**SA WG2 Meeting #S2-137E S2-2002029R07**

**24 - 27 February, 2020, Electronic Meeting (revision of S2-200xxxx)**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
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|  | **23.502** | **CR** | **2115** | **rev** | **-** | **Current version:** | **16.3.0** |  |
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| *For* ***HE******LP*** *on using this form: comprehensive instructions can be found at 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:***  | Corrections for Registration and Service Request  |
|  |  |
| ***Source to WG:*** | Ericsson, Huawei, Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | ETSUN |  | ***Date:*** | 18/02/2020 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-16 |
|  | *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. | *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)* |
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| ***Reason for change:*** | 1. Intra 5GS Idle mode mobility registration procedure is not properly described, as it refers to Service Request procedure without sufficient details. This cases an incorrect description of mobility registration.
2. The current ETSUN procedure for service request procedure is lacking the linkage to HLCOM
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| ***Summary of change:*** | 1. Update the ETSUN Registration procedure
2. Update the ETSUN Service request procedure
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| ***Consequences if not approved:*** | Incorrect and missing descriptions in Registration and Service Request procedures |
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| ***Clauses affected:*** | 4.23.3, 4.23.4.3 |
|  |  |
|  | **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 ...  |
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| ***Other comments:*** |  |
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| ***This CR's revision history:*** | R02:Updating the description to have aproper step order, clarifying which AMF acts (e;g. the new AMF determines…)R04: update the step17 description, remove “before step ”R05 editorials + * the new AMF invokes Nsmf\_PDUSession\_CreateSMContext (PDU Session ID, SM Context ID at SMF)
* (case b): In case the AMF has changed, the new AMF invokes Nsmf\_PDUSession\_CreateSMContext (PDU Session ID, SM Context ID at SMF) towards the I-SMF
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\*\*\*\* BEGINNING OF 1st CHANGES \*\*\*\*

### 4.23.3 Registration procedure

The following impacts are applicable to clause 4.2.2.2 (Registration procedure) when the UE has established PDU Session(s):

- Step 5: The UE context transferred from old AMF includes SMF information. If I-SMF is available for the PDU Session(s), the received SMF information includes I-SMF information and SMF information.

- Step 10: the (new) AMF determines whether I-SMF insertion/change/removal is needed. If the (new) AMF does not have the service area of the SMF(s), the (new) AMF queries the NRF to get service area information of the received SMF(s). The (new) AMF determines on a per PDU Session basis whether a (new) I-SMF needs to be selected based on UE location and service area of the received SMF information. It includes the following cases:

a. if the received SMF information includes only SMF information and service area of SMF includes the area where the UE camps, new I-SMF selection is not needed; or

b. if the received SMF information includes both I-SMF information and SMF information, and service area of I-SMF includes the area where the UE camps, the I-SMF can be reused; or

c. if the received SMF information includes both I-SMF information and SMF information, and the UE moves into the service area of SMF, the I-SMF removal process is triggered; or

d. if the received SMF information includes only SMF information, and the service area of SMF does not include the area where the UE camps, the AMF selects an I-SMF. The I-SMF insertion process is triggered; or

e. if the received SMF information includes both I-SMF and SMF information, and the service area of SMF and I-SMF does not include the area where the UE camps, the AMF selects a new I-SMF. The change of I-SMF process is triggered.

For each PDU Session, if the UE context retrieved from the old AMF includes an I-SMF and the (new) AMF determines the I-SMF needs to be changed or removed, the (new) AMF includes a corresponding indication in Namf\_Communication\_RegistrationStatusUpdate sent to old AMF

- Step 17: the (new) AMF contacts the SMF/I-SMF (" cases" below are same as step 10).

For case a), no additional change to step 17 of clause 4.2.2.2.2 is needed for the update of the PDU Session.

