**SA WG2 Meeting #145eS2-2104684**

**17-28 May, 2021; Elbonia (revision of S2-2103059)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **23.502** | **CR** | **2858** | **rev** | **-** | **Current version:** | **17.0.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | 4G <-> 5GS mobility corrections to cope with areas of GERAN/UTRAN-only coverage | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Vodafone | | | | | | | | | |
| ***Source to TSG:*** | S2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5GS\_Ph1, TEI17 | | | | |  | ***Date:*** | | | 2021-05-10 |
|  |  | | | |  | |  | | |  |
| ***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 can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To reduce the number of times that the UE performs Attach in 2G/3G, and, to allow PS handover from 4G to 3G to continue to work, it is useful if the EPC’s knowledge of the 2G/3G TI is not lost at mobility with 5GS.  This can be solved by using allowing N26 to carry the TI in the same way as it is done on S10 (MME-MME) interface.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  LS on interworking to 5GS with N26 due to UE’s N1 mode capability disabling/re-enabling (C1-207531/S2-2102085): The question is on whether (and if yes how) to preserve data connectivity in following scenario: an UE has disabled N1 mode capability,then established a PDN connection, then enabled N1 mode back and is finally moved to 5GC.  R17 specifications try to support preserve data connectivity in that scenario when a UE supporting 5G NAS is able to negotiate 5GS parameters over EPS even though N1 mode is currently disabled on the UE.  The differences between the R16 and the R17 CR are highlighted in yellow | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. in signalling sent on the N26 interface, the MME and AMF send the TI of the default EPS bearer in the Bearer Context within the PDN Connection IE in the Forward Relocation Request and Context Response messages. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | ; 4.11.1.3.2, 4.11.1.3.3; 5.2.2.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **x** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | No changes are proposed to “4.11.1.2.1 5GS to EPS handover using N26 interface” because step 3 in it is that “The AMF sends a Forward Relocation Request as in step 3 in clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13],….” And TS 23.401 says that the 2G/3G TI is sent as part of the EPS Bearer Context. | | | | | | | | |

*FIRST CHANGE*

##### 

##### 4.11.1.3.2 5GS to EPS Idle mode mobility using N26 interface

In the case of network sharing the UE selects the target PLMN ID according to clause 5.18.3 of TS 23.501 [2].

Clause 4.11.1.3.2 covers the case of idle mode mobility from 5GC to EPC. UE performs Tracking Area Update procedure in E-UTRA/EPS when it moves from NG-RAN/5GS to E-UTRA/EPS coverage area.

The procedure involves a Tracking Area Update to EPC and setup of default EPS bearer and dedicated bearers in EPC in steps 1-11 and re-activation, if required.



Figure 4.11.1.3.2-1: 5GS to EPS Idle mode mobility using N26 interface

The TAU procedure in TS 23.401 [13] is used with the following 5GS interaction:

1. Step 1 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13].

2. Step 2 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13] with the modification captured in clause 4.11.1.5.3.

3-4. Steps 3-4 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13].

5a. The AMF verifies the integrity of the TAU request message:

The AMF determines for a PDU Session whether to retrieve context including mapped UE EPS connection from V-SMF (in the case of HR roaming) or from the SMF+PGW-C (in the case of non roaming or LBO roaming) as follows:

- If the AMF determines that one or more of the EBI(s) can be transferred, the AMF sends Nsmf\_PDUSession\_ContextRequest to the V-SMF or SMF+PGW-C and includes in the message EBI value(s) if any that cannot be transferred.

- The EBI values(s) that cannot be transferred is determined by the AMF if the target MME does not support 15 EPS bearers, i.e. the AMF determines the EBI values in range 1-4 as not to be transferred to EPS, and if there are still more than 8 EBI values associated with PDU Sessions, the AMF then determines EBI value(s) not to be transferred to EPS based on S-NSSAI and ARP as specified in clause 5.17.2.2.1 of TS 23.501 [2].

- The AMF does not retrieve the context for a PDU Session that cannot be transferred to EPS due to no EBI allocated, or allocated EBIs not transferrable, or combination of the two.

In non-roaming or LBO roaming, the AMF retrieves context that includes the mapped EPS Bearer Contexts.

- The AMF provides in Nsmf\_PDUSession\_ContextRequest the target MME capability to the PGW C+SMF in the request to allow the SMF+PGW-C to determine whether to include EPS Bearer context for Ethernet PDN type or non-IP PDN Type or not.

- If the AMF includes in Nsmf\_PDUSession\_ContextRequest EBI list not to be transferred, and if the EBI value of the QoS Flow associated with the default QoS Rule is included in that list, the SMF+PGW-C shall not return the PDN Connection context (which implies the whole PDU Session is not transferred to EPS), otherwise if the EBI value of the QoS Flow associated with the default QoS Rule is not included in the EBI list not to be transferred, the V-SMF or SMF+PGW-C shall not provide the EPS bearer context(s) mapped from QoS Flow(s) associated with that list.

The above step is performed with all the SMF+PGW-Cs corresponding to PDU Sessions of the UE which are associated with 3GPP access and have EBI(s) allocated to them.

In Home Routed roaming, the AMF requests the V-SMF to provide SMF Context by using Nsmf\_PDUSession\_ContextRequest.

