



## Location Based QoS Override

This feature enables the gateway to override the QoS values based on subscriber location and also to provide unlimited bandwidth to subscribers.

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## Feature Description

With the previous implementation, subscriber bandwidth is limited based on QoS provided by PCRF in order to comply with 3GPP standards. In this release, subscriber is provided with unlimited bandwidth by allowing QoS override based on LAC and/or TAC (individual or range) configured in a local-policy (LP) rule on the gateway. If the subscriber is in the LAC or TAC region and hits the LP rule, the gateway ignores the QoS limits imposed by PCRF and allows the subscriber to have unlimited bandwidth.



### Important

This feature requires the license to configure local-policy. For more information on the licensing requirements, contact Cisco account representative.

Configuration changes are performed at both ECS and local-policy to achieve this functionality.

For this feature to work, the following operations must be performed in the order as specified below:

- When a subscriber is in the configured RAI or TAI range, the local-policy identifies the associated local-policy rule and sends the rule to ECS for activation.
- ECS provides a configuration in the service scheme, which matches the active lp-rules trigger-condition and associates the trigger-action to be taken when a local-policy rule activation is received. ECS then performs throttle suppression to provide unlimited bandwidth based on the subscriber location.



### Important

The service-scheme is associated with the subscriber based on the conditions configured under subscriber-class at call setup time.

The location based throttle suppress will override the existing functionality of time based throttle suppression. Irrespective of the configured time delay, if the subscriber is in a particular location for which throttle suppression has been configured then it will hold effect.

Whenever there is new-call or location-change event, the rulebase is checked for location and the LP rules to add and delete are passed to ECS module.

By default, the Change Reporting Action (CRA) notification is sent to MME when ULI-Change, TAI-Change and/or ECGI-Change are installed as part of actiondef configuration. New CLI configuration is provided to control the CRA notification towards MME.

The QoS Override feature can be enabled for subscribers classified based on APN, virtual-APN, rulebase or a combination of these.

This feature works in local-policy fallback, dual-policy mode, and dual-fallback modes. In local-policy fallback mode, irrespective of where the event triggers are being registered, all the event triggers will be reported to local-policy and the corresponding actions will be taken. Whereas in the dual-policy and dual-fallback modes, the event triggers are sent to both local-policy and PCRF depending on where the triggers are registered. Local-policy module handles all the location related events and PCRF handles all other event triggers.

## Relationships to Other Features

It is required to have both local-policy and service scheme framework configured to enable this feature for a subscriber. For redundancy support, the corresponding ICSR configuration must also be present.

The service-scheme framework helps in overriding feature behavior specific to a subscriber or a set of subscribers. The user can update the policies specific to subscribers based on predefined events. For more information on the service-scheme framework, see the *ECS Administration Guide*.

## How it Works

This section describes how the QoS override is performed based on the location of subscriber.

The following example shows the TAC configuration and how the throttle suppression is applied considering the TAC values as 100 -199 for throttle suppress. The configuration for LAC will be similar to the TAC.

### Sample local-policy Configuration:

```
configure
  context context_name
    apn apn_name
    ims-auth-service service_name
  end
configure
  context context_name
    ims-auth-service service_name
    policy-control
      associate failure-handling-template template_name
      associate local-policy-service service_name dual-mode
    end
configure
  failure-handling-template template_name
```

```

    msg-type any failure-type any action continue local-fallback
end
configure
  local-policy-service service_name
    suppress-cra event-triggers uli-change
    eventbase eventbase_name
      rule priority 1 event new-call ruledef allcalls actiondef
activate_triggers continue
      rule priority 2 event new-call ruledef tai-group actiondef
activate_lp_action
      rule priority 3 event location-change ruledef tai-group actiondef
activate_lp_action
      ruledef allcalls
        condition priority 1 imsi match *
      ruledef tai_group
        condition priority 1 tai mcc 232 mnc 344 tac ge 100
        condition priority 2 tai mcc 232 mnc 344 tac lt 200
      actiondef activate_triggers
        action priority 1 event-triggers uli-change
      actiondef activate_lp_action
        action priority 1 activate-lp-rule name tac_list_1
end