 For case b), the SMF in step 17 of clause 4.2.2.2.2 is changed to I-SMF, and in addition, the reference clause 4.2.3.2 is changed to clause 4.23.4.2. In case the AMF has changed, the new AMF invokes Nsmf\_PDUSession\_UpdateSMContext (SM Context ID at SMF) towards the I-SMF

 For cases c), d) and e), the new AMF invokes Nsmf\_PDUSession\_CreateSMContext (PDU Session ID, SM Context ID at SMF) towards the new I-SMF in case of I-SMF insertion or change, or towards SMF in case of I-SMF removal. Steps from step 3 onwards as described in clause 4.23.4.3 are executed with following enhancements:

Step 9 (for cases d and e): The N2 SM information is only provided by the I-SMF to AMF when N3 tunnel needs to be established (i.e. due to buffered DL data in old I-SMF/old-I-UPF or AMF has indicated to I-SMF to active user plane for the PDU session based on List of PDU Sessions To Be Actived received from the UE).

Step 16 (i.e. case c): The N2 SM information is only provided by the SMF to AMF when N3 tunnel need to be established (i.e. due to buffered DL data in old I-SMF/old-I-UPF or AMF has indicated to SMF to active user plane for the PDU session based on List of PDU Sessions To Be Actived received from the UE).

Step 17 is executed when N3 tunnel needs to be established. The NAS message Service Accept is replaced with Registration Accept (i.e. step 21 in clause 4.2.2.2).

Step 17a and 17b is triggered by old AMF towards the old I-SMF based on the I-SMF change or removal indication received from new AMF, when the timer (i.e. started in step 5 of clause 4.2.2.2) in old AMF expires.

NOTE: Step 17a is executed by old AMF together with step 14d and 14e in clause 4.2.2.2.

Steps 18 to 21 (i.e. case d and e) and steps 22 to 25 (i.e. case c): These steps are executed if N2 SM information is provided by the I-SMF/SMF in step 9 or step 16 above.

- Step 21: This step is omitted if step 17 of clause 4.23.4.3 is excuted as described above.

\*\*\*\* BEGINNING OF 2nd CHANGES \*\*\*\*

#### 4.23.4.3 UE Triggered Service Request with I-SMF insertion/change/removal

When, as part of a UE Triggered Service Request, I-SMF is to be inserted, changed or removed, the procedure in this clause is used. It includes the following cases:

- the UE moves from SMF service area to new I-SMF service area, a new I-SMF is inserted (i.e. I-SMF insertion); or

- the UE moves from old I-SMF service area to new I-SMF service area, the I-SMF is changed (i.e. I-SMF change); or

- the UE moves from old I-SMF service area to SMF service area, the old I-SMF is removed (i.e. I-SMF removal).

If the service request is triggered by network due to downlink data and a new I-UPF is selected, forwarding tunnel is established between the old I-UPF(if the old I-UPF is different from PSA) and the new I-UPF to forward buffered data.

For Home Routed Roaming case, the I-SMF (old and new) and I-UPF (old and new) are located in Visted PLMN, while the SMF and UPF(PSA) are located in the Home PLMN. In this HR roaming case only the case of I-SMF change applies (there is always a V-SMF for the PDU Session).



Figure 4.23.4.3-1: UE Triggered Service Request procedure with I-SMF insertion/change/removal

1. Same as the steps 1-3 defined clause 4.2.3.2.

2. The AMF determines whether new I-SMF needs to be selected based on UE location and service area of the SMF, if new I-SMF needs to be selected, the AMF selects a new I-SMF as described in clause 4.23.2.

Case: I-SMF insertion or I-SMF change, steps 3-9 are skipped for I-SMF removal case.

3. If the AMF has selected a new I-SMF, the AMF sends a Nsmf\_PDUSession\_CreateSMContext Request (PDU Session ID, SM Context ID, UE location info, Access Type, RAT Type, Operation Type) to the new I-SMF. The SM Context ID points to the old I-SMF in case of I-SMF change or to SMF in case of I-SMF insertion.

