**3GPP TSG-SA WG2 Meeting #146E e-meetingS2-21xxxxx**

**Elbonia, 16-27 August, 2021**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **23.502** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **17.1.0** |  |
|  | | | | | | | | |
| *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:*** | TS23.502 Correction to the NSAC for signalling optimisation | | | | | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | | | | | |
| ***Source to WG:*** | NEC | | | | | | | | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | | | | | |
| ***Work item code:*** | eNS\_Ph2 | | | | | | | | |  | ***Date:*** | | | 2021-06-26 | | | |
|  |  | | | | |  | | | | |  | | |  | | | |
| ***Category:*** | **F** |  | | | | | | | | | ***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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | | | | |
|  |  | | | | | | | | | | | | | | | | |
| ***Reason for change:*** | | This is a corresponding CR to the 23.501 CR that proposes to fix the following editor's note in 23.501 section 5.15.11.14.  *Editor's note: NSAC mechanism during the mobility between EPC and 5GC can be revisited to make it align with 5GC mechanism, i.e. mobility between AMFs.* | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Summary of change:*** | | If NSAC for a network slice is supported in both, the 5GS and EPS, at UE intersystem change, de-registration from one of them and registration to the other of them for the same network slice is avoided, i.e followed the intra 5GS mobility behaviour.  At 5GS to EPS handover, if NSAC is not required for the network slice in EPS, the AMF interacts with the NSACF to deregister the UE for network slice and the SMF+PGW-C interacts with the NSACF to deregister the PDU Session(s) from the network slice, if subject to NSAC in 5GS.  At At EPS to 5GS handover, if NSAC is not required for the network slice in EPS, the AMF interacts with the NSACF to register the UE for the network slice in 5GS and the SMF+PGW-C interacts with the NSACF to register the PDU Session(s) from the network slice, if subject to NSAC in 5GS. | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Consequences if not approved:*** | | NSAC for EPC interworking is not complete. | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Clauses affected:*** | | 4.11.1.2.1, 4.11.1.2.2.1, 4.11.1.2.2.3 | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
|  | | **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 ... | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | | | | | | | | |
|  | |  | | | | | | | | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | | | | | | | | |

**\* \* \* \* start of 1st change \* \* \* \***

##### 4.11.1.2.1 5GS to EPS handover using N26 interface

Figure 4.11.1.2.1-1 describes the handover procedure from 5GS to EPS when N26 is supported.

In the case of handover to a shared EPS network, the source NG-RAN determines a PLMN to be used in the target network as specified by TS 23.501 [2]. The source NG-RAN shall indicate the selected PLMN ID to be used in the target network to the AMF as part of the TAI sent in the HO Required message.

In the case of handover from a shared NG-RAN, the AMF may provide the MME with an indication that the 5GS PLMN is a preferred PLMN at later change of the UE to a 5GS shared networks.

During the handover procedure, as specified in clause 4.9.1.3.1, the source AMF shall reject any SMF+PGW-C initiated N2 request received since handover procedure started and shall include an indication that the request has been temporarily rejected due to handover procedure in progress.

Upon reception of a rejection for an SMF+PGW-C initiated N2 request(s) with an indication that the request has been temporarily rejected due to handover procedure in progress, the SMF+PGW-C behaves as specified in TS 23.401 [13].



Figure 4.11.1.2.1-1: 5GS to EPS handover for single-registration mode with N26 interface

The procedure involves a handover to EPC and setup of default EPS bearer and dedicated bearers for QoS Flows that have EBI assigned, in EPC in steps 1-16 and re-activation, if required, of dedicated EPS bearers for non-GBR QoS Flows that have no EBI assigned, in step 19. This procedure can be triggered, for example, due to new radio conditions, load balancing or in the presence of QoS Flow for normal voice or IMS emergency voice, the source NG-RAN node may trigger handover to EPC.

