5GS Interworking using N26 Interface Support

This chapter describes the following topics:

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Feature Summary and Revision History

Summary Data

Applicable Product(s) or Functional Area	MME
Applicable Platform(s)	• ASR 5500 • VPC-DI • VPC-SI
Feature Default	• Disabled - Configuration Required
Related Changes in This Release	Not Applicable
Related Documentation	• *Command Line Interface Reference* • *MME Administration Guide*

Revision History

Revision Details	Release
Support is introduced for dynamic selection mechanism to select PGW-C+SMF and peer-AMF.	21.25

Revision Details	Release
The N26 interface for interworking with 5GS functionality is fully qualified in this release.	21.20.3
MME supports N26 interface between AMF in 5GC and MME in Evoloved Packet Core (EPC) to provide seamless session continuity for single registration mode UE. **Important** This feature is not fully qualified in this release, and is available only for testing purposes. For more information, contact your Cisco Account Representative.	21.20
First introduced. This release supports N26 Interface for interworking with 5GS functionality. **Important** This feature is not fully qualified in this release, and is available only for testing purposes. For more information, contact your Cisco Account Representative.	21.19

Feature Description

MME supports 5GS interworking with N26 interface in compliance with 3GPP 5GS standards. Interworking procedures using the N26 interface, enables the exchange of Mobilty Management (MM) and Session Management (SM) states between the source and target network.

5GS interworking with N26 interface, the User Equipment (UE) operates in the single registration mode. MME supports N26 interface between Access and Mobility Management Function (AMF) in 5GC and MME in EPC to provide seamless session continuity (for example, for voice services) for single registration mode UE. For the 3GPP access, the network keeps only one valid MM state for the UE either in the AMF or MME.

MME uses either the static or dynamic mechanism to select PGW-C+SMF and peer-AMF.

MME supports the following interworking procedures with N26 interface:

- Attach
- EPS to 5GS Mobility Registration
- 5GS to EPS Idle Mode Mobility
- 5GS to EPS Handover
- EPS to 5GS Handover
- 5GS to EPS Handover Cancel
- EPS to 5GS Handover Cancel

Supported IEs and AVPs

MME supports the following IEs for the 5GS interworking feature:

S1AP (eNodeB) Interface:

- **GUMMEI Type**— The S1-AP interface supports **mappedFrom5G** in the Globally Unique Mobility Management Entity Identifier (GUMMEI) type IE. If the UE was previously registered in 5GS, the UE provides a GUMMEI in Access Stratum signalling mapped from the 5G-GUTI and is indicated as **Mapped from 5G-GUTI**.
- **Handover Type**— This indicates the type of handover that was triggered in the source side. The Handover type IE currently supports **EPSto5GS** and **5GStoEPS** type.
- **Handover Restriction List**— This supports **Core Network Type Restrictions**, **NR Restriction in 5GS** and **Last NG-RAN PLMN Identity**.

Note MME currently includes only one serving PLMN in Core Network Restrictions Type IE.

- **Target ID**—This supports **Global RAN Node ID** and **Selected TAI(5GS TAI)**.

Note Global ng-eNB under Global RAN Node ID is currently not supported.

NAS (UE) Interface

- **UE Network Capability (N1-mode)** — MME supports N1-mode handling in theUE Network Capability IE. For UE that supports N1 mode, the UE sets the N1 mode bit to **N1 mode supported** in the UE network capability IE of the ATTACH REQUEST/TRACKING AREA UPDATE REQUEST message.
- **UE Status IE** — MME supports UE Status IE in the ATTACH REQUEST/TRACKING AREA UPDATE REQUEST message and provides the network with information related to the current UE registration status that is used for interworking with 5GS.
- **EPS Network Feature Support (IWK N26)** — MME supports IWK N26 indicator to specify whether interworking without N26 interface is supported or not in ATTACH ACCEPT/TAU ACCEPT message.

S6a (HSS) Interface

- **Interworking-5GS-Indicator AVP** — MME supports Interworking-5GS-Indicator to indicate whether the interworking between 5GS and EPS is subscribed or not subscribed for the APN.
- **Core-Network-Restrictions AVP** — MME supports Core-Network-Restrictions to indicate the types of Core Network that are disallowed for a user.
- **Access-Restriction-Data AVP** — MME supports bit 10 NR in 5GS Not Allowed to check whether NR is 5GS is Allowed or Not Allowed. The Access-Restriction-Data AVP is of type Unsigned32 type and contains a bit mask where each bit when set to 1 indicates a restriction.

S11 (SGW) Interface:

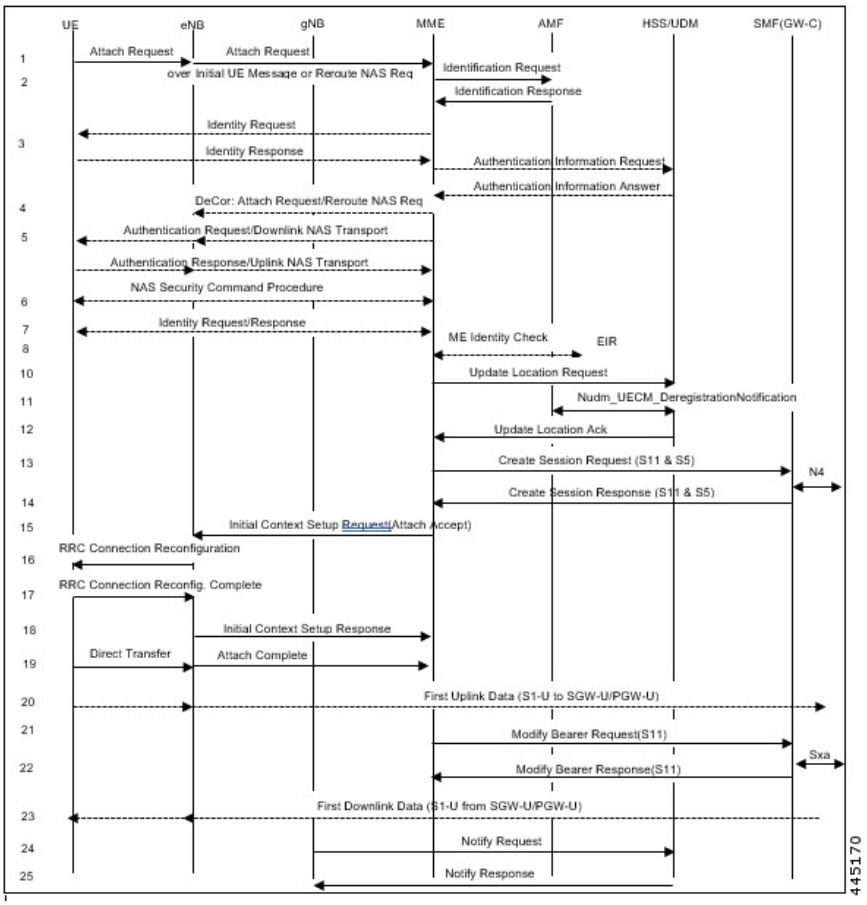
- **Indication Flag** — MME supports 5GSIWKI (5GS Interworking Indication) and REPREFI (Return Preferred Indication) flags.