 The AMF set the Operation Type to "UP activate" to indicate establishment of N3 tunnel User Plane resources for the PDU Session(s). The AMF determines Access Type and RAT Type based on the Global RAN Node ID associated with the N2 interface.

 If the UE Time Zone has changed compared to the last reported UE Time Zone then the AMF shall include the UE Time Zone IE in this message.

4a. The new I-SMF retrieves SM Context from the old I-SMF (in case I-SMF change) or SMF (in case I-SMF insertion) by invoking Nsmf\_PDUSession\_Context Request (SM context type, SM Context ID). The new I-SMF uses SM Context ID received from AMF for this service operation. SM Context ID is used by the recipient of Nsmf\_PDUSession\_Context Request in order to determine the targeted PDU Session. SM context type indicates that the requested information is all SM context, i.e. PDN Connection Context and 5G SM context.

4b. The old I-SMF in case of I-SMF change or SMF in case of I-SMF insertion responds with the SM context of the indicated PDU Session.

 If there is Extended Buffering is applied and the Extended Buffering timer is still running in old-SMF or old I-UPF, or the service request is triggered by downlink data, the old I-SMF or SMF includes a forwarding indication in the response to indicate that a forwarding tunnel is needed for sending buffered downlink packets . For I-SMF insertion, if I-UPF controlled by SMF was available for the PDU Session, the SMF includes a forwarding indication.

5. The new I-SMF selects a new I-UPF: Based on the received SM context, e.g. S-NSSAI, and UE location information, the new I-SMF selects a new I-UPF as described in clause 6.3.3 of TS 23.501 [2].

6. The new I-SMF initiates a N4 Session Establishment to the new I-UPF. In case tunnel endpoint is allocated by the new I-UPF, the new I-UPF provide tunnel endpoints to the new I-SMF, otherwise the new I-SMF allocates the tunnel endpoints and provides them to the new I-UPF.

 If forwarding indication was received, the new I-SMF also allocates the tunnel endpoints for transferring the buffered DL data from the old I-UPF, or requests the new I-UPF to allocate them. In this case, the new I-UPF begins to buffer the downlink packet(s) received from the UPF (PSA) and start a timer.

7a. If the tunnel endpoints for the buffered DL data were allocated, the new I-SMF invokes Nsmf\_PDUSession\_UpdateSMContext Request (tunnel endpoints for buffered DL data) to the old I-SMF in the case of I-SMF change in order to establish the forwarding tunnel. The new I-SMF uses the SM Context ID received from AMF for this service operation.

7b. The old I-SMF, in the case of I-SMF change initiates a N4 session modification to the old I-UPF to send the tunnel endpoints for buffered DL data to the old I-UPF. After this step, the old I-UPF starts to send buffered DL data to the new I-UPF.

7c. The old I-SMF, in the case of I-SMF change responds the new I-SMF with Nsmf\_PDUSession\_UpdateSMContext response.

8a. In the case of I-SMF change, the new I-SMF invokes Nsmf\_PDUSession\_Update Request (SUPI, PDU Session ID, new I-UPF DL tunnel information, SM Context ID at I-SMF, Access Type, RAT Type, DNAI list supported by the new I-SMF) towards the SMF. The new I-SMF uses the SM Context ID at SMF received from old I-SMF for this service operation.

 In the case of I-SMF insertion, the new I-SMF invokes Nsmf\_PDUSession\_Create Request (new I-UPF DL tunnel information, new I-UPF tunnel endpoint for buffered DL data, SM Context ID at I-SMF, Access Type, RAT type, DNAI list supported by the new I-SMF) towards the SMF.

 The SM Context ID at I-SMF is to be used by the SMF for further PDU Session operation, e.g. to notify the new I-SMF of PDU session release. If SM Context ID at the I-SMF exists (i.e. in the case of I-SMF change), the SMF shall replace the SM Context ID at I-SMF.