For Ethernet and Unstructured PDU Session Types, the PDN Type Ethernet and non-IP respectively are used, when supported, in EPS.

When EPS supports PDN Type non-IP but not PDN type Ethernet, PDN type non-IP is used also for Ethernet PDU sessions. The SMF shall also set the PDN Type of the EPS Bearer Context to non-IP in this case. After the handover to EPS, the PDN Connection will have PDN Type non-IP, but it shall be locally associated in UE and SMF to PDU Session Type Ethernet or Unstructured respectively.

In the roaming home routed case, the SMF+PGW-C always provides the EPS Bearer ID and the mapped QoS parameters to UE. The V-SMF caches the EPS Bearer ID and the mapped QoS parameters obtained from H-SMF for this PDU session. This also applies in the case that the HPLMN operates the interworking procedure without N26.

NOTE 1: The IP address preservation cannot be supported, if SMF+PGW-C in the HPLMN doesn't provide the mapped QoS parameters.

If NSAC is not required for a network slice in EPS, the AMF interacts with the NSACF to deregister the UE for network slice and the SMF+PGW-C interacts with the NSACF to deregister the PDU Session(s) from the network slice, if subject to NSAC in 5GS.

1. NG-RAN decides that the UE should be handed over to the E-UTRAN. If NG-RAN is configured to perform Inter RAT mobility due to IMS voice fallback triggered by QoS flow setup and request to setup QoS flow for IMS voice was received, NG-RAN responds indicating rejection of the QoS flow establishment because of mobility due to fallback for IMS voice via N2 SM information and triggers handover to E-UTRAN. The NG-RAN sends a Handover Required (Target eNB ID, Direct Forwarding Path Availability, Source to Target Transparent Container, inter system handover indication) message to the AMF. NG-RAN indicates bearers corresponding to the 5G QoS Flows for data forwarding in Source to Target Transparent Container.

If the source NG RAN and target E-UTRAN support RACS as defined in TS 23.501 [2], the Source to Target transparent container need not carry the UE radio access capabilities (instead the UE Radio Capability ID is supplied from the CN to the target E-UTRAN). However, if the source NG-RAN has knowledge that the target E-UTRAN might not have a local copy of the Radio Capability corresponding to the UE Radio Capability ID (i.e. because the source NG-RAN had itself to retrieve the UE's Radio Capability from the AMF) then the source NG-RAN may also send some (or all) of the UE's Radio Capability to the target E-UTRAN (the size limit based on configuration). In the case of inter-PLMN handover, when the source NG-RAN and target E-UTRAN support RACS as defined in TS 23.501 [2] and TS 23.401 [13], and the source NG-RAN determines that the target PLMN does not support the UE Radio Capability ID assigned by the source PLMN based on local configuration, then the source NG-RAN includes the UE radio access capabilities in the Source to Target transparent container.

Direct Forwarding Path Availability indicates whether direct forwarding is available from the NG-RAN to the E-UTRAN. This indication from NG-RAN can be based on e.g. the presence of IP connectivity and security association(s) between the NG-RAN and the E-UTRAN.

If the handover is triggered due to Emergency fallback, the NG-RAN may forward the Emergency indication to the target eNB in the Source to Target Transparent Container, and the target eNB allocates radio bearer resources taking received indication into account.

2a-2c. The AMF determines from the 'Target eNB Identifier' IE that the type of handover is Handover to E-UTRAN. The AMF selects an MME as described in TS 23.401 [13] clause 4.3.8.3.

The AMF determines for a PDU Session whether to retrieve context including mapped UE EPS PDN Connection from the V-SMF (in the case of HR roaming) or 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.

When the AMF sends Nsmf\_PDUSession\_ContextRequest the AMF provides also the target MME capability to the V-SMF or the SMF+PGW-C to allow it to determine whether to include EPS Bearer context for Ethernet PDN Type or non-IP PDN Type or not.