NOTE 1: The AMF knows the MME capability to support 15 EPS bearers, Ethernet PDN Type and/or non-IP PDN type or not through local configuration.

5b. For Non-roaming or roaming with local breakout scenario, if the CN Tunnel Info for EPS bearer(s) have not been allocated before, the SMF sends N4 Session Modification Request to PGW-U+UPF to establish the tunnel for each EPS bearers, and PGW-U+UPF provides the PGW-U Tunnel Info for each EPS bearers to SMF+PGW-C.

NOTE 2: In home routed roaming case, the CN Tunnel Info for each EPS bearer has been prepared by the SMF+PGW-C and provided to the V-SMF as specified in clause 4.11.1.4.1.

5c. For PDU Sessions that are anchored a UPF, in non-roaming or roaming with local breakout, the SMF+PGW-C returns mapped EPS bearer contexts, which includes PGW-C control plane tunnel information of the PDN connection corresponding to the PDU session, EBI for each EPS bearer, PGW-U tunnel information for each EPS bearer, and EPS QoS parameters for each EPS bearer. For PDU Sessions with PDU Session Type Ethernet, if the UE and target MME supports Ethernet PDN type, the SMF+PGW-C provides SM Context for Ethernet PDN Type, otherwise if the UE or target MME does not support Ethernet Type but support non-IP Type, the SMF+PGW-C provides SM Context for non-IP PDN Type. For PDU Sessions with PDU Session Type Unstructured, the SMF provides SM Context for non-IP PDN Type. In home routed roaming, V-SMF provides the SM Context.

For PDU Sessions that are anchored at an NEF, the SMF returns an SCEF+NEF ID and an EBI for each PDN connection corresponding to a PDU Session.

If the SMF+PGW-C has marked that the status of one or more QoS Flows are deleted in the 5GC but not synchronized with the UE yet according to clause 4.3.3.2, the SMF+PGW-C does not return to the AMF the EPS context(s) if all its associated QoS Flows are marked as deleted, that is, the SMF+PGW-C returns to the AMF the EPS bearer contexts mapped from QoS Flows where at least one of the QoS Flow for the EPS bearer is not marked as deleted.

6. The AMF responds with a Context Response message carrying mapped MM context (including mapped security context), Return preferred and SM EPS UE Context (default and dedicated GBR bearers) to the MME. If the verification of the integrity protection fails, the AMF returns an appropriate error cause. Return preferred is an optional indication by the AMF of a preferred return of the UE to the 5GS PLMN at a later access change to a 5GS shared network. The AMF may start an implementation specific (guard) timer for the UE context. If the AMF has any TI stored for an EPS bearer, then that TI shall be included in the Bearer Context sent to the MME.

From the received context and the Tracking Area indicated by the RAN, the MME can determine whether the UE is performing Inter-RAT mobility to or from NB-IoT.

7 - 14. Steps 6-12 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13] are performed with following addition and modification:

In the step 10, if the PDU Session (PDN connection) has QoS Flows that do not have EPS bearer ID(s) assigned, the SMF+PGW-C deletes the PCC rule(s) associated with those QoS Flows and informs the PCF about the removed PCC rule(s).

In the step 11, the SMF+PGW-C requests the PGW-U+UPF to establish the tunnel for each EPS bearer by providing SGW-U Tunnel Info.

In step 10, the SMF+PGW-C may need to report some subscribed event to the PCF by performing an SMF initiated SM Policy Association Modification procedure as defined in clause 4.16.5. If the mapped EPS bearers are not included in Modify Bearer Request, the SMF+PGW-C deletes the PCC rule(s) associated with the QoS Flows corresponding to those mapped EPS bearers.

Step 9a from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13] with the modification captured in clause 4.11.1.5.3

If the SCEF connection is to be established, the steps 9-13 are replaced with the steps 2-3 from clause 5.13.1.2 of TS 23.682 [23]. The SCEF+NEF ID and the EBI received from the AMF are included in the Create SCEF Connection Request.

15-15c. The HSS+UDM invokes Nudm\_UECM\_DeregistrationNotification to notify the AMF associated with 3GPP access with reason as 5GS to EPS Mobility. If the timer started in step 6 is not running, the old AMF removes the UE context. Otherwise, the AMF may remove UE context when the timer expires.

The AMF requests the release of the PDU Session(s) which is associated with 3GPP access and not expected to be transferred to EPC, i.e. AMF requests the release of:

- PDU Session(s) whose corresponding SMF+PGW-C(s) are not contacted by AMF for SM context because the AMF determines that none of EBI(s) for the PDU Session can be transferred to EPS at step 5a; and

- PDU Session(s) for which the SM context retrieval failed at step 5c.

The AMF requests the release of the SM context in the V-SMF only and the V-SMF releases resource in the V-UPF, for Home Routed PDU Session with EBIs allocated. The 5GC may also keep UE context to allow the use of native security parameters when UE moves back from EPS to 5GS later.

If PCC is enabled, the AMF initiates AM Policy Association Termination procedure as defined in clause 4.16.3.2 and UE Policy Association Termination procedure as defined in clause 4.16.13.1.

Registration associated with the non-3GPP access in the AMF is not removed (i.e. an AMF that was serving the UE over both 3GPP and non-3GPP accesses does not consider the UE as deregistered over non 3GPP access and will remain registered and subscribed to subscription data updates in UDM).