```

#### Sample Configuration at ECS:

```

configure
  active-charging service s1
    trigger-action tal
    throttle-suppress
    exit
  trigger-condition tc1
    local-policy-rule = tac_list_1
  exit
  trigger-condition tc2
    any-match = TRUE
  exit
  service-scheme s1
    trigger sess-setup
    priority 1 trigger-condition tc2 trigger-action tal
    trigger loc-update
    priority 1 trigger-condition tc1 trigger-action tal
    exit
  subs-class sc1
    rulebase = rb1
  exit
  subscriber-base sb1
    priority 1 subs-class sc1 bind service-scheme ss1
  exit

```

Local-policy provides ECS, the list of rules to activate and the list of rules to delete. In case, the rule to be activated is already installed, ECS ignores this rule. Similarly if the rule to be deleted was not installed, ECS ignores this rule as well. The trigger action will be applied only to a subset of traffic that matches the criteria

defined under trigger condition. If trigger-condition is any-match, then trigger action will be applied to all the flows created after event activation.



#### Important

The "lp-activate-rule" action must be configured as part of "new-call" and "location-change" events.

Based on the subscriber location, the local-policy reporting and the trigger actions vary as provided below.

1. When subscriber starts a session in a zone with tac = 100, local-policy reports a lp-rule-name-install event as it matches the rule tac\_list\_1.
2. ECS matches the event against the entries for trigger type "loc-update" and perform the throttle-suppress action.
3. If the subscriber moves out to a different zone, LP reports an lp-rule-name-remove for tac-list-1 so that ECS can turn off throttle-suppress.

## Limitations

This section identifies the known limitations of this feature.

- Throttling is not supported for uplink packets in case of APN-AMBR. When applying throttling to such packets, it will have no effect.
- For a given ruledef all the conditions should match. Due to this, the current implementation on local-policy has the following restrictions:
  - For every new set of MCC and MNC, a new ruledef should be configured. Also, for every ecgi/3guli/tai range of the given MCC/MNC, a new ruledef should be configured.
  - For each ruledef, new-call and location-change events should be configured additionally in "eventbase" configuration.
  - If a disjoint set of TAC or LAC should be configured, note that up to 32 such values can be configured in a ruledef.
  - Local-Policy supports up to 7 lp-rules to be activated for a given session.
- Based on location received in CPC or UPC, necessary action is taken in local-policy and the LP rule is activated. If the location is received without that ULI type in the next message (update PDP context), then this will be considered as a location change with ULI value as 0 and the rule will be deactivated even if the location of the UE is not changed.
- The location change is not identified in the response of network requested update PDP context message. Also if the location change is notified along with call termination, then this is not identified as a location-change.
- Upon receiving SGSN change and if SGSN supports CRA handling, the CRA with value 0 is reported even though the CRA reporting is suppressed by LP/PCRF.

# Configuring Location Based QoS Override

The following sections provide the configuration commands to enable location based QoS Override functionality.

This functionality is achieved through the CLI configurations provided at both local-policy and ECS.

## Local-Policy Configurations

The following sections provide the configuration commands that should be enabled within local-policy for the feature to work.

### Activating Local-Policy Rule

Use the following configuration to activate the local-policy rule within service scheme based on the configured RAI or TAI range of subscribers.

```
configure
  local-policy-service local_policy_service_name
    actiondef actiondef_name
      action priority priority activate-lp-rule name lprule_name
    end
```

#### Notes:

- **activate-lp-rule** *lprule\_name*: This keyword activates a local-policy rule within service scheme when a subscriber is in the configured RAI or TAI range. *lprule\_name* must be an existing local-policy rule within the service scheme expressed as an alphanumeric string of 1 through 63 characters.

When the subscriber moves out of the configured RAI or TAI range, the local-policy rule is deactivated.

- Local-Policy can support up to 7 lp-rules to be activated for a given session.

### Controlling CRA Events

Use the following configuration to suppress the CRA for event triggers enabled in local policy configurations.

```
configure
  local-policy-service local_policy_service_name
    suppress-cra event-triggers { ecgi-change | tai-change | uli-change } +
  end
```

#### Notes:

- **suppress-cra event-triggers { ecgi-change | tai-change | uli-change }**: This keyword restricts sending of CRA towards MME depending on the ECGI-Change, TAI-Change and ULI-Change event triggers configured in local-policy service.
- Use the **no suppress-cra** command to configure the default behavior. By default, the CRA notification is sent to MME if one or a combination of these event triggers is installed.

