**3GPP TSG-WG SA2 Meeting #146E e-meeting  *S2-2105699***

**Elbonia, August 16 – 27, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **23.502** | **CR** | **2957** | **rev** | **-**  | **Current version:** | **17.1.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network | **X** |

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|  |
| ***Title:***  | Update on Supporting UP Integrity Protection Policy Handling for Interworking from 5GS to EPS |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, Vodafone, Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | TEI17, 5GS\_Ph1 |  | ***Date:*** | 2021-08-09 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | According to the LS from SA3 (S3-212196), it is concluded that when the UE and EPS support UPIP, PDU Sessions with UP integrity protection of UP Security Enforcement Information set to Required should also support interworking.\*\*\*SA3 have agreed a draft CR to TS 33.401 in S3-212308. |
|  |  |
| ***Summary of change:*** | Based on the SA3’s conclusion, add related UE capability on UPIP support in EPS. Besides, remove the restriction on the EBI allocation and transfer when the UE and MME support UPIP in EPS. The SMF will only allocate EBIs when the UE support UPIP in EPS and transfer the bearer context when the MME also support it. Besides, the SMF also needs to know the AMF capability on UPIP support in EPS, otherwise, in roaming scenario, when neither MME nor AMF support UPIP in EPS, but the UE does support it. Then the Home SMF (which is in a different country to the VPLMN’s AMF) would use a policy of UPIP to allocate the EBIs, which is not correct.UPIP related PDN Connection establishment in EPS is described in 4.11.0a.5. |
|  |  |
| ***Consequences if not approved:*** | Not aligned with SA3. |
|  |  |
| ***Clauses affected:*** | 4.11.0a.5, 4.11.1.1, 4.11.1.2.1, 4.11.1.3.2, 4.11.5.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **x** |  |  Other core specifications  | TS 23.501 CR 3009  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Changes from r07 (which was submitted before the revision deadline) are in turquoise and green |

\* \* \* \* First change \* \* \* \*

#### 4.11.0a.5 PDN Connection Establishment

During establishment of non-emergency PDN connection in the EPC, the UE and the SMF+PGW-C exchange information via PCO as described in clause 5.15.7 of TS 23.501 [2]. For UE with 5GC NAS capability disabled (i.e. N1 mode is disabled), the UE may also allocate a PDU Session ID and send it to the SMF+PGW-C via PCO. If the SMF+PGW-C supports more than one S-NSSAI and the APN is valid for more than one S-NSSAI, before the SMF+PGW-C provides an S-NSSAI to the UE, the SMF+PGW-C should check such that the selected S-NSSAI is among the UE's subscribed S-NSSAIs, and that the S-NSSAI is not subject to Network Slice-Specific Authentication and Authorization, by retrieving the Subscribed S-NSSAI from UDM using the Nudm\_SDM\_Get service operation (the SMF+PGW-C discovers and selects a UDM as described in clause 6.3.8 of TS 23.501 [2]). If the SMF+PGW-C is in a VPLMN, the SMF+PGW-C uses the Nnssf\_NSSelection\_Get service operation to retrieve a mapping of the Subscribed S-NSSAIs to Serving PLMN S-NSSAI values. If the S-NSSAIs supported by the SMF+PGW-C are all subject to NSSAA, then the SMF+PGW-C should reject the PDN connection establishment.

As described in TS 23.548 [74], during establishment of a PDN connection, a UE that hosts EEC(s) may indicate to the SMF+PGW-C, in the PCO, that it supports the ability to receive ECS address(es) via NAS and to transfer the ECS Address(es) to the EEC(s). If the UE indicated in the PCO that it supports the ability to receive ECS address(es) via NAS, the SMF+PGW-C may provide the ECS Address Configuration Information (as described in clause 6.5.2 of TS 23.548 [74]) to the UE in the PCO. The SMF+PGW-C may derive the Edge Configuration Server Information based on local configuration, the UE's location, and/or UE subscription information.