How it Works

This section describes the call flow procedures related to 5GS interworking with N26 interface.

The following call flow describes the working of 5Gs to EPS attach procedure.

Figure 1: E-UTRAN Initial Attach Call Flow



E-UTRAN Initial Attach Procedure

The following table describes 5GS to EPS attach procedure.

Table 1: E-UTRAN Initial Attach Procedure

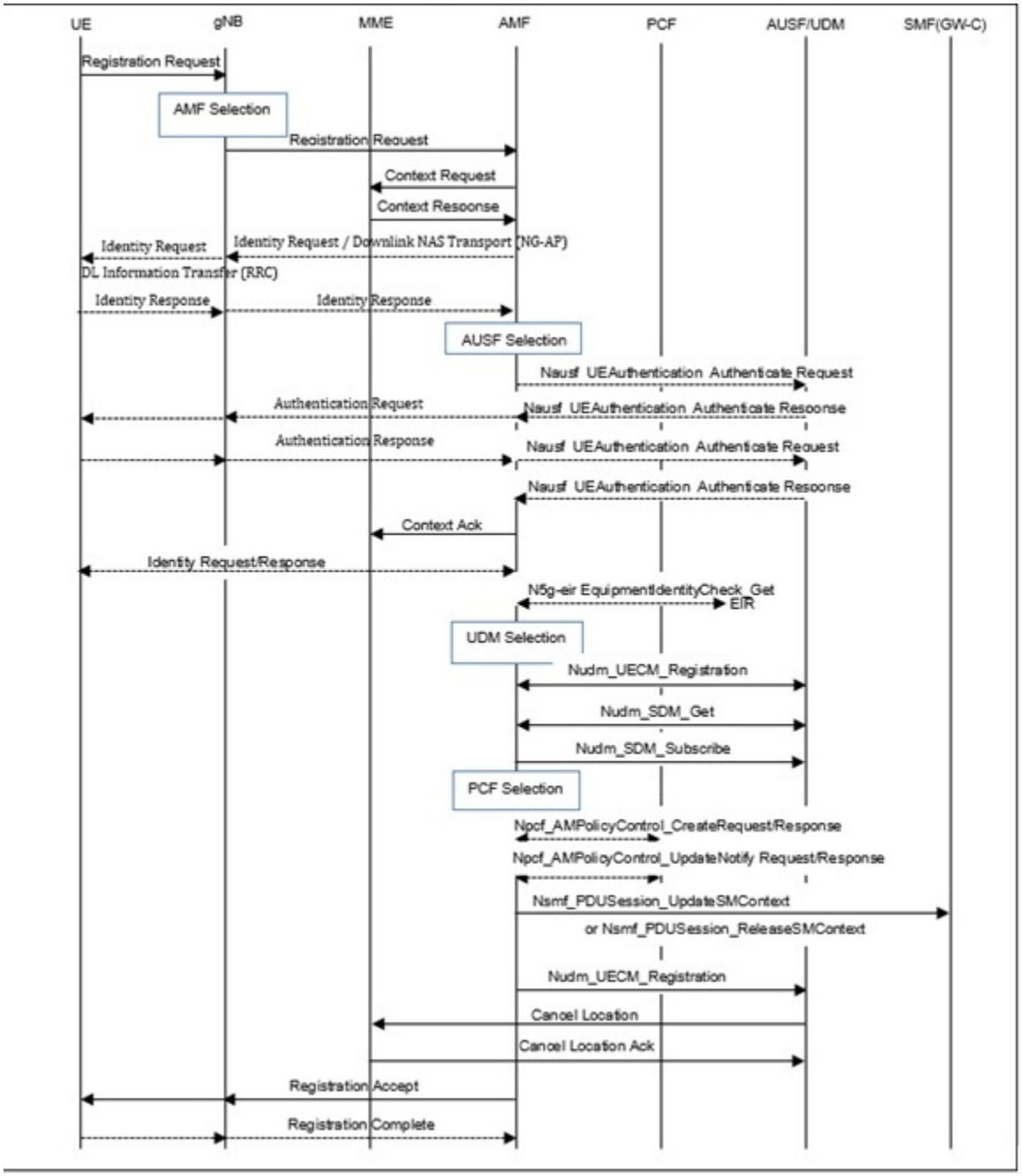
Step	Description
1	Attach Request is carried over Initial UE Message with following conditions: • UE includes N1-mode capability in the **UE Network Capability IE**. • UE includes GUMMEI in the S1-AP message and. indicates that GUMMEI is Mapped from 5G-GUTI. • UE includes a GUTI, mapped from 5G-GUTI into the EPS mobile identity IE, includes old GUTI type IE with GUTI type set to **native GUTI** and includes the UE status IE with a 5GMM registration status set to **UE is in 5GMM-DEREGISTERED state**.
2	MME construct the 5G-GUTI from the received GUTI IE according to the mapping relationship between GUTI and 5G-GUTI defined in 3GPP TS 23.003. MME uses the constructed 5G GUTI to determine the peer AMF address based on DNS or local Static AMF GUAMI configuration. If MME is unable to find the peer AMF address, the new MME sends an Identity Request to the UE to request the IMSI. The UE responds with Identity Response (IMSI).
3	MME sends Identification Request message to the selected peer AMF. .
4	AMF responds with Identification Response message **Note** MME sends Identification Request to the peer AMF irrespective of the "n1-mode" configuration in CC profile (or) MME Service and the feature support check is performed after receiving "Identification Response" message from peer AMF. If the feature support is disabled (or) the UE is unknown in the old AMF, MME initiates Identity procedure with UE.
5	MME sends Update Location Request to HSS and will not set the Dual-registration 5G-indication in ULR-Flag.
6	MME processes and handles the below AVP in the ULA from HSS. MME uses the received information for Mobility restrictions and PGW-C+SMF gateway selection: • Interworking-5GS-Indicator • Core-Network-Restriction • Access-Restriction-Data (NR in 5GS Not Allowed) AVP
7	MME selects PGW-C+SMF based on UE Network capability and mobility restrictions based on the following mechanisms: • Static configuration • Dynamic DNS configuration
8	MME sets the **5GS Interworking Indication** in Indication flags in the Create Session Request and sends to the selected P-GW-C+SMF gateway. MME does not set the Indication bit if Standalone P-GW-C is selected.

Step	Description
9	If the MME receives ePCO from the UE during the Initial Attach or UE requested PDN Connectivity procedures, the MME forwards the ePCO IE to the SGW, if the MME supports ePCO. The SGW shall also forward it to the PGW if the SGW supports ePCO.
10	If UE supports N1 mode in UE network capability, and the Interworking-5GS-Indicator is set to subscribed, MME sets IWKN26 bit to **Interworking without N26 interface not supported** in the Attach Accept message.

EPS to 5GS Mobility Registration Call Flow

The following call flow describes the registration procedure from EPS to 5GS Mobility when, N26 interface is supported for idle and connected states.

Figure 2: EPS to 5GS Mobility Registration Call Flow



The following table describes the procedure to register from EPS to 5GS.

