE: After this step the PCF can subscribe to SMF events associated with the PDU Session.

### 4.16.5 SM Policy Association Modification

#### 4.16.5.0 General

The following SM Policy Association Modification procedures concern both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved. In the local breakout roaming case, the H-PCF is not involved. In the home routed roaming case, the V-PCF is not involved and the H-PCF interacts with the H-SMF.

The SM Policy Association Modification procedure may be initiated either by the SMF or by the PCF.

#### 4.16.5.1 SMF initiated SM Policy Association Modification

The SMF may initiate the SM Policy Association Modification procedure if a Policy Control Request Trigger is met.



Figure 4.16.5.1-1: SMF initiated SM Policy Association Modification

For local breakout roaming, the interaction with HPLMN (e.g. step 2) is not used. In local breakout roaming, the V-PCF interacts with the UDR of the VPLMN.

1. When a Policy Control Request Trigger condition is met the SMF requests to update (Npcf\_SMPolicyControl\_Update) the SM Policy Association and provides information on the conditions that have been met.

 If the SMF is notified by NRF that the stored PCF instance is not reachable, it should query the NRF for PCF instances within the PCF set and select another instance (see clause 6.3.1.0 of TS 23.501 [2]).

2. When an AF has subscribed to an event that is met due to the report from the SMF, the PCF reports the event to the AF by invoking the Npcf\_PolicyAuthorization\_Notify service operation.

 When integration with TSN applies (see clause 5.28 in TS 23.501 [2]), the AF may provide a Port Management Information Container, MAC address reported for the PDU Session and related port number in response. If the SMF has reported that a manageable Ethernet port has been detected and no AF session exists for this PDU session yet, then the PCF informs a pre-configured AF using the Npcf\_PolicyAuthorization\_Notify service operation of 5GS Bridge ID, the port number of the DS-TT Ethernet port, and MAC address of the DS-TT Ethernet port for the PDU Session.

 When the AF receives the Npcf\_PolicyAuthorization\_Notify message over the pre-configured AF session, the AF shall use the Npcf\_PolicyAuthorization service described in clause 5.2.5.3 to request creation of a new AF session specific to the received MAC address of the DS-TT Ethernet port. The AF shall then use the Npcf\_PolicyAuthorization service to subscribe for notifications for TSN related events over the newly established AF session.

 If the SMF has reported UE-DS-TT Residence Time or PMIC with port number or BMIC, then the PCF also provides these information elements to the AF, the AF calculates the bridge delay for each port pair, i.e. composed of (DS-TT Ethernet port, NW-TT Ethernet port), using the UE-DS-TT Residence Time for all NW-TT Ethernet ports serving 5GS bridge indicated by the 5GS Bridge ID.

3. If the PCF determines a change to policy counter status reporting is required, it may alter the subscribed list of policy counters using the Initial, Intermediate or Final Spending Limit Report Retrieval procedures as defined in clause 4.16.8.

4. The PCF makes a policy decision as described in TS 23.503 [20]. The PCF may determine that updated or new policy information needs to be sent to the SMF.

 If the SMF reported accumulated usage for the PDU session in step 1 the PCF deducts the value from the remaining allowed usage for the subscriber, DNN, and S-NSSAI in the UDR by invoking Nudr\_DM\_Update (SUPI, DNN, S-NSSAI, Policy Data, Remaining allowed Usage data, updated data) service operation.

 If the SMF reported accumulated usage for a MK(s) in step 1 the PCF deducts the value from the remaining allowed usage for the MK in the UDR by invoking Nudr\_DM\_Update (SUPI, DNN, S-NSSAI, Policy Data, Remaining allowed Usage data, updated data (including MK(s))) service operation.

 When new PCF instance is selected in step 1, the new PCF should invoke Nbsf\_Management\_Update service operation to update the binding information in BSF.

In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.5.3.

5. The PCF answers with a Npcf\_SMPolicyControl\_Update response with updated policy information about the PDU Session determined in step 4.