## Configuring Location Change Event Triggers

Use the following configuration to install ECGI Change, TAI-Change and/or ULI-Change event triggers from local policy.

```
configure
  local-policy-service service_name
    actiondef actiondef_name
      action priority priority event-triggers { ecgi-change | tai-change
| uli-change }
    exit
  eventbase default
    rule priority priority event new-call ruledef ruledef_name actiondef
actiondef_name [ continue ]
  end
```

### Notes:

- **priority priority**: Specifies a priority for the specified action. **priority** must be unique and an integer from 1 to 2048.
- **event-triggers { ecgi-change | tai-change | uli-change }**: This keyword specifies to install ECGI-Change, TAI-Change and/or ULI-Change event triggers. If enabled, the respective event triggers are installed from local policy.
- This CLI command is configured in local-policy if operator wants to enable the respective change notification in MME by sending a CRA value.

## Applying Rules for TAI-Change Event

Use the following configuration to enable TAI-Change detection and take specific action for TAI-CHANGE event reported by MME.

```
configure
  local-policy-service service_name
    eventbase eventbase_name
      rule priority priority event tai-change ruledef ruledef_name actiondef
actiondef_name [ continue ]
    end
```

### Notes:

- **priority priority**: Specifies a priority for the specified rule. **priority** must be unique and an integer from 1 to 2048.
- **ruledef ruledef\_name**: Associates the rule with a specific ruledef. **ruledef\_name** must be an existing ruledef within this local QoS policy service.
- **actiondef actiondef\_name**: Associates the rule with a specific actiondef. **actiondef\_name** must be an existing actiondef within this local QoS policy service expressed as an alphanumeric string of 1 through 63 characters.
- **tai-change**: Enables a new event to detect TAI-Change and applies specific action for the TAI-Change event as defined in actiondef configuration.
- **continue**: Subsequent rules are also matched; otherwise, rule evaluation is terminated on first match.

## Enforcing LP Rule based on Event Parameter Values

Use the following configuration to apply rules based on the values of ECGI, 3G-ULI, and TAI received in event notification by MME.

```
configure
  local-policy-service service_name
    ruledef ruledef_name
      condition priority priority ecgi mcc mcc_num mnc mnc_num eci { eq | ge
| gt | le | lt | match | ne | nomatch } regex | string_value | int_value | set
      }
      condition priority priority tai mcc mcc_num mnc mnc_num tac { eq | ge
| gt | le | lt | match | ne | nomatch } regex | string_value | int_value |
set }
      condition priority priority 3g-uli mcc mcc_num mnc mnc_num lac { eq |
ge | gt | le | lt | match | ne | nomatch } regex | string_value | int_value
| set }
    exit
```

### Notes:

- **priority priority**: Specifies a priority for the specified condition. *priority* must be unique and an integer from 1 to 2048.
- **ecgi mcc mcc\_num mnc mnc\_num eci**: Configures ECGI with values for MCC, MNC and ECI.
  - *mcc\_num*: MCC is a three digit number from 001 to 999. It is a string of size 3 to 3.
  - *mnc\_num*: MNC is two/three digit number from 01 to 999. It is a string of size 2 to 3.
  - *eci*: ECI is a hexadecimal number from 0x1 to 0xffffffff. It is a string of size 1 to 7.
- **tai mcc mcc\_num mnc mnc\_num tac**: Configures TAI with values for MCC, MNC and TAC.
  - *mcc\_num*: MCC is a three digit number from 001 to 999. It is a string of size 3 to 3.
  - *mnc\_num*: MNC is two/three digit number from 01 to 999. It is a string of size 2 to 3.
  - *tac*: TAC is a 4 byte field. It is a string of 4 hexadecimal values from 0x1 to 0xffff.
- **3g-uli mcc mcc\_num mnc mnc\_num lac**: Configures 3G-ULI parameter with values for MCC, MNC and LAC.
  - *mcc\_num*: MCC is a three digit number from 001 to 999. It is a string of size 3 to 3.
  - *mnc\_num*: MNC is two/three digit number from 01 to 999. It is a string of size 2 to 3.
  - *lac*: LAC is a 4 byte field. It is a string of 4 hexadecimal values from 0x1 to 0xffff.
- This CLI command is configured in local-policy if operator wants to take specific action based on certain event parameter value received in Change event notification by MME.