When Nsmf\_PDUSession\_Context Request is received in the V-SMF or the SMF+PGW-C, the V-SMF or the SMF+PGW-C provides context that includes the mapped EPS PDN Connection as follows:

- If there is EBI list not to be transferred, and the EBI value of the QoS Flow associated with the default QoS Rule is included in that list, the V-SMF or 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 EBI list not to be transferred, the V-SMF or PGW C+SMF shall not provide the EPS bearer context(s) mapped from QoS Flow(s) associated with the EBI list not to be transferred.

- For PDU Sessions with PDU Session Type Ethernet, if the UE and target MME supports Ethernet PDN type, the V-SMF or the PGW C+SMF provides Context for Ethernet PDN Type, otherwise if the target MME does not support Ethernet Type but support non-IP Type, the V-SMF or the PGW C+SMF provides Context for non-IP PDN Type. For PDU Sessions with PDU Session Type Unstructured, the V-SMF or the SMF+PGW-C provides Context for non-IP PDN Type.

In the case of non roaming or LBO roaming, when Nsmf\_PDUSession\_ContextRequest is received in PGW C+SMF, if the SMF+PGW-C determines that EPS Bearer Context can be transferred to EPS and the CN Tunnel Info for EPS bearer(s) have not been allocated before, the SMF+PGW-C sends N4 Session modification to the PGW-U+UPF to establish the CN tunnel for each EPS bearer and provides EPS Bearer Contexts to AMF, as described in step 8 of clause 4.11.1.4.1. The PGW-U+UPF is ready to receive the uplink packet from E-UTRAN.

This step is performed with all the SMF+PGW-Cs corresponding to PDU Sessions of the UE which are associated with 3GPP access and have at leaset one EBI(s) determined to be transferred to EPS.

NOTE 2: 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.

In home routed roaming scenario, the UE's EPS PDN Contexts are obtained from the V-SMF. If Small Data Rate Control applies on PDU Session, the V-SMF retrieves the SM Context, including Small Rate Control Status information from the H-SMF using Nsmf\_PDUSession\_Context Request.

If EPS supports NSAC, the SMF+PGW-C includes the NSAC support indicator in the Nsmf\_PDUSession\_ContextResponse to the AMF.

3. 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], with the following modifications and clarifications:

- Parameter "Return preferred" may be included. Return preferred is an optional indication by the MME of a preferred return of the UE to the 5GS PLMN at a later access change to a 5GS shared network. An MME may use this information as specified by TS 23.501 [2].

- The SGW address and TEID for both the control-plane or EPS bearers in the message are such that target MME selects a new SGW.

- The AMF determines, based on configuration and the Direct Forwarding Path Availability, the Direct Forwarding Flag to inform the target MME whether direct data forwarding is applicable.

- The AMF includes the mapped SM EPS UE Contexts for PDU Sessions with and without active UP connections.

- Subject to operator policy if the secondary RAT access restriction condition is the same for EPS and 5GS, the AMF may set EPS secondary RAT access restriction condition based on the UE's subscription data.

4-5. Step 4 and 4a respectively in clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

6. Step 5 (Handover Request) in clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13] with the following modification:

- Handover Request may contain information Handover Restriction List with information about PLMN IDs as specified by TS 23.251 [35], clause 5.2a for eNodeB functions.

- The target eNB should establish E-RABs indicated by the list of EPS bearer to be setup provided by the MME, even if they are not included in the source to target container.

7-9. Step 5a through 7 in clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

10a. If data forwarding applies, the AMF sends the Nsmf\_PDUSession\_UpdateSMContext Request (data forwarding information) to the SMF+PGW-C. If multiple SMF+PGW-Cs serves the UE, the AMF maps the EPS bearers for Data forwarding to the SMF+PGW-C address(es) based on the association between the EPS bearer ID(s) and PDU Session ID(s). In home-routed roaming case, the AMF requests the V-SMF to create indirect forwarding tunnel if indirect forwarding applies.