#### 4.16.5.2 PCF initiated SM Policy Association Modification

The PCF may initiate SM Policy Association Modification procedure based on local decision or triggered by other peers of the PCF (AF, CHF, UDR).



Figure 4.16.5.2-1: PCF initiated SM Policy Association Modification

This procedure may be triggered by a local decision of the PCF or based on triggers from other peers of the PCF (AF, CHF, UDR):

For local breakout roaming, the interaction with HPLMN (e.g. step 1b and step 2) is not used. In local breakout roaming, the V-PCF interacts with the UDR of the VPLMN.

1a. Alternatively, optionally, the AF provides/revokes service information to the PCF e.g. due to AF session signalling, by invoking Npcf\_PolicyAuthorization\_Create Request or Npcf\_PolicyAuthorization\_Update Request service operation. The PCF responds to the AF.

1b. Alternatively, optionally, the CHF provides a Spending Limit Report to the PCF as described in clause 4.16.8. and responds to the CHF.

1c Alternatively, optionally, the UDR notifies the PCF about a policy subscription change by invoking Nudr\_DM\_Notify (Notification correlation Id, Policy Data, SUPI, updated data, "PDU Session Policy Control Data" | "Remaining allowed Usage data"); The PCF responds to the UDR.

1d Alternatively, optionally, some internal event (e.g. timer, or local decision based on information received from NWDAF) occurs at the PCF.

2. If the PCF determines a change to policy counter status reporting is required, it may alter the subscribed list of policy counters using the Initial, Intermediate or Final Spending Limit Report Retrieval procedures as defined in clause 4.16.8.

NOTE: The PCF ensures that information received in step 1 and 2 can be used by later policy decisions.

3. The PCF makes a policy decision. The PCF may determine that updated or new policy information need to be sent to the SMF. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.5.3. If the AF provided a Background Data Transfer Reference ID in step 1a, the PCF may retrieve it from the UDR by invoking the Nudr\_DM\_Query (BDT Reference Id, Policy Data, Background Data Transfer) service.

4. If the PCF has determined that SMF needs updated policy information in step 3 or if the PCF has received a Port Management Information Container, MAC address reported for the PDU Session and related port number from the AF in Step 1a, the PCF issues a Npcf\_SMPolicyControl\_UpdateNotify request with possibly updated policy information about the PDU Session.

5. The SMF acknowledges the PCF request with a Npcf\_SMPolicyControl\_UpdateNotify response.

 If the Npcf\_SMPolicyControl\_UpdateNotify request is received from new PCF instance in the PCF Set, the SMF store the SM policy association towards the new PCF instance.

\* \* \* \* Next Change – adding a new subclause\* \* \* \*

#### 4.16.5.3 PCF initiated SMF Policy Association Modification per NWDAF provided analytics.

The PCF may initiate SM Policy Association Modification procedure based on analytic information provided by the NWDAF. The following Analytics IDs are relevant for SM Policy decisions: ""Service Experience", "Abnormal behaviour", "UE Communication", "User Data Congestion" and "Data Dispersion



Figure 4.16.5.3-1: PCF initiated SM Policy Association Modification per PCF interaction with NWDAF

This procedure applies to non-roaming scenarios.

NOTE: In this release NWDAF is not supporting roaming scenario.

1. Triggered by a policy decision e.g. to enable determination of Session-AMBR value the PCF requests analytics information from the NWDAF. The type of requested analytics (i.e. Analytics Id) can include the following: Data User Congestion at an area of interest, UE Data Dispersion, Service Experience, UE Communication, Abnormal behaviour. as described in TS 23.503 [20] clause 6.1.1.3.
2. The NWDAF obtains the relevant parameters as described in TS 23.288 [50].
3. The NWDAF provides analytics to the PCF.

4. Based provided analytics the PCF makes a policy decision. The PCF may determine that updated or new policy information need to be sent to the SMF. The PCF may also decide to subscribe to new Analytics Id, as in step 1.

