



Multi-access Edge Computing (MEC); MEC in Park Enterprises deployment scenario

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Foreword

This Group Report (GR) has been produced by ETSI Industry Specification Group (ISG) Multi-access Edge Computing (MEC).

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1 Scope

The present document describes the key issues, solution proposals and recommendations needed to support MEC deployment in Park Enterprise scenario.

The following aspects are addressed: How 3GPP and MEC system cooperate for UEs to access MEC system based on location (e.g. based on ULCL insertion), including DN-AAA authentication and authorization, MEC application Slicing support, MEC efficient consumption of 5GC exposure capability and dynamic management according to user requirements, remote access of enterprise MEC applications.

In addition the present document considers the related work of other standard/industry bodies such as 3GPP and all related work done in ETSI. The outcome is to generate recommendations for future standard work, e.g. enhancements to current MEC system, interface enhancements, etc.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TS 123 501: "5G; System architecture for the 5G System (5GS) (3GPP TS 23.501 Release 17)".
- [i.2] ETSI TS 123 502: "5G; Procedures for the 5G System (5GS) (3GPP TS 23.502 Release 17)".
- [i.3] ETSI GS MEC 003: "Multi-access Edge Computing (MEC); Framework and Reference Architecture".
- [i.4] ETSI GR MEC 031: "Multi-access Edge Computing (MEC); MEC 5G Integration".
- [i.5] ETSI GS MEC 011: "Multi-access Edge Computing (MEC); Edge Platform Application Enablement".
- [i.6] ETSI GR MEC 001: "Multi-access Edge Computing (MEC); Terminology".
- [i.7] ETSI GS MEC 014: "Multi-Access Edge Computing (MEC); UE Identity API".
- [i.8] ETSI GS MEC 021: "Multi-access Edge Computing (MEC); Application Mobility Service API".
- [i.9] ETSI GS MEC 002: "Multi-access Edge Computing (MEC); Phase 2: Use Cases and Requirements".
- [i.10] ETSI TS 133 501: "5G; Security architecture and procedures for 5G System (3GPP TS 33.501 Release 17)".
- [i.11] ETSI GR MEC 024: "Multi-access Edge Computing (MEC); Support for network slicing".

- [i.12] ETSI GS MEC 010-2: "Multi-access Edge Computing (MEC); MEC Management; Part 2: Application lifecycle, rules and requirements management".
- [i.13] 3GPP TR 28.801: "Telecommunication management; Study on management and orchestration of network slicing for next generation network".
- [i.14] 3GPP TR 23.748: "Study on enhancement of support for Edge Computing in 5G Core network (5GC)".
- [i.15] ETSI TS 123 548: "5G; 5G System Enhancements for Edge Computing; Stage 2 (3GPP TS 23.548)".
- [i.16] ETSI TS 129 518: "5G; 5G System; Access and Mobility Management Services; Stage 3 (3GPP TS 29.518)".
- [i.17] ETSI GR MEC 044: "Multi-access Edge Computing (MEC); Study on MEC Application Slices".
- [i.18] ETSI TS 123 558: "5G; Architecture for enabling Edge Applications (3GPP TS 23.558 Release 17)".
- [i.19] ETSI TS 128 530: "5G; Management and orchestration; Concepts, use cases and requirements (3GPP TS 28.530 Release 17)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GR MEC 001 [i.6] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GR MEC 001 [i.6] and the following apply:

5GC	5G Core network
5GS	5G System
AF	Application Function
AMF	Access and Mobility management Function
CSMF	Communication Service Management Function
DN	Data Network
DNAI	Data Network Access Identifier
DNN	Data Network Name
FQDN	Fully Qualified Domain Name
GPSI	Generic Public Subscription Identifier
LADN	Local Area Data Network
LBO	Local Break Out
L-NEF	Local Network Exposure Function
NEF	Network Exposure Function
NF	Network Function
NRF	Network Repository Function
NSMF	Network Slice Management Function
NSSAI	Network Slice Selection Assistance Information
PCC	Policy and Charging Control
PCF	Policy Control Function
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network

PSA	PDU Session Anchor
SMF	Session Management Function
TA	Tracking Area
UDR	Unified Data Repository
UE	User Equipment
UL	UpLink
UL CL	UpLink Classifier
UPF	User Plane Function

4 Overview

The present document studies how MEC system can be used to provide MEC services for Park Enterprises' users based on ULCL insertion from 3GPP 5G network.

Clause 4 provides the description of each identified study area.

Clause 5 proposes all identified key issues and their related solution proposals.

Clause 6 contains evaluation of proposed solutions. Based on identified gaps, recommendations for further work are provided.