The SMF+PGW-C may use the bearer modification procedure without bearer QoS update to send the UE a PCO with updated ECS Address Configuration Information as defined in clause 6.5.2 of TS 23.548 [74] to the UE.

During establishment of non-emergency PDN connection in the EPC, if PGW-C+SMF is selected for a UE that has 5GS subscription, the SMF may be configured to obtain the subscribed IP index from UDM as part of subscription data using the Nudm\_SDM\_Get service operation (the PGW-C+SMF discovers and selects a UDM as described in clause 6.3.8 of TS 23.501 [2]).

During establishment of non-emergency PDN connection in the EPC, if SMF+PGW-C is selected for a UE that has 5GS subscription but does not support 5GC NAS and is accessing via EPC/E-UTRAN and if the SMF+PGW-C supports more than one S-NSSAI and the APN is valid for more than one S-NSSAI, the SMF+PGW-C+PGW-C may proceed as specified in first paragraph of this clause or select any S-NSSAI associated with the APN of the PDN connection. The SMF+PGW-C shall not provide any 5GS related parameters to the UE.

NOTE: The SMF+PGW-C knows that the UE does not support 5GS NAS if the UE does not provide PDU Session ID in PCO (see clause 5.15.7 of TS 23.501 [2]).

During establishment of emergency PDN connection:

- The SMF+PGW-C is to be derived from the emergency APN or to be statically configured in the Emergency Configuration Data in MME.

- 5GC interworking support with N26 or without N26 is determined based on UE's 5G NAS capability and local configuration (in the Emergency Configuration Data in MME).

- The S-NSSAI configured for the emergency APN in SMF+PGW-C is not sent to the UE by the SMF+PGW-C. One S-NSSAI is configured for the emergency APN.

During establishment of non-emergency PDN connection and emergency PDN connection, if SMF+PGW-C is selected for a UE that does not support 5GC NAS, the SMF+PGW-C creates unique PDU Session ID for each PDN connection of the UE.

The unique PDU Session ID can be created based on the EPS Bearer IDs assigned by the MME for the PDN Connections associated with the UE and not be in the range of PDU Session ID values that can be created by a 5GC NAS capable UE.

When the SMF+PGW-C establishes the PDN connection successfully, the SMF+PGW-C provides the ID of the PCF ID selected for the PDN connection in the UDM using the Nudm\_UECM\_Registration service operation.

A SMF+PGW-C may support L2TP as described in clause 4.3.2.4. In this case step 1 and step 7 of Figure 4.3.2.4‑1 correspond to a PDN Connection establishment and a SMF+PGW-C replaces the SMF in that Figure.

To support User Plane Integrity Protection with EPS and policies that Require User Plane integrity protection to be used, at PDN connection establishment, the MME shall indicate to the SMF+PGW-C (via the Serving GW) whether the UE and the MME support User Plane Integrity Protection in EPS. If the MME and the UE support User Plane Integrity Protection, then the SMF+PGW-C informs the MME of the User Plane integrity protection policy (Required, Preferred, Not Needed) applicable to the PDN connection on a per-EPS bearer basis.

\* \* \* \* Second change \* \* \* \*

### 4.11.1 N26 based Interworking Procedures

#### 4.11.1.1 General

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

Interworking between EPS and 5GS is supported with IP address preservation by assuming SSC mode 1.

When the UE is served by the 5GC, during PDU Session establishment and GBR QoS Flow establishment, SMF+PGW-C performs EPS QoS mappings, from the 5G QoS parameters obtained from the PCF, and allocates TFT with the PCC rules obtained from the PCF if PCC is deployed. Otherwise, EPS QoS mappings and TFT allocation are mapped by the SMF+PGW-C locally. The PGW+SMF ignores 5G QoS parameters that are not applicable to EPC (e.g. QoS Notification control). If a TFT is to be allocated for a downlink unidirectional EPS bearer mapped from a downlink only QoS Flow, the SMF+PGW-C shall allocate a TFT packet filter that effectively disallows any useful uplink packet as specified in TS 23.401 [13]. EPS Bearer IDs are allocated by the serving AMF requested by the SMF if the SMF determines that EPS Bearer IDs need to be assigned to the QoS Flows. For each PDU Session, EPS bearer IDs are allocated to the default EPS bearer and dedicated bearers. The SMF shall be able to determine the QoS flows that require EPS Bearer IDs, based on the QoS profile and operator policies.