5. If the PCF has determined that SMF needs updated policy information in step 4, the PCF issues a Npcf\_SMPolicyControl\_UpdateNotify request with updated policy information about the PDU Session.

6. The SMF acknowledges the PCF request with a Npcf\_SMPolicyControl\_UpdateNotify response.

### 4.16.6 SM Policy Association Termination



Figure 4.16.6-1: SM Policy Association Termination

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved. In the local breakout roaming case, the H-PCF is not involved. In the home routed roaming case, the V-PCF is not involved and the H-PCF interacts only with the H-SMF.

The procedure for Session Management Policy Termination may be initiated by:

- (Case A) the PCF.

- (Case B) the SMF.

For local breakout roaming, the interaction with HPLMN (e.g. step 6) is not used. In local breakout roaming, the V-PCF interacts with the UDR of the VPLMN.

1. (Case A) The PCF may invoke the Npcf\_SMPolicyControl\_UpdateNotify service operation to request the release of a PDU Session. The SMF acknowledges the request.

 The rest of the procedure corresponds to both Case A &B.

2. The SMF may invoke the Npcf\_SMPolicyControl\_Delete service operation to request the deletion of the SM Policy Association with the PCF. The SMF provides relevant information to the PCF.

3. When receiving the request from step2, the PCF finds the PCC Rules that require an AF to be notified and removes PCC Rules for the PDU Session.

 If the SMF reported accumulated usage for the PDU session in step 1 the PCF deducts the value from the remaining allowed usage for the subscriber, DNN, and S-NSSAI in the UDR by invoking Nudr\_DM\_Update (SUPI, DNN, S-NSSAI, Policy Data, Remaining allowed Usage data, updated data) service operation.

 If the SMF reported accumulated usage for a MK(s) in step 1 the PCF deducts the value from the remaining allowed usage for the MK in the UDR by invoking Nudr\_DM\_Update (SUPI, DNN, S-NSSAI, Policy Data, Remaining allowed Usage data, updated data (including MK(s))) service operation.

4. The SMF removes all policy information about the PDU Session associated with the PDU Session.

5. The PCF notifies the AF as explained in clause 7.3.1 steps 6-7 of TS 23.203 [24].

 PCF may invoke Nbsf\_Management\_Deregister service operation to delete the binding created in BSF.

In non-roaming case, the PCF unsubscribes to analytics from NWDAF if any.

6. The PCF may invoke the procedure defined in clause 4.16.8 to unsubscribe to policy counter status reporting (If this is the last PDU Session for this subscriber requiring policy counter status reporting) or to modify the subscription to policy counter status reporting, (if any remaining existing PDU Sessions for this subscriber requires policy counter status reporting).

7. The PCF removes the information related to the terminated PDU Session and acknowledges to the SMF that the PCF handling of the PDU Session has terminated. This interaction is the response to the SMF request in step 2.

8. The PCF may (e.g. if it is the last PDU Session on the (DNN, S-NSSAI) couple) unsubscribe to the notification of the PDU Session related data modification from the UDR by invoking Nudr\_DM\_Unsubscribe (Subscription Correlation Id) if it had subscribed such notification.

\* \* \* \* Next Change \* \* \* \*

### 4.16.11 UE Policy Association Establishment

This procedure concerns the following scenarios:

1. UE initial registration with the network.

2. The AMF relocation with PCF change in handover procedure and registration procedure.

3. UE registration with 5GS when the UE moves from EPS to 5GS and there is no existing UE Policy Association between AMF and PCF for this UE.



Figure 4.16.11-1: UE Policy Association Establishment

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved and the role of the H-PCF is performed by the PCF. For the roaming scenarios, the V-PCF interacts with the AMF and the H-PCF interacts with the V-PCF:

1. The AMF establishes UE Policy Association with the (V-)PCF when a UE Policy Container is received from the UE. If a UE Policy Container is not received from the UE, the AMF may establish UE Policy Association with the (V-)PCF based on AMF local configuration.

