

Events Monitoring

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Feature Description

The Event Monitoring functionality allows monitoring of specific events in the 3GPP system and makes the event information available through either Service Capability Exposure Function (SCEF) or Home Subscriber Server (HSS). Allows the identification of the 3GPP network elements that are suitable for configuring specific events, detecting events, and reporting events to the authorized users.

The following example explains a specific use case for a individual subscriber.

A subscriber can track the following events:

- Location Reporting
- UE reachability
- Availability after DDN failure
- PDN Connectivity Status
- · Loss of connectivity
- Communication failure
- Number of UEs available in a geographical location
- or Idle Status Indication for Availability after DDN failure for a specific subscriber (UE) from MME or HSS

Once the tracking is initiated SCEF queries the MME service and reports the list of events failed or affected for that specific subscriber (UE).

In this release, MME supports monitoring events on s6a and t6a interfaces for monitoring the following events:

• Number of UEs present in a geographical location - This is triggered from SCEF to MME in Configuration information request message. MME responds with a configuration information Answer messages with the reports, status and supported AVPs. The following table describes the supported feature AVPs.

AVPs	Parameters
Number-of-UE-Per-Location-Configuration	{ EPS-Location-Information }
	[IMSI-Group-Id]
MME-Location-Information	[E-UTRAN-Cell-Global-Identity]
	[Tracking-Area-Identity]
	[User-CSG-Information]
	[eNodeB-ID]
Number-of-UE-Per-Location-Report	{ EPS-Location-Information }
	{ UE-Count }
	IMSI-Group-Id
	{ Group-Service-Id }
	{ Group-PLMN-Id }
	{ Local-Group-Id }
Not Supported AVP	
Location Information	[Geographical-Information]
	[Geodetic-Information]
	[Current-Location-Retrieved]
	[Age-Of-Location-Information]
	[Extended-eNodeB-ID]

Table 1: Supported and Not Supported AVPs

• Location Reporting - Montoring Events sends report when the MME detects that the UE changed location with the granularity as requested by the monitoring event configuration. If there is Minimum Reporting Interval, while the timer is running, the MME suppresses sending consecutive Location Reporting notification. On timer expiry MME sends location information that was contained in the latest suppressed Location Reporting notification and restarts the timer.

Location Reporting is supported for Current Location or the Last Known Location of a UE. The Location Reporting type allows:

- One Time Reporting: If request is for "Last known" of a UE the supported Accuracy in the network is at either cell level (CGI/ECGI), eNodeB, TA/RA level.
- Periodic Reporting: Request is for current location type.
- Continuous Location Reporting: Unless a Minimum Reporting Interval was provided, the serving node(s) sends a notification every time it becomes aware of a location change.

AVPs	Parameters
Location-Information-Configuration	[MONTE-Location-Type]
	[Accuracy]
	[Periodic-Time]
MONTE-Location-Type	CURRENT_LOCATION (0)
	LAST_KNOWN_LOCATION (1)
	Note The default value, when this AVP is not included, is LAST_KNOWN_LOCATION (1).
Common Parameter	Maximum number of reports should not be greater than one if Monitoring-Type is LOCATION_REPORTING (2) and MONTE-Location-Type is LAST_KNOWN_LOCATION (1)
MME Location Information	[E-UTRAN-Cell-Global-Identity]
	[Tracking-Area-Identity]
	[E-UTRAN-Cell-Global-Identity]
	[Current-Location-Retrieved]
	[User-CSG-Information]
	[eNodeB-ID]
Not Supported AVP	1
MME Location Information	[Geographical-Information]
	[Geodetic-Information]
	[Current-Location-Retrieved]
	[Age-Of-Location-Information]
	[Extended-eNodeB-ID]

Table 2: Supported and Not Supported AVPs

• UE Reachability – Monitoring Events reports when UE transitions to ECM-CONNECTED mode (for a UE using Power Saving Mode or extended idle mode DRX) or when the UE reaches for paging (for a UE using extended idle mode DRX).

