

TAI-based Routing for 20-bit and 28-bit eNB ID

This feature enables MME to perform TAI-based routing for both 20-bit and 28-bit eNB IDs.

- Feature Summary and Revision History, on page 1
- Feature Description, on page 2
- Configuring TAI-based Lookup of eNB, on page 3
- Monitoring and Troubleshooting the TAI-based Lookup, on page 5

Feature Summary and Revision History

Summary Data

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

Revision History

Revision Details	Release
HeNBGW Selection Enhancement in MME.	21.18
HeNBGW Selection Enhancement in MME.	21.15

Revision Details	Release
First introduced.	21.1

Feature Description

MME supports TAI-based routing of handover (HO) and configuration transfer messages towards Pico controller/HeNBGW when the target eNB ID is 28 bits, but it could not support TAI-based routing when the target Pico eNB ID is 20 bits.

Pico controller can transfer the target Pico eNB ID to 28 bits from 20 bits if the handover is Pico-to-Pico, but it could not handle Macro-to-Pico handover as there is no Pico Controller for Macro.

In releases 21.1 and beyond, the behavior of MME is modified so that it can perform TAI-based routing even if target home-eNB ID is 20 bits.

This feature provides a configurable option within MME service to configure target HeNB type (home or macro or both) behind HeNBGW. Based on this configuration, MME allows TAI-based lookup of target eNB, if target eNB ID is not found by MME during handover. By default, TAI-based lookup is performed only for home eNB ID (28-bits).

This feature is also introduced to support identification of target eNB using target TAI for target eNB type Macro or Pico nodes or both so that handover to such eNB can be supported if it is connected to MME through Pico controller/HeNBGW. From MME point of view, Pico controller is a Macro eNB which is using 20 bit eNB ID to support multi-cell.

Along with S1 based intra-MME HO, this feature can be applied to inter MME S1 HO procedures (inbound S10, S3 and Gn handovers). Please note that, in Gn case, MME converts target RNC ID to macro eNB ID so target TAI-based lookup for macro eNB works fine.

This feature allows operators to configure the global eNodeB IDs of HeNBGWs in the MME service. The MME uses this information to perform HeNBGW related functions. In case of S1-based handovers to home eNodeBs served by a HeNBGW, the lookup at MME for the target eNodeB based on global eNB ID will fail, as MME is aware of only the HeNBGW. In those cases, additional lookup needs to be done based on TAI to find the HeNBGW serving the home eNodeB.

Since TAI-based lookup for home or macro eNBs is supported for HeNBGWs, all such HeNBGWs should be defined in HeNBGW management database (HeNBGW-mgmt-db). The HeNBGW-mgmt-db should be associated within mme-service.

The number of HeNBGW entries in the HeNBGW-mgmt-db has been increased from 8 to 512.

HeNBGW Selection Enhancement

TAI is unique and it is not shared across multiple HeNBGWs. If the TAIs are shared, then any one of the target eNBs sharing the TAC under consideration will be selected during TAI-based target eNB selection and handed over to the eNB may fail. To overcome this failure, HeNBGW matched with MSB 10 bits of Target HeNB ID (macro-enb 20 bit or home-enb 28 bits) and eNB ID of HeNBGW must be selected. If no match is found, then any one of the target eNBs sharing the TAC under consideration is selected during the TAI-based target eNB selection and handover to the eNB may ultimately fail.

Note If there are several HeNBGW with same TAI, CISCO MME supports selection of HeNBGW with MSB 10 bits (macro-enb 20 bit or home-enb 28 bits)) of HeNB ID.

Limitations

The following are the limitations of this feature:

- TAI-based lookup is performed only for home eNB.
- TAI should be unique and should not be shared across multiple HeNBGWs. If the TAIs are shared, then any one of the target eNBs sharing the TAC under consideration will be chosen during TAI-based target eNB selection and handover to the eNB might fail.

Configuring TAI-based Lookup of eNB

The following section provides the configuration commands to enable the TAI-based lookup of eNB.