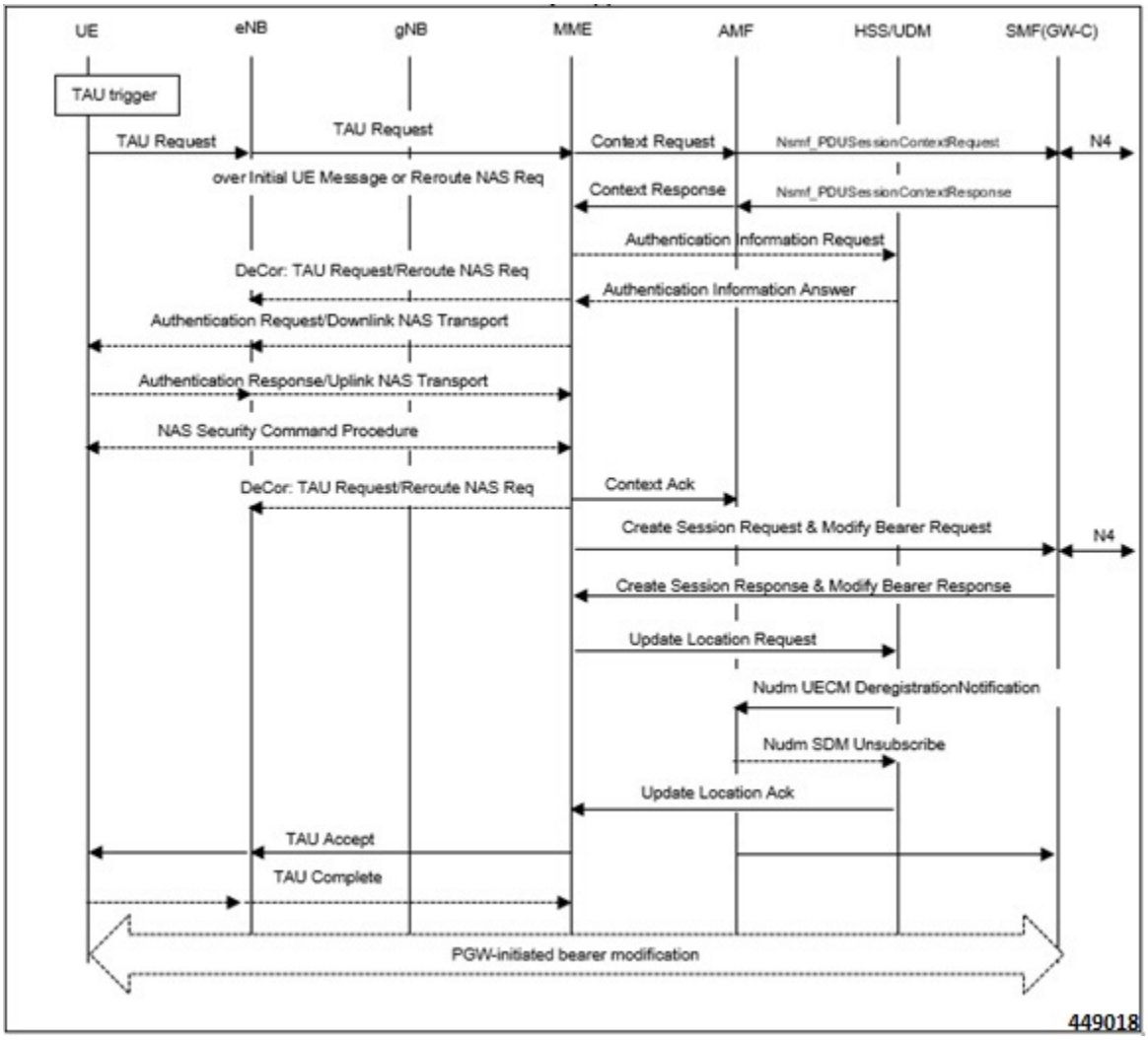
Table 2: EPS to 5GS Mobility Registration Procedure

Step	Description
1	For IDLE mode mobility, the target 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. The MME validates the TAU message. **Note** • MME supports FTEID Interface types **S10/N26 MME GTP-C interface (12)** and **N26 AMF GTP-C interface (40)** received in the **Context Request** message from peer AMF. • MME would use the RAT type NR in the **Context Request** message to determine if the peer is AMF.
2	MME includes EPS MM Context, IMSI, ME Identity, UE EPS security context, UE Network Capability, and EPS Bearer context(s) in the Context Response message and sends to the peer AMF. The MME EPS Bearer context includes for each EPS PDN connection the IP address and FQDN for the S5/S8 interface of the PGW-C+SMF and APN. MME also includes in the Context Response 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 stores the last used EPS PLMN ID in UE Context. MME sends Context Response failure if feature support is disabled, Unknown RAT type other than NR is received (or) mobility is restricted.
3	The target AMF sends Context Acknowledge (Serving GW change indication) to MME.
4	HSS+UDM cancels the location of the UE in the MME.

5GS to EPS Idle Mode Mobility Call Flow

The following call flow describes the idle and connected states.

Figure 3: 5GS to EPS Idle Mode Mobility Call Flow



UE performs Tracking Area Update (TAU) procedure in E-UTRA/EPS when it moves from NG-RAN/5GS to E-UTRAN/EPS coverage area. The procedure involves a Tracking Area Update to EPC and setup of default EPS bearer and dedicated bearers in EPC and re-activation, if required.

