State-Location Information Retrieval Flag

The MME indicates in the ULR command that it supports State/Location Information Retrieval so the HSS sets the "EPS User State Request", "EPS Location Information Request" and "Current Location Request" bits in IDR-Flags AVP in IDR commands towards that MME. This chapter explains how the MME supports this flag.

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Feature Description

The MME sends the "State/Location-Information-Retrieval" flag set in the Feature-List AVP of the Update Location Request (ULR) message over the S6a interface to the HSS at the time the UE attaches. With the "State/Location-Information-Retrieval" flag set, the HSS knows to set the "EPS User State Request", "EPS Location Information Request" and "Current Location Request" bits in the IDR-Flags AVP in IDR messages towards the MME. This subscriber data provides the UE's current location information needed in multiple service scenarios, such as VoLTE services on the IMS side.

How It Works

MME Behavior for IDR-initiated Paging

Upon receipt of an IDR message with the "Current Location Request" bit set in the IDR-Flags AVP, the MME behavior complies with Feature-List AVP, IDR-Flags AVP, and EPS-Location-Information AVP sections as specified in 3GPP TS 29.272 v11.9.0. So when the IDR messages are received with "EPS Location Information Request" and "Current Location Request" bits set in IDR-Flags AVP, the MME sends the UE's current location information or the UE's last known location information in the "EPS-Location-Information" AVP of the IDA message

If IDR is received with "EPS Location Information Request" and "Current Location Request" flags set in IDR-Flags AVP, the MME's IDA response depends on whether :

- the UE is in connected mode with Location Reporting active making location information available, then the MME sends the IDA message without "Current-Location-Retrieved" AVP in "EPS-Location-Information" AVP.
- the UE is in connected mode without Location Reporting active so location information is not available, then the MME sends a Location-Reporting-Control message to the eNB to get the ECGI and the TAI.
  - If the MME receives a Location-Report message, then the MME sends an IDA message without "Current-Location-Retrieved" AVP and the "Age-Of-Location-Information" is set to zero in the "EPS-Location-Information" AVP sent to the HSS.
  - If the MME does not receive a Location-Report message, then the MME sends IDA message with last known location information with "Age-Of-Location-Information" AVP and without "Current-Location-Retrieved" AVP to the HSS.
- the UE is in idle mode, then the MME pages the UE to bring the UE to connected mode.
  - If paging is successful, then the MME sends an IDA message with "Age-Of-Location-Information" and "Current-Location-Retrieved" both set to zero in the "EPS-Location-Information" AVP to the HSS.
  - If paging is not successful, then the MME sends IDA messages with last known location information with "Age-Of-Location-Information" AVP and without "Current-Location-Retrieved" AVP to the HSS.

Location Reporting Control

The Location Report Control messages allow the MME to request the eNB to report where the UE is currently located.

MME's IDR-initiated Paging Process

If the UE is in ECM-IDLE and the MME receives IDR with "EPS Location Information Request" and "Current Location Request" flags set in IDR-Flags AVP, then the MME starts the ISDA guard timer (configurable for 1-100 seconds**) and also triggers the paging procedure. If the MME receives a response from the eNB before the timer expires, then MME sends an IDA message with the UE's current location information in the "EPS-Location-Information" AVP. Otherwise the MME sends an IDA message with the last known location information in "EPS-Location-Information" AVP when the ISDA timer expires. (**Configuration as of Release 17.4.)

Paging initiation is similar to paging for signaling events. However, a separate event shall be used in this case and be processed. If the paging procedure is already running for that UE, then when IDR is received with both flags set the MME shall not trigger paging again. MME behavior depends on the precedence configuration under paging-map:

- If the paging procedure already running for the UE has a higher precedence than for IDR, then when IDR is received with both flags set and if the other paging is not successful, then the MME does not trigger IDR paging again.
- If the paging procedure already running for the UE has a lower precedence than for IDR, and if IDR is received with both flags set, then the MME stops the ongoing paging procedure and triggers an IDR paging procedure.

