**SA WG2 Meeting #143eS2-210**

**Feb 24th – March 9th, 2021 ; Elbonia (revision of S2-210)**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **23.502** | **CR** |  | **rev** | **-** | **Current version:** | **16.7.1** |  |
|  |
| *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:***  | EC KI2 Target PSA bufferin |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | eEDGE\_5GC |  | ***Date:*** | 2021-01-18 |
|  |  |  |  |  |
| ***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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | TR 23.748 § 9.2.1 Conclusions for Key Issue #2: Reducing packet loss during EAS relocationBuffering uplink packets in the target PSA until receiving the indication of successful EAS relocation from the AF as proposed in Solution #27 and Solution #38 is recommended for normative phase. The old EAS may continue to serve the UE until the successful EAS relocation is done in order to reduce the packet loss. When the EAS relocation starts is out of scope of 3GPP.This solution may be applied to all connectivity models. Whether Buffering of uplink packets applies to the application traffic depends on the application requirement. |
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| ***Summary of change:*** |  |
|  |  |
| ***Consequences if not approved:*** |  |
|  |  |
| ***Clauses affected:*** | 4.3.6.3 ; 4.3.5.6 ; 4.3.5.7 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | This CR version does not yet contain the changes needed to the service descriptions in clause§ 4.3.5.7 needs similar updates to § 4.3.5.6 |

*FIRST CHANGE*

#### 4.3.6.3 Notification of User Plane Management Events

The SMF may send a notification to the AF if the AF had subscribed to user plane management event notifications as described in clause 4.3.6.2 and in TS 23.501 [2] clause 5.6.7. The following are the examples of such events:

- A PDU Session Anchor identified in the AF subscription request has been established or released.

- A DNAI has changed.

- The SMF has received a request for AF notification and the on-going PDU Session meets the conditions to notify the AF.

- Ethernet PDU Session Anchor Relocation as defined in clause 4.3.5.8.

The SMF uses notification reporting information received from PCF to issue the notification either via an NEF (2a, 2b and 4a, 4b) or directly to the AF (2c and 4c).

The following flow depicts the sequence of events:



Figure 4.3.6.3-1: Notification of user plane management event

1. A condition for an AF notification has been met as described above. The SMF sends notification to the NF that is subscribed for SMF notifications. Further processing of the SMF notification depends on the receiving NF, as shown in steps 2a and 2c.

2a. If early notification via NEF is requested by the AF, the SMF notifies the NEF of the target DNAI of the PDU Session by invoking Nsmf\_EventExposure\_Notify service operation.

2b. When the NEF receives Nsmf\_EventExposure\_Notify, the NEF performs information mapping (e.g. AF Transaction Internal ID provided in Notification Correlation ID to AF Transaction ID, SUPI to GPSI, etc.) as applicable according to TS 23.501 [2], clause 5.6.7, and triggers the appropriate Nnef\_TrafficInfluence\_Notify message. In this case, step 2c is not applicable.

2c. If early direct notification is requested by the AF, the SMF notifies the AF of the target DNAI of the PDU Session by invoking Nsmf\_EventExposure\_Notify service operation.

2d. The AF replies to Nnef\_TrafficInfluence\_Notify by invoking Nnef\_TrafficInfluence\_AppRelocationInfo service operation either immediately or after any required application relocation in the target DNAI is completed. AF may include N6 traffic routing details corresponding to the target DNAI and /or indicate that buffering of uplink traffic to the target DNAI is needed as long as traffic to the target DNAI is not authorized by the AF. AF may reply in negative e.g. if the AF determines that the application relocation cannot be completed successfully and/or on time.

NOTE: The maximum time the new PSA is to buffer UL data relates to the maximum delay between steps 4a-4C and steps 4e-4g of Figure 4.3.6.3-1. SMF local policies can control that the SMF receives from the AF an indication to stop buffering (in step 4f/4g of Figure 4.3.6.3-1) with a delay compatible with the UPF buffering capacity.

