Multiple PLMN Support

Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	SMF
Applicable Platform(s)	SMI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
Added the non-standard PLMN list configuration.	2023.04.0
Removed the **visitor-hrt** CLI keyword from the configuration in Operator Policy.	2021.02.3
First introduced.	2021.01.0

Feature Description

The multi-PLMN feature supports multiple PLMNs for homer and roamer networks. A maximum number of 32 PLMNs can be configured.

SMF uses the primary PLMN configured under profile DNN for peer discovery. The feature supports homer and roamer networks with different session type configuration. Homer with IPv6 session type configuration and roamer with IPv4 or IPv6 session type is a typical configuration.

This feature supports emergency calls from 4G and 5G RATs from roamer UEs with SIM (unauthenticated IMSI) and without SIM. For emergency calls without IMSI, if primary PLMN is not configured (no PLMN ID and no primary PLMN under profile DNN), then one of the PLMNs in the PLMN list is used as primary PLMN for external messaging.

SMF validates UE PLMN on receiving SmContextCreate or CreateSessionRequest message and populates the PLMN in external messaging.

For more details on the roaming functionality, see the Roaming Support chapter.

How it Works

The operator PLMNs configured under PLMN list includes all UE PLMNs and serving PLMNs.

On receiving the Create Request from 4G or 5G RAT (SmContextCreate or Create Session Request), the SMF extracts UE PLMN from SUPI. SMF compares the UE PLMN and serving PLMN with the configured PLMN list and populates the PLMN in external messaging. The SMF determines the roaming status of subscribers based on the HPLMN values.

If the UE PLMN and the serving PLMN both belong to the PLMN list that is configured in SMF, then it is a home subscriber. If the UE PLMN does not belong to the configured PLMN list and the serving PLMN belongs to the configured PLMN list, then it is a visitor. If the UE PLMN belongs to the configured PLMN list and the serving PLMN does not belong to the configured PLMN list, then it is a roamer.

Configuring Multiple PLMNs

This section describes how to configure the multi-PLMN feature.

Configuration-based Peer NF Selection

This section describes how to configure the use of NRF discovery or local configuration for selecting peer network function.

The configuration under profile network-element allows the user to have different selection logic linked to subscriber policy. For example, the user can configure peer NF selection logic for homers, roamers, or visitors.

To select the configuration for NF discovery, use the following sample configuration:

```
config
  profile network-element amf amf_profile_name
    discovery local
    end
```

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Configuring PLMN ID

NOTES:

>   • **discovery local**: Specify to use local configuration for NF discovery.

Configuring PLMN ID

This section describes how to configure the PLMN ID.

To configure one or multiple PLMN IDs, use the following sample configuration:

```
config
  profile smf smf_profile_name
    plmn-id mcc mcc_value mnc mnc_value
    plmn-list { mcc mcc_value mnc mnc_value | range mcc mcc_value mnc mnc_value
}
    end
```

NOTES:

>   • **plmn-id mcc** *mcc_value* **mnc** *mnc_value*: Specify the 3-digit Mobile Country Code (MCC) and 2- or 3-digit Mobile Network Code (MNC) of the PLMN ID. *mcc_value* and *mnc_value* must be a string.

>   • **plmn-list { mcc** *mcc_value* **mnc** *mnc_value* | **range mcc** *mcc_value* **mnc** *mnc_value* **}**: Specify the list of 3-digit Mobile Country Code (MCC) and 2- or 3-digit Mobile Network Code (MNC) of multiple PLMNs. *mcc_value* and *mnc_value* must be a string.

Note
>   • A maximum number of 32 PLMNs can be configured.
>
>   • All operator PLMNs are configured under PLMN list including all UE-PLMNs and serving PLMNs.

Configuring Non-standard PLMN List

This section describes how to configure the non-standard PLMN list.

