ENVELOPE

Evaluation and validation of connected mobility in real open systems beyond 5GS

Edge Cloud – NEF Monitoring Event API

HORIZON JU Innovation Actions | 101139048 |
ENVELOPE - HORIZON-JU-SNS-2023

Co-funded by the European Union

6GSNS

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1 Introduction

The present document focuses on the NEF MonitoringEvent API that facilitates the information about location area for a certain UE via 5G Core Network. This document specifies the necessary API with the data model and data format.

The specification follows the 3GPP TS 29.122 document, particularly the MonitoringEvent API for location info feature, sharing the main data model structures.

The objective of the MonitoringEvent API is to provide Monitoring Event Reports of location area information about a certain UE to an AF running on the network side.

2 API overview

The NEF MonitoringEvent API allows external applications to:

- **Subscribe** to monitoring events like Location Reporting for UE's **current location**.
- **Receive reports** (via callback URL) based on event occurrences or configured intervals.
- **Query the last known location** for a specific UE.
- **Simulate MonitoringEventReports** via MongoDB for testing or integration with northbound APIs like **CAMARA** or **xAPP**.

The implementation follows the **3GPP TS 29.122** specification for MonitoringEvent API and supports integration within the **CAPIF** security framework.

Lastly, NEF retrieves location information for a UE based on a Log Agent functionality that extracts related logs from AMF and writes them in a mongo database. Thus, the NEF API fetches the related location data from the mongo database.

3 Sequence Diagram

There are two distinct flows according to the main operation of that API. The first one is the flow when a CURRENT_LOCATION Request has been performed for a certain UE as shown in figure 1. The other is for a LAST_KNOWN_LOCATION Request as can be seen in figure 2.

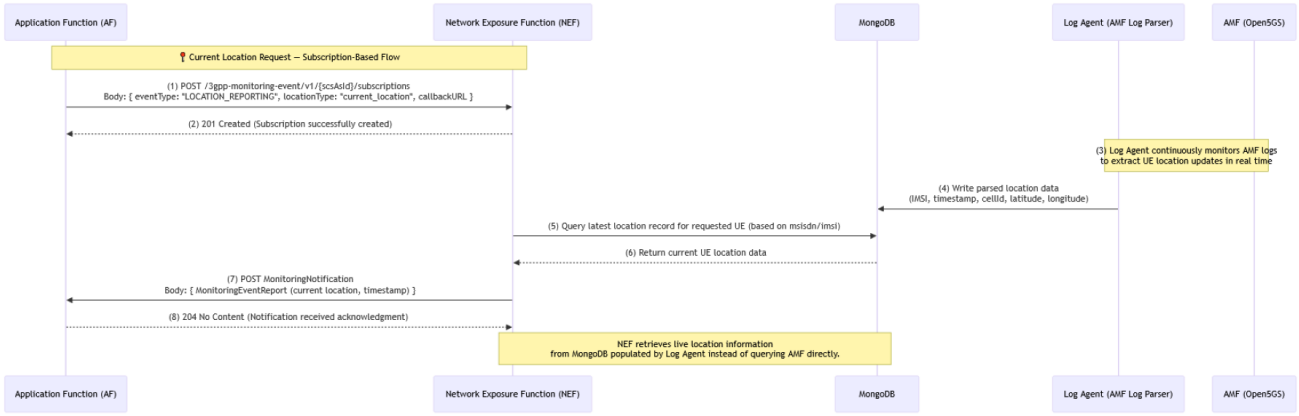

Figure 1 – Current Location Request flow

The following steps are made in the sequence diagram of figure 1:

1. AF sends POST subscription request for current location.
2. NEF acknowledges subscription creation (201 Created).
3. Log Agent parses AMF logs and stores location updates in MongoDB.
4. NEF retrieves the latest UE location record from MongoDB.
5. NEF sends a MonitoringNotification to AF's callback URL with a MonitoringEventReport message encapsulated.
6. AF acknowledges that a Monitoring Notification is received by sending back a 204 No Content HTTP message.