Table 3: 5GS to EPS Idle Mode Mobility Procedure

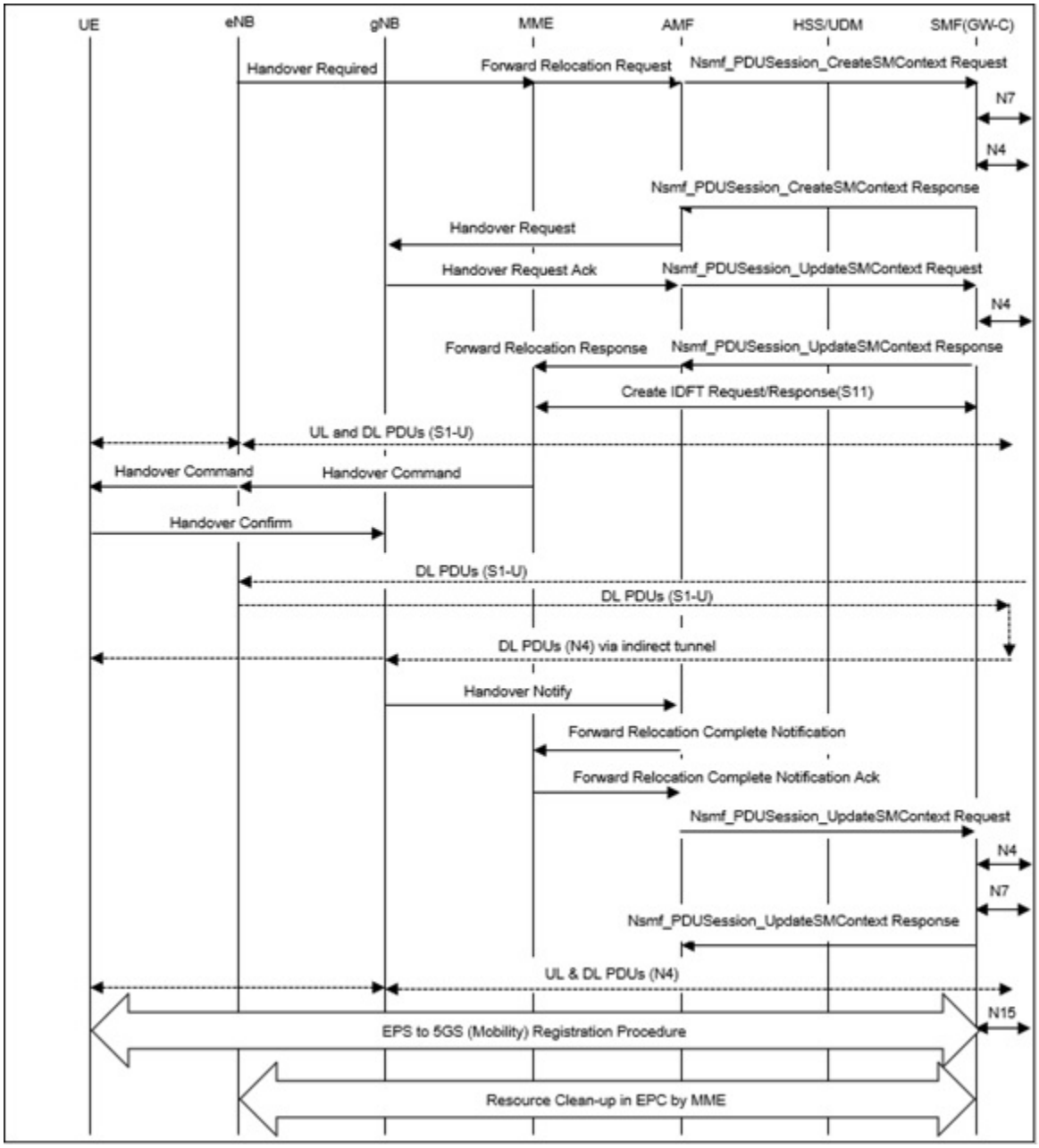
Step	Description
1	Tracking Area Update Request is carried over Initial UE Message with following conditions: • UE includes N1-mode capability in the **UE Network Capability** IE. • UE includes GUMMEI in the S1-AP message and indicates that GUMMEI is Mapped from 5G-GUTI. • UE includes a GUTI, mapped from 5G-GUTI into the EPS mobile identity IE, includes old GUTI type IE with GUTI type set to **native GUTI** and includes the UE status IE with 5GMM registration status set to **UE is in 5GMM-REGISTERED** state.

Step	Description
2	MME constructs the 5G-GUTI from the received GUTI IE according to the mapping relationship between GUTI and 5G-GUTI defined in 3GPP TS 23.003. MME uses the constructed 5G GUTI to determine the peer AMF address based on DNS or local Static AMF GUAMI configuration. If MME is unable to find the peer AMF address, the new MME rejects the TAU Request.
3	MME sends Context Request message to the selected peer AMF.
4	The AMF responds with a Context Response message carrying mapped MM context (including mapped security context), UUT, 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 PDN GW Address and TEID(s) is part of the EPS Bearer Context for PDN connection in Context Response. However, SGW S11 IP address and TEID for Control Plane is not provided by AMF. **Note** . • MME supports **S10/N26 MME GTP-C** and **N26 AMF GTP-C** FTEID Interface types from peer AMF. • MME sends Context Request to the peer AMF irrespective of the **n1 mode** configuration in CC profile (or) MME Service and the feature support check is performed after receiving **Contect Response** message from peer AMF. If the feature support is disabled, MME rejects the TAU Request and sends the Context Acknowledgement failure.
5	MME selects new SGW-C and send Create Session Request towards the SGW. MME will set the **5GS Interworking Indication** in Indication Flags in the Create Session Request message.
6	MME sends Update Location Request to HSS and will not set the Dual-registration 5G-indication in ULR-Flag.
7	MME processes and handles the following AVPs in the ULA from HSS. • Interworking-5GS-Indicator • Core-Network-Restriction • Access-Restriction-Data (NR in 5GS Not Allowed) AVP. MME uses the received information for Mobility restrictions and PGW-C+SMF gateway selection.
8	If UE supports N1 mode in UE network capability, and the Interworking-5GS-Indicator is set to subscribed, MME shall set IWKN26 bit to “Interworking without N26 interface not supported” in TAU Accept.

EPS to 5GS Handover Call Flow

The following call flow describes the EPS to 5GS handover using N26 interface.

Figure 4: EPS to 5GS Handover Call Flow



The following table describes the handover procedure from EPS to 5GS using N26 interface. 5GS Mobility Registration Procedure is performed, and steps from Context Request to Context Acknowledgement are skipped during the handover to 5GS.