10b. If indirect data forwarding applies, the SMF+PGW-C may select an intermediate PGW-U+UPF for data forwarding. The SMF+PGW-C maps the EPS bearers for Data forwarding to the 5G QoS flows based on the association between the EPS bearer ID(s) and QFI(s) for the QoS flow(s) in the SMF+PGW-C, and then sends the QFIs, Serving GW Address(es) and TEID(s) for data forwarding to the PGW-U+UPF. The CN Tunnel Info is provided by the PGW-U+UPF to SMF+PGW-C in this response. In home-routed roaming case, the V-SMF selects the V-UPF for data forwarding.

10c. The SMF+PGW-C returns an Nsmf\_PDUSession\_UpdateSMContext Response (Cause, Data Forwarding tunnel Info, QoS flows for Data Forwarding). Based on the correlation between QFI(s) and Serving GW Address(es) and TEID(s) for data forwarding, the PGW-U+UPF maps the QoS flow(s) into the data forwarding tunnel(s) in EPC.

11. The AMF sends the Handover Command to the source NG-RAN (Transparent container (radio aspect parameters that the target eNB has set-up in the preparation phase), Data forwarding tunnel info, QoS flows for Data Forwarding). The source NG-RAN commands the UE to handover to the target Access Network by sending the HO Command. The UE correlates the ongoing QoS Flows with the indicated EPS Bearer IDs to be setup in the HO command. The UE locally deletes the PDU Session if the QoS Flow associated with the default QoS rule in the PDU Session does not have an EPS Bearer ID assigned. If the QoS Flow associated with the default QoS rule has an EPS Bearer ID assigned, the UE keeps the PDU Session (PDN connection) and for the remaining QoS Flow(s) that do not have EPS bearer ID(s) assigned, the UE locally deletes the QoS rule(s) and the QoS Flow level QoS parameters if any associated with those QoS Flow(s) and notifies the impacted applications that the dedicated QoS resource has been released. The UE deletes any UE derived QoS rules. The EPS Bearer ID that was assigned for the QoS flow of the default QoS rule in the PDU Session becomes the EPS Bearer ID of the default bearer in the corresponding PDN connection.

If indirect data forwarding is applied, Data forwarding tunnel info includes CN tunnel info for data forwarding per PDU session. For the QoS Flows indicated in the "QoS Flows for Data Forwarding", NG-RAN initiate data forwarding via to the PGW-U+UPF based on the CN Tunnel Info for Data Forwarding per PDU Session. Then the PGW-U+UPF maps data received from the data forwarding tunnel(s) in the 5GS to the data forwarding tunnel(s) in EPS, and sends the data to the target eNodeB via the Serving GW.

If direct data forwarding is applied, Data forwarding tunnel info includes E-UTRAN tunnel info for data forwarding per EPS bearer. NG-RAN initiate data forwarding to the target E-UTRAN based on the Data Forwarding Tunnel Info for Data Forwarding per EPS bearer.

12-12c. Step 13 to step 14 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13] with the following clarification:

- The AMF requests the release of the PDU Session which is associated with 3GPP access and not expected to be transferred to EPC, i.e. the 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 2a; and

- PDU Session(s) for which the SM context retrieval failed at step 2c.

12d. The AMF acknowledges MME with Relocation Complete Ack message. A timer in AMF is started to supervise when resource in NG-RAN shall be released.

12e. In the case of home routed roaming, the AMF invokes Nsmf\_PDUSession\_ReleaseSMContext Request (V-SMF only indication) to the V-SMF. This service operation request the V-SMF to remove only the SM context in V-SMF, i.e. not release PDU Session context in the SMF+PGW-C.

If indirect forwarding tunnel(s) were previously established, the V-SMF starts a timer and releases the SM context on expiry of the timer. If no indirect forwarding tunnel has been established, the V-SMF immediately releases the SM context and its UP resources for this PDU Session in V-UPF locally.