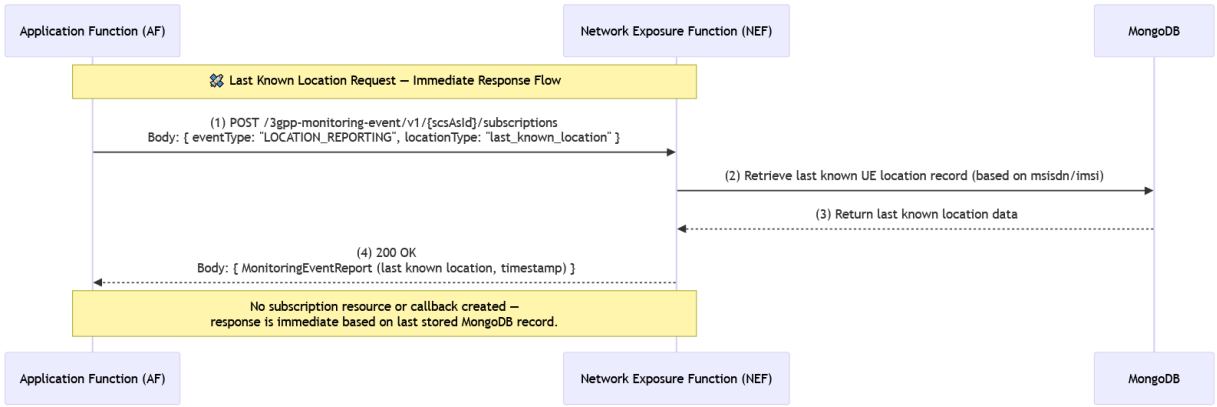

Figure 2 – Last Known Location Request flow

The following steps are made in the sequence diagram of figure 2:

1. AF requests last known location for a certain UE.

2. NEF fetches the last known location of the UE from MongoDB.
3. If any data entry is found in the database, the last known location returned to NEF.
4. NEF immediately returns a 200 OK with the MonitoringEventReport.

4 Monitoring Event API Definition

4.1 Resource Structure

4.1.1 Resource URIs

The root of the resource URIs of this API shall be:

{apiRoot}/{apiName}/{apiVersion}/

where *apiName* shall be set to *3gpp-monitoring-event*, and *apiVersion* shall be set to *v1* for the current version of the present document.

The resource URI structure of this API is introduced in *Figure 3*.