NOTE 1: In roaming scenario, the AMF local configuration can indicate whether UE Policy delivery is needed based on the roaming agreement with home PLMN of the UE.

2. The AMF sends a Npcf\_UEPolicyControl Create Request with the following information: SUPI, may include Access Type and RAT, PEI, ULI, UE time zone, Serving Network (PLMN ID, or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]), the Internal-Group-ID-list and UE Policy Container (the list of stored PSIs, operating system identifier, Indication of UE support for ANDSP). In roaming scenario, based on operator policies, the AMF may provide to the V-PCF the PCF ID of the selected H-PCF. The V-PCF contacts the H-PCF. In roaming case, steps 3 and 4 are executed, otherwise step 5 follows.

3. The V-PCF forwards the information received from AMF in step 2 to the H-PCF. When a UE Policy Container is received at initial registration, the H-PCF may store the PEI, the OSId or the indication of UE support for ANDSP in the UDR using Nudr\_DM\_Create including DataSet "Policy Data" and Data Subset "UE context policy control data".

4. The H-PCF sends a Npcf\_UEPolicyControl Create Response to the V-PCF. The H-PCF may provide the Policy Control Request Trigger parameters in the Npcf\_UEPolicyControl Create Response.

5. The (V-) PCF sends a Npcf\_UEPolicyControl Create Response to the AMF. The (V-)PCF relays the Policy Control Request Trigger parameters in the Npcf\_UEPolicyControl Create Response.

 The (V-)PCF also subscribes to notification of N1 message delivery of policy information to the UE using Namf\_Communication\_N1N2MessageSubscribe service which is not shown in this figure.

6. The (H-)PCF gets policy subscription related information and the latest list of PSIs from the UDR using Nudr\_DM\_Query service operation (SUPI, Policy Data, UE context policy control data, Policy Set Entry) if either or both are not available and makes a policy decision. The (H-)PCF may get the PEI, the OSId or the indication of UE support for ANDSP in the UDR using Nudr\_DM\_Query including DataSet "Policy Data" and Data Subset "UE context policy control data" if the AMF relocates and the PCF changes. The (H-)PCF may get the 5G VN group data for each Internal-Group-ID received from the AMF using Nudr\_DM\_Query (Internal-Group-Id, Subscription Data, Group Data). The (H-)PCF may store the 5G VN group data for later use for other SUPIs that belong to the same Internal-Group-ID. The (H-)PCF may request notifications from the UDR on changes in the subscription information by invoking Nudr\_DM\_Subscribe (Policy Data, SUPI, DNN, S-NSSAI, Notification Target Address (+ Notification Correlation Id), Event Reporting Information (continuous reporting), UE context policy control data) service. The (H-)PCF may request notifications from the UDR on changes in the 5G VN group data associated to each of the Internal-Group-Id provided to the PCF associated with 5G VN group data by invoking Nudr\_DM\_Subscribe (Subscription Data, 5G VN group data, Internal Group ID, Notification Target Address (+ Notification Correlation Id), Event Reporting Information (continuous reporting)) service. The (H-)PCF creates the UE policy container including UE policy information as defined in clause 6.6 of TS 23.503 [20] and in the case of of roaming H-PCF provides the UE policy container in the Npcf\_UEPolicyControl UpdateNotify Request. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.12.3.

7. The V-PCF sends a response to H-PCF using Npcf\_UEPolicyControl UpdateNotify Response.

NOTE 2: Step 6 (and step 7) can be omitted. Then the (H-)PCF creates the UE policy container including UE polices in step 2 (in the case of non-roaming) or step 3 (in the case of roaming). This means that the potential interactions with UDR as in step 6 will have to be executed in step 2 (non-roaming) or step 3 (roaming).