 The new I-UPF tunnel endpoint for buffered DL data is used to establish the forwarding tunnel (from old I-UPF controlled by SMF to new I-UPF controlled by new I-SMF).

8b. The SMF initiates N4 Session Modification toward the PDU Session Anchor UPF. During this step:

- The SMF provides the new I-UPF DL tunnel information.

- If different CN Tunnel Info need be used by PSA UPF, i.e. the CN Tunnel Info at the PSA for N3 and N9 are different, a CN Tunnel Info for the PDU Session Anchor UPF is allocated.

- For I-SMF insertion, if a new I-UPF tunnel endpoint for buffered DL data is received, the SMF triggers the transfer of buffered DL data to the new I-UPF tunnel endpoint for buffered DL data.

 From now on the PDU Session Anchor UPF begins to send the DL data to the new I-UPF as indicated in the new I-UPF DL tunnel information. The UPF (PSA) sends one or more "end marker" packets for each N9 tunnel to the old I-UPF immediately after switching the path to new I-UPF. The new I-UPF should not send the DL packet(s) received from the UPF (PSA) until end marker packets were received from the old I-UPF or the timer started at step 6 is expired.

8c. The SMF responds to the new I-SMF with Nsmf\_PDUSession\_Update Response (the DNAI(s) of interest for this PDU Session in the case of I-SMF change) or Nsmf\_PDUSession\_Create Response (the DNAI(s) of interest for this PDU Session Tunnel Info at UPF(PSA) for UL data in the case of I-SMF insertion if it is allocated in step 8b).

 In the case of I-SMF insertion and the PDU session corresponds to a LADN, the SMF shall release the PDU session after the service request procedure is completed.

 In the case of I-SMF insertion the SMF starts a timer to release resource, i.e. resource for the indirect data forwarding tunnel.

9. The new I-SMF sends a Nsmf\_PDUSession\_CreateSMContext Response (N2 SM information (PDU Session ID, QFI(s), QoS profile(s), CN N3 Tunnel Info, S-NSSAI, User Plane Security Enforcement, UE Integrity Protection Maximum Data Rate), N1 SM Container, Cause)) to the AMF. The CN N3 Tunnel Info is the UL Tunnel Info of the new I-UPF.

 If the PDU Session has been assigned any EPS bearer ID, the new I-SMF also includes the mapping between EPS bearer ID(s) and QFI(s) into the N2 SM information to be sent to the NG-RAN.

 The new I-SMF starts a timer to release resource, i.e. reource for the indirect data forwarding tunnel.

Case: I-SMF removal: steps 10 to 16 are skipped for I-SMF insertion or I-SMF change cases.

10. If the UE has moved from service area of old I-SMF into the service area of SMF, the AMF sends a Nsmf\_PDUSession\_CreateSMContext Request (SUPI, PDU Session ID, AMF ID, SM Context ID at I-SMF, UE location info, Access Type, RAT Type) to the SMF.

 If the UE Time Zone has changed compared to the last reported UE Time Zone then the AMF shall include the UE Time Zone IE in this message.

 The AMF set the Operation Type to "UP activate" to indicate establishment of User Plane resources for the PDU Session(s). The AMF determines Access Type and RAT Type based, as defined in clause 4.2.3.2.

11a. The SMF retrieves SM Context from the I-SMF by invoking Nsmf\_PDUSession\_Context Request (SM context type). The SMF uses SM Context ID received from AMF for this service operation. SM context type indicates that the requested SM context is all, i.e. PDN Connection Context and 5G SM context.

11b. The old I-SMF responds with the SM context of the indicated PDU Session. If the there is Extended Buffering is applied and the Extended Buffering timer is still running in old-SMF or old I-UPF, or service request is triggered by downlink data (i.e. the old I-SMF received downlink data notification from old I-UPF), the old I-SMF includes a forwarding indication in the response to indicate that a forwarding tunnel is needed for sending buffered downlink packets from old I-UPF to new I-UPF or PSA (in the case that new I-UPF is not selected).