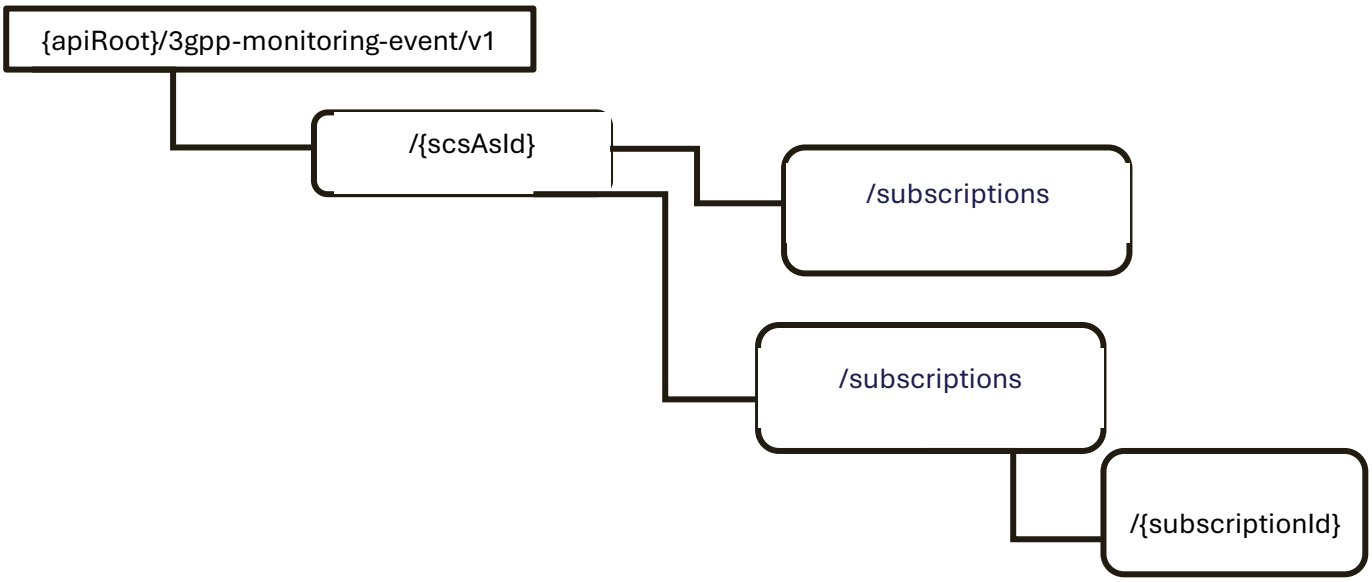

Figure 3 – Resource URI structure for the MonitoringEvent API

Table 1 introduces an overview of the resources and the methods.

Table 1 – Resources and methods Overview

Resource Name	Resource URI	HTTP method	Description

Monitoring Event Subscriptions	/3gpp-monitoring-event/v1/{scsAsId}/subscriptions	POST	Create a MonitoringEvent subscription
Monitoring Event Subscriptions	/3gpp-monitoring-event/v1/{scsAsId}/subscriptions/	GET	Read all of the active subscriptions for the AF
Individual Monitoring Event Subscription	/3gpp-monitoring-event/v1/{scsAsId}/subscriptions/{subscriptionId}	GET	Read an active subscription for the AF and the subscription Id
Individual Monitoring Event Subscription	/3gpp-monitoring-event/v1/{scsAsId}/subscriptions/{subscriptionId}	DELETE	Deletes an already existing subscription

5 Data Model

Data Model is based on the TS 29.122 3GPP document, particularly for location_info feature.

5.1 MonitoringEventSubscriptionRequest data type

Table 2. MonitoringEventSubscriptionRequest data type

Field Name	Type	Required	Description
accuracy	Accuracy	No	**(Not Supported)** Represents a desired granularity of accuracy of the requested location information.
externalId	str	No	**(Not Supported)** Identifies a user (clause 4.6.2 TS 23.682).
msisdn	str	No	Identifies the MS internal PSTN/ISDN number allocated for a UE.
ipv4Addr	IPvAnyAddress	No	**(Not Supported)** Identifies the IPv4 address.
ipv6Addr	IPvAnyAddress	No	**(Not Supported)** Identifies the IPv6 address.
notificationDestination	AnyHttpUrl	Yes	URI of a notification destination that the T8 message shall be delivered to.
monitoringType	MonitoringType	Yes	Enumeration of monitoring type. Refer to clause 5.3.2.4.3.
maximumNumberOfReports	int	No	Identifies the maximum number of event reports to be generated

			by the AMF to the NEF and then the AF.
monitorExpireTime	datetime	No	**(Not Supported)** Identifies the absolute time at which the related monitoring event request is considered to expire.
locationType	LocationType	No	Indicates whether the request is for Current Location, Initial Location, or Last Known Location.
repPeriod	DurationSec	No	Identifies the periodic time for the event reports.
minimumReportInterval	DurationSec	No	Identifies a minimum time interval between Location Reporting notifications.

5.2 MonitoringEventSubscriptionResponse data type

Table 3. MonitoringEventSubscriptionResponse data type

Field	Type	Required	Description
self_link	AnyHttpUrl	Yes	Link to the individual monitoring event subscription resource.
externalId	str	No	**(Not Supported)** Identifies a user (clause 4.6.2 TS 23.682).
msisdn	str	No	Identifies the MS internal PSTN/ISDN number allocated for a UE.
ipv4Addr	IPvAnyAddress	No	**(Not Supported)** IPv4 address.
ipv6Addr	IPvAnyAddress	No	**(Not Supported)** IPv6 address.
monitoringType	MonitoringType	Yes	Type of monitoring.
maximumNumberOfReports	int	No	Maximum number of event reports generated.
monitorExpireTime	datetime	No	**(Not Supported)** Expiration time of the monitoring request.
monitoringEventReport	MonitoringEventReport	No	Monitoring event report sent from NEF to AF.

