

Operator Policy Selection Based on IMEI-TAC

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Feature Description

Operator policies (proprietary Cisco functionality) empower the carrier/network operators to configure preferred call handling practices. Also, operator policies can be configured to determine the granularity of the implementation: to groups of incoming calls or simply to one single incoming call. The purpose, use, and configuration of operator policies is outlined in the *Operator Policy* chapter elsewhere in this guide.

Based on the configuration (see *Configuring Operator Policy Based on IMEI-TAC*), the MME will select / re-select the operator policy whenever the MME retrieves the IMEI or IMEI-SV in one of the following scenario:

- normal 4G Attach when the IMEI/IMEI-SV is retrieved via Identity-Request with IMEI.
- normal 4G Attach when the IMEI/IMEI-SV is retrieved via Security-Mode-Complete (**policy attach imei-query-type** under MME service must be enabled).
- normal 4G TAU when the IMEI/IMEI-SV is retrieved via Security-Mode-Complete (**policy tau imei-query-type** under MME service must be enabled).
- inbound handover when IMEI/IMEI-SV is received with IMSI via the Forward-Relocation-Request.
- S10 and S3 Attaches when IMEI/IMEI-SV is retrieved with IMSI via EGTP-Identification-Request.
- Inter-RAT TAU and Intra-RAT TAU with MME change when IMEI/IMEI-SV is received with IMSI in Context-Response.

Selection Based on IMEI-TAC

With Releases 18.5 and higher,"Operator Policy Selection Based on IMEI-TAC" enables the MME to selects / re-select an operator policy for call handling *based on the user equipment's (UE's) unique international mobile equipment identity - type allocation code (IMEI-TAC)* rather than the normal selection method, which is based on the UE's international mobile subscriber identity (IMSI) and PLMN-ID. The IMEI number is assigned to a mobile device or user equipment (UE) by the manufacturer. The network uses the IMEI to identify if devices are valid.

Including the type allocation code (TAC) in the operator policy selection process supports network access restrictions being applied to UEs based on the type of wireless device identified by the IMEI-TAC. The TAC,

the first eight digits of the 15-digit IMEI or 16-digit IMEI-SV, identifies the equipment manufacturer, the wireless device type and the model number (if there is one); for example, TAC of 35201906 identifies an Apple iPhone 5S.

IMEI-TAC Groups

With Release 18.6 and higher, the MME supports configuration of up to 25,000 IMEI-TAC, up from the original number of 1024 IMEI-TAC per MME. As well, these IMEI-TAC can be configured in groups listing individual IMEI-TAC and/or organized in ranges of IMEI-TAC. Up to 50 IMEI-TAC groups can be configured per MME and once an IMEI-TAC group is created, each group can be configured with up to 500 unique IMEI-TAC values and/or up to 20 IMEI-TAC ranges - which can overlap. For command details, refer to the *Configuration* section below.

Granular Selection Options for IMEI-TAC: MCC/MNC, MSIN, PLMNID

With Release 19.4 and higher, the operator is allowed more granular control of configuration for operator policy selection. Besides operator policy selection based on IMEI-TAC of the UE, the operator can optionally configure selection based on:

1. IMEI-TAC only,
2. IMEI-TAC + Service PLMNID,
3. IMEI-TAC + MCC-MNC of UE,
4. IMEI-TAC + MCC-MNC of UE + Serving PLMNID,
5. IMEI-TAC + IMSI,
6. IMEI-TAC + IMSI + Serving PLMNID,

The MME uses this configuration to select the operator policy whenever it retrieves the IMEI/IMEI-SV from either a UE or a peer for all non-emergency calls.