Table	3: Su	pported	AVPs
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AVPs	Parameters
UE-Reachability-Configuration	[Reachability-Type]
	[Maximum-Response-Time
	MME uses the Maximum Response Time as the Active Time for PSM UEs.
Event Reporting	UE_REACHABILITY (1)
	REACHABLE_FOR_DATA(1)
	Maximum-UE-Availability-Time
	Maximum Latency: : Sent by SCEF to HSS. HSS uses this Maximum Latency to calculate the subscribed periodic RAU/TAU timer.
Handover Scenatio	Monitoring Event Information IE, NSR flag, SCEF Ref id, SCEF id, and Remaining number of reports.

• Availability after DDN failure – MME triggers this event when the UE contacts the network. For example, to perform a TAU, or to executes a service request after DDN Failure.

The SCEF sends Monitoring request without adding Max Number of Reports, since the "Availability after DDN Failure" is an ongoing event that needs explicit deletion to cancel further reports. The information is provided to the serving node (MME) at registration. The serving node notes this and sets a Notify-on-available-after-DDN-failure flag after a DDN failure. If the flag is set when the UE next contacts the network, the serving node notifies the SCEF that the UE is reachable, and clears the flag.



Note Not every DDN failure triggers this event. This event is triggered only when the UE is in PSM or eDRX mode.

Table 4: Supported AVPs

AVPs	Parameters
Event configuration	Monitoring -Type: AVAILABILITY_AFTER_DDN_FAILURE (6)
Event Reporting	Monitoring-Type set to AVAILABILITY_AFTER_DDN_FAILURE (6)
Handover Scenatio	Monitoring Event Information IE, NSR flag, SCEF Ref id, SCEF id, and Remaining number of reports.

• PDN Connectivity Status - The following AVPs are supported.

AVPs	Parameters
Event configuration: HSS to MME	ULA / ISDR Monitoring-Type set to PDN_CONNECTIVITY_STATUS (10)
	PDN-Connectivity-Status-Configuration
	[Service-Selection]
	If the Service-Selection AVP is included, then the monitoring applies to that specific APN. if the
	If the Service-Selection is not available, the monitoring request applies to all APNs.
PDN-Connectivity-Status-Report	{ Service-Selection }
	{ PDN-Connectivity-Status-Type }
	[PDN-Type]
	[Non-IP-PDN-Type-Indicator]
	[Non-IP-Data-Delivery-Mechanism]
	[Served-Party-IP-Address]

Table 5: Supported AVPs

• Loss of Connectivity– Event is triggered when UE's radio connectivity is lost. HSS configures events HSS through ULA/ISDR messages. Event reporting happens through RIR with event specific parameters. The following AVPs are supported.

Table 6: Supported AVPs

AVPs	Parameters
Loss-Of-Connectivity-Reason - Identifies the reason	UE_DETACHED_MME (0)
of loss of connectivity	UE_DETACHED_SGSN (1)
	MAX_DETECTION_TIME_EXPIRED_MME (2)
	MAX_DETECTION_TIME_EXPIRED_SGSN (3)
	UE_PURGED_MME (4)
	UE_PURGED_SGSN (5)

• **Communication failure** – Event is triggered when the MME becomes aware of a RAN or NAS failure event. Event configuration by HSS through ULA/ISDR messages.



hut Handover and Roaming functions are not supported.

Table 7: Supported AVPs

AVPs	Parameters
Communication-Failure-Information	[Cause-Type]
	[S1AP-Cause]

• Idle Status Indication for Availability after DDN failure and UE reachability – MME supports Idle Status Indication when the UE transitions into idle mode. The MME includes the time at which the UE transitioned into idle mode, the active time, and the periodic TAU/RAU time granted to the UE by the MME in the notification towards the SCEF, the eDRX cycle length, and the suggested number of downlink packets if a value is provided to the S-GW.