NOTE 1: Based on operator policies, an SMF can map all non-GBR QoS flows to default EPS bearer in which case it requests only one EBI for all the non-GBR QoS flows. Alternatively, an SMF can also map one non-GBR QoS flow to one dedicated EPS bearer in which case it requests a dedicated EBI for non-GBR QoS flow that should be mapped to dedicated EPS bearer. In between these two extreme cases, the SMF can also map more than one (but not all) non-GBR QoS Flow to the same EPS bearer (either default EPS bearer or dedicated EPS bearer).

NOTE 2: To reduce the probability of AMF revoking the EBI corresponding to the QoS Flow associated with the default QoS rule, ARP priority level of dedicated QoS Flows can be set to higher value than that of the QoS Flow associated with the default QoS rule within the same PDU Session.

When a new QoS Flow needs to be mapped to an EPS Bearer ID that has already been assigned for an existing QoS Flow, the SMF includes the already assigned EPS Bearer ID in the QoS Flow description sent to the UE.

For Ethernet and Unstructured PDU Session Types, only EPS Bearer ID for the default EPS Bearer is allocated. The EPS Bearer IDs for these EPS bearers are provided to the SMF+PGW-C by the AMF, and are provided to the UE and NG-RAN by the SMF+PGW-C using N1 SM NAS message and N2 SM message. The UE is also provided with the mapped QoS parameters. The UE and the SMF+PGW-C store the association between the QoS Flow and the corresponding EBI and the EPS QoS parameters. When the QoS Flow is deleted e.g. due to PDU Session status synchronization or PDU Session Modification, the UE and the SMF+PGW-C delete any possibly existing EPS QoS parameters associated with the deleted QoS Flow.

In this release, for a PDU Session for a LADN or for Multi-homed IPv6 PDU Session, the SMF doesn't allocate any EBI or mapped QoS parameters.

For PDU Sessions with UP integrity protection of UP Security Enforcement Information set to Required, the SMF does not allocate any EBI or mapped QoS parameters unless the UE support User Plane Integrity Protection with EPS and the AMF supports the associated functionality.

If the UE supports User Plane Integrity Protection with EPS, as indicated in the S1 UE network capability, and the AMF supports the related functionality, the AMF indicates the UE support for EPS User Plane Integrity Protection to SMF. Then, for PDU Sessions with UP integrity protection of UP Security Enforcement Information set to Required, the SMF may perform the EPS bearer ID allocation procedure as described in clause 4.11.1.4.

If the MME indicates support for EPS User Plane Integrity Protection to SMF+PGW-c, the SMF+PGW-c provides User Plane Security Enforcement Information for the EPS bearer contexts to the MME (via the SGW).

For PDU Sessions with UP integrity protection of UP Security Enforcement Information set to Required, the SMF does not allocate any EBI or mapped QoS parameters.