When the UE decides to deregister over non-3GPP access or the old AMF decides not to maintain a UE registration for non-3GPP access anymore, the old AMF then deregisters from UDM by sending a Nudm\_UECM\_Deregistration service operation, unsubscribes from Subscription Data updates by sending an Nudm\_SDM\_Unsubscribe service operation to UDM and releases all the AMF and AN resources related to the UE.

16 - 18. Steps 17-21 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13] with the following modification:

- The MME may provide the eNodeB with a PLMN list in the Handover Restriction List taking into account the last used 5GS PLMN ID and the Return preferred indication. The Handover Restriction List contains a list of PLMN IDs as specified by TS 23.251 [35] clause 5.2a for eNodeB functions.

- The MME may not release the signalling connection with the UE based on the indication received in the step 1 that the UE is moving from 5GC.

19. [conditional] Step 19 from clause 4.11.1.2.1 applies.

If some of the QoS Flow(s) for an EPS bearer were marked as deleted, the SMF+PGW-C may initiate bearer modification as specified in clause 5.4.3 of TS 23.401 [13] to remove the TFT filter(s) corresponding to the Packet Filter Set(s) in the QoS rules.

*NEXT CHANGE (5)*

##### 4.11.1.3.3 EPS to 5GS Mobility Registration Procedure (Idle and Connected State) using N26 interface

Figure 4.11.1.3.3-1 describes the mobility registration procedure from EPS to 5GS when N26 is supported for idle and connected states.



Figure 4.11.1.3.3-1: EPS to 5GS mobility for single-registration mode with N26 interface

1. The Registration procedure is triggered, e.g. the UE moves into NG-RAN coverage. Step 2 to 9 except step 5, 6 and 8 follow the Registration procedure in clause 4.2.2 with following enhancement.

2. The UE sends Registration Request with registration type set to "Mobility Registration Update".

The UE includes 5G-GUTI mapped from EPS GUTI as the old GUTI, the native 5G-GUTI (if available) as additional GUTI and indicating that the UE is moving from EPC. The UE includes the UE Policy Container containing the list of PSIs, indication of UE support for ANDSP and OSId if available.

When the Registration Request is triggered due to UE mobility from EPS to 5GS, if the UE has locally deleted the EPS bearer which has allocated 5GS parameters and the EPS bearer status has not been synchronized with the network, the UE shall include the EPS bearer status in the Registration Request.

The Additional GUTI is provided both in Idle state and Connected state, if available. The Additional 5G-GUTI enables the AMF to retrieve the UE's MM context from the old AMF (if available). The UE includes the S-NSSAIs associated with the established PDN connections in the Requested NSSAI in RRC and NAS (as described in TS 23.501 [2] clause 5.15.7). In the case of Configured NSSAI applicable to this PLMN or an Allowed NSSAI are not present in the UE, the associated HPLMN S-NSSAI(s) shall be provided in the mapping of Requested NSSAI in the NAS as described in the clause 5.15.5.2.1 TS 23.501 [2].

In the case of idle mode mobility the UE additionally includes a TAU request message integrity protected using the EPS security context (for further security verification by the MME) in the Registration Request. If the UE holds a native 5G-GUTI for this PLMN then the UE also includes the GUAMI part of the native 5G-GUTI in RRC to enable the NG-RAN to route the Registration Request to the same AMF (if available), and otherwise the UE provides in RRC signalling a GUAMI mapped from the EPS GUTI and indicates it as "Mapped from EPS".

The UE integrity protects the Registration Request message using a 5G security context (if available).

3-4. Steps 2-3 of clause 4.2.2.2.2 are performed.

In the case of idle mode mobility, the AMF derives S-NSSAIs values for the Serving PLMN based on the S-NSSAIs values for the HPLMN, received in NAS Registration Request, associated with the established PDN connections, the AMF may send the S-NSSAIs values for the HPLMN to NSSF by invoking Nnssf\_NSSelection\_Get service operation and NSSF provides corresponding S-NSSAIs values for VPLMN to AMF.

NOTE 1: In connected mode mobility, the AMF devices S-NSSAIs values during the handover procedure.

Steps 5 and 8 are not performed when this procedure is part of EPS to 5GS handover.

5a. [Conditional] This step is only performed for IDLE mode mobility. The AMF derives the MME address and 4G GUTI from the old 5G-GUTI and sends Context Request to MME including EPS GUTI mapped from 5G-GUTI and the TAU request message according to TS 23.401 [13]. The MME validates the TAU message.

5b. [Conditional] If step 5a is performed, step 5 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13] is performed with the modification captured in clause 4.11.1.5.3.

Note: step 5a in 5.3.3.1 TS 23.401 requires the TI to be transferred as part of the EPS Bearer Context,

The AMF converts the received EPS MM Context into the 5GS MM Context. The received EPS UE context includes IMSI, ME Identity, UE EPS security context, UE Network Capability, and EPS Bearer context(s), and may also include LTE-M Indication. The MME EPS Bearer context includes for each EPS PDN connection the IP address and FQDN for the S5/S8 interface of the SMF+PGW-C and APN. If the SCEF connection is invoked, the MME EPS Bearer context includes the SCEF+NEF ID of the PDN connection, EBI, APN, User Identity. The AMF disregards any LTE-M Indication received in the EPS UE context, and instead takes into account the LTE M Indication received from NG-RAN, at step 1.