Table 8: Supported AVPs

AVPs	Parameters
Idle-Status-Indication	[Idle-Status-Timestamp] – Time at which the UE transitioned into idle mode.
	[Active-Time] d – Shows the active time if PSM is enabled.
	[Subscribed-Periodic-RAU-TAU-Timer] – The periodic TAU/RAU time granted to the UE by the MME in the notification towards the SCEF.
	[eDRX-Cycle-Length] – Shows the eDRX cycle length if eDRX is enabled.
	[DL-Buffering-Suggested-Packet-Count] – Displays the Suggested number of downlink packets if a value is provided to the S-GW.
Handover Scenarois	Monitoring Event Information IE, NSR flag, SCEF Ref id, SCEF id, and Remaining number of reports.

• External-identifier on MME for monitoring events

- The External-identifier feature is applicable for the ULR/ULA, DSR/DSA and IDR/IDA command pairs over S6a (and S6d), when the MME (or combined MME/SGSN) supports the External-identifer.

• If the MME/SGSN includes the External-Identifier or the MSISDN if present in the subscription data received from the HSS, the UE contains the identity of the UE, which is a grouped AVP that contains MSISDN or the External-identifier.



Note If the MME or combined MME/SGSN does not support External-identifier:

- The HSS shall not send the External-Identifier subscription data to the MME or combined MME/SGSN within ULA.
- The HSS shall not send Monitoring Event configuration for UEs that are part of a group and have no MSISDN as part of its subscription data to the MME/SGSN.
- The HSS shall not indicate External-Identifier-Withdrawal in the DSR-Flags AVP of the DSR.
- Gtpv2 handover scenarios
- For adding TAC field in the Monitoring reporting information requests (RIR) from MME

How it Works

This section describes how montoring events work for the following two events:

- Number of UEs present in a geographical location The UE information is exchanged by MME and SCEF based on the requested TAI through Configuration Information Request (CIR) and Configuration Information Answer (CIA) messages.
- **Communication failure** Communication failure events that happend between MME and HSS can be monitored. The communication failure event is monitored when HSS sends a communication failure message in the monitoring event configuration. In MME, the message is received through Insert Subscriber Data Request (ISDR) on s6a interface. The MME sends the Monitoring Event Report for the communication failure event to SCEF over t6a interface through RIR (Reporting-Information-Request) messages.
- External-identifier The External-identifier feature is applicable for the ULR/ULA, DSR/DSA and IDR/IDA command pairs over S6a (and S6d), when the MME (or combined MME/SGSN) supports the External-identifer.

If the MME/SGSN includes the External-Identifier or the MSISDN if present in the subscription data received from the HSS, the UE contains the identity of the UE, which is a grouped AVP that contains MSISDN or the External-identifier.

Note If the MME or combined MME/SGSN does not support External-identifier:

- The HSS shall not send the External-Identifier subscription data to the MME or combined MME/SGSN within ULA.
- The HSS shall not send Monitoring Event configuration for UEs that are part of a group and have no MSISDN as part of its subscription data to the MME/SGSN.
- The HSS shall not indicate External-Identifier-Withdrawal in the DSR-Flags AVP of the DSR.

Monitoring Events WorkFlow

This section describes the call flows in which the monitoring events procedure are performed.

Figure 1: Call Flow from SCEF to MME



Table 9: Monitoring Event Configuration and Deletion through MME Procedure

Step	Description
1	The SCS/AS sends a Monitoring Request (SCS/AS Identifier, Monitoring Type, Monitoring Duration, Maximum Number of Reports, T8 Destination Address, TLTRI for Deletion) message to the SCEF. The SCEF assigns a TLTRI that identifies the Monitoring Request.