2e. When the NEF receives Nnef\_TrafficInfluence\_AppRelocationInfo, the NEF triggers the appropriate Nsmf\_EventExposure\_AppRelocationInfo message.

2f. The AF replies to Nsmf\_EventExposure\_Notify by invoking Nsmf\_EventExposure\_AppRelocationInfo service operation either immediately or after any required application relocation in the target DNAI is completed. AF includes N6 traffic routing details corresponding to the target DNAI. AF may reply in negative e.g. if the AF determines that the application relocation cannot be completed successfully on time.

3. The SMF enforces the change of DNAI or addition, change, or removal of a UPF. This may correspond to the procedure described in Figure 4.3.5.6-1 or in Figure 4.3.5.7-1

 If the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF may wait for a response from the AF to the early notification before this step. The SMF does not perform this step until it receives a positive response from the AF, as described in TS 23.501 [2] clause 5.6.7.

4a. If late notification via NEF is requested by the AF, the SMF notifies the NEF of the target DNAI of the PDU Session by invoking Nsmf\_EventExposure\_Notify service operation.

 If the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF may send late notification and wait for a positive response from the AF before activating the new UP path, as described in TS 23.501 [2] clause 5.6.7.

4b. When the NEF receives Nsmf\_EventExposure\_Notify, the NEF performs information mapping (e.g. AF Transaction Internal ID provided in Notification Correlation ID to AF Transaction ID, SUPI to GPSI, etc.) as applicable according to TS 23.501 [2], clause 5.6.7, and triggers the appropriate Nnef\_EventExposure\_Notify message. In this case, step 4c is not applicable.

4c. If late direct notification is requested by the AF, the SMF notifies the AF of the target DNAI of the PDU Session by invoking Nsmf\_EventExposure\_Notify service operation.

4d. When the AF receives either the Nnef\_EventExposure\_Notify message or the Nsmf\_EventExposure\_Notify message, the AF checks whether it can serve the target DNAI. If the AF instance change is needed, the AF determines the proper target AF for the target DNAI and performs the AF migration.

NOTE 1: The determination of the target AF for the target DNAI and the AF migration to the target AF are out of the scope of this release.

4e. The AF replies to Nnef\_TrafficInfluence\_Notify by invoking Nnef\_TrafficInfluence\_AppRelocationInfo service operation either immediately or after any required application relocation in the target DNAI is completed. AF includes N6 traffic routing details corresponding to the target DNAI. AF may reply in negative e.g. if the AF determines that the application relocation cannot be completed successfully on time. If the AF instance change happens in step 4d, the AF includes the indication of AF change, target AF ID and notification target address of the target AF in the Nnef\_TrafficInfluence\_AppRelocationInfo message. Nnef\_TrafficInfluence\_AppRelocationInfo may indicate that buffering of uplink traffic to the target DNAI is no more needed as traffic to the target DNAI is now authorized by the AF

4f. When the NEF receives Nnef\_TrafficInfluence\_AppRelocationInfo, the NEF triggers the appropriate Nsmf\_EventExposure\_AppRelocationInfo message.

4g. The AF replies to Nsmf\_EventExposure\_Notify by invoking Nsmf\_EventExposure\_AppRelocationInfo service operation either immediately or after any required application relocation in the target DNAI is completed. AF includes N6 traffic routing details corresponding to the target DNAI. AF may reply in negative e.g. if the AF determines that the application relocation cannot be completed successfully on time. If the AF instance change happens in step 4d, the AF includes the indication of AF change, target AF ID and notification target address of the target AF in the Nsmf\_TrafficInfluence\_AppRelocationInfo message. Nsmf\_EventExposure\_AppRelocationInfo may indicate that buffering of uplink traffic to the target DNAI is no more needed as traffic to the target DNAI is now authorized by the AF