Configuring Target eNB Type for TAI-based Lookup

Use the following configuration commands to configure the target eNB type or target henb-type as home or macro.

```
configure
   context context_name
      mme-service service_name
         henbgw henb-type { macro-enb | home-enb | all }
         end
```

Notes:

- The **henbgw henb-type { macro-enb | home-enb | all }** is a new CLI command introduced in 21.1 release to support TAI-based lookup functionality.
- **henbgw**: Configures Home eNodeB gateway options.
- **henbgw-type**: Configures HeNB type. TAI-based lookup depends on HeNB type.
  - **home-enb**: Configures HeNB type home-enb (28-bits)
  - **macro-enb**: Configures HeNB type macro-enb (20-bits)
  - **all**: Configures HeNB type both macro-enb (20-bits) and home-enb (28-bits)
- By default, when the **henbgw henb-type** command is not applied explicitly, target eNB type is set as home-enb.
- Use the **no henbgw henb-type** command to delete the existing configuration, if previously configured.

- The target eNB type configuration is effective only when the **henbgw henb-type** CLI command is configured within mme-service and the HeNBGW-mgmt-db is associated with HeNBGWs inside mme-service.

Verifying the Target eNB Type Configuration

Use the following commands to verify the configuration status of this feature.

```
show mme-service all
```

- or -

```
show mme-service name service_name
```

service_name must be the name of the MME service specified during the configuration.

This command displays all the configurations that are enabled within the specified MME service.

The following is a sample configuration of this feature.

```
configure
   lte policy
      mme henbgw mgmt-db db_name
         henbgw-global-enbid mcc 123 mnc 456 enbid 12345
         henbgw-global-enbid mcc 123 mnc 456 enbid 12543
         end
configure
   context context_name
      mme-service service_name
         henbgw henb-type macro-enb
         associate henbgw-mgmt-db henbdb
         end
```

NOTES:

- By default, when the **henbgw henb-type** command is not configured, target eNB type is set as **home-enb**.

Configuring HeNBGW msb-10-bits Selection

Use the following commands to configure HeNBGW selection using HeNB MSB 10 bits for the same TAI.

```
configure
  context context_name
    mme-service service_name
      henbgw selection msb-10-bits
      no henbgw selection
      end
```

NOTES:

- **no** : Removes the configured HeNBGW selection for the same TAI.
- **henbgw**: Configures HeNBGW options.
- **selection**: Configures HeNBGW selection for same TAI.

- **msb-10-bits** Configures HeNBGW selection using HeNB MSB 10 bits for same TAI. By default this is disabled.

Note HeNBGW selection using HeNB MSB 10 bits is performed only when TAIs are shared across multiple HeNBGWs.

The TAI lookup happens only in the following instance:

- When henb-type {all | macro-enb} for handover to target Henbgw macro 20 bits.
- When henb-type **{all | home-enb}** is configured for handover to target HeNBGW home 28 bits. However, when henb-type {macro} is configured for handover to target HeNBGW home 28 bits, the lookup at MME for the target eNodeB will fail in handover preparation.

Monitoring and Troubleshooting the TAI-based Lookup

This section provides information regarding show commands and/or their outputs in support of this feature.

The following operations can be performed to troubleshoot any failure related to this feature:

- Verify if the feature is enabled using **show mme-service all** CLI command. If not enabled, configure the **henbgw henb-type** CLI command in MME service Configuration mode and check if it works.
- Collect and analyze the output of **show configuration**, **show support details**, **show mme-service name** *service_name* and **show mme-service statistics handover** commands. Also, check the reported logs, if any. For further analysis, contact Cisco account representative.
- Check and analyze the debug logs for mme-app, s1ap, mmemgr, and mmedemux facilities to determine if TAI-based lookup fails for a particular TAI.

show mme-service all

The following field is added to the output of the **show mme-service all** command in support of this feature.

```
HENBGW HeNodeB Type: macro-enb
```

Table 1: show mme-service all Command Output Descriptions

Field	Description
HENBGW HeNodeB Type	Displays the configured type for HeNodeB gateway. HENBGW HeNodeB Type can be one of the following: • macro-enb • home-enb • all