When the UE is served by the EPC, during PDN connection establishment, the UE allocates the PDU Session ID and sends it to the SMF+PGW-C via PCO. During PDN Connection establishment and dedicated bearer establishment, SMF+PGW-C performs EPS QoS mappings, from the 5G QoS parameters obtained from the PCF, and allocates TFT with the PCC rules obtained from the PCF if PCC is deployed. Otherwise, EPS QoS mappings and TFT allocation are mapped by the SMF+PGW-C locally. Other 5G QoS parameters corresponding to the PDN connection, e.g. Session AMBR, and QoS rules and QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s), are sent to UE in PCO. The UE and the SMF+PGW-C store the association between the EPS Context and the PDU Session Context to use it in the case of handover from EPS to 5GS. During the EPS bearer establishment/modification procedure, QoS rules corresponding to the related EPS bearers are allocated and sent to UE in PCO. The 5G QoS parameters are stored in the UE and are to be used when the UE is handed over from EPS to the 5GS. The 5G QoS parameters may be provided to SMF+PGW-C by the PCF, if PCC is deployed. On mobility from EPS to 5GS, the UE sets the SSC mode of the mapped PDU Session to SSC mode 1. The UE and the SMF+PGW-C store the association between the EPS bearer and the corresponding 5G QoS Rules and QoS Flow level QoS parameters if needed for the QoS Flow(s) associated with the QoS rule(s). When the EPS bearer is deleted e.g. due to EPS bearer status synchronization or bearer deactivation, the UE and the SMF+PGW-C delete any possibly existing 5G QoS Rule(s) and QoS Flow level QoS parameters if any for the QoS Flow(s) associated with the QoS rule(s) associated with the deleted EPS bearer.

In the roaming case, if the VPLMN supports interworking with N26, the UE shall operate in Single Registration mode.

During the 5GS-EPS handover, indirect forwarding may apply for the downlink data forwarding performed as part of the handover. From its configuration data the AMF knows whether indirect forwarding applies and it requests to allocate downlink data forwarding paths on UPFs for indirect forwarding. From its configuration data the MME knows whether indirect forwarding applies and it requests to allocate downlink data forwarding paths on Serving GWs for indirect forwarding. It is configured on AMF and MME whether indirect downlink data forwarding does not apply, applies always or applies only for inter PLMN inter RAT handovers.

During the 5GS-EPS handover, direct forwarding may apply for the downlink data forwarding performed as part of the handover. From its configuration data the source RAN node knows whether direct forwarding applies and indicates to source CN the direct data forwarding is available.

During 5GS-EPS handover, on the target side, the CN informs the target RAN node whether data forwarding is possible or not.

During interworking from EPS to 5GS, as the SMF+PGW-C may have different IP addresses when being accessed over S5/S8 and N11/N16 respectively, the AMF shall discover the SMF instance by an NF/NF service discovery procedure using the FQDN for the S5/S8 interface received from the MME as a query parameter.

This is required for both non-roaming and roaming with local breakout, as well as for home routed roaming.

NOTE 3: As the AMF is not aware of the S-NSSAI assigned for the PDN Connection, the NF/NF service discovery used to find the SMF instance can use PLMN level NRF.

During interworking from 5GS to EPS, as a PDU Session may be released while the UE is served by EPS, if Small Data Rate Control is used the SMF+PGW-C obtains the Small Data Rate Control Status from the PGW-U+UPF in the N4 Session Modification procedure or from the SCEF+NEF and passes the Small Data Rate Control Status in the PDU Session Context Response to the AMF, for the AMF to store. The time to store the Small Data Rate Control Statuses is implementation specific. If the UE and PGW-U+UPF / SCEF+NEF have stored APN Rate Control parameters and optionally APN Rate Control Status they are only applied when the UE is served by EPS.

During interworking from 5GS to EPS, for PDU Sessions with UP integrity protection of UP Security Enforcement Information set to Required, the SMF+PGW-C does not provide the EPS bearer context unless both the UE and the MME support User Plane Integrity Protection with EPS.

During interworking from EPS to 5GS the UE and PGW-U+UPF / SCEF+NEF store the APN Rate Control parameters and APN Rate Control Status while the UE is served by 5GS, so they can be used if the UE moves back to EPS.

At EPS to 5GS mobility:

- The UE considers the PDN connections released if those PDN connections were established over EPS and for which the UE has not received mapped 5GS QoS parameters from the network.

NOTE 4: UE not receiving mapped 5GS QoS parameters from the network covers the case that a UE did not provide a PDU Session ID to the network when establishing a PDN connection while UE's N1 mode is disabled and the case that a UE provided PDU Session ID where the network (SMF+PGW-C) does not provide mapped 5GS parameters .