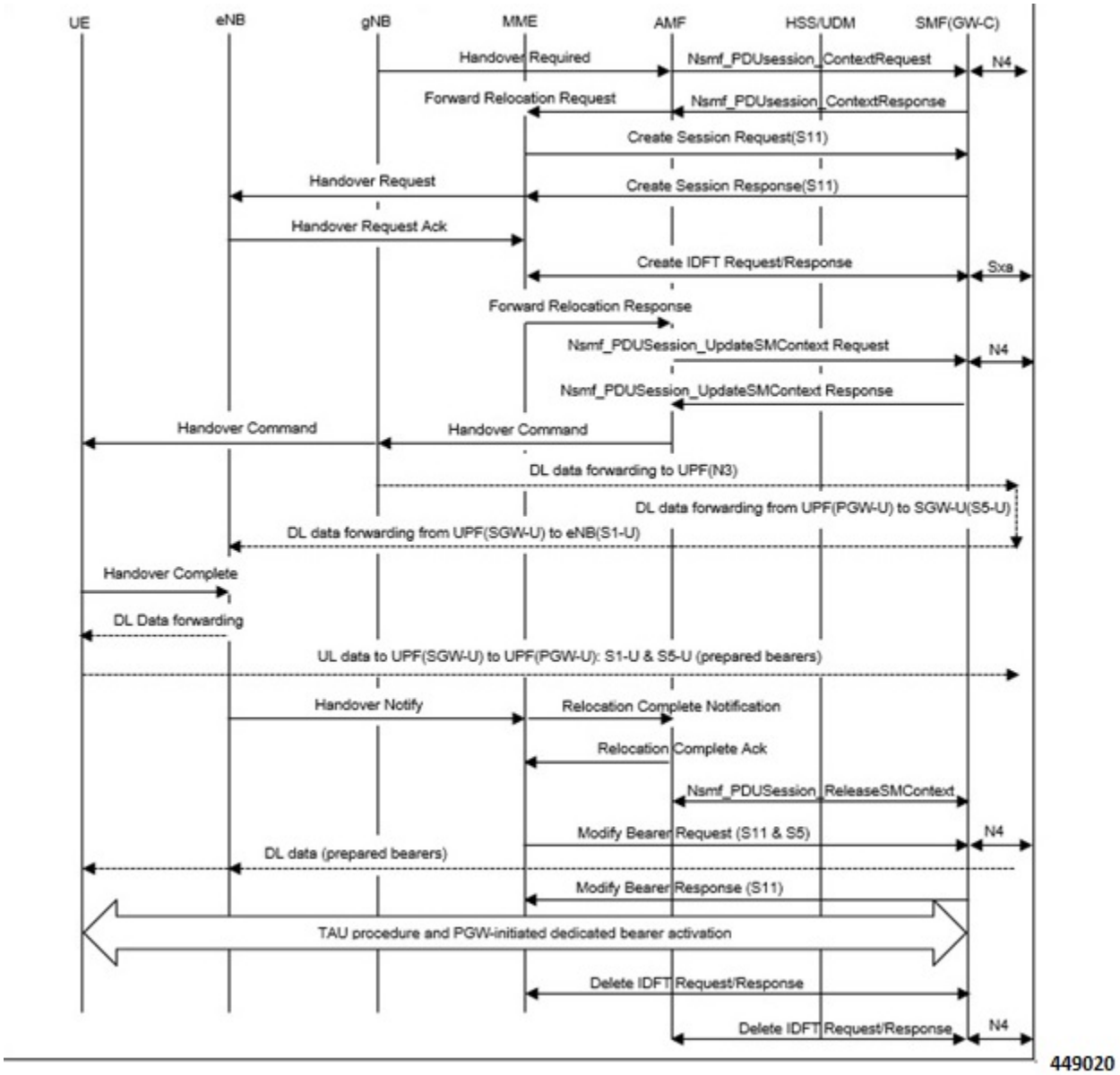
Table 4: EPS to 5GS Handover Procedure

Step	Description
1	MME receives Handover Required from eNB with the Handover type set **EPSto5GS**, Target ID with Global gNB ID and selected 5GS TAI information. **Note** Global ng-eNB is currently not supported.
2	MME uses the 5GS TAI information to determine the peer AMF address based on DNS or local Static AMF TAI configuration. If MME is unable to find the peer AMF address or the feature is disabled, MME sends Handover preparation failure to eNB.
3	MME sends Forward Relocation Request message to the selected peer AMF with the following information: • MME includes EPS MM Context, IMSI, ME Identity, UE security context, UE Network Capability, and EPS Bearer context(s) in the Forward Relocation Request message. The MME EPS Bearer context(s) includes for each EPS PDN connection the IP address and FQDN for the S5/S8 interface of the PGW-C+SMF and APN, and for each EPS bearer the IP address and CN Tunnel Info at the UPF+PGW-U for uplink traffic. • MME includes an additional optional parameter Return preferred; Return preferred is an optional indication provided by the MME to indicate 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 stores the last used EPS PLMN ID in the UE Context.
4	MME receives Forward Relocation Response (Cause, Target to Source Transparent Container, S-GW change indication, CN Tunnel Info for data forwarding, EPS Bearer Setup List, AMF Tunnel Endpoint Identifier for Control Plane, Addresses and TEIDs) from AMF. The EPS Bearer Setup list is the combination of EPS Bearer Setup list from different P-GW-C+SMF(s). **Note** MME supports **S10/N26 MME GTP-C** and **N26 AMF GTP-C** FTEID Interface types from peer AMF.
5	The source MME sends Create Indirect Data Forwarding Tunnel Request (addresses and TEIDs for forwarding) to the S-GW. If the S-GW is relocated it includes the tunnel identifier to the target S-GW. The S-GW responds with a Create Indirect Data Forwarding Tunnel Response (S-GW addresses and TEIDs for forwarding) message to the source MME.
6	The source MME sends a Handover Command (Target to Source transparent container, Bearers subject to forwarding, Bearers to Release) message to the source eNodeB. The Bearers subject to forwarding includes list of addresses and TEIDs allocated for forwarding. The Bearers to Release includes the list of bearers to be released.
7	The NG-RAN notifies the AMF that UE is handover over to NG-RAN and AMF sends Forward Relocation Complete Notification message to the source MME. The source MME in response sends a Forward Relocation Complete Acknowledge message to the target AMF.

5GS to EPS Handover Call Flow

The following call flow describes the 5GS to EPS handover using N26 interface.

Figure 5: 5GS to EPS Handover Call Flow



The following table describes the handover procedure from 5GS to EPS using N26 interface.

Table 5: 5GS to EPS Handover Procedure

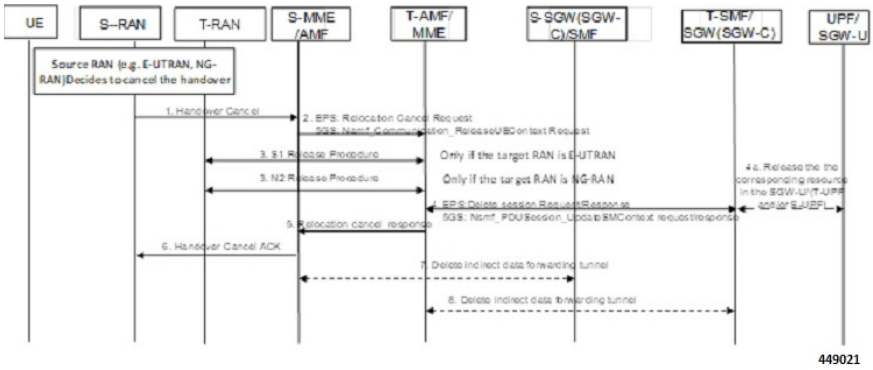
Step	Description
1	MME receives Forward Relocation Request message from AMF. AMF shall include **Return preferred Indication** to indicate preferred return of the UE to the 5GS PLMN at a later access change to a 5GS shared network. AMF includes reserved S-GW address and TEID for both the control plane or EPS bearers in the message. **Note** • MME supports FTEID Interface types **S10/N26 MME GTP-C interface (12)** and **N26 AMF GTP-C interface (40)** received in the **Context Request** message from peer AMF. • MME would use the SGW-C FTEID reserved **TEID** values in the Forward Relocation Request message to determine if the peer is AMF. • If the feature support is disabled, the MME sends Forward Relocation Response failure to peer AMF with cause **Service not supported** .
2	MME selects a new S-GW-C and would send Create Session Request to S-GW and receives Create Session Response from S-GW.
3	MME sends Handover Request message towards eNB with Handover type “5GStoEPS” and includes the Handover Restriction list for eNodeB functions.
4	The target eNodeB sends a Handover Request Acknowledge (EPS Bearer Setup list, EPS Bearers failed to setup list Target to Source transparent container) message to the target MME. The EPS Bearer Setup list includes a list of addresses and TEIDs allocated at the target eNodeB for downlink traffic on S1-U reference point (one TEID per bearer) and addresses and TEIDs for receiving forwarded data if necessary.
5	IDFT enable MME initiate create IDFT Request msg to SMF/GW-C and receives create IDFT response msg from SMF/GW-C.
6	The target MME sends a Forward Relocation Response (Cause, Target to Source transparent container, Serving GW change indication, EPS Bearer Setup List, Addresses and TEIDs) message to the source MME. **Note** For indirect forwarding, this message includes S-GW Address and TEIDs for indirect forwarding (source or target). S-GW change indication indicates that a new S-GW has been selected.
7	The target eNodeB sends a Handover Notify (TAI+ECGI, Local Home Network ID) message to the target MME.
8	The target MME sends a Relocation Complete Notification message to the source AMF. The AMF acknowledges MME with Relocation Complete Acknowledgement message.
9	MME sends Modify bearer request to S-GW and receives Modify bearer response from S-GW.
10	UE initiates Connected mode Tracking Area Update procedure towards MME.