The AMF can determine the whether the UE is performing Inter-RAT mobility to or from NB-IoT based on the received "TAI of last TAU" in the EPC MM Context and the RAT Type used for the Registration Request.

If the Context Response includes the FQDN for the S5/S8 interface of the SMF+PGW-C, the AMF queries the NRF in serving PLMN by issuing the Nnrf\_NFDiscovery\_Request including the FQDN for the S5/S8 interface of the SMF+PGW-C, and the NRF provides the IP address or FQDN of the N11/N16 interface of the SMF+PGW-C.

If the Context Response includes an SCEF+NEF ID, the AMF performs the SMF selection.

The Context Response may include new information Return Preferred. Return Preferred is an indication by the MME of a preferred return of the UE to the last used EPS PLMN at a later access change to an EPS shared network. Based on the Return Preferred indication, the AMF may store the last used EPS PLMN ID in UE Context.

If the AMF cannot retrieve the address of the corresponding SMF for a PDN connection, it will not move the PDN connection to 5GS.

Step 6 is performed only if the AMF is different from the old AMF and the old AMF is in the same PLMN as the AMF.

6a. [Conditional] If the UE includes the 5G-GUTI as Additional GUTI in the Registration Request message, the AMF sends message to the old AMF. The old AMF validates the Registration request message.

The AMF retrieves UE's SUPI and MM Context, event subscription information by each consumer NF and the list of SM PDU Session ID/associated SMF ID for the UE using one of the following three options:

- AMF may invoke the Namf\_Communication\_UEContextTransfer to the old AMF identified by the additional 5G-GUTI; or

- if the old AMF and the AMF are in the same AMF Set and UDSF is deployed, AMF may invoke Nudsf\_UnstructuredDataManagement\_Query service operation for the UE identified by the additional 5G-GUTI from the UDSF; or

- if the old AMF and the AMF are in the same AMF Set, AMF may use implementation specific means to share UE context.

6b. [Conditional] If step 6a is performed, the response is performed as described in step 5 in clause 4.2.2.2.2. If a native 5G security context for 3GPP access is available in the AMF (or has been retrieved in step 6a), the AMF may continue to use this security context. Otherwise, the AMF shall either derive a mapped security context from the EPS security context obtained from the MME or initiate an authentication procedure to the UE.

If the new AMF determines that the UE has emergency PDU Session and the AMF is configured to allow emergency services for unauthenticated UE, the new AMF behaves as follows:

- If the UE has only an emergency PDU Session, the AMF either skips the authentication and security procedure in step 7 or accepts that the authentication may fail and continues the Mobility Registration Update procedure; or

- If the UE has both emergency and non emergency PDU Sessions and authentication fails, the AMF continues the Mobility Registration Update procedure and deactivates all the non-emergency PDU Sessions as specified in clause 4.3.4.2.

NOTE 2: The new AMF can determine if a PDU Session is used for emergency service by checking whether the DNN matches the emergency DNN.

7. [Conditional] If the AMF determines to initiate the authentication procedure to the UE in step 6b (e.g. the AMF can not obtain the UE MM context from AMF or other reasons), steps 8-9 of clause 4.2.2.2.2 are optionally performed.

7a. In the case of idle mode mobility, the AMF decide whether a new AMF needs to be selected. If a new AMF is to be selected, the AMF reroute the Registration request to the new AMF as described in clause 4.11.1.3.4, where the initial AMF refers to the AMF.

8. [Conditional] If step 5b is performed and the AMF accepts to serve the UE, the AMF sends Context Acknowledge (Serving GW change indication) to MME according to TS 23.401 [13].

9. Steps 11-12 of clause 4.2.2.2.2 are optionally performed.

10. Void.

11. Steps 13-14e of clause 4.2.2.2.2 are performed: This includes that if an MM context is retrieved from the old AMF in step 6 (i.e. corresponding to an existing UE registration for non-3GPP access in 5GC), then the AMF indicates to the UDM that the AMF identity to be registered in the UDM applies to both 3GPP and non-3GPP accesses by sending separate/independent Nudm\_UECM\_Registration service operations for "3GPP Access" and "non-3GPP Access".

12. Void.

13. Void.

14-14f. Step 16 of clause 4.2.2.2.2 (AM Policy Association Establishment) is optionally performed.

In the home-routed roaming case and connected state mobility, based on the S-NSSAI value for the Serving PLMN of the PDU Session(s), the AMF decides whether V-SMF change is needed or not. If the V-SMF reallocation is not needed, and if the two values (i.e. the S-NSSAI value configured in AMF for interworking and S-NSSAI value for the Serving PLMN) are different, the AMF invokes Nsmf\_PDUSession\_UpdateSMContext (PDU Session ID, S-NSSAI value for the Serving PLMN). The V-SMF updates 5G AN with the new S-NSSAI of VPLMN by sending a N2 SM message to 5G AN via AMF. If the V-SMF change is needed, the AMF performs as the case of I-SMF change defined in clause 4.23.4.3.