To configure one or multiple non-standard PLMN lists, use the following sample configuration:

```
config
  profile smf smf_profile_name
    non-standard-plmn-list mcc mcc_value mnc mnc_value
    end
```

NOTES:

>   • **non-standard-plmn-list mcc** *mcc_value* **mnc** *mnc_value* : Specify the list of supported non-standard PLMN to derive UE PLMN ID. *mcc_value* and *mnc_value* must be an integer.

Verifying Non-standard PLMN List

This section describes how to verify the non-standard PLMN list feature configuration.

Use the following show command to view the list of non-standard PLMN configured.

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```
show running-config profile smf plmn-list
```

The following is an example output of this show command.

```
[smf] smf# show running-config profile smf smf1 non-standard-plmn-list
   profile smf smf1
      non-standard-plmn-list mcc 200 mnc 111
      exit
      non-standard-plmn-list mcc 100 mnc 100
      exit
exit
```

Configuring Primary PLMN

This section describes how to configure the primary PLMN under DNN profile.

To configure the primary PLMN for peer discovery, use the following sample configuration:

```
config
   profile dnn dnn_profile_name
      primary-plmn mcc mcc_value mnc mnc_value
      exit
```

NOTES:

- **primary-plmn mcc** *mcc_value* **mnc** *mnc_value*: Specify the 3-digit Mobile Country Code (MCC) and 2- or 3-digit Mobile Network Code (MNC) of the primary PLMN. *mcc_value* and *mnc_value* must be a string.

Configuring PLMN in NRF Discovery

This section describes how to configure the PLMN for NRF Discovery.

To configure the PLMN query parameters, use the following sample configuration:

```
config
   profile network-element pcf pcf_profile_name
      query-target-plmn { primary | serving | ue }
      exit
```

NOTES:

- **query-target-plmn { primary | serving | ue }**: Specify the query parameter target-plmn to be used in NRF discovery. It can be one of the following:

   - **primary**: Configure the primary PLMN which is sent in the target PLMN.

   - **serving**: Configure the serving PLMN which is sent in the target PLMN.

   - **ue**: Configure the UE PLMN which is sent in the target PLMN.

Configuring Serving PLMN MNC list

This section describes how to configure the MNC list for serving PLMN.

To configure the serving PLMN information, use the following configuration:

```
config
  policy subscriber policy_name
    precedence precedence_value
    serving-plmn { mcc mcc_value | mnc mnc_value | mnc-list mnc_list_values }
    exit
```

NOTES:

- **serving-plmn { mcc** *mcc_value* | **mnc** *mnc_value* | **mnc-list** *mnc_list_values* **}**: Specify the 3-digit Mobile Country Code (MCC), 2- or 3-digit Mobile Network Code (MNC), or the list of MNC values of the serving PLMN. *mcc_value* and *mnc_value* must be a string.

  mnc_list_values must be a string. For example: [580 660]

- This configuration is backward compatible. If both **mnc** and **mnc-list** are configured, both are considered while selecting the operator policy.

Configuring Roamer in Operator Policy

This section describes how to configure the roamer network in operator policy.

To configure the operator policy-specific roaming configuration, use the following sample configuration:

```
config
  policy operator operator_policy_name
    roaming-status { roamer | visitor-lbo }
    exit
```

NOTES:

- **roaming-status { roamer | visitor-lbo }**: Specify the roaming status. It can be one of the following:

  - **roamer**: Specify the status of roamer in homer network.

  - **visitor-lbo**: Specify the status of roamer in local breakout session.

- In the absence of roaming status configuration, the SMF uses the values of PLMN and SUPI to determine the roaming status of subscribers.

OAM Support for Multiple PLMNs

This section describes operations, administration, and maintenance support for this feature.

Bulk Statistics Support

The following statistics are updated to support the multiple PLMN feature.

- smf_service_stats: This statistics includes roaming_status label to indicate the roaming status of the subscriber session.

- smf_service_counters: This statistics includes roaming_status label to indicate the roaming status of the subscriber session.

- smf_session_counters: This statistics includes roaming_status label to indicate the roaming status of the subscriber session.

- smf_session_stats: This statistics includes roaming_status label to indicate the roaming status of the subscriber session.