Field	Description
HeNBGW selection using HeNodeB MSB 10 bits for same TAI	• Enabled • Disabled

show mme-service name *service_name*

The following field is added to the output of the **show mme-service name** *service_name* command in support of this feature.

```
HENBGW HeNodeB Type: macro-enb
```

Table 2: show mme-service name service_name Command Output Descriptions

Field	Description
HENBGW HeNodeB Type	Displays the configured type for HeNodeB gateway. HENBGW HeNodeB Type can be one of the following: • macro-enb • home-enb • all

show mme-service statistics handover

The following fields are added to the output of the **show mme-service statistics handover** command in support of this feature.

```
Handover Statistics:
  Intra MME Handover
    .
    .
    Target TAI based S1 handover
      Attempted:       4
      Success:         3
      Failures:        1
.
.
  EUTRAN<-> EUTRAN using S10 Interface:
    .
    .
    Inbound relocation using Target TAI based S1 HO procedure:
      Attempted:       0
      Success:         0
      Failures:        0
```

Table 3: show mme-service statistics Command Output Descriptions

Field	Description
Target TAI based S1 handover	
Attempted	Displays the total number of attempted intra MME S1 handovers that used target TAI to identify the target HeNodeB, if target eNB ID is unknown.
Success	Displays the total number of successful intra MME S1 handovers that used target TAI to identify the target HeNodeB.
Failures	Displays the total number of failed intra MME S1 handovers that used target TAI to identify the target HeNodeB.
Inbound relocation using Target TAI based S1 HO procedure	
Attempted	Displays the total number of attempted inter MME S10 handovers where target MME used target TAI to identify the target HeNodeB, if target eNB ID is unknown.
Success	Displays the total number of successful inter MME S10 handovers where target MME used target TAI to identify the target HeNodeB.
Failures	Displays the total number of failed inter MME S10 handovers where target MME used target TAI to identify the target HeNodeB.

show mme-service statistics peer-id

The following fields are added to the output of the **show mme-service statistics peer-id** *peer_id* **handover** command in support of this feature.

```
Handover Statistics:
  Intra MME Handover
    .
    .
    Target TAI based S1 handover
      Attempted:       4
      Success:         3
      Failures:        1
.
.
  EUTRAN<-> EUTRAN using S10 Interface:
    .
    .
    Inbound relocation using Target TAI based S1 HO procedure:
      Attempted:       0
      Success:         0
      Failures:        0
```

*Table 4: **show mme-service statistics** Command Output Descriptions*

Field	Description
Target TAI based S1 handover	
Attempted	Displays the total number of attempted intra MME S1 handovers that used target TAI to identify the target HeNodeB, if target eNB ID is unknown.
Success	Displays the total number of successful intra MME S1 handovers that used target TAI to identify the target HeNodeB.
Failures	Displays the total number of failed intra MME S1 handovers that used target TAI to identify the target HeNodeB.
Inbound relocation using Target TAI based S1 HO procedure	
Attempted	Displays the total number of attempted inter MME S10 handovers where target MME used target TAI to identify the target HeNodeB, if target eNB ID is unknown.
Success	Displays the total number of successful inter MME S10 handovers where target MME used target TAI to identify the target HeNodeB.
Failures	Displays the total number of failed inter MME S10 handovers where target MME used target TAI to identify the target HeNodeB.

Bulk Statistics

MME Schema

The following bulk statistics have been added to the MME schema to track the TAI-based lookup attempts, successes and failures during intra-MME S1 and inter-MME inbound S10 handovers:

- emmevent-s1ho-target-tai-attempt
- emmevent-s1ho-target-tai-success
- emmevent-s1ho-target-tai-failure
- in-s1-ho-4gto4g-s10-target-tai-attempted
- in-s1-ho-4gto4g-s10-target-tai-success
- in-s1-ho-4gto4g-s10-target-tai-failures

For detailed information on these bulk statistics, refer to the **BulkstatStatistics_documentation.xls** spreadsheet that is included as part of the software companion package for this release.