In the home-routed roaming case and idle state mobility, the AMF selects a default V-SMF per PDU Session and invokes Nsmf\_PDUSession\_CreateSMContext service operation of the V-SMF to create an association with the AMF. It includes UE EPS PDN Connection, H-SMF ID, S-NSSAI and indicates all the PDU Session(s) to be re-activated as received in the Registration request message along with List Of PDU Sessions To Be Activated. The S-NSSAI is the S-NSSAI configured in AMF for interworking, which is associated with default V-SMF. The V-SMF creates the association and based on the received SMF ID, the V-SMF invokes Nsmf\_PDUSession\_Create request service operation of the H-SMF and provides the information received from the AMF. Before invoking PDUSession\_Create service operation, the V-SMF request the V-UPF to provide the CN tunnel info.

The subsequent handling is performed as follows:

- The H-SMF finds the corresponding PDU Session based on the PDN Connection Context in the request. The H-SMF initiates N4 Session modification procedure to establish the CN tunnel for the PDU Session. The tunnel info for PDU Session is allocated by PGW-U+UPF and provided to the SMF+PGW-C. The H-SMF responds V-SMF with the PDU Session ID corresponding to the PDN Connection Context in the request, the allocated EBI(s) information, the S-NSSAI of the PDU Session, S-NSSAI of HPLMN, UE EPS PDN connection(s), and other PDU session parameters, such as PDU Session Type, Session AMBR in the Nsmf\_PDUSession\_Create response.

- The V-SMF updates its SM contexts and returns a Nsmf\_PDU\_Session\_CreateSMContextResponse message including the information received from the H-SMF. The V-SMF updates the V-UPF of the CN tunnel info of SMF+PGW-C. The V-SMF also includes the N2 SM Context in the response message sent to the AMF if the corresponding PDU Session is in the received List Of PDU Sessions To Be Activated. The V-SMF stores an association of the PDU Session ID and the H-SMF ID. The AMF stores the V-SMF ID and it also stores S-NSSAI and the allocated EBI(s) associated to the PDU Session ID. Based on the S-NSSAI value for the Serving PLMN of the PDU Session(s) the AMF decides whether V-SMF relocation is needed or not. If V-SMF relocation is not needed, and if the two values (i.e. the S-NSSAI value configured in AMF for interworking and S-NSSAI value for the Serving PLMN) are different, the AMF sends the S-NSSAI value for the Serving PLMN to V-SMF by invoking Nsmf\_PDUSession\_UpdateSMContext service operation. The V-SMF updates NG RAN with the S-NSSAI value for the Serving PLMN via N2 SM message. If V-SMF relocation is needed, the AMF performs V-SMF relocation as defined in clause 4.23.4.3.

In non-roaming and LBO cases and idle state mobility, AMF invokes Nsmf\_PDUSession\_CreateSMContext Request (UE EPS PDN Connection) service operation of the SMF+PGW-C and indicates all the PDU Session(s) to be re-activated as received in the Registration request message along with List Of PDU Sessions To Be Activated. This step is performed for each PDN Connection and the corresponding SMF+PGW-C address/ID in the UE context the AMF received in Step 6.

If the P-GW-C+SMF (H-SMF in the case of home-routed roaming case) determines that seamless session continuity from EPS to 5GS is not supported for the PDU Session,,then it does not provide SM information for the corresponding PDU Session but includes the appropriate cause code for rejecting the PDU Session transfer within the N2 SM Information.

The SMF+PGW-C finds the corresponding PDU Session based on the PDN Connection Context in the request. The SMF+PGW-C initiates N4 Session modification procedure to establish the CN tunnel for the PDU Session, and for Idle state mobility registration, releases the resource of the CN tunnels for EPS bearers corresponding to the PDU session as well. If the SMF+PGW-C has not yet registered for this PDU Session ID, the SMF+PGW-C registers with the UDM using Nudm\_UECM\_Registration (SUPI, DNN, PDU Session ID) for a given PDU Session as in step 4 of PDU Session Establishment Procedure in clause 4.3.2. The tunnel info for PDU Session is allocated by PGW-U+UPF and provided to the SMF+PGW-C. The SMF+PGW-C updates its SM contexts and returns the AMF a Nsmf\_PDUSession\_CreateSMContext Response message including the PDU Session ID corresponding to the PDN Connection Context in the request, the allocated EBI(s) information, the S-NSSAI of the PDU Session, and the N2 SM Context if the corresponding PDU Session is in the received List Of PDU Sessions To Be Activated. The AMF stores an association of the PDU Session ID and the SMF ID, S-NSSAI, and the allocated EBI(s) associated to the PDU Session ID. Based on the allocated EBI(s) information received from all the related SMF+PGW-C for this UE, an EPS bearer status, which reflects all existing EPS bearer, is generated by the AMF.

NOTE 3: For Connected State mobility registration, the release of CN tunnels for EPS bearers and UDM registration for the session corresponding to the PDU session is performed in the handover execution phase.

If the PDN Type of a PDN Connection in EPS is non-IP, and it was originally established as Ethernet PDU Session when UE was camping in 5GS (known based on local context information that was set to PDU Session Type Ethernet in UE and SMF), the PDU Session Type in 5GS shall be set to Ethernet by the SMF and UE. If the PDN type of a PDN Connection in EPS is non-IP, and is locally associated in UE and SMF to PDU Session Type Unstructured, the PDU Session Type in 5GS shall be set to Unstructured by the SMF and UE.

NOTE 4: If the non-IP PDN Type is originally established as Ethernet PDU Session, it means that Ethernet PDN Type is not supported in EPS.