*NEXT CHANGE (2)*

#### 4.3.5.6 Change of additional PDU Session Anchor for IPv6 multi-homing or UL CL

The following procedure is triggered by an SMF when the SMF needs to modify IPv6 multi-homing or UL CL rule (i.e., traffic filter in the Branching Point or the UL CL) in order to move the some or whole traffic flows of the existing additional PDU Session Anchor which was established by the IPv6 multi-homing or the UL CL operations (i.e. PSA1 in figure 4.3.5.6-1) to a new additional PDU Session Anchor (i.e. PSA2 in figure 4.3.5.6-1) which is established under the same Branching Point or UL CL for a UE where the UE already has a PDU Session Anchor which was established before the event of Branching Point or UL CL insertion (i.e., PSA0 in figure 4.3.5.6-1). This procedure establishes a new additional PDU Session Anchor (i.e., PSA2) and conditionally releases the existing additional PDU Session Anchor (i.e. PSA1), while modifying IPv6 multi-homing or UL CL rule in the same Branching Point or UL CL under controlled by the same SMF.



Figure 4.3.5.6-1: Change of additional PSA for a PDU Session in IPv6 multi-homing or UL CL case

1. The SMF decides to change one additional PSA of a PDU Session with IPv6 multi-homing or UL CL, due to events that may benefit from such change or upon request from an Application Function.

2. If the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF sends an early notification to the AF after PSA2 is selected and waits for a notification response from the AF before configuring the PSA2. If the SMF receives a negative notification response from the AF, the SMF may stop the procedure. This is defined in Figure 4.3.6.3-1

 The SMF sends an N4 Session Establishment Request to PSA2 and provides the tunnel ID of Branching Point or UL CL, Packet detection, enforcement and reporting rules to be installed on the PSA2 for this PDU Session. The SMF may also indicate local PSA2 to buffer the uplink data

 The PSA2 acknowledges by sending an N4 Session Establishment Response. The tunnel ID of PSA2 is provided to the SMF in this step.

 In the case of IPv6 multi-homing PDU Session, a new IPv6 prefix corresponding to PSA2 is allocated (by the SMF or by the UPF depending on the deployment), and if the PCF has subscribed to the IP allocation/release event, the SMF performs the Session Management Policy Modification Procedure as defined in clause 4.16.5 to provide the new allocated IPv6 prefix to the PCF.

3a. In the case of PDU session with UL CL, if the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF sends a late notification to the AF and waits for a notification response from the AF. If the SMF receives a negative notification response from the AF, the SMF may stop the procedure. This is further defined in Figure 4.3.6.3-1.

 The SMF sends an N4 Session Modification Request to the Branching Point or UL CL to update the UL traffic filter according to new allocated IPv6 prefix allocated to PSA 2 or the UL CL rules regarding to the traffic flows that the SMF tries to move from PSA1 to PSA2. The N4 Session Modification Request message contains the identifications of traffic filter that needs to be updated and the tunnel ID of PSA2.

NOTE: The identification of a traffic filter can be either the index of the traffic filter, or a single value of the information field in traffic filter (e.g., the tunnel ID of next hop), or a combination value of some information field in the traffic filter (e.g., the tunnel ID of next hop with source port number).

3b. The Branching Point or the UL CL acknowledges by N4 Session Modification Response the Branching Point or when the UL CL successfully updates all the traffic filters that the SMF requests to modify.

4. In the case of IPv6 multi-homing PDU Session, if the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF sends a late notification to the AF and waits for a notification response from the AF. If the SMF receives a negative notification response from the AF, the SMF may stop the procedure. This is further defined in Figure 4.3.6.3-1.

 In the case of IPv6 multi-homing PDU Session, The SMF notifies the UE of the availability of the new IP prefix @ PSA2. This is performed using an IPv6 Router Advertisement message (RFC 4861 [6]). Also, the SMF sends IPv6 multi-homed routing rule along with the IPv6 prefix to the UE using an IPv6 Router Advertisement message (RFC 4191 [21]) as described in TS 23.501 [2] clause 5.8.2.2.2.