13. Step 15 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

14a. Step 16 (Modify Bearer Request) from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13] with the following clarification:

- If the PDU Session (PDN connection) has QoS Flows that do not have EPS bearer ID(s) assigned, or QoS Flow(s) for which the mapped EPS bearers are not included in Modify Bearer Request, the SMF+PGW-C deletes the PCC rule(s) associated with those QoS Flows and informs the PCF about the removed PCC rule(s).

NOTE 4: If the QoS flow is deleted, the IP flows of the deleted QoS rules will continue flowing on the default EPS bearer if it does not have an assigned TFT. If the default EPS bearer has an assigned TFT, the IP flows of the deleted QoS Flow may be interrupted until step 19 when dedicated bearer activation is triggered by a request from the PCF.

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.

15. The SMF+PGW-C initiates a N4 Session Modification procedure towards the UPF+PGW-U to update the User Plane path, i.e. the downlink User Plane for the indicated PDU Session is switched to E-UTRAN. The SMF+PGW-C releases the resource of the CN tunnel for PDU Session in UPF+PGW-U.

16. Step 16a (Modify Bearer Response) from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13]. At this stage the User Plane path is established for the default bearer and the dedicated EPS bearers between the UE, target eNodeB, Serving GW and the PGW-U+UPF. The SMF+PGW-C uses the EPS QoS parameters as assigned for the dedicated EPS bearers during the QoS Flow establishment. SMF+PGW-C maps all the other IP flows to the default EPS bearer (see NOTE 4).

If indirect forwarding tunnel(s) were previously established, the SMF+PGW-C starts a timer, to be used to release the resource used for indirect data forwarding.

17. Step 17 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

18. The UE initiates a Tracking Area Update procedure as specified in step 18 of clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

This includes the deregistration of the old AMF for 3GPP access from the HSS+UDM as specified in clause 4.11.1.5.3. Any registration associated with the non-3GPP access in the old 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).

NOTE 5: The behaviour whereby the HSS+UDM cancels location of CN node of the another type, i.e. AMF, is similar to HSS behaviour for MME and Gn/Gp SGSN registration (see TS 23.401 [13]). The target AMF that receives the cancel location from the HSS+UDM is the one associated with 3GPP access.

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.

Unless the AMF receives NSAC support indicator in step 2c, the AMF interacts with the NSACF to deregister the UE from the network slice, if subject to NSAC in 5GS. The SMF+PGW-C may interact with the NSACF to deregister the PDU Session(s) from the network slice, if subject to NSAC in 5GS but not in EPS.

19. If PCC is deployed, the PCF may decide to provide the previously removed PCC rules to the SMF+PGW-C again thus triggering the SMF+PGW-C to initiate dedicated bearer activation procedure. This procedure is specified in TS 23.401 [13], clause 5.4.1 with modification captured in clause 4.11.1.5.4. This step is applicable for PDN Type IP or Ethernet, but not for non-IP PDN Type.

20. Step 21 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

21. In the case of home routed roaming, at the expiry of the timer at V-SMF started at step 12e, the V-SMF locally releases the SM context and the UP resource for the PDU Session including the resources used for indirect forwarding tunnel(s) that were allocated at step 10.

In non-roaming or local breakout roaming, if SMF+PGW-C has started a timer in step 16, at the expiry of the timer, the SMF+PGW-C sends N4 Session Modification Request to PGW-U+UPF to release the resources used for the indirect forwarding tunnel(s) that were allocated at step 10.

When the timer set in step 12d expires, AMF also sends a UE Context Release Command message to the source NG RAN. The source NG RAN releases its resources related to the UE and responds with a UE Context Release Complete message.

**\* \* \* \* end of 1st change \* \* \* \***

**\* \* \* \* start of 2nd change \* \* \* \***

4.11.1.2.2.1 General

N26 interface is used to provide seamless session continuity for single registration mode.