If the AMF has received the EPS Bearer Status in the Registration Request from UE, the AMF shall send the EPS Bearer Status to all corresponding SMF+PGW-Cs. If the SMF+PGW-C receives the EPS Bearer Status from AMF, the SMF+PGW-C shall check whether the EPS bearer(s) has been deleted by UE but not notified to network. If yes, the SMF+PGW-C shall release those EPS bearer(s), the corresponding 5G QoS Rule(s) and the QoS Flow level QoS parameters locally.

If the SCEF+NEF ID is provided to the SMF, the SMF establishes the SMF-NEF connection as described in steps 2-3 from clause 4.25.2, the SMF provides the SCEF+NEF ID, EBI, APN, User Identity to the SCEF+NEF, and the SCEF+NEF updates the SM contexts and returns the NEF ID, PDU Session ID, DNN and User Identity to the SMF.

If the UE is performing Inter-RAT mobility to or from NB-IoT, the (H-)SMF will maintain, reconnect, release or leave PDU Session handling to the local VPLMN policy in the case of roaming for each PDU session according to the "PDU Session continuity at inter RAT mobility" subscription information. If the (H-)SMF does not have "PDU Session continuity at inter RAT mobility" for a PDU session, the (H-)SMF retrieves it from the UDM before determining any action. The SMF may use local policy to determine the handling a PDU Session if "PDU Session continuity at inter RAT mobility" cannot be retrieved from the UDM.

15 - 16a. HSS+UDM cancels the location of the UE in the MME as defined in steps 13 - 14 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13]. Subsequently, the steps 18 - 19 from clause 5.3.3.1 (Tracking Area Update procedure with Serving GW change) in TS 23.401 [13] are also executed with the following modification:

According to configuration, for the PDN connections which are anchored in a standalone PGW, the MME initiates PDN connection release procedure as specified in TS 23.401 [13].

17-18. These steps follow the steps 21, 21b and 22 of Registration procedure in clause 4.2.2.2.2.

The Registration Accept message shall include the updated 5G-GUTI to be used by the UE in that PLMN over any access. If the active flag was included in the Registration request, The AMF may provide NG-RAN with a Mobility Restriction List taking into account the last used EPS PLMN ID and the Return preferred indication. The Mobility Restriction List contains a list of PLMN IDs as specified by TS 23.501 [2]. The Allowed NSSAI in the Registration Accept message shall contain at least the S-NSSAIs corresponding to the active PDN Connection(s) and the corresponding mapping to the HPLMN S-NSSAIs.

The AMF shall include the EPS bearer status, which is generated at step 14, in the Registration Accept message. Based on the received EPS bearer status information, the UE shall check whether there are QoS Flow(s) existing locally but no associated EPS bearer(s) in the received EPS bearer status. The UE shall locally delete the 5G QoS Rule(s) and QoS Flow level QoS parameters of the QoS Flow(s) if the associated EPS bearer(s) do not exist in the received EPS bearer status.

*NEXT CHANGES*

##### 5.2.2.2.2 Namf\_Communication\_UEContextTransfer service operation

**Service operation name:** Namf\_Communication\_UEContextTransfer

**Description:** Provides the UE context to the consumer NF.

**Input, Required:** 5G-GUTI or SUPI, Access Type, Reason.

**Input, Optional:** Integrity protected message from the UE that triggers the context transfer.

**Output, Required:** The UE context of the identified UE or only the SUPI and an indication that the Registration Request has been validated. The UE context is detailed in table 5.2.2.2.2-1.

**Output, Optional:** Mobile Equipment Identifier (if available), Allowed NSSAI, Mapping Of Allowed NSSAI.

See clause 4.2.2.2.2 for example of usage of this service operation. If the consumer NF sent an integrity protected message from the UE, the AMF uses it to verify whether this request is permitted to retrieve the UE context of the UE. If it is permitted, the AMF provides UE context to the consumer NF in the Namf\_Communication\_UEContextTransfer response. The following table illustrates the UE Context:

Table 5.2.2.2.2-1: UE Context in AMF

| Field | Description |
| --- | --- |
| SUPI | SUPI (Subscription Permanent Identifier) is the subscriber's permanent identity in 5GS. |
| Routing Indicator | UE's Routing Indicator that allows together with SUCI/SUPI Home Network Identifier to route network signalling to AUSF and UDM instances capable to serve the subscriber |
| AUSF Group ID | The AUSF Group ID for the given UE. |
| UDM Group ID | The UDM Group ID for the UE. |
| PCF Group ID | The PCF Group ID for the UE. |
| SUPI-unauthenticated-indicator | This indicates whether the SUPI is unauthenticated. |
| GPSI | The GPSI(s) of the UE. The presence is dictated by its storage in the UDM. |
| 5G-GUTI | 5G Globally Unique Temporary Identifier. |
| PEI | Mobile Equipment Identity |
| Internal Group ID-list | List of the subscribed internal group(s) that the UE belongs to. |
| UE Specific DRX Parameters | UE specific DRX parameters for E-UTRA and NR. |
| UE Specific DRX Parameters for NB-IoT | UE Specific DRX Parameters for NB-IoT |
| UE MM Network Capability | Indicates the UE MM network capabilities. |
| 5GMM Capability | Includes other UE capabilities related to 5GCN or interworking with EPS. |
| Events Subscription | List of the event subscriptions by other CP NFs. Indicating the events being subscribed as well as any information on how to send the corresponding notifications |
| LTE-M Indication | Indicates if the UE is a Category M UE. This is based on indication provided by the NG-RAN or by the MME at EPS to 5GS handover. |
| MO Exception Data Counter | MO Exception Data Counter used for Small Data Rate Control purposes, see clause 5.31.14.3 of TS 23.501 [2]. |
| AMF-Associated Expected UE Behaviour parameters | Indicates per UE the Expected UE Behaviour Parameters and their corresponding validity times as specified in clause 4.15.6.3. |
| **For the AM Policy Association:** | |
| AM Policy Information | Information on AM policy provided by PCF. Includes the Policy Control Request Triggers and the Policy Control Request Information. Includes the authorized RFSP and the authorized Service Area Restrictions. |
| PCF ID | The identifier of the PCF for AM Policy. In roaming, the identifier of V-PCF (NOTE 2). |
| **For the UE Policy Association:** | |
| Trigger Information | The Policy Control Request Triggers on UE policy provided by PCF. |
| PCF ID(s) | The identifier of the PCF for UE Policy. In roaming, the identifiers of both V-PCF and H-PCF (NOTE 1) (NOTE 2). |
| **Other information** | |
| Subscribed RFSP Index | An index to specific RRM configuration in the NG-RAN that is received from the UDM. |
| RFSP Index in Use | An index to specific RRM configuration in the NG-RAN that is currently in use. |
| UE-AMBR in serving network | The UE-AMBR that has been sent to RAN (e.g. based on subscribed UE-AMBR from UDM or UE-AMBR received from PCF) |
| MICO Mode Indication | Indicates the MICO Mode for the UE. |
| Extended idle mode DRX Parameters | Negotiated extended idle mode DRX parameters. |
| Active Time Value for MICO mode | UE specific Active Time value allocated by AMF for MICO mode handling. |
| Strictly Periodic Registration Timer Indication | An indication that UE shall perform the Periodic Registration Update in a strictly periodic time, see TS 23.501 [2], clause 5.31.7.5. |
| Voice Support Match Indicator | An indication whether the UE radio capabilities are compatible with the network configuration. The AMF uses it as an input for setting the IMS voice over PS Session Supported Indication over 3GPP access. |
| Homogenous Support of IMS Voice over PS Sessions | Indicates per UE if "IMS Voice over PS Sessions" is homogeneously supported in all TAs in the serving AMF or homogeneously not supported, or, support is non-homogeneous/unknown, see clause 5.16.3.3 of TS 23.501 [2]. |
| UE Radio Capability for Paging Information | Information used by the NG-RAN to enhance the paging towards the UE (see clause 5.4.4.1 of TS 23.501 [2]). |
| Information On Recommended Cells And RAN nodes For Paging | Information sent by the NG-RAN, and used by the AMF when paging the UE to help determining the NG-RAN nodes to be paged as well as to provide the information on recommended cells to each of these NG-RAN nodes, in order to optimize the probability of successful paging while minimizing the signalling load on the radio path. |
| UE Radio Capability Information | Information sent by the NG-RAN node and stored in the AMF. The AMF sends this information to the NG-RAN node within the UE context during transition to CM-CONNECTED state, except for NB-IoT when NB-IoT specific UE Radio Access Capability are sent instead. |
| UE Radio Capability ID | Pointer that uniquely identifies a set of UE Radio Capabilities in UCMF as defined in TS 23.501 [2]. |
| NB-IoT specific UE Radio Access Capability Information | NB-IoT specific UE radio access capabilities. |
| WUS Assistance Information | Assistance information for determining the WUS group (see TS 23.501 [2]). |
| SMSF Identifier | The Identifier of the SMSF serving the UE in RM‑REGISTERED state. |
| SMSF Address | The Address of the SMSF serving the UE in RM-REGISTERED state. (see clause 4.13.3.1). |
| SMS Subscription | Indicates subscription to any SMS delivery service over NAS irrespective of access type. |
| SEAF data | Master security information received from AUSF. |
| Last used EPS PLMN ID | The identifier of the last used EPS PLMN. |
| Paging Assistance Data for CE capable UE | Paging Assistance Data for Enhanced Coverage level and cell ID provided by the last NG-RAN the UE was connected to. |
| Enhanced Coverage Restricted Information | Specifies per PLMN whether CE mode B is restricted for the UE, or both CE mode A and CE mode B are restricted for the UE, or both CE mode A and CE mode B are not restricted for the UE. |
| NB-IoT Enhanced Coverage Restricted Information | Specifies per PLMN whether the Enhanced Coverage is restricted or not for the UE. |