5.3 MonitoringNotification data type

Table 4. MonitoringNotification data type

Field Name	Type	Required	Description

subscription	AnyHttpUrl	Yes	Link to the subscription resource related to this notification.
monitoringEventReports	List [MonitoringEvent Report]	No	List of monitoring event reports (optional).
cancelInd	bool	No	Indicates whether to cancel the corresponding monitoring subscription (default false).

5.4 MonitoringEventReport data type

Table 5. MonitoringEventReport data type

Field	Type	Required	Description
externalId	str	No	**(Not Supported)** Identifies a user (clause 4.6.2 TS 23.682).
msisdn	str	No	Identifies the MS internal PSTN/ISDN number allocated for a UE.
locationInfo	LocationInfo	No	User location-related information.
locFailureCause	LocationFailureCause	No	Location positioning failure cause.
monitoringType	MonitoringType	Yes	Identifies the type of monitoring (clause 5.3.2.4.3).
eventTime	datetime	No	Time when the event is detected or received.

5.5 LocationInfo data type

Table 6. LocationInfo data type

Field	Type	Required	Description
ageOfLocationInfo	DurationMin	No	Elapsed time since the last network contact of the UE.
cellId	str	No	Cell ID where the UE is located.
trackingAreaId	str	No	Tracking Area ID where the UE is located.
plmnId	PlmnId	No	PLMN ID where the UE is located.
enodeBId	str	No	**(Not Supported by open5gs)** eNodeB ID where the UE is located.
routingAreaId	str	No	**(Not Supported by open5gs)** Routing Area ID where the UE is located.
twanId	str	No	**(Not Supported by open5gs)** TWAN ID where the UE is located.

geographicArea	GeographicArea	No	**(Not Supported by open5gs)** Identifies a geographic area where the UE is located.

5.6 LocationFailureCase data type

Table 7. LocationFailureCase data type

Name	Value	Description
POSITION_DENIED	"POSITIONING_DENIED"	**(Not Supported)** Positioning is denied.
UNSUPPORTED_BY_UE	"UNSUPPORTED_BY_UE"	**(Not Supported)** Positioning not supported by UE.
NOT_REGISTERED_UE	"NOT_REGISTERED_UE"	UE is not registered.
UNSPECIFIED	"UNSPECIFIED"	**(Not Supported)** Unspecified cause.

5.7 LocationType data type

Table 8. LocationType data type

Name	Value	Description
CURRENT_LOCATION	"CURRENT_LOCATION"	The AF requests to be notified for the current location.
LAST_KNOWN	"LAST_KNOWN_LOCATION"	The AF requests to be notified for the last known location.

5.8 MonitoringType data type

Table 9. MonitoringType data type

Name	Value	Description
LOCATION_REPORTING	"LOCATION_REPORTING"	Identifies a location reporting monitoring event.

5.9 PlmnId data type

Table 10. PlmnId data type

Field	Type	Required	Description
mcc	str	Yes	String encoding a Mobile Country Code (3 digits).
mnc	str	Yes	String encoding a Mobile Network Code (2 or 3 digits).

5.10 GeographicArea data type

Table 11. PlmnId data type

Field	Type	Required	Description
polygon	Polygon	No	Identifies a polygonal geographic area.

6 Monitoring Event API Operations

6.1 Resource: Monitoring Event Subscriptions

Resource URI: {apiRoot}/3gpp-monitoring-event/v1/{scsAsId}/subscriptions

The content of the methods requests and response is JSON, and it is indicated by setting the content type "application/json".

