



# Roaming Support

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## Feature Summary and Revision History

### Summary Data

*Table 1: Summary Data*

Applicable Product(s) or Functional Area	AMF
Applicable Platform(s)	SMI
Feature Default Setting	Enabled - Always-on
Related Documentation	<a href="#">Steering of Roaming, Roaming Restrictions, and Operator Policy Support</a>

### Revision History

*Table 2: Revision History*

Revision Details	Release
First introduced.	2022.01.0

## Feature Description

AMF supports the following roaming types:

- Inter-operator roaming
- Roaming on N9 and S8 interface
- Steering of roaming, roaming restrictions and operator Policy Support

# N9 and S8 Roaming

## Feature Description

*Table 3: Feature History*

Feature Name	Release Information	Description
Local Break Out (LBO) Support for N9 Roaming	2024.01.1	AMF supports local breakout for N9 roaming irrespective of presence of NRF configuration. This LBO support ensures a seamless network connectivity for roaming subscribers.

AMF checks if the subscriber is a roamer or homer, during registration. For a roamer subscriber, AMF selects one of the following roaming procedures:

- Home-routed roaming: This procedure enables the subscribers to access the visited network through the home PDN gateway (H-PGW) and obtain services provided by their home networks.
- Local Break Out (LBO) roaming: This procedure enables the subscribers to obtain visitor network provided services. LBO routes the traffic to the visited network, without routing through the home network before sending to or from the end destination.

AMF discovers the following NFs using NRF services, as per the selection of homer or roamer:

- AUSF
- PCF
- UDM
- SMF

### Prerequisites

NRF configuration must be available.

## How it Works

This section describes how this feature works.

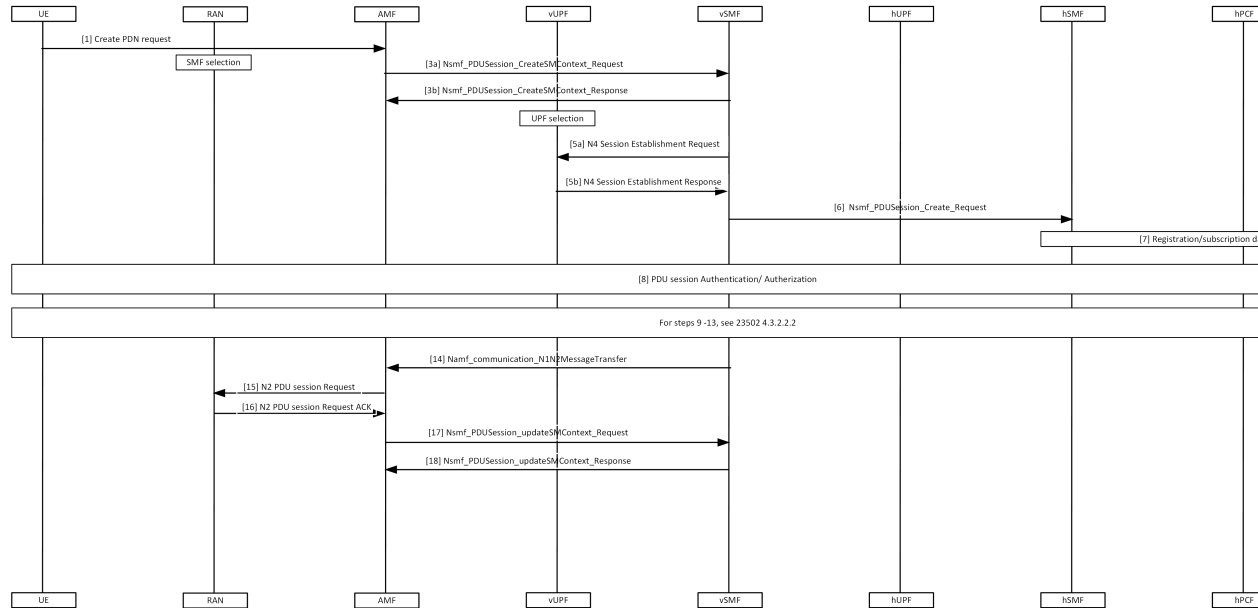
# Call Flows

This section describes the key call flows for this feature.

## N9 Home Routed Roaming Call Flow

This section describes the N9 Home Routed Roaming call flow.

**Figure 1: N9 Home Routed Roaming Call Flow**



**Table 4: N9 Home Routed Roaming Call Flow Description**

Step	Description
1	The UE sends the Create PDN Request to AMF.
2, 3a, 3b	AMF performs the SMF selection and sends Nsmf_PDUSession_CreateSMContext_Request to vSMF and receives response.
4	vUPF performs the UPF selection.
5a, 5b	vSMF sends the N4 Session Establishment Request to vUPF and receives a response from it.
6	vSMF sends Nsmf_PDUSession_Create_Request to the hSMF.
7	Registration or subscription data retrieval is performed.
8	PDU session Authentication or Authorization procedure is performed.
9-13	See 3GPP TS 23502, version 15.4.0, section 4.3.2.2.2.
14	vSMF sends Namf_communication_N1N2MessageTransfer to SMF.
15, 16	AMF sends N2 PDU Session Request to RAN and receives a response.

Step	Description
17, 18	AMF sends Nsmf_PDUSession_updateSMContext_Request to vSMF and receives a response.