Step	Description
2	The SCEF stores the TLTRI, and also assigns it to an SCEF Reference ID.
3	The SCEF sends a Monitoring Request (SCEF ID, SCEF Reference ID, Monitoring Type, Monitoring Duration, Maximum Number of Reports, SCEF Reference ID for Deletion) message to the MME(s)/SGSN(s).
4	The MME/SGSN examines whether to accept the request from the SCEF based on operator configuration or whether it serves the SCEF Reference ID for Deletion and can delete it. If acceptable, the MME/SGSN stores SCEF ID, SCEF Reference ID, Monitoring Duration, Maximum Number of Reports and other relevant parameters unless it is a One-time request and the Monitoring Event is available to the MME/SGSN at this time. The MME/SGSN deletes the monitoring configuration identified by the SCEF Reference ID for Deletion, if provided.
5	The MME/SGSN sends a Monitoring Response (SCEF Reference ID, Cause) message to the SCEF to acknowledge acceptance of the Monitoring Request and to provide the requested monitoring information or to acknowledge the deletion of the identified monitoring event configuration, if it was requested.
6	The SCEF sends a Monitoring Response (TLTRI, Cause, Monitoring Event Report) message to the SCS/AS to acknowledge acceptance of the Monitoring Request and to provide the requested monitoring information in Monitoring Event Report parameter or to acknowledge the deletion of the identified monitoring event configuration at the time of request.



Figure 2: Monitoring Event Configuration and Deletion through HSS Call Flow

Table 10: Monitoring Event Configuration and Deletion through HSS Procedure

Step	Description
1	The Diamproxy client, which is running on the StarOS device receives Monitoring Event Configuration Requests from the HSS through s6a interface under Subscription data grouped AVP or from the SCEF through t6a in Configuration Information Request message.
2	AVP information received from the device is parsed and the message is sent to corresponding Session Manager for further handling.

Step	Description
3	The Session Manager parses the event message and decodes the appropriate event.
	Important MME running as part of Session Manager identifies if the message is synchronous and responds immediately or asynchronously. Requests from HSS are received in the Update Location Answer(ULA)/Insert Subscriber Data Request(ISDR).
	If the response is determined as asynchronous, then the response are notified through t6a to SCEF directly.
4	Event handling routine invokes handler for appropriate events.
5	After the event handling, the report is sent through Monitoring Event Report message on s6a and t6a interface. Based on the event type, MME choses to dispatch the report on S6a interface. The Subcriber Data Answer message and Subscription
	Data can contain the report on s6a interface. Configuration Information Answer and Reporting Information Request message can contain the report on t6a interface

Configuring, monitoring, and reporting of new messages and AVPs for Home Subscribers are supported by following mechanisms:

- · Monitoring Event Configuration AVP in CIR message from SCEF over t6a interface
- Monitoring Event Configuration in ULA/ISDR from HSS over s6a interface
- Monitoring Event Report AVP from MME over t6a interface through CIA for the number of UE in a geographical area event
- Monitoring Event Report AVP to MME over t6a interface through RIR message for any communication failure events under Subscription Data

Configuring MME Services and Call Control Profiles

This section describes how to configure monitoring events for a call control profile.

C)

Important

When you configure MME service for users, monitoring-events is disabled by default.

Enabling the CLI monitoring-events in a Call Control Profile

Use the following configuration to enable CLI monitoring-events for all users in a call control profile .

configure

```
call-control-profile profile_name
[ no ] monitoring-events
end
```

NOTES:

- call-control-profile *profile_name*: Creates an instance of a call control profile. *profile_name* specifies the name of the call control profile as an alphanumeric string of 1 to 64 characters.
- monitoring-events: Monitors an event under the call control profile mode.
- no: Disables CLI monitoring-events in a Call-Control-Profile for an MME service.

Configuring Monitoring Events for an MME Service

Use the following configuration to monitor events for an MME service:

```
configure
```

```
context context_name
  mme-service service_name
  [ no ] monitoring-events
  end
```

NOTES:

- **mme-service** *service_name*: Creates an MME service or configures an existing MME service in the current context. *service_name* specifies the name of the MME service must be a string from 1 to 63 characters.
- monitoring-events: Configures monitoring events for MME service users.
- no: Disables CLI monitoring-events in an MME Service.

Verifying the CLI monitoring-events in an MME Service

The following command is used to verify the parameters for Event Monitoring in an MME service:

```
show mme-service all | grep Monitor
Monitoring Events : Enabled
```