8. The (V-)PCF triggers UE Configuration Update Procedure in clause 4.2.4.3 to sends the UE policy container including UE policy information to the UE. The (V-)PCF checks the size limit as described in TS 23.503 [20] clause 6.1.2.2.2.

9. If the V-PCF received notification of the reception of the UE Policy container then the V-PCF forwards the notification response of the UE to the H-PCF using Npcf\_UEPolicyControl\_Update Request.

10. The H-PCF sends a response to the V-PCF.

### 4.16.12 UE Policy Association Modification

#### 4.16.12.1 UE Policy Association Modification initiated by the AMF

##### 4.16.12.1.1 UE Policy Association Modification initiated by the AMF without AMF relocation

This procedure addresses the scenario where a Policy Control Request Trigger condition is met.



Figure 4.16.12.1.1-1: UE Policy Association Modification initiated by the AMF

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved. In the roaming case, the AMF interacts with the V-PCF and the H-PCF interacts with the V-PCF.

1. When a Policy Control Request Trigger condition is met the AMF updates UE Policy Control Association and provides information on the conditions that have changed to the PCF. The AMF sends a Npcf\_UEPolicyControl Update Request with the following information: UE Policy Association ID associated with the SUPI defined in TS 29.525 [58] and the Policy Control Request Trigger met. In roaming scenario, based on operator policies, the AMF may provide to the V-PCF the PCF ID of the selected H-PCF. The V-PCF contacts the H-PCF.

 In the roaming case, steps 2 and 3 are executed, otherwise step 4 follows.

2. The V-PCF forwards the information received from AMF in step 1 to the (H-)PCF.

3. The H-PCF replies to the V-PCF. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.5.3.

4. The (V-) PCF sends a Npcf\_UEPolicyControl Update Response to the AMF.

5. The (H-)PCF may create the UE policy container including UE policy information as defined in clause 6.6 of TS 23.503 [20]. In the case of roaming the H-PCF may include the UE policy container in the Npcf\_UEPolicyControl UpdateNotify Request.

6. The (V-)PCF sends a response to H-PCF using Npcf\_UEPolicyControl UpdateNotify Response.

 Steps 7, 8 and 9 are the same as steps 8, 9 and 10 of procedure UE Policy Assocaition Establishment in clause 4.16.11.

#### 4.16.12.1.2 UE Policy Association Modification with old PCF during AMF relocation

This procedure addresses the scenario where a UE Policy Association Modification with the old PCF during AMF relocation.



Figure 4.16.12.1.2-1: Policy Association Modification with the old PCF during AMF relocation

This procedure addresses both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved. In the roaming case, the AMF interacts with the V-PCF and the V-PCF interacts with the H-PCF.

1. [Conditional] When the old AMF and the new AMF belong to the same PLMN, the old AMF transfers to the new AMF the UE Policy Association information including policy control request trigger(s) and the PCF ID(s). For the roaming case, the new AMF receives both V-PCF ID and H-PCF ID.

2. Based on local policies, the new AMF decides to re-use the UE policy association for the UE Context with the (V-)PCF and contacts the (V)-PCF identified by the PCF ID received in step 1.

NOTE: The scenario that only the H-PCF is reused by the new AMF but the V-PCF is not reused is not considered in this Release.

3. The new AMF sends Npcf\_UEPolicyControl\_Update to the (V-)PCF to update the UE policy association with the (V-)PCF. If a Policy Control Request Trigger condition is met, the information matching the trigger condition may also be provided by the new AMF.

 In the roaming case, step 4 and 5 are executed, otherwise step 6 follows.

4. The V-PCF forwards the information received from new AMF in step 3 to the (H-)PCF.

5. The H-PCF replies to the V-PCF. In non-roaming case, the PCF may subscribe to Analytics as defined in clause 4.16.5.3.

6. The (V-)PCF updates the stored information provided by the old AMF with the information provided by the new AMF. The (V-)PCF sends a Npcf\_UEPolicyControl Update Response to the AMF.