**Note** For Local Breakout, the AMF uses the local SMF configuration in the absence of an NRF configuration.

## S8 Home Routing Call Flow

This section describes the S8 Home Routing call flow.

For the preparation phase, see *3GPP TS 23502, Release 15.4.0, section 4.11.1.2.2.2-1—EPS to 5GS (4G to 5G) handover using N26 interface*.

The home-routed roaming scenarios support the following functionalities:

- H-PLMN supports the following nodes:
  - PGW-C and SMF
  - UPF and PGW-U
- AMF selects a default vSMF per PDU session, and invokes the Nsmf\_PDUSession\_CreateSMContext service operation with the following:
  - UE PDN connection contexts
  - AMF ID
  - SMF
  - PGW-C address
  - S-NSSAI
- The S-NSSAI is configured for interworking and is associated with default vSMF.
- The default vSMF puts S-NSSAI in the N2 SM information container.
- AMF selects PGW-C and SMF through NRF from S8 FQDN (obtained from the MME).

## Standards Compliance

This feature complies with the following standards specifications:

- *3GPP TS 23.501 "System Architecture for the 5G System"*
- *3GPP TS 23.502 "Procedures for the 5G System"*
- *3GPP TS 24.501 "Non-Access-Stratum (NAS) protocol for 5G System"*
- *3GPP TS 29.503 "Unified Data Management Services"*
- *3GPP TS 29.513 "Policy and Charging Control signalling flows and QoS parameter mapping"*
- *3GPP TS 29.518 "Access and Mobility Management Services"*

## Feature Configuration

Configuring this feature involves the following steps:

- Configure the LBO—This configuration provides the commands to configure LBO roaming. For more information, refer to [Configuring the LBO, on page 5](#).
- Configure the MNC digits in SUPI—This configuration provides the commands to configure the number of MNC digits in SUPI. For more information, refer to [Configuring the MNC bits in SUPI, on page 6](#).  
Configure the MNC bits in SUPI to discover the exact peer NF in roaming.
- Configure the Globally Unique AMF ID (GUAMI) for AMF selection—This configuration provides the commands to configure the GUAMI. For more information, refer to [Configuring the GUAMI for AMF Selection, on page 6](#).

### Configuring the LBO

To configure Local Break Out, use the following configuration:

```
config
  amf-global
    dnn-policy policy_name
      lbo-roaming-allowed { true | false }
    end
```

#### NOTES:

- **dnn-policy *policy\_name***—Specify the DNN policy name.
- **lbo-roaming-allowed { true | false }**—Specify LBO roaming allowed or not. Configuring **lbo-roaming-allowed** has minimum priority. The priorities are as follows:
  1. When UE includes a DNN name in the PDU Establishment Request, the DNN name is validated with the UDM subscription data. The LBO flag in the UDM subscription data has maximum priority.
  2. When UE doesn't include DNN name in PDU Establishment Request, AMF checks for the default DNN in UDM subscription. If the default DNN is available in the UDM subscription, the LBO flag is considered from the UDM subscription data.
  3. When UE doesn't include DNN name and UDM doesn't provide any default DNN, AMF checks for the configured default DNN. The corresponding DNN policy is checked for the configured default DNN and the LBO is configured using *Configuring the LBO*.

When **lbo-roaming-allowed** configured as true, or UDM sends this flag, LBO roaming is considered. Otherwise Home-routed roaming is considered.



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**Note** AMF provides a **lbo-roaming-allowed** CLI within the DNN Policy. This CLI allows overriding the LBO flag sent in the UDM subscription. Specifically, when the LBO flag is false or missing, you can configure the override CLI to true.

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## Configuration Example

The following is an example configuration.

```
config
  amf-global
    dnn-policy dn1
      lbo-roaming-allowed true
    end
```

## Configuring the MNC bits in SUPI

To configure the MNC bits in SUPI, use the following configuration:

```
config
  amf-global
    call-control-policy policy_name
      supi
        mnc number_of_mnc_bits
      end
```

### NOTES:

- **call-control-policy *policy\_name***—Specify the call control policy name.
- **mnc *number\_of\_mnc\_bits***—Specify the number of MNC bits. Must be either 2 or 3.

## Configuration Example

The following is an example configuration.

```
config
  amf-global
    call-control-policy local
      supi
        mnc 2
      end
```

## Configuration Verification

To verify the configuration:

```
show running-config amf-global call-control-policy local
amf-global
call-control-policy local
supi mnc 2
```

## Configuring the GUAMI for AMF Selection

To configure the GUAMI for AMF selection, use the following configuration:

```
config
  profile network-element amf amf_name
    query-params guami
  end
```

### NOTES:

- **profile network-element amf *amf\_name***—Specify AMF name. Must be a string.
- **query-params guami**—Specify query parameters as GUAMI.

## Configuration Verification

To verify the configuration:

```
show running-config profile network-element amf amf1 query-params
profile network-element amf amf1
query-params guami
```

# Configuring the 5GC Inter-PLMN Roaming

To configure this feature, use the following configuration:

```
config
  amf-global
    call-control-policy policy_name
    local-cause-code-map registration-restriction cause-code-5gmm
  plmn-not-found
  end
```

### NOTES:

- **call-control-policy** *policy\_name*—Specify the call control policy name.
- **local-cause-code-map registration-restriction cause-code-5gmm plmn-not-found**—When the subscriber is a roamer and has registration restrictions, the AMF rejects the subscriber with the **plmn-not-found** cause setting.