The procedure involves a handover to 5GS and setup of QoS Flows in 5GS.

In the home routed roaming case, the PGW-C+ SMF in the HPLMN always receives the PDU Session ID from UE and provides PDN Connection associated 5G QoS parameter(s) and S-NSSAI to the UE. This also applies in the case that the HPLMN operates the interworking procedure without N26.

In the case of handover to a shared 5GS network, the source E-UTRAN determines a PLMN to be used in the target network as specified by TS 23.251 [35] clause 5.2a for eNodeB functions. A supporting MME may provide the AMF via N26 with an indication that source EPS PLMN is a preferred PLMN when that PLMN is available at later change of the UE to an EPS shared network.

NOTE 1: If the UE has active EPS bearer for normal voice or IMS emergency voice, the source E-UTRAN can be configured to not trigger any handover to 5GS.

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 Ethernet or Unstructured, the PDU Session Type in 5GS shall be set to Ethernet or Unstructured respectively.

NOTE 2: If the non-IP PDN Type is locally associated in UE and SMF to PDU Session Type Ethernet, it means that Ethernet PDN Type is not supported in EPS.

NOTE 3: The IP address continuity can't be supported, if SMF+PGW-C in the HPLMN doesn't provide the mapped QoS parameters.

If NSAC is not required for a network slice in EPS, the AMF interacts with the NSACF to register the UE for the network slice and the SMF+PGW-C interacts with the NSACF to register the PDU Session(s) for the network slice, if subject to NSAC in 5GS.

**\* \* \* \* end of 2nd change \* \* \* \***

**\* \* \* \* start of 3rd change \* \* \* \***

4.11.1.2.2.3 Execution phase

Figure 4.11.1.2.2.3-1 shows the Single Registration-based Interworking from EPS to 5GS procedure.



Figure 4.11.1.2.2.3-1: EPS to 5GS handover using N26 interface, execution phase

NOTE: Step 6 P-GW-C+SMF Registration in the UDM is not shown in the figure for simplicity.

1 - 2. Step 9 - 11 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13]. Different from step 9a of clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13], upon reception of Handover Command, the UE will keep the QoS Flow context for which it did not receive the corresponding radio resources in the NG-RAN until the QoS Flow is released by the network using PDU Session Modification procedure in clause 4.3.3. If the QoS Flow with a default QoS Rule of a PDU Session does not have the corresponding radio resources in the NG-RAN, UE considers that the user plane of this PDU Session is deactivated.

3. Handover Confirm: the UE confirms handover to the NG-RAN.

The UE moves from the E-UTRAN and synchronizes with the target NG-RAN. The UE may resume the uplink transmission of user plane data only for those QFIs and Session IDs for which there are radio resources allocated in the NG-RAN.

The E-UTRAN sends DL data to the Data Forwarding address received in step 1. If the indirect data forwarding is applied, the E-UTRAN forward the DL data to NG-RAN via the SGW and the v-UPF. The v-UPF forwards the data packets to the NG-RAN using the N3 Tunnel Info for data forwarding, adding the QFI information. The target NG-RAN prioritizes the forwarded packets over the fresh packets for those QoS flows for which it had accepted data forwarding.

If Direct data forwarding is applied, the E-UTRAN forwards the DL data packets to the NG-RAN via the direct data forwarding tunnel.

4. Handover Notify: the NG-RAN notifies to the target AMF that the UE is handed over to the NG-RAN.

5. Then the target AMF knows that the UE has arrived to the target side and informs the MME by sending a Forward Relocation Complete Notification message.

6. Step 14 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13].

7. Target AMF to SMF +PGW-C (V-SMF in the case of roaming and Home-routed case): Nsmf\_PDUSession\_UpdateSMContext Request (Handover Complete Indication for PDU Session ID). In the Home-routed roaming case, the V-SMF invokes Nsmf\_PDUSession\_Update Request (V-CN Tunnel Info, Handover Complete Indication) to SMF+PGW-C.