7. The (H-)PCF may create the UE policy containter including UE policy information as defined in clause 6.6 of TS 23.503 [20]. In the case of roaming the H-PCF may include the UE policy container in the Npcf\_UEPolicyControl UpdateNotify Request.

8. The V-PCF sends a response to H-PCF using Npcf\_UEPolicyControl UpdateNotify Response.

 Steps 9, 10 and 11 are the same as steps 8, 9 and 10 of procedure UE Policy Assocaition Establishment in clause 4.16.11.

#### 4.16.12.2 UE Policy Association Modification initiated by the PCF

This procedure is used to update UE policy and/or UE policy triggers.



Figure 4.16.12.2-1: UE Policy Association Modification initiated by the PCF

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case the V-PCF is not involved and the role of the H-PCF is performed by the PCF. In the roaming case, the H-PCF provides UE policy decision, and provides the policy to the AMF via V-PCF.

1a and 1b. If (H-)PCF subscribed to notification of subscriber´s policy data change or 5G VN group data change and a change is detected, the UDR notifies that the subscriber´s policy data of a UE or 5G VN group data has been changed.

 The UDR notifies the (H-)PCF of the updated policy control subscription information profile via Nudr\_DM\_Notify (Notification correlation Id, Policy Data, either UE context policy control data or Policy Set Entry data or both, SUPI), or

 The UDR notifies the (H-)PCF of the updated 5G VN group data via Nudr\_DM\_Notify (Notification correlation Id, Group data, Internal-Group-Identifier), or

 The (V-)UDR notifies the (V-)PCF of the updated policy control subscription information profile via Nudr\_DM\_Notify (Notification correlation Id, Policy Data, PolicySetEntry Data. PLMN ID).

1c and 1d. PCF determines locally that UE policy information needs to be sent to the UE.

2a and 2b. The PCF makes the policy decision. If the group data is updated, the (H-) PCF checks the UE Policy Associations for those SUPIs within the Internal-Group-Id and may need to perform step 3 to step 9 for each UE Policy Association that needs to be updated with new UE Policies sent to each UE.

3. The (H-)PCF may create the UE policy container including UE policy information as defined in clause 6.1.2.2.2 of TS 23.503 [20]. In the case of roaming, the H-PCF may send the UE policy container in the Npcf\_UEPolicyControl UpdateNotify Request. The H-PCF may provide updated policy control triggers for the UE policy association.

4. The V-PCF sends a response to H-PCF using Npcf\_UEPolicyControl UpdateNotify Response.

5. The (V-)PCF provides the Policy Control Request Trigger parameters in the Npcf\_UEPolicyControl UpdateNotify Request to the AMF. In the case of roaming, the V-PCF may also provide UE policy information to the UE. The V-PCF may also provide updated policy control triggers for the UE policy association to the AMF.

6. The AMF sends a response to (V-)PCF.

 Steps 7, 8 and 9 are the same as steps 8, 9 and 10 of procedure UE Policy Association Establishment in clause 4.16.11.

#### 4.16.12.3 PCF initiated SMF UE Policy Association Modification per NWDAF provided analytics.

The PCF may initiate UE Policy Association Modification procedure based on analytic information provided by the NWDAF. The following Analytics IDs are relevant for UE Policy decisions: “WLAN performance”



Figure 4.16.5.3-1: PCF initiated SM Policy Association Modification per PCF interaction with NWDAF

This procedure applies to non-roaming scenarios.

NOTE: In this release NWDAF is not supporting roaming scenario.

1. Triggered by a policy decision e.g. to enable determination of UE Policies the PCF requests analytics information from the NWDAF. The type of requested analytics (i.e. Analytics Id) can include the following: WLAN Performance and is described in TS 23.503 [20] clause 6.1.1.3
2. The NWDAF obtain the relevant parameters as described in TS 23.288 [50]
3. The NWDAF provides analytics to the PCF.