How It Works

Based on the configuration (see *Configuring Operator Policy Based on IMEI-TAC*), the MME will select / re-select the operator policy whenever the MME retrieves the IMEI or IMEI-SV in one of the following scenario:

- normal 4G Attach when the IMEI/IMEI-SV is retrieved via Identity-Request with IMEI.
- normal 4G Attach when the IMEI/IMEI-SV is retrieved via Security-Mode-Complete (**policy attach imei-query-type** under MME service must be enabled).
- normal 4G TAU when the IMEI/IMEI-SV is retrieved via Security-Mode-Complete (**policy tau imei-query-type** under MME service must be enabled).
- inbound handover when IMEI/IMEI-SV is received with IMSI via the Forward-Relocation-Request.
- S10 and S3 Attaches when IMEI/IMEI-SV is retrieved with IMSI via EGTP-Identification-Request.
- Inter-RAT TAU and Intra-RAT TAU with MME change when IMEI/IMEI-SV is received with IMSI in Context-Response.

Supported Options

With this feature, the MME supports location-based restriction based on the IMEI-TAC. The MME Service configuration must include settings to instruct the MME to retrieve/query the IMEI/IMEI-SV for Attach and TAU. Refer to *Configuring Policy Selection for Normal 4G Attach/TAU*.

Restrictions

For all emergency calls, the MME selects the emergency profile and not an operator policy based on IMEI-TAC configuration.

Currently, the MME allows a maximum of 1024 associations of operator policy to the key where the key can be any of the following: IMSI, SERVICE PLMN-ID, SSI-ID, Domain, IMEI-TAC and ALL.

Configuring Operator Policy Selection Based on IMEI-TAC

There are multiple components involved in the configuration of this feature. We recommend that for first time feature configuration, you perform the configurations in the order in which they are presented below.

Configuration of this feature makes use of many previously existing commands and keywords. Only new or modified commands and keywords are explained in detail in this document.

Configuring the Operator Policy(s) and Call Control Profile(s)

We recommend that you first configure the operator policy and call control profile and make a note of the names you assign the policy and profile.

```
configure
  operator-policy name policy_name
    associate call-control-profile name profile_name
    exit
  call-control-profile name profile_name
    end
```

Notes:

- For information about these commands and keywords, refer to the *Command Line Interface Reference*.

Configuring Policy Selection for Normal 4G Attach/TAU

To enable the MME to retrieve the IMEI from the UE, the following MME service configuration is required. The following configures the Operator Policy selection based on IMEI-TAC for normal 4G Attach or normal 4G TAU when the IMEI/IMEI-SV is retrieved via Security-Mode-Complete. After the operator policy and call control profile are configured, then perform the additional configuration of the **imei-query-type** for the MME service.

```
configure
 context context_name
     mme-service name service_name
       policy { attach | tau } imei-query-type { imei | imei-sv }
verify-equipment-identity [ allow-on-eca-timeout | deny-greylisted |
```

```
deny-unknown | verify-emergency ]
        end
```

Notes:

- The command listed above are not new for this feature. For information about these commands and keywords, refer to the *Command Line Interface Reference*.

Configuring IMEI-TAC based Selection of the Operator Policy

Important The operator policy(s), call-control profile(s), and IMEI-TAC group(s) need to be configured already and according to the instructions above.

To setup IMEI-TAC-based operator policy selection, use the **precedence** command in the LTE Subscriber Map configuration mode to:

- set the order of precedence for the subscriber map,
- set which type of matching criteria is to be used to determine which operator policy to select - for this procedure, use the **imei-tac** keyword,
- optionally, set more granular IMEI-TAC matching criteria, either singly or in pairs:
  - mcc + mnc
  - imsi
  - service-plmnid
- point to an operator policy for subscribers meeting the match criteria.

Important The following example details configuration for IMEI-TAC-based selection. Other match criteria options are not included here. For more information on configuration options, refer to the *Command Line Interface Reference*.

```
configure
   lte-policy
      subscriber-map map_name
         precedence precedence_number match-criteria imei-tac group group_name [
 imsi mcc mcc mnc mnc
[ msin { first start_msin_value last end_msin_value } ] ] [ operator-policy-name
 policy_name
         no precedence precedence_number
         end
```

Notes:

- **precedence** *precedence_number*- The precedence level defined by the operator is used to resolve the selection of the operator policy when multiple variable combinations match for a particular UE. The lower precedence number takes greater priority during selection.