## ECS Configurations

The following section provides the configuration commands that should be enabled within ECS for the feature to work.

## Enabling Location Based QoS Override

Use the following configuration to enable QoS override based on subscriber location.

```
configure
  active-charging service service_name
    trigger-action trigaction_name
      [ no ] throttle-suppress
  exit
```

### Notes:

- **throttle-suppress**: This keyword allows operators to suppress the throttling when the subscriber is in a particular LAC or TAC location.
- Use the **no throttle-suppress** CLI command to disable this feature for the subscriber.

## Configuring Local-Policy Rule within ECS

Use the following configuration to specify the local-policy rule within ECS for enabling trigger condition.

```
configure
  active-charging service service_name
    trigger-condition trigcond_name
      [ no ] local-policy-rule = lprule_name
  exit
```

### Notes:

- **local-policy-rule**: This keyword allows operators to suppress the throttling when the subscriber is in a particular LAC or TAC location and hits the specified local-policy rule. The local-policy-rule contains either a list, range, or index of LAC and/or TAC entries.
- *lprule\_name*: Specifies the local-policy rule name. *lprule\_name* must be an existing local-policy rule within the service scheme expressed as an alphanumeric string of 1 through 63 characters.
- Use the **no local-policy-rule** CLI command to disable this feature for the subscriber.

## Verifying the Location Based QoS Override Configuration

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

```
show configuration
```

This command displays all the configurations that are enabled within the chassis for the subscriber. This display can be used to verify if the Location based QoS Override feature is enabled or disabled.

This is an example configuration to enable this feature for a subscriber on a particular rulebase *rb1*, for a particular local-policy-rule for zone A.

```
configure
  active-charging service s1
    trigger-action ta1
      throttle-suppress
  exit
  trigger-condition tc1
    local-policy-rule = zone_A
```



```
exit
service-scheme ss1
  trigger loc-update
    priority 1 trigger-condition tc1 trigger-action ta1
  exit
subs-class sc1
  rulebase = rb1
exit
subscriber-base sb1
  priority 1 subs-class sc1 bind service-scheme ss1
exit
```

## Monitoring and Troubleshooting the Location Based QoS Override

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

Use the following CLI commands and collect the output to troubleshoot if any issue is encountered with this feature.

```
logging filter active facility local-policy level debug
show local-policy statistics all
show active-charging sessions full all
show ims-authorization sessions full all
logging filter active facility ims-auth level debug
```

### show active-charging subscribers full all

The following field is newly added to the output of this show command in support of this feature.

- Local-policy RAI/TAI Rules Active List – Displays the list of local-policy rules for RAI/TAI that are currently activated for the subscriber.

### show active-charging trigger-action all

The following field indicates whether suppress throttling is enabled or disabled.

- Throttle Suppress

### show active-charging trigger-condition all

The following field displays the name of the configured local-policy (LP) rule.

- Local-policy Rule Name

## show ims-authorization policy-control statistics

The following field is newly added to the output of this show command in support of this feature.

- Session Recovery Failure
  - Activate-LP-Rule – This field indicates the number of times lp-activate-rules session recovery or ICSR recovery failed.

## show local-policy statistics all

The following fields are newly added to the output of this show command in support of this feature.

- Event Statistics
  - 3G-ULI Change – Displays the number of 3G-ULI-CHANGE event triggers that has been received by Local-Policy
  - TAI Change – Displays the number of TAI-CHANGE event triggers that has been received by Local-Policy
- Action Statistics
  - Activate LP Rule – The total number of times the lp-activate-rule action is triggered by local-policy module.
  - Activate LP Rule Failure – The total number of times the lp-activate-rule action fails.
  - Activate LP Rule Success – The total number of times the lp-activate-rule action succeeds.
- Variable Matching Statistics
  - 3G-ULI – Displays the number of times the 3G-ULI value is matched and the specific action is applied based on the event.
  - TAI – Displays the number of times the TAI is matched and the specific action is applied based on the event.