- The MME does not transfer to 5GS a PDN connection that does not support 5GS interworking, e.g. PDN connection was established on a stand-alone PGW, or 5GS interworking is restricted by subscription data.

\* \* \* \* 3rd 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.

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 clause 4.3.8.3 of TS 23.401 [13].

 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 the AMF sends Nsmf\_PDUSession\_ContextRequest to the V-SMF or the SMF+PGW-C, the AMF indicates whether the target MME supports User Plane Integrity Protection with 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. The AMF knows the MME capability to support User Plane integrity protection through local configuration but the actual EPS support may depend on the target E-UTRAN coverage (see step 14)

 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.

- If the UP integrity protection policy for the EPS bearer context is set to “Required”, the V-SMF or the PGW C+SMF shall not provide the EPS bearer context unless the MME capability indicates support for User Plane Integrity Protection with EPS and the UE supports User Plane Integrity Protection with EPS .

 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.

 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.

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 clause 5.2a of TS 23.251 [35] 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.

 If the MME does not indicate support of User Plane integrity protection or the UE does not support User Plane Integrity Protection with EPS, and the UP integrity protection policy is set to “Required” then the SMF+PGW-C releases the bearers associated with the PDN CONNECTION.

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.

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 clause 5.4.1 of TS 23.401 [13] 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.

\* \* \* \* 4th 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.

- When the AMF sends Nsmf\_PDUSession\_ContextRequest to the V-SMF or the SMF+PGW-C, the AMF indicates whether the target MME supports User Plane Integrity Protection with EPS.

 The above steps are 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 support User Plane Integrity Protection with EPS, 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.

If the UP integrity protection policy for the EPS bearer context is set to “Required”, the V-SMF or the PGW C+SMF shall not provide the EPS bearer context unless the MME supports User Plane Integrity Protection with EPS and the UE supports User Plane Integrity Protection with EPS.

 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.

 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 10, if the MME does not indicate support of User Plane integrity protection or the UE does not support User Plane Integrity Protection with EPS, and the UP integrity protection policy is set to “Required” then the SMF+PGW-C releases the bearers associated with the PDN CONNECTION.

 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 clause 5.2a of TS 23.251 [35] 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.

\* \* \* \* 5th change \* \* \* \*

#### 4.11.5.3 UE Requested PDU Session Establishment procedure

For PDU Session via 3GPP, the following impacts are applicable to clause 4.3.2.2 (UE Requested PDU Session Establishment procedure) to support interworking with EPS:

 In clause 4.3.2.2.1 Non-roaming and Roaming with local breakout:

- Step 1: In PDU Session Establishment Request message, the UE includes also the UE capability of Ethernet PDN type support in EPS to the SMF (or H-SMF in home routing roaming);

- Step 3: The AMF determines that a PDU Session supports EPS interworking with N26 or without N26, based on e.g. 5GMM capability (e.g. "S1 mode supported"), UE subscription data (e.g. Core Network Type Restriction to EPS, EPC interworking support per (S-NSSAI, subscribed DNN)) and network configuration if EPS interworking with N26 or without N26 is supported. The AMF then includes in the Nsmf\_PDUSession\_CreateSMContext an indication whether the PDU Session supports EPS Interworking with N26 or without N26.

 For PDU Session with Request Type "initial emergency request", the AMF decides the EPS interworking with N26 or without N26 based on 5GMM capability and local configuration.

 For PDU Session with Request Type "Existing Emergency PDU Session", the AMF shall use Emergency Information received from HSS+UDM and the S-NSSAI locally configured in Emergency Configuration Data.

 If the Request Type indicates "Existing PDU Session" the AMF selects the SMF based on SMF-ID or SMF+PGW-C FQDN received from UDM during the Registration or Subscription Profile Update Notification procedure. The case where the AMF does not recognize the PDU Session ID or the subscription context that the AMF received from UDM neither contains an SMF ID nor a SMF+PGW-C FQDN corresponding to the PDU Session ID constitutes as an error case.