12. The SMF may select a new I-UPF: If the SMF determines that the service area of the PSA does not cover the UE location, the SMF selects a new I-UPF based on S-NSSAI, and UE location information as described in clause 6.3.3 of TS 23.501 [2].

13. If a new I-UPF is selected by SMF, the SMF initiates a N4 Session Establishment to the new I-UPF. If the tunnel endpoint is allocated by the new I-UPF, the new I-UPF provide tunnel endpoints to the SMF, otherwise the SMF allocates the tunnel endpoints and provides them to the new I-UPF. If forwarding indication was received, the SMF also allocate the tunnel endpoints for the buffered DL data from the old I-UPF, or request the new I-UPF to allocate them. In this case, the new I-UPF begins to buffer the downlink packet(s) received from the UPF (PSA) and start a timer.

 If the new I-UPF is not selected, i.e. the PSA can serve the UE location, the SMF may initiate N4 Session Modification to the PSA to allocate UL N3 tunnel endpoints Info of PSA. The SMF provides the UL N3 tunnel endpoints Info to PSA in case tunnel endpoint is allocated by the SMF, otherwise, the PSA provides the UL N3 tunnel endpoints to SMF. If the forwarding indication was received, the SMF allocates the tunnel endpoints for the buffered DL data from the old I-UPF, or request the PSA to allocate them. In this case, the UPF (PSA) begins to buffer the DL data it may receive at the same time from the N6 interface and start a timer. The UPF (PSA) sends one or more "end marker" packets for each N9 tunnel to the old I-UPF immediately after switching the path to (R)AN. The UPF (PSA) should not send the DL data received from the N6 interface until it receives end marker packets from the old I-UPF or the timer is expired.

14a. If the tunnel endpoints for the buffered DL data were allocated, the SMF invokes Nsmf\_PDUSession\_UpdateSMContext Request (tunnel endpoints for buffered DL data) to the old I-SMF in order to establish the forwarding tunnel. The SMF uses the SM Context ID received from AMF for this service operation.

14b. The old I-SMF initiates a N4 session modification to the old I-UPF and sends the tunnel endpoints for buffered DL data to the old I-UPF. After this step, the old I-UPF start to send buffered DL data to the new I-UPF or PSA in case new I-UPF is not selected.

14c. The old I-SMF responds the SMF with Nsmf\_PDUSession\_UpdateSMContext response.

15. If a new I-UPF was selected by SMF, the SMF initiates N4 Session Modification toward the PDU Session Anchor UPF, providing the new I-UPF DL tunnel information. The PSA begins to send the DL data to the new I-UPF as indicated in the new I-UPF DL tunnel information. The UPF (PSA) sends one or more "end marker" packets to the old I-UPF immediately after switching the path to new I-UPF. The new I-UPF should not send the DL packet(s) received from the UPF (PSA) until end marker packets were received from the old I-UPF or the timer started at step 13 is expired.

16. The SMF sends a Nsmf\_PDUSession\_CreateSMContext Response (N2 SM information (PDU Session ID, QFI(s), QoS profile(s), CN N3 Tunnel Info, S-NSSAI), N1 SM Container, Cause)) to the AMF. The CN N3 Tunnel Info is the UL Tunnel Info of the new I-UPF.

 If the PDU Session has been assigned any EPS bearer ID, the SMF also includes the mapping between EPS bearer ID(s) and QFI(s) into the N2 SM information to be sent to the NG-RAN.

 The SMF starts a timer to release the resource, i.e. resource for indirect data forwarding tunnel.

17. These steps are same as steps 12 to 14 in clause 4.2.3.2. After step 16, the Uplink data is transferred from (R)AN via new I-UPF (if exists) to PSA. If procedure in clause 4.2.3 is triggered together with this procedure, this step can be executed together with the corresponding steps in clause 4.2.3.