If the paging procedure completes before the ISDA guard timer expires and a paging response is not received from the eNB, then the MME sends an asynchronous IDA response immediately without waiting for ISDA timeout.

MME's Immediate Response Through IDA

In Release 21.0 the MME responds to the IDR messages immediately with the cached location information, if the request is received within a configured amount of time. Earlier, when the MME received an IDR request for the current location of the UE, it sends a query to the eNodeB to acquire the location information of the UE, though MME had the location information available in it's cache memory.

Now, based on a configurable timer under mme-service configuration, the location information, that is, ECGI and TAI of the UE, available in the MME cache memory, is sent immediately in the IDA message. This location information is sent only if the configured timer has not expired. The eNodeB is not queried with any messages if the location information is available in the MME.

If both flags 'EPS Location Information' and 'Current Location Request' are received in the IDR, the MME immediately sends the cached location information through the IDA, if the configured timer has not expired.

This specific functionality of MME to respond immediately to the incoming IDR is license controlled. Contact your Cisco Account or Support representative for information on how to obtain a license.

Standards Compliance

The MME's support of the State/Location Information Retrieval flag complies with the following standards:

- Feature-List AVP, IDR-Flags AVP,. and EPS-Location-Information AVP sections as specified in 3GPP TS 29.272 v11.9.0

Configuring Support for the State Location Information Retrieval Flag

There is no configuration to enable or disable the MME's support of the State/Location-Information-Retrieval Flag. But, we highly recommend that you set precedence for IDR paging appropriate to your network. The significance of precedence is explained above in the *MME's IDR-initiated Paging Process* section.

Important If precedence is not configured, then the lowest precedence is automatically assigned.

Configuring Precedence for IDR Paging

Precedence for IDR paging is set using the existing **precedence** command with a special **idr** added as a paging trigger option to the signaling filter of the **traffic-type** keyword. The **precedence** command enables the operator to apply a priority for different paging-profiles based on traffic type. When a defined MME service is associated with a configured paging map, the system checks the configured profile map to determine which paging-profile to adopt for a given paging trigger, such as an IDR.

```
configure
  lte-policy
    paging-map paging_map_name
      precedence precedence traffic-type signaling [ idr ] paging-profile
 paging_profile_name
```

```
no precedence precedence
end
```

Notes:

- *paging_map_name* must be an alphanumeric string of up to 64 characters to identify a unique paging map associated with the LTE Policy.
- *precedence* must be an integer from 1 (lowest precedence) to 4 (highest precedence) to specify the handling precedence for this particular configuration definition.
- **idr** option selects IDR as the signaling traffic sub-type that triggers paging. (There are several other signaling traffic-type options.)
- *paging_profile_name* must be an alphanumeric string of up to 64 characters to identify a unique paging profile associated with the paging map and the LTE Policy.
- **no precedence** *precedence* removes the precedence configuration associated with the paging-map.

Verifying the Precedence Configuration

The **show lte-policy paging-map name** *map_name* command allows you to see the precedence information configured, for example:

```
show lte-policy paging-map name pm1
=====================================================================
  Paging Map : pm1
=====================================================================
  Precedence 1 : Signaling-IDR  Paging is performed as per paging-profile pm1
---------------------------------------------------------------------
```

Configuring the ISDA Guard Timer

isda-guard-timeout

This new command in the MME Service configuration mode enables the operator to set the number of seconds the MME waits for current location information for the UE. If the current location is not learned before expiry, because there is no paging response or location reporting control from the eNB, then the MME sends the ISDA with the last-known location upon expiry of this timer.

```
configure
  context context_name
    mme-service service_name
      [ no ] isda-guard-timeout seconds
      end
```

Notes:

- **no** prepended to the command disables any configuration for this timer and resets the wait time to the default of 25 seconds.
- Only when the ISDR is received with both location flags (current and last-known locations) set is the ISDA guard timer started. Upon expiry of this wait timer, the MME sends the ISDA with the last-known location of the UE.
- In situations where the MME receives the ISDR with only the last-known location flag set, then the MME immediately sends the ISDA with location information - no delay and this timer is not started even if configured.