Handover Complete Indication is sent per each PDU Session to the corresponding SMF +PGW-C (sent by V-SMF in the roaming and Home-routed case) to indicate the success of the N2 Handover.

If indirect forwarding is used, a timer in SMF+PGW-C (V-SMF in the case of roaming and Home-routed case) is started to supervise when resources in UPF (for indirect data forwarding) shall be released.

8. The SMF + PGW-C updates the UPF + PGW-U with the V-CN Tunnel Info, indicating that downlink User Plane for the indicated PDU Session is switched to NG-RAN or V-UPF in the case of roaming in Home-routed case and the CN tunnels for EPS bearers corresponding to the PDU session can be released.

For each EPS Bearer one or more "end marker" is sent to Serving GW by the UPF+PGW-U immediately after switching the path. The UPF + PGW-U starts sending downlink packets to the V-UPF.

9. If PCC infrastructure is used, the SMF + PGW-C informs the PCF about the change of, for example, the RAT type and UE location.

10. SMF +PGW-C to target AMF: Nsmf\_PDUSession\_UpdateSMContext Response (PDU Session ID, NSAC counting indicator).

SMF +PGW-C confirms reception of Handover Complete. If NSAC was required for the network slice in EPS, the SMF+PGW-C includes the NSAC support indicator.

- If the SMF has not yet registered for this PDU Session ID, then the SMF 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.

11. For home-routed roaming scenario: The V-SMF provides to the v-UPF with the N3 DL AN Tunnel Info. This step is executed after step 7.

12. The UE performs the EPS to 5GS Mobility Registration Procedure from step 2 in clause 4.11.1.3.3. The UE includes the UE Policy Container containing the list of PSIs, indication of UE support for ANDSP and OSId if available. If the UE holds a native 5G-GUTI it also includes the native 5G-GUTI as an additional GUTI in the Registration Request. The UE shall select the 5G-GUTI for the additional GUTI as follows, listed in decreasing order of preference:

- a native 5G-GUTI assigned by the PLMN to which the UE is attempting to register, if available;

- a native 5G-GUTI assigned by an equivalent PLMN to the PLMN to which the UE is attempting to register, if available;

- a native 5G-GUTI assigned by any other PLMN, if available.

The additional GUTI enables the target AMF to find the UE's 5G security context (if available). The target AMF provides NG-RAN with a PLMN list in the Handover Restriction List containing at least the serving PLMN, taking into account of the last used EPS PLMN ID and Return preferred indication as part of the Registration procedure execution and target AMF signalling to NG-RAN. The Handover Restriction List contains a list of PLMN IDs as specified by TS 23.501 [2].

Unless NSAC counting indicator is included in Nsmf\_PDUSession\_UpdateSMContext Response from the SMF+PGW-C in step 10, the AMF interacts with the NSACF to register the UE for network slice, if subject to NSAC in 5GC. The SMF+PGW-C may interact with the NSACF to register the PDU Session(s) from the network slice, if subject to NSAC in 5GS but not in EPS.

13. Step 19 from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13]. Step 20a - 20b from clause 5.5.1.2.2 (S1-based handover, normal) in TS 23.401 [13], with the following modification:

For the PDN connections that are not possible to be transferred to 5GS (e.g. PDN connections are anchored in a standalone PGW), the MME initiates PDN connection release procedure as specified in TS 23.401 [13].

14. If indirect forwarding was used, then the expiry of the timer started at step 7 triggers the SMF+PGW-C (V-SMF in the case of roaming and Home-routed case) to release temporary resources used for indirect forwarding that were allocated at steps 11 to 13 in clause 4.11.1.2.2.2.

**\* \* \* \* end of 3rd change \* \* \* \***