In releases prior to 21.8: *precedence_number* must be an integer from 1 to 1024.

In 21.8 and later releases: *precedence_number* must be an integer from 1 to 10000, where 1 has the highest precedence.

- **match-criteria** - Selects which set of variables will be 'matched-to' to select an operator policy. For this procedure, use the **imei-tac** keyword to select the IMEI-TAC group as the matching criteria. For more granular match criteria, include the following singly or in pairs: IMSI and/or MCC+MNC and/or serving PLMNID in accordance with the following usage options:
  - Operator policy selection based on IMEI-TAC only, syntax example:

    ```
    precedence 1 match-criteria imei-tac-group myGroup
    operator-policy-name BESTpol
    ```

  - Operator policy selection based on IMEI-TAC + Service PLMNID, syntax example:

    ```
    precedence 1 match-criteria imei-tac-group myGroup service-plmnid
     12345
     operator-policy-name BESTpol
    ```

  - Operator policy selection based on IMEI-TAC + MCC-MNC of UE, syntax example:

    ```
    precedence 1 match-criteria imei-tac-group myGroup imsi mcc 123
    mnc 234 operator-policy-name BESTpol
    ```

  - Operator policy selection based on IMEI-TAC + MCC-MNC of UE + Serving PLMNID, syntax example:

    ```
    precedence 1 match-criteria imei-tac-group myGroup imsi mcc 123
    mnc 234 service-plmnid 56789 operator-policy-name BESTpol
    ```

  - Operator policy selection based on IMEI-TAC + IMSI, syntax example:

    ```
    precedence 1 match-criteria imei-tac-group myGroup imsi mcc 123
    mnc 234 msin first 1223 last 2333 operator-policy-name BESTpol
    ```

  - Operator policy selection based on IMEI-TAC + IMSI + Serving PLMNID, syntax example:

    ```
    precedence 1 match-criteria imei-tac-group myGroup imsi mcc 123
    mnc 234 msin first 1223 last 2333 service-plmnid 56789
    operator-policy-name BESTpol
    ```

- **group** *group_name* - Identifies the name of the previously-defined IMEI-TAC group with the configured IMEI-TAC values to use for matching. The group name is a string of 1 through 64 alphanumeric characters.
- **operator-policy-name** *policy_name* - Configures the name of the operator policy to which selection should be pointed after the criteria matching is completed. The policy name is a string of 1 through 63 alphanumeric characters.
- For more information about the **lte-policy**, **subscriber-map**, and the **precedence** commands, refer to the *LTE Subscriber MAP Configuration Mode* chapter in the *Command Line Interface Reference* .

Verifying the Configuration

From the Exec mode, use the following to verify the configuration for operator policy selection based on IMEI-TAC:

show configuration

The following is an example of the type of information that would be presented in the show output:

```
config
... ... ...
  lte-policy
    subscriber-map submap1
      precedence 1 match-criteria imei-tac group itacgrp1 operator-policy-name oppo11
      precedence 2 match-criteria imei-tac group imeitacgrp11 service-plmnid 12345
operator-policy-name op2
      precedence 3 match-criteria imei-tac group imeitacgrp2 operator-policy-name op1
    exit
    imei-tac-group itacgrp1
      tac 31441551 77777777 87650506 87654321
      tac-range from 23456789 to 98765432
    exit
    imei-tac-group imeitacgrp11
      tac 01192119 66666666 87650999 98765432
      tac-range from 11001100 to 11111111
…... … ….
    exit
... ... …
end
```

Monitoring and Troubleshooting the Operator Policy Selection Based on IMEI-TAC

Verify Configuration

Use the following show commands to verify the configuration to ensure that it is correct:

- **show operator policy full { all | name***policy_name* **}**
- **show call-control-profile full { all | name** *profile_name* **}**
- **show mme-service name** *service_name*
- **show lte-policy subscriber-map name** *map_name*
- **show lte-policy imei-tac-group summary**
- **show lte-policy imei-tac-group name** *group_name*