NOTE 1: If the AMF receives from the UDM, for a PDU Session, both a SMF ID and a SMF+PGW-C FQDN, the SMF ID takes precedence.

 If the AMF has stored APN Rate Control Status and the PDU Session is considered a new first PDU Session to a DNN that is the same as the APN in stored APN Rate Control Status and interworking with EPC is enabled for this PDU Session, then the AMF sends the APN Rate Control Status to the SMF.

The AMF indicates to the SMF whether the UE support User Plane Integrity Protection with EPS and whether the AMF has associated functionality.

- Step 4: If the EPS Interworking indication received from AMF indicates that the UE supports EPS interworking and the SMF determines, based on the EPS interworking support indication from the AMF and additional UE subscription data (e.g. whether UP integrity protection of UP Security Enforcement Information is not set to required, EPS interworking is allowed for this DNN and S-NSSAI), that the PDU Session supports EPS interworking, the SMF+PGW-C FQDN for S5/S8 interface is included in the Nudm\_UECM\_Registration Request.

- Step 10a: If APN Rate Control Status is received from the AMF then the SMF provides the configured APN Rate Control Status to the PGW-U+UPF.

- Step 13 In PDU Session Establishment Accept message, the SMF also includes indication of Ethernet PDN type supported if the Ethernet PDN type is supported by both the UE and the SMF+PGW-C. The SMF and the UE stores the information if Ethernet PDN type is supported for later use when UE moves from 5GS to EPS.

- Step 16c: For PDU Session establishment with Request Type "initial PDU Session", if the SMF+PGW-C selects the same PCF as the PCF ID received from AMF as specified in clause 4.3.2.2.1 and if the PDU Session supports EPC interworking, the SMF provide the selected PCF ID in the UDM using the Nudm\_UECM\_Registration service operation.

NOTE 2: The subscription data "EPS interworking support indication" is used by AMF when determining the EPS interworking support for the PDU Session. Therefore, when the UE establishes the PDU Session via the 3GPP access, the SMF does not need to consider the same subscription data "EPS interworking support indication" again.

 In clause 4.3.2.2.2 Home-routed Roaming:

- Step 3a: Same impact as for step 3 for the non-roaming and roaming with local breakout case above.

- Step 5: Same impact as for step 10a for the Non-roaming and Roaming with Local Breakout case above.

- Step 6 The V-SMF pass the EPS interworking support indication received from the AMF to the H-SMF in Nsmf\_PDUSession\_Create.

- Step 7: If the EPS interworking indication received from V-SMF indicates that the PDU Session supports EPS interworking and the H-SMF determines, based on the EPS interworking support indication from the AMF and additional information such as UP integrity protection of UP Security Enforcement Information as described in clause 4.11.1.1, that the PDU Session supports EPS interworking, the SMF+PGW-C FQDN for S5/S8 interface is included in the Nudm\_UECM\_Registration Request.

- Step 15: Same impact as in step 13 for the non-roaming and roaming with local breakout case above with the difference that it's the home SMF+PGW-C that includes the indication of Ethernet PDN type supported.

 For interworking with the N26 interface, if the PDU Session supports interworking with EPS, the SMF+PGW-C invokes EBI allocation as described in clause 4.11.1.4.1.

For non-emergency PDU Session via non-3GPP, the AMF determines if EPS interworking is supported and sends the indication to the SMF in the same way as for PDU Session via 3GPP. The SMF makes the final decision on the EPS interworking in the same way as for PDU Session via 3GPP with the following modification:

- If the SMF does not receive the interworking indication, the SMF makes its decision based on subscription.

For emergency PDU Session via non-3GPP, the AMF determines if EPS interworking is supported and sends the indication to the SMF in the same way as for emergency PDU Session via 3GPP supporting EPS interworking.

\* \* \* \* End of changes \* \* \* \*