5. In the case of IPv6 multi-homing PDU Session, The SMF may re-configure the UE for the original IP prefix @ PSA0,i.e. SMF sends IPv6 multi-homed routing rule along with the IPv6 prefix to the UE using an IPv6 Router Advertisement message (RFC 4191 [21]) as described in TS 23.501 [2] clause 5.8.2.2.2.

6. Step 6 occurs only if the Branching Point or UL CL does not have any traffic filter on the PDU Session which forwards a traffic flow to PSA1.

6a. The SMF sends an N4 Session Release Request with N4 session ID to PSA1. The PSA1 shall release all tunnel resources and contexts associated with the N4 session.

6b. PSA1 sends an N4 Session Release Response with N4 session ID to the SMF at the same moment that PSA1 successfully releases all tunnel resources and contexts associated with the N4 session.

*NEXT CHANGE (3)*

#### 4.3.5.7 Simultaneous change of Branching Point or UL CL and additional PSA for a PDU Session

Simultaneous change of UL CL or Branching Point and additional PSA can be performed after Xn based handover, N2 based handover and Service Request procedures.

The following procedure is triggered by SMF in order to change the Branching Point or the UL CL and additional PSA serving a PDU Session for a UE.



Figure 4.3.5.7-1: Simultaneous change of Branching Point or UL CL and additional PSA for a PDU Session

UE has an established PDU Session with a UPF including the PDU Session Anchor (Remote UPF). The PDU Session user plane involves at least the Source (R)AN, Source Branching Point or Source UL CL, local Source UPF (PSA2) and the Remote UPF (PDU Session Anchor, PSA1), where Source Branching Point or Source UL CL and PSA2 can be co-located.

1. At some point SMF decides to change the Branching Point or the UL CL due to UE mobility.

2. The SMF selects a local Target UPF (PSA3) and using N4 establishes the local Target UPF for the PDU Session. In the case of IPv6 multi-homing PDU Session, the SMF also allocates a new IPv6 prefix corresponding to PSA3, and if the PCF has subscribed to the IP allocation/release event, the SMF performs the Session Management Policy Modification procedure as defined in clause 4.16.5 to provide the new allocated IPv6 prefix to the PCF.

 The SMF may send an earlier notification to the AF after PSA3 is selected. If the runtime coordination between 5GC and AF is enabled based on local configuration as specified in clause 4.3.6.3, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF waits for a notification response from the AF before configuring the PSA3. If the SMF receives a negative notification response from the AF, the SMF may stop the procedure.

3. The SMF selects a UPF and using N4 establishes the Target Branching Point or Target UL CL for the PDU Session. SMF provides the necessary uplink forwarding rules towards the PSA3 and PSA1 including the Tunnel Info for each UPF. If session continuity upon UL CL relocation is used, the SMF also uses N4 to establish an N9 forwarding tunnel between the Source UL CL and Target UL CL, including the Tunnel Info for each UPF. In addition, the AN Tunnel Info to target (R)AN is provided for downlink forwarding. In the case of UL CL, the SMF provides traffic filters indicating what traffic shall be forwarded towards PSA3, PSA1 and Source UL CL, respectively. In the case of IPv6 multi-homing, the SMF also provides traffic filters for the IPv6 prefixes corresponding to PSA3 and PSA1 indicating what traffic shall be forwarded towards PSA3 and PSA1 respectively. Target Branching Point or Target UL CL provides the CN Tunnel Info for downlink traffic.

NOTE 1: If the Target Branching Point or Target UL CL and the PSA3 are co-located in a single UPF then steps 2 and 3 can be merged.

NOTE 2: When session continuity upon UL CL relocation is used, the downlink traffic at this point goes through Source UL CL, Target UL CL and Target (R)AN.

4. The SMF updates the PSA1 via N4. It provides the PDU Session CN Tunnel Info for the downlink traffic.

5. The SMF updates the PSA3. It provides the CN Tunnel Info for downlink traffic.

NOTE 3: If the Target Branching Point or the Target UL CL and the PSA3 are co-located in a single UPF then step 5 is not needed.