17a. If the step 9 or step 16 was successful response, in case of I-SMF removal or change, the AMF sends Nsmf\_PDUSession\_ReleaseSMContext Request (I-SMF only indication) to old I-SMF for the release of resources in old I-SMF. The I-SMF only indication indicates to old I-SMF not to invoke resource release in SMF.

 The old I-SMF starts a timer to release resources, i.e. resource for indirect data forwarding tunnel.

17b. The old I-SMF responds to AMF with Nsmf\_PDUSession\_ReleaseSMContext response.

Case: I-SMF insertion or I-SMF change: steps 18 to 21 are skipped for the I-SMF removal case.

18. The AMF sends an Nsmf\_PDUSession\_UpdateSMContext Request (N2 SM information, RAT type, Access type) to the new I-SMF.

 If the AMF received N2 SM information (one or multiple) in step 17, then the AMF shall forward the N2 SM information to the relevant new I-SMF per PDU Session ID.

19. The new I-SMF updates the new I-UPF with the AN Tunnel Info and List of accepted QFI(s). Downlink data is now forwarded from new I-UPF to UE.

20a. The new I-SMF invokes Nsmf\_PDUSession\_Update request (RAT type, Access type) to SMF. The SMF updates associated access of the PDU Session.

20b. If dynamic PCC is deployed, SMF may initiate notification about new location information to the PCF (if subscribed) by performing an SMF initiated SM Policy Modification procedure as defined in clause 4.16.5.1. The PCF may provide updated policies.

20c. The SMF responds with Nsmf\_PDUSession\_Update Response.

21. The new I-SMF sends a Nsmf\_PDUSession\_UpdateSMContext Response to AMF.

Case: I-SMF removal: steps 22 to 25 are skipped for the I-SMF insertion or I-SMF change cases.

22. The AMF sends a Nsmf\_PDUSession\_UpdateSMContext Request (N2 SM information, RAT Type, Access Type) to the SMF. The AMF determines Access Type and RAT Type based on the Global RAN Node ID associated with the N2 interface.

 If the AMF received N2 SM information (one or multiple) in step 17, then the AMF shall forward the N2 SM information to the relevant new I-SMF per PDU Session ID.

23. If dynamic PCC is deployed, SMF may initiate notification about new location information to the PCF by performing an SMF initiated SM Policy Modification procedure as defined in clause 4.16.5.1. The PCF may provide updated policies.

24. If a new I-UPF was selected by the SMF, the SMF updates the new I-UPF with the AN Tunnel Info and List of accepted QFI(s), otherwise, the SMF updates the PSA with the AN Tunnel Info and List of accepted QFI(s).

25. The SMF sends a Nsmf\_PDUSession\_UpdateSMContext Response to AMF.

26a. In the case of I-SMF insertion or I-SMF change, upon timer set in step 9 expires and the indirect data forwarding tunnel was established before, the new I-SMF sends N4 Session Modification request to new I-UPF to release resources for the forwarding tunnel.

 In the case of I-SMF removal, upon timer set in step 16 expires and the indirect data forwarding tunnel was established before, the SMF sends N4 Session Modificatin request to the new I-UPF or PSA to release the resource for the forwarding tunnel.

26b. In the case of I-SMF removal or change, upon timer set in step 17a expires and the indirect data forwarding tunnel was established before, the old I-SMF sends N4 Session Release request to the old I-UPF to release resources for the PDU Session. The old I-SMF releases the SM Context for the PDU Session. If the old I-UPF acts as UL CL and is not co-located with local PSA, the old I-SMF also sends N4 Session Release request to the local PSA to release resources for the PDU Session.

 In the case of I-SMF insertion, upon timer set in step 8c expires and the indirect data forwarding tunnel was established before, the SMF sends N4 Session Release request to the old I-UPF to release the resource for the PDU Session.

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