Step	Description
11	If PCC is deployed, the PCF provides the previously removed PCC rules to the P-GW-C+SMF, which triggers the P-GW-C+SMF to initiate dedicated bearer activation procedure and the dedicated Bearer gets activated at MME.

Handover Cancellation Procedure

This section describes Handover cancelation call flow and procedures from EPS to 5GS and from 5GS to EPS.

Figure 6: EPS to 5GS Handover Cancel Call Flow



EPS to 5GS Handover Cancel Procedure

1. The source eNB decides to cancel the previously requested relocation of Handover resources. This may be due to not enough accepted bearers, UE returned to source cell or any other reason.
2. MME terminates the relocation towards the AMF by sending a Relocation Cancel Request message to AMF. MME also resumes operation on the resources in the source side.
3. The AMF acknowledges the release of all resources on the target side by returning a Relocation Cancel Response (Cause) message to the source MME.
4. If indirect forwarding tunnel is setup during handover preparation, then cancellation of handover triggers the MME to send a Delete Indirect Data Forwarding Tunnel Request message to the S-GW to release the temporary resources used for indirect forwarding.

5GS to EPS Handover Cancel Procedure

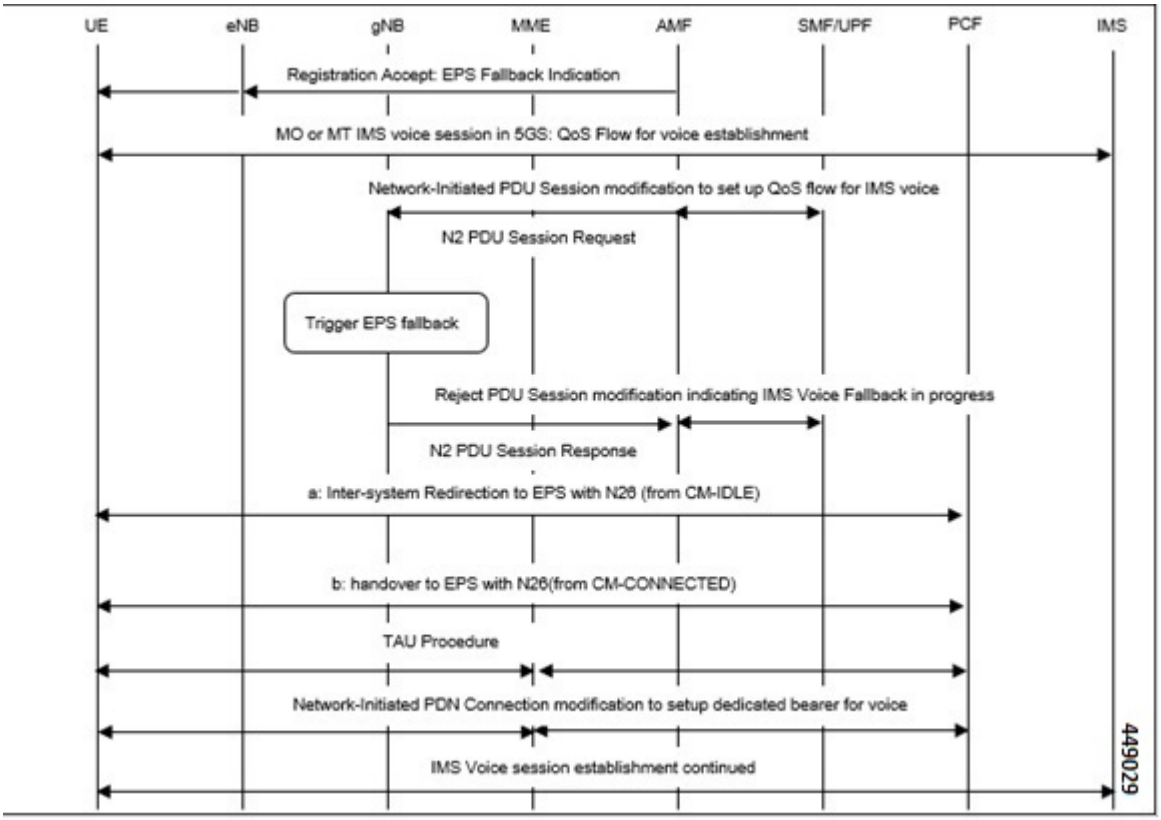
1. MME receives **Relocation Cancel Request** from AMF.
2. MME triggers release of resources towards target RAN node. The target RAN node releases the RAN resource allocated for the handover.
3. MME sends the **Delete session request** (IMSI, Relocation Cancel Indication) to the S-GW/S-GW-C. Based on the Relocation Cancel Indication, MME deletes the session resources established during handover preparation phase in S-GW (S-GW-C and S-GW-U).
4. MME sends **Relocation Cancel Response** towards the AMF.

5. AMF responds with handover cancel ACK towards the source RAN.
6. If indirect forwarding tunnel is setup during handover preparation phase, then cancellation of handover triggers MME to release the temporary resources used for indirect forwarding.

EPS Fallback for IMS Voice Support

MME supports EPS fallback for IMS voice according to 3GPP 23.502.

Figure 7: EPS Fallback for IMS Voice



Combined PGW-C and SMF Selection Procedure

MME supports DNS and Static PGW-C/SMF combined Gateway selection. You can configure PGW-C+SMF in MME Service and in APN profile configuration commands for static gateway selection. 5GSIWKI is set when combined PGW-C/SMF node is selected.

The following steps explain the static based combined P-GW-C/SMF selection procedure and how the fallback to the next available option happens if the selection fails:

1. MME chooses Combined PGW-C/SMF node that supports UE usage type and collocation with S-GW.
2. If step 1 fails, MME selects the Combined PGW-C+SMF node that supports UE usage type.
3. If step 2 fails, MME selects the Combined PGW-C+SMF node that supports collocation with S-GW.

4. If step 3 fails, MME selects the Combined PGW-C+SMF node.
5. If step 4 fails, MME selects the gateway based on UE usage type and standalone PGW collocation.
6. If step 5 fails, MME selects the standalone PGW that supports UE usage type.
7. If step 6 fails, MME selects the gateway that supports standalone PGW collocation.
8. If step 7 fails, MME selects any gateway from all configured entries.