4. Based provided analytics the PCF makes a policy decision. The PCF may determine that updated or new policy information need to be sent to the AMF. The PCF may also decide to subscribe to new AnalyticsId, as in step 1.

5. If the PCF has determined that UE needs updated policy information in step 4, the PCF issues a Npcf\_UEPolicyControl\_UpdateNotify request with updated policy information to the UE.

6. The SMF acknowledges the PCF request with a Npcf\_UEPolicyControl\_UpdateNotify response.

### 4.16.13 UE Policy Association Termination

#### 4.16.13.1 AMF-initiated UE Policy Association Termination

The following case is considered for UE Policy Association Termination:

1. UE Deregistration from the network.

2. The mobility with change of AMF (e.g. new AMF is in different PLMN or new AMF in the same PLMN).

3. [Optional] 5GS to EPS mobility with N26 if the UE is not connected to the 5GC over a non-3GPP access in the same PLMN.



Figure 4.16.13.1-1: AMF-initiated UE Policy Association Termination

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case, the V-PCF is not involved and the role of the H-PCF is performed by the PCF. For the roaming scenarios, the V PCF interacts with the AMF. The V PCF contacts the H-PCF to request removing UE Policy Association.

1. The AMF decides to terminate the UE Policy Association.

2. The AMF sends the Npcf\_UEPolicyControl\_Delete service operation including UE Policy Association ID to the (V-)PCF.

3. The (V-)PCF removes the policy context for the UE and replies to the AMF with an Acknowledgement including success or failure. The V-PCF may interact with the H-PCF. The (V-)PCF may unsubscribe to subscriber policy data changes with UDR by Nudr\_DM\_Unsubscribe (Subscription Correlation Id). The AMF removes the UE Policy Context.

 Step 4 and Step 5 apply only to the roaming case.

4. The V-PCF sends the Npcf\_UEPolicyControl\_Delete service operation including UE Policy Association ID to the H-PCF.

5. The H-PCF removes the policy context for the UE and replies to the V-PCF with an Acknowledgement including success or failure. The H-PCF may unsubscribe to subscriber policy data changes with UDR by Nudr\_DM\_Unsubscribe (Subscription Correlation Id) for subscriber policy changes. In non-roaming case, the PCF unsubscribes to analytics from NWDAF if any.

#### 4.16.13.2 PCF-initiated UE Policy Association Termination



Figure 4.16.13.2-1: PCF-initiated UE Policy Association Termination

This procedure concerns both roaming and non-roaming scenarios.

In the non-roaming case, the V-PCF is not involved and the role of the H-PCF is performed by the PCF. For the roaming scenarios, the H-PCF interacts with the V-PCF to request removing Policy Association.

The PCF is subscribed to notification of changes in Data Set "Policy Data" for a UE Policy Association ID.

1. The Policy data is removed, either the Data Set "Policy Data" or the Data Subset "UE context policy control".

2. The UDR sends the Nudr\_DM\_Notify\_Request (Notification correlation Id, Policy Data, SUPI, UE Context Policy Control data, updated data) including the SUPI, the Data Set Identifier, the Data Subset Identifier and the Updated Data including empty "Policy Data" or empty "UE context policy control".

3. The PCF sends the Nudr\_DM\_Notify\_Response to confirm reception and the result to UDR.

4. The PCF may notify the AMF of the removal of the UE Policy Association via Npcf\_UEPolicyControl\_UpdateNotify service operation. Alternatively, the PCF may decide to maintain the Policy Association if a default profile is applied, in this case steps 4, 5 and 6 are not executed.

In non-roaming case, the PCF unsubscribes to analytics from NWDAF if any.

5. The AMF acknowledges the operation.

6. Steps 2-5 in clause 4.16.13.1 AMF-initiated UE Policy Association Termination are performed to remove the UE Policy Association for this UE and the subscription to Policy Control Request Triggers for that UE Policy Association.

\* \* \* \* End of Changes \* \* \* \*