6. In the case of PDU session with UL CL, if the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF sends a late notification to the AF and waits for a notification response from the AF. If the SMF receives a negative notification response from the AF, the SMF may stop the procedure and remove the Target Branching Point or Target UL CL and PSA3.

 The SMF updates (R)AN via N2 SM information over N11. It provides the new CN Tunnel Info corresponding to the Target Branching Point or the Target UL CL. If there is an existing UPF between the Target (R)AN and Target Branching Point or Target UL CL, the SMF updates the existing UPF via N4 instead of updating the (R)AN.

NOTE 4: When session continuity upon UL CL relocation is used, the uplink traffic destined to PSA2 at this point goes through Target (R)AN, Target UL CL and Source UL CL.

7. In the case of IPv6 multi-homing PDU Session, if the runtime coordination between 5GC and AF is enabled based on local configuration, according to the indication of "AF acknowledgment to be expected" included in AF subscription to SMF events, the SMF sends a late notification to the AF and waits for a notification response from the AF. If the SMF receives a negative notification response from the AF, the SMF may stop the procedure.

 In the case of IPv6 multi-homing, the SMF notifies the UE of the availability of the new IP prefix @ PSA3. This is performed using an IPv6 Router Advertisement message (RFC 4861 [6]). Also, the SMF sends IPv6 multi-homed routing rule along with the IPv6 prefix to the UE using an IPv6 Router Advertisement message (RFC 4191 [21]) as described in TS 23.501 [2] clause 5.8.2.2.2.

8. In the case of IPv6 multi-homing, the SMF may re-configure the UE for the original IP prefix @ PSA1, i.e. SMF sends IPv6 multi-homed routing rule along with the IPv6 prefix to the UE using an IPv6 Router Advertisement message (RFC 4191 [21]) as described in TS 23.501 [2] clause 5.8.2.2.2.

9. The SMF sends a Late Notification to the AF indicating a change of DNAI as described in clause 4.3.6.3. In cases where target local DN is associated with another AF instance, SMF also sends notification to target AF as described in 4.3.6.3 and cancels any future notification message to source AF as it is no longer involved.

NOTE 5: The message can include routing information to the application located in the target local DN. Alternatively the routing information to the application located in the target local DN can be determined by the AF based on the new DNAI, in which case the AF can invoke the AF triggered influence on traffic routing procedure targeting single UE as described in clause 4.3.6.4, which assists the SMF in generation of the routing rule on the Target UL CL towards PSA3 (i.e. towards the application located in the target local DN). It is up to network configuration whether the routing information to the application located in the target local DN is configured in the SMF or in the AF.

NOTE 6: When session continuity upon UL CL relocation is used the AF can also trigger mechanisms that are out of the scope of this specification (e.g. IP-level or HTTP-level redirection) by which the traffic is redirected towards the application in the target local DN. Based on this redirection the UE starts using a new destination IP address which leads the Target UL CL to force the traffic towards PSA3.

10. When session continuity upon UL CL relocation is used, detection of no active traffic over the N9 forwarding tunnel is performed during a preconfigured time interval in order to release the N9 forwarding tunnel. The detection can be done by either Source UL CL or Target UL CL, either of which notifies the SMF.

NOTE 7: It is up to network configuration whether the detection of no active traffic is performed by the Source UL CL or the Target UL CL. As an alternative to the detection of no active traffic, the AF can send an explicit notification to the SMF when traffic to/from this UE ceases to exist, leading the SMF to release the Source UL CL and the Source UPF (PSA2).

11. The SMF releases via N4 the PSA2.

12. The SMF releases the Source Branching Point or the Source UL CL.

NOTE 8: If the Target Branching Point or Target UL CL and the PSA2 are co-located in a single UPF then steps 11 and 12 can be merged.

*NEXT CHANGE (4)*

*NEXT CHANGE (5)*

*END OF CHANGES*