The following steps explain the DNS-based combined PGW-C+SMF selection procedure and how fallback occurs to the next available option if the selection fails:

1. MME selects a gateway matching the UE Usage type, DCNR, and SMF network capability.
2. If step 1 fails, MME selects the gateway matching the DCNR and SMF network capability.
3. If step 2 fails, MME selects the gateway matching the UE usage type and SMF network capability.
4. If step 3 fails, MME selects the gateway matching the SMF network capability.
5. If step 4 fails, MME selects the gateway matching the UE usage type and DCNR network capability.
6. If step 5 fails, MME selects the gateway matching the DCNR network capability.
7. If step 6 fails, MME selects the gateway matching the UE usage type.
8. If step 7 fails, MME selects the gateway matching the default service parameter.
9. If step 8 fails, MME selects the gateway based on local static configuration.

Note The above steps are only for reference purpose based on probable combination where UE/MME supports UUT, DCNR and SMF capability. The selection order varies/depends based on the DNS response, UE capability and MME configuration.

Limitations

This section describes the known limitations for the N26 interface functionality:

- Configuration Transfer Tunnel message is not supported.
- Feature-specific optional IEs are not supported. For example, Extended Trace Information IE.
- Default EGTP service is used for GTPv2 messages on N26 interface.
- A maximum of 32 peer-AMF entries can be configured for GUAMI or TAI configuration.
- NBIoT and CIOT optimization is not supported.
- PGW-C+SMF selection for Emergency Attach or Emergency PDN is not supported.

Supported Standards

The N26 feature support is compliant with the following standards:

- 3GPP 23.401 version 15.10.0 - General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access
- 3GPP 23.501 version 15.8.0 - System architecture for the 5G System (5GS
- 3GPP 23.502 version 15.8.0 - Procedures for the 5G System (5GS)
- 3GPP 33.501 version 15.7.0 - Security architecture and procedures for 5G System
- 3GPP 24.301 version 15.8.0 - Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS)
- 3GPP 36.413 version 15.8.0 - S1 Application Protocol (S1AP)
- 3GPP 29.272 version 15.10.0 - Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol
- 3GPP 29.274 version 15.9.0 - Tunnelling Protocol for Control plane (GTPv2-C)
- 3GPP 23.003 version 15.8.0 - Numbering, addressing and identification
- 3GPP 29.303 version 15.5.0 - Domain Name System Procedures

Configuring N26 Interface for MME

This section describes the configuration of 5GS Interworking support using N26 interface on MME.

Configuring 5GS Interworking using N26 Interface in Call Control Profile

Use the following configuration to enable 5GS Interworking support using N26 interface.

```
configure
  call-control-profile profile_name
    [ no | remove] n1-mode 5gs-interworking-with-n26
    end
```

NOTES:

- **call-control-profile** *profile_name*: Creates an instance of a call control profile. *profile_name* specifies the name of a call control profile entered as an alphanumeric string of 1-64 characters.
- **n1-mode** : Configures interworking with 5GS for UEs supporting N1 mode.
- **5gs-interworking-with-n26** : Enables 5GS-EPS interworking with N26 interface.
- **no** : Disables 5GS-EPS interworking with N26 interface.
- **remove**: Removes the configuration from the Call Control profile and the MME Service configuration applies.

Peer AMF Configuration

Configure Peer AMF GUAMI

Use the following configuration to statically configure the peer AMF address in MME service.

```
configure
  context context_name
    mme service service_name
      peer-amf guami { mcc mcc_value mnc mnc_value region-id region_id set-id
 set_id pointer pointer_value address { ipv4_address | ipv6_address }
      [ no ] peer-amf guami { mcc mcc_value mnc mnc_value region-id region_id
 set-id set_id pointer pointer_value }
      end
```

NOTES:

- **mme-service** *service_name*: Configures MME Service. *mme_service* must be an alphanumeric string of 1-63 characters.
- **peer-amf**: Configures a Peer AMF for 5Gs interworking.
- **guami**: Configures Globally Unique AMF Identifier for this Peer.
- **mcc**: Configures the Mobile Country Code for this Peer AMF.
- **mnc**: Configures the Mobile Network Code for this Peer AMF.
- **region-id**: Configures the Region Identifier for this Peer AMF.
- **set-id** : Configures the Set Identifier for this Peer AMF.
- **pointer**: Configures the Pointer value for this Peer AMF.
- **address**: Configures address of Peer AMF. Must be followed by address using dotted-decimal notation. This can also be specified as an IPv6 address.

Configure Peer AMF TAI

```
configure
  context context_name
    mme service service_name
     peer-amf tai-match priority { val mccmcc_value mnc mnc_value tac area_code
 address { ipv4_address | ipv6_address }
      [ no ] peer-amf tai-match priority  val
      end
```

NOTES:

- **mme-service** *service_name*: Configures MME Service. *mme_service* must be an alphanumeric string of 1-63 characters.
- **peer-amf**: Configures a Peer AMF for 5Gs interworking.
- **tai-match**: Configures 5GS Tracking Area Information match for this Peer AMF.
- **mcc**: Configures the Mobile Country Code for this Peer AMF.
- **mnc**: Configures the Mobile Network Code for this Peer AMF.
- **address**: Configures address of Peer AMF. Must be followed by address using dotted-decimal notation. This can also be specified as an IPv6 address.

Configure PGW-C with SMF Combined

Use the following command to configure the PGW-C with smf combined configuration in mme-service.

```
configure
   context context_name
      mme service service_name
         [ no ] pgw-address ipv4_address | ipv6_address ue-usage-type  UUT_Value
collocated-node collocated_name smf-combined   weightweight_value
        end
```

Use the following command to configure the P-GW-C with smf combined configuration in apn-call-control-profile.

```
configure
   context context_name
      apn profile profile_name
         [ no ] pgw-address ipv4_address | ipv6_address ue-usage-type  UUT_Value
collocated-node collocated_name smf-combined
        end
```

NOTES:

- **mme-service** *service_name*: Configures MME Service. *mme_service* must be an alphanumeric string of 1-63 characters.
- **pgw-address**: Configures p-gw address. Must be followed by address using dotted-decimal notation. This can also be specified as an IPv6 address.
- **ue-usage-type** : Configures UE usage type for disconnecting PDN for up service area.
- **collocated-node**: Configures the Collocation name to select the collocated S/PGW node IP addresses and/or P-GW Node name for 5GS Interworking.

Note Make sure to configure P-GW Node name under **Collocated-node** for 5GS interworking with N26 interface. This configuration allows P-GW Node Name IE to include the configured name in **Context Response** and **Forward relocation Request** messages from MME to AMF over N26 interface.

- **smf-combined** : Configures a combined P-GW and SMF.
- **no**: Removes the configured PGW address.

Configuring DNS Peer AMF

Use the following sample configuration to configure peer-AMF selection using the DNS interface:

```
configure
   mme-service mme_svc_name
      dns peer-amf
      end
```

NOTES:

- **dns peer-amf**: MME sends a DNS query to the DNS server for selecting AMF.

Note The **dns pgw** command under MME Service and Call Control Profile can be reused to configure DNS to select the PGW-C+SMF address.

Monitoring and Troubleshooting

This section provides information regarding show commands and outputs available to monitor and troubleshoot the N26 Interface feature.