6.1.1 Resource Methods

6.1.2 GET

The GET method allows to read all or queried active subscriptions for a given SCS/AS (AF). The AF shall initiate the HTTP GET request message and the NEF shall respond to the message.

Table 12. Data structures supported by the GET request on this resource

Request body	Data type	Cardinality	Notes
	None	-	-

Table 13. Data structures supported by the GET response on this resource

	Data type	Cardinality	Response Codes	Notes
Response body	Array (MonitoringEventSubscriptions)	0.. N	200 OK	The subscription information for the AF in the request URI is returned.
	ErrorResponse	0..1	401	Authentication problem with the client request (UNAUTHORIZED)

	ErrorResponse	0..1	404	Not found (NOT FOUND)

6.1.3 POST

The POST method creates a new subscription resource to monitor an event for a given AF. The AF shall initiate the HTTP POST request message and the NEF shall respond to the message. The NEF shall construct the URI of the created resource.

Table 14. Data structures supported by the POST request on this resource

	Data type	Cardinality	Notes
Request body	MonitoringEventSubscription	1	Parameters to register a subscription to notifications about monitoring event with the NEF.

Table 15. Data structures supported by the POST response on this resource

	Data type	Cardinality	Response Codes	Notes
Response body	MonitoringEvent Subscriptio	1	201 Created	The subscription resource was created successfully. The URI of the created resource shall be returned in the "Location" HTTP header.
	MonitoringEvent Report	1	200 OK	The operation is successful, and corresponding monitoring event report is included. This is only applicable for the one-time monitoring request if report is available in the response.
	ErrorResponse	0..1	400	Problem with the client request (Bad Request)

	ErrorResponse	0..1	401	Authentication problem with the client request (UNAUTHORIZED)
	ErrorResponse	0..1	404	Not found (NOT FOUND)

6.2 Resource: Individual Monitoring Event Subscription

Resource URI:

{apiRoot}/3gpp-monitoring-event/v1/{scsAsId}/subscriptions/{subscriptionId}

This resource allows an AF to read or delete an active monitoring event subscription at the NEF.

The content of the methods requests and response is JSON, and it is indicated by setting the content type "application/json".

6.2.1 Resource Methods

6.2.2 GET

The GET method allows to read an active subscription resource to obtain details of the subscription. The AF shall initiate the HTTP GET request message and the NEF shall respond to the message.

Table 16. Data structures supported by the GET request on this resource

Request body	Data type	Cardinality	Notes
	None	-	

Table 17. Data structures supported by the GET response on this resource

	Data type	Cardinality	Response Codes	Notes
Response body	MonitoringEvent Subscriptions	1	200 OK	The subscription information related to the request URI is returned.
	ErrorResponse	0..1	401	Authentication problem with the client request (UNAUTHORIZED)
	ErrorResponse	0..1	404	Not found (NOT FOUND)

6.2.3 DELETE

The DELETE method deletes the related resource and terminates the related monitoring subscription. The AF shall initiate the HTTP DELETE request message and the NEF shall respond to the message.

Table 18. Data structures supported by the DELETE request on this resource

Request body	Data type	Cardinality	Notes
	None	-	-

Table 19. Data structures supported by the DELETE response on this resource

	Data type	Cardinality	Response Codes	Notes
Response body	None	1	204 No Content	The subscription was terminated successfully.
	Array (MonitoringEventReport)	1.. N	200 OK	The subscription was terminated successfully, the Monitoring event report(s) shall be included if received.
	ErrorResponse	0..1	401	Authentication problem with the client request (UNAUTHORIZED)
	ErrorResponse	0..1	404	Not found (NOT FOUND)

7 Additional Info

For more information about the data types and error codes you can refer to 3GPP TS 291.22v17

8 Swagger - ReDoc

https://redocly.github.io/redoc/?url=https://raw.githubusercontent.com/FRONT-research-group/NEF/refs/heads/main/monitoring_event_api.yaml

9 NEF's Github Repo

https://github.com/FRONT-research-group/NEF