- When the ISDA guard timer expires, the paging procedure does not stop until the page timer expires but the MME ignores the paging timer and sends the ISDA with the last-known location ***if*** the ISDR was received with both location flags set and the UE is in EMM-idle mode.
- While the MME is serving the ISDR (where both location flags are set) from the HSS, if the HSS tries to send another similar request then the MME responds to the HSS with DIAMETER_UNABLE_TO_COMPLY.

Configuring Location Validation Timer for IDA

loc-validity-time

This command is used to configure a timer value, with which the location information of the UE is sent immediately through the IDA message. If the current location is not learned before expiry, because there is no paging response or location reporting control from the eNB, the MME sends the IDA with the last-known location upon expiry of this timer.

```
configure
  context context_name
    mme-service service_name
      [ no ] isda loc-validity-timeout timer_value
      end
```

Notes:

- **no** disables the location validity configuration.
- *timer_value* specifies the amount of time in seconds. The timer is an integer value that ranges from 1 to 1000 seconds.
- **isda** command specifies/selects the Insert Subscriber Data Answer sent to the HSS.
- **loc-validity-time** command specifies the expiry time for the age of the UE's location information. During this time, if the EPS Location Information with current location is requested in the ISDR, the MME does not process a location procedure with the eNodeB, but sends the location information from the cache.

Verifying the Precedence Configuration

The **show lte-policy paging-map name** *map_name* command allows you to see the precedence information configured, for example:

```
show lte-policy paging-map name pm1
=====================================================================
  Paging Map : pm1
=====================================================================
  Precedence 2 : Signaling-IDR  Paging is performed as per paging-profile pm1
---------------------------------------------------------------------
```

Monitoring the MME's Support for the State - Location Information Retrieval Flag

show mme-service statistics

Counters have been added, to the output generated by this command, to display quantitative data for successes and failures of paging initiated in response to IDR:

```
Paging Initiation for SIGNALING IDR Events:
Attempted:                  0     Success:   0
Failures:                   0
Success at Last n eNB:      0     Success at Last TAI:       0
Success at TAI List:        0
```

show mme-service all

On execution of the above command, the following fields are displayed:

```
Service Name                    : mmesvc
---------------
ISDA Gaurd Timeout              : 10s
ISDA Location Availability      : 10s
Mobile Reachable Timeout        : 3480s
---------------
```

show hss-peer-service statistics service

On executing the above command, the following fields are displayed:

```
HSS statistics for Service: mme1
Location Message Stats:
  Asynchronous ISDR Req       0Asynchronous ISDR Dropped   0
  Asynchronous ISDA           0             Asynchronous ISDA Dropped   0
  ISDR with Current Location  0             ISDA with Cached Location   0
```

Notes:

- **ISDR with Current Location:** This statistics is updated when ISDR is received with the Current Location bit set in the IDR flags.
- **ISDA with Cached Location:** This statistics is updated when an ISDR is responded with the current location information immediately from the cache, before the location validity timer expires.

show hss-peer-service statistics

In support of the new "State/Location Information Retrieval" flag functionality, counters have been added to the output generated by the **show hss-peer-service statistics** command :

- Asynchronous Message Stats:
- Asynchronous ISDR Req
- Asynchronous ISDR Dropped

- Asynchronous ISDA
- Aynchronous ISDA Dropped
- ISDR Req with Current Location
- ISDA with Cached Location

Bulk Statistics

Functional descriptions, triggers and statistic type are defined for each of the bulk statistics listed below in the *Statistics and Counters Reference*.

The following bulk statistics have been added to the **MME schema** to track paging initiated in response to IDR:

- signaling-idr-paging-init-events-attempted
- signaling-idr-paging-init-events-success
- signaling-idr-paging-init-events-failures
- signaling-idr-paging-last-enb-success
- signaling-idr-paging-last-tai-success
- signaling-idr-paging-tai-list-success

The following bulk statistics have been added to the **HSS Schema** to track the location information response to the IDR:

- msg-isdr-curr-loc
- msg-isda-cached-location