| Service Gap Time | Used to set the Service Gap timer for Service Gap Control (see TS 23.501 [2] clause 5.31.16). |
| Running Service Gap expiry time | The time of expiry of a currently running Service Gap Timer (see TS 23.501 [2] clause 5.31.16). |
| NB-IoT UE Priority | Numerical value used by the NG-RAN to prioritise between UEs accessing via NB-IoT. |
| List of Small Data Rate Control Statuses | List of Small Data Rate Control Statuses by DNN and S-NSSAI for the released PDU Sessions, see TS 23.501 [2] clause 5.31.14.3. |
| List of APN Rate Control Statuses | Indicates for each APN, the APN Rate Control Status (see TS 23.401 [13] clause 4.7.7.3) received from an MME when mobility from EPC to 5GC occurs. This information is provided to the MME during 5GC to EPC mobility. |
| **For each access type level context within the UE access and mobility context:** | |
| Access Type | Indicates the access type for this context. |
| RM State | Registration management state. |
| Registration Area | Current Registration Area (a set of tracking areas in TAI List). |
| TAI of last Registration | TAI of the TA in which the last Registration Request was initiated. |
| User Location Information | Information on user location. |
| Mobility Restrictions | Mobility Restrictions restrict mobility handling or service access of a UE. It consists of RAT restriction, Forbidden area, Service area restrictions and Core Network type restriction. It may also contain an Allowed CAG list and, optionally an indication whether the UE is only allowed to access 5GS via CAG cells. |
| Security Information for CP | As defined in TS 33.501 [15]. |
| Security Information for UP | As defined in TS 33.501 [15]. |
| Allowed NSSAI | Allowed NSSAI consisting of one or more S-NSSAIs for serving PLMN in the present Registration Area. |
| Mapping Of Allowed NSSAI | Mapping Of Allowed NSSAI is the mapping of each S-NSSAI of the Allowed NSSAI to the S-NSSAIs of the Subscribed S-NSSAIs. |
| S-NSSAIs subject to Network Slice-Specific Authentication and Authorization | Subscribed S-NSSAIs which are subject to NSSAA procedure.  Also including the status, i.e. result, of the NSSAA if already executed or whether the S-NSSAI is pending the completion of an NSSAA procedure. |
| Inclusion of NSSAI in RRC Connection Establishment Allowed by HPLMN | [Only for 3GPP access] it defines whether the UDM has indicated that the UE is allowed to include NSSAI in the RRC connection Establishment in clear text. |
| Access Stratum Connection Establishment NSSAI Inclusion Mode | Defines what NSSAI, if any, to include in the Access Stratum connection establishment as specified in TS 23.501 [2] clause 5.15.9. |
| CM state for UE connected via N3IWF/TNGF | Identifies the UE CM state (CM-IDLE, CM-CONNECTED) for UE connected via N3IWF/TNGF |
| N2 address information for N3IWF/TNGF | Identifies the N3IWF/TNGF to which UE is connected. Exists only if CM state for UE connected via N3IWF/TNGF is CM-CONNECTED. |
| AMF UE NGAP ID | Identifies the UE association over the NG interface within the AMF as defined in TS 38.413 [10]. This parameter exists only if CM state for the respective Access Type is CM-CONNECTED. |
| RAN UE NGAP ID | Identifies the UE association over the NG interface within the NG-RAN node as defined in TS 38.413 [10]. This parameter exists only if CM state for the respective Access Type is CM-CONNECTED. |
| Network Slice Instance(s) | The Network Slice Instances selected by 5GC for this UE. |
| URRP-AMF information | UE Reachability Request Parameter contains a list of URRP-AMF flags and associated authorised NF IDs. Each URRP-AMF flag indicates whether direct UE reachability notification has been authorised by the HPLMN towards the associated NF ID or not. |
| SoR Update Indicator for Initial Registration | An indication whether the UDM requests the AMF to retrieve SoR information when the UE performs NAS Registration Type "Initial Registration". |
| SoR Update Indicator for Emergency Registration | An indication whether the UDM requests the AMF to retrieve SoR information when the UE performs NAS Registration Type "Emergency Registration". |
| Charging Characteristics | The Charging Characteristics as defined in Annex A of TS 32.256 [71]. |
| **For each PDU Session level context:** | |
| S-NSSAI(s) | The S-NSSAI(s) associated to the PDU Session. |
| DNN | The associated DNN for the PDU Session. |
| Network Slice Instance id | The network Slice Instance information for the PDU Session |
| PDU Session ID | The identifier of the PDU Session. |
| SMF Information | The associated SMF identifier and SMF address for the PDU Session.  When an I-SMF is used, this additionally include the information correspond to an I-SMF. |
| Access Type | The current access type for this PDU Session (for a MA PDU Session this may correspond to information indicating 2 Access Type). |
| EBI-ARP list | The allocated EBI and associated ARP pairs for this PDU session. |
| Associated TI | If received from an MME or AMF, the TI associated with an EPS bearer ID |
| 5GSM Core Network Capability | The UEs 5GSM Core Network Capability as defined in TS 23.501 [2] clause 5.4.4b. |
| SMF derived CN assisted RAN parameters tuning | These are PDU Session specific parameters received from the SMF and used by the AMF to derive the Core Network assisted RAN parameters tuning. |
| NOTE 1: The AMF transfers the PCF ID to the SMF during PDU Session Establishment. The SMF may select the PCF identified by the PCF ID as described in TS 23.501 [2], clause 6.3.7.1. In HR roaming case, the AMF transfers the identifier of H-PCF as described in clause 4.3.2.2.2. In LBO roaming case, the AMF transfers the identifier of V-PCF as described in clause 4.3.2.2.1.  NOTE 2: The PCF ID in AM Policy Association information and the PCF ID in UE Policy Association Information should be the same in non-roaming case. The V-PCF ID in AM Policy Association information and the V-PCF ID in UE Policy Association Information should be the same in roaming case. | |

*End of CHANGES*