Show Commands and Outputs

show call-control-profile full name

The output of this command includes the **5GS-EPS interworking with N26 interface** field, which indicates if the 5GS-EPS interworking with N26 interface feature is enabled or disabled under N1 mode at call control profile.

show mme-service all

The output of this command includes the following fields:

- **5GS-EPS interworking with N26 interface**
- **Peer AMF GUAMI**
- **Peer AMF TAI**

show mme-service statistics output

The output of this command includes the following fields:

Field	Description
Outbound relocation using EPS-5GS Mobility procedure	Displays the number of attempts, successes, and failures of outbound relocation using EPS-5GS mobility procedure.
Outbound relocation using EPS-5GS HO procedure	Displays the number of attempts, successes, and failures of outbound relocation using EPS-5GS handover procedure.
Inbound relocation using EPS-5GS Mobility procedure	Displays the number of attempts, successes, and failures of Inbound relocation using EPS-5GS mobility procedure.
Inbound relocation using EPS-5GS HO procedure	Displays the number of attempts, successes, and failures of Inbound relocation using EPS-5GS handover procedure.

show mme-service statistics recovered-values output

The output of this command includes the following fields:

Field	Description
Outbound relocation using EPS-5GS Mobility procedure	Displays the number of attempts, successes, and failures of outbound relocation using EPS-5GS mobility procedure.
Outbound relocation using EPS-5GS HO procedure	Displays the number of attempts, successes, and failures of outbound relocation using EPS-5GS handover procedure.
Inbound relocation using EPS-5GS Mobility procedure	Displays the number of attempts, successes, and failures of outbound relocation using EPS-5GS mobility procedure.
Inbound relocation using EPS-5GS HO procedure	Displays the number of attempts, successes, and failures of Inbound relocation using EPS-5GS handover procedure.

show mme-service statistics 5gs-interworking

Table 6: show mme-service statistics 5gs-interworking Command Output Descriptions

Field	Description
Attach Request Rcvd	Displays the number of Attach Request messages received with UE advertising N1 Mode support.
TAU Request Rcvd	Displays the number of TAU Request messages received with UE advertising N1 Mode support.
SMF-Combined	Displays the number of times P-GW DNS selection procedures performed with DNS RR including the N1 Mode network capability.
NR Capable	Displays the number of times P-GW DNS selection procedures performed with DNS RR including the NR network capability.
Common	Displays the number of times P-GW DNS selection procedures performed with DNS RR excluding the N1 Mode network capability.
PGW Local Config	Displays the number of times P-GW selection procedures performed with locally configured P-GW address, without considering the N1 Mode network capability.

show session disconnect-reasons

The output of this command includes the following fields:

Field	Description
mme-reselection-to-amf	This disconnect reason is incremented, if the subscriber reselects AMF as part of the EPS to 5GS Idle Mobility Registration procedure.

Field	Description
mme-relocation-to-amf	This disconnect reason is incremented, if the subscriber relocates to AMF as part of the EPS to 5GS Handover procedure.

Bulk Statistics

MME Schema

MME Service Bulk Statistics

The following MME Service bulk statistics are included in the MME Schema.

Counters	Description
out-mob-4gto5g-n26-attempted	Displays the total number of attempted outbound relocation using EPS to 5GS Idle mode mobility procedure in N26 interface.
out-mob-4gto5g-n26-success	Displays the total number of successful outbound relocation using EPS to 5GS Idle mode mobility procedure in N26 interface
out-mob-4gto5g-n26-failures	Displays the total number of failed outbound relocation using EPS to 5GS Idle mode mobility procedure in N26 interface.
out-ho-4gto5g-n26-attempted	Displays the total number of attempted outbound relocation using EPS to 5GS Handover procedure in N26 interface.
out-ho-4gto5g-n26-success,	Displays the total number of successful outbound relocation using EPS to 5GS Handover procedure in N26 interface.
out-ho-4gto5g-n26-failures	Displays the total number of failed outbound relocation using EPS to 5GS Handover procedure in N26 interface.
in-mob-5gto4g-n26-attempted	Displays the total number of attempted inbound relocation using 5GS to EPS Idle mode mobility procedure in N26 interface.
in-mob-5gto4g-n26-success	Displays the total number of successful inbound relocation using 5GS to EPS Idle mode mobility procedure in N26 interface.
in-mob-5gto4g-n26-failure	Displays the total number of failed inbound relocation using 5GS to EPS Idle mode mobility procedure in N26 interface.
in-ho-5gto4g-n26-attempted	Displays the total number of attempted inbound relocation using 5GS to EPS Handover procedure in N26 interface.
in-ho-5gto4g-n26-success	Displays the total number of successful inbound relocation using 5GS to EPS Handover procedure in N26 interface.
in-ho-5gto4g-n26-failures	Displays the total number of failed inbound relocation using 5GS to EPS Handover procedure in N26 interface.

Counters	Description
mme-decor-ue-usage-type-src-peer-amf	Displays the the number of MME subscriber sessions, where UE usage type was obtained from peer AMF as part of handover.
n1-mode-atttach-req	Displays the total number of Attach Requests received with N1 mode supported.
n1-mode-tau-req	Displays the total number of TAU Requests received with N1 mode supported.
n1-mode-dns-pgw-selection-smf	Displays the total number of times P-GW selection procedures were performed with locally configured P-GW address, without considering the N1 Mode network capability.
n1-mode-dns-pgw-selection-nr	Displays the number of times P-GW DNS selection procedures are performed with DNS RR including the NR network capability.
n1-mode-dns-pgw-selection-common	Displays the number of times P-GW DNS selection procedures are performed with DNS RR excluding the N1 Mode network capability.
n1-mode-dns-pgw-selection-local	Displays the total number of times P-GW selection procedures were performed with locally configured P-GW address, without considering the N1 Mode network capability.

MME Service Backup Bulk Statistics

The following MME Service backup bulk statistics are included in the MME-BK Schema.

Counters	Description
recovered-out-mob-4gto5g-n26-attempted	Shows recovered values for total number of attempted outbound relocation using EPS to 5GS Idle mode mobility procedure in N26 interface.
recovered-out-mob-4gto5g-n26-success	Shows recovered values for total number of successful outbound relocation using EPS to 5GS idle mode mobility procedure in N26 interface.
recovered-out-ho-4gto5g-n26-attempted	Shows recovered values for total number of attempted outbound relocation using EPS to 5GS Handover procedure in N26 interface.
recovered-out-ho-4gto5g-n26-success	Shows recovered values for total number of successful outbound relocation using 5GS to EPS handover procedure in N26 interface.
recovered-in-mob-5gto4g-n26-attempted	Shows recovered values for total number of attempted inbound relocation using 5GS to EPS Idle mode mobility procedure in N26 interface.
recovered-in-mob-5gto4g-n26-success	Shows recovered values for total number of successful inbound relocation using 5GS to EPS Idle mode mobility procedure in N26 interface.

Counters	Description
recovered-in-ho-5gto4g-n26-attempted	Shows recovered values for total number of attempted inbound relocation using 5GS to EPS Handover procedure in N26 interface.
recovered-in-ho-5gto4g-n26-success	Shows recovered values for total number of successful inbound relocation using 5GS to EPS Handover procedure in N26 interface.