5 Key issues and potential solutions

5.1 Key issue #1: ULCL PSA insertion based on Location

5.1.1 Description

At present, with the development of the Internet and the intensification of innovation, similar enterprises in parks have appeared all over the world. This type of company is small and relies on the unified communications services provided by the park. As 5G/MEC is convenient and fast, it becomes the first choice of communication services in the park.

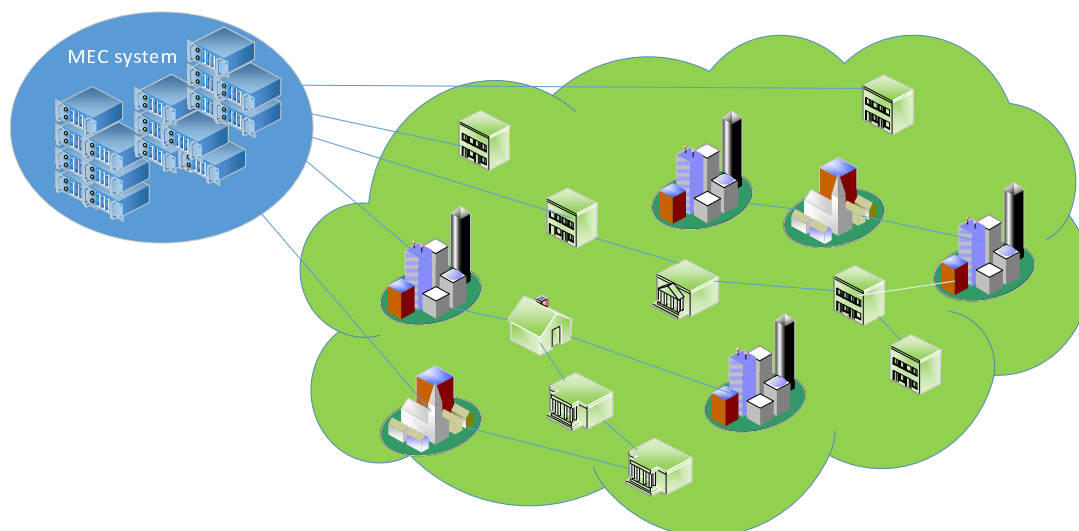


Figure 5.1.1-1: MEC in Park Enterprises

It is known that MEC is a nearby service for users who subscribe to MEC services and move to MEC's service area. 3GPP defines three ways to enable MEC services/local access to a DN, such as:

- 1) Uplink Classifier (UL CL).

- 2) IPv6 multi-homed PDU session.
- 3) Local Area Data Network (LADN).

For an industrial park, a location-based ULCL insertion is generally the preferred solution. The MEC service area of the park is mapped into a new Tracking Area (TA). When the user enters this new TA from other areas, SMF is triggered to insert ULCL PSA for the user. There are two types of operations:

- 1) If the user does not carry out the central business related to edge applications, SMF establishes edge UPF anchor points in advance for users entering the park, so that the anchor points can be directly placed on the edge DN when launching edge services.
- 2) If the user is engaged in services related to edge applications, the services will be transferred to the DN deployed on MEC to improve user experience.

The extended question here is whether the user has subscribed to edge MEC service. If the user subscribing to the MEC service has the permission to access to the MEC system, SMF will successfully insert ULCL. Therefore, this scenario is one of the main scenarios in which 5G interacts with MEC, that is, SMF directly enables traffic steering to the MEC system according to the users' location.

5.1.2 Solution proposal #1: AF detecting UE Location and report to PCF

5.1.2.1 Description

MEC system, as an Application Function (AF), can subscribe the location information of users served by MEC system through the NEF network element defined by 3GPP as stated in clause 5.6.7 of ETSI TS 123 501 [i.1]. When the user's location changes, the NEF will inform MEC system of the change.

More specifically, in the MEC system in Park Enterprise scenario, the process can be like the following: the end users initially register to 5G network and go through the central PSA/UPF by default, and there is a central AF deployed in the 5G network docking with all MEC systems at the edge to realize information exchange and enable system configuration and adjustment. When end users enter the park area, the central AF will receive notifications from AMF if the AF subscribes location event earlier. And then, the AF will enable the traffic guidance mode to instruct 3GPP network to add new PSA anchor points and transfer the users' business from the centre to the MEC system.

5.1.2.2 Backgrounds

5.1.2.2.1 NEF service operations information flow

The procedure is used by the AF to subscribe to notifications and to explicitly cancel a previous subscription. Cancelling is done by sending Nnef_EventExposure_Unsubscribe request identifying the subscription to cancel with Subscription Correlation ID. The notification steps 6 to 8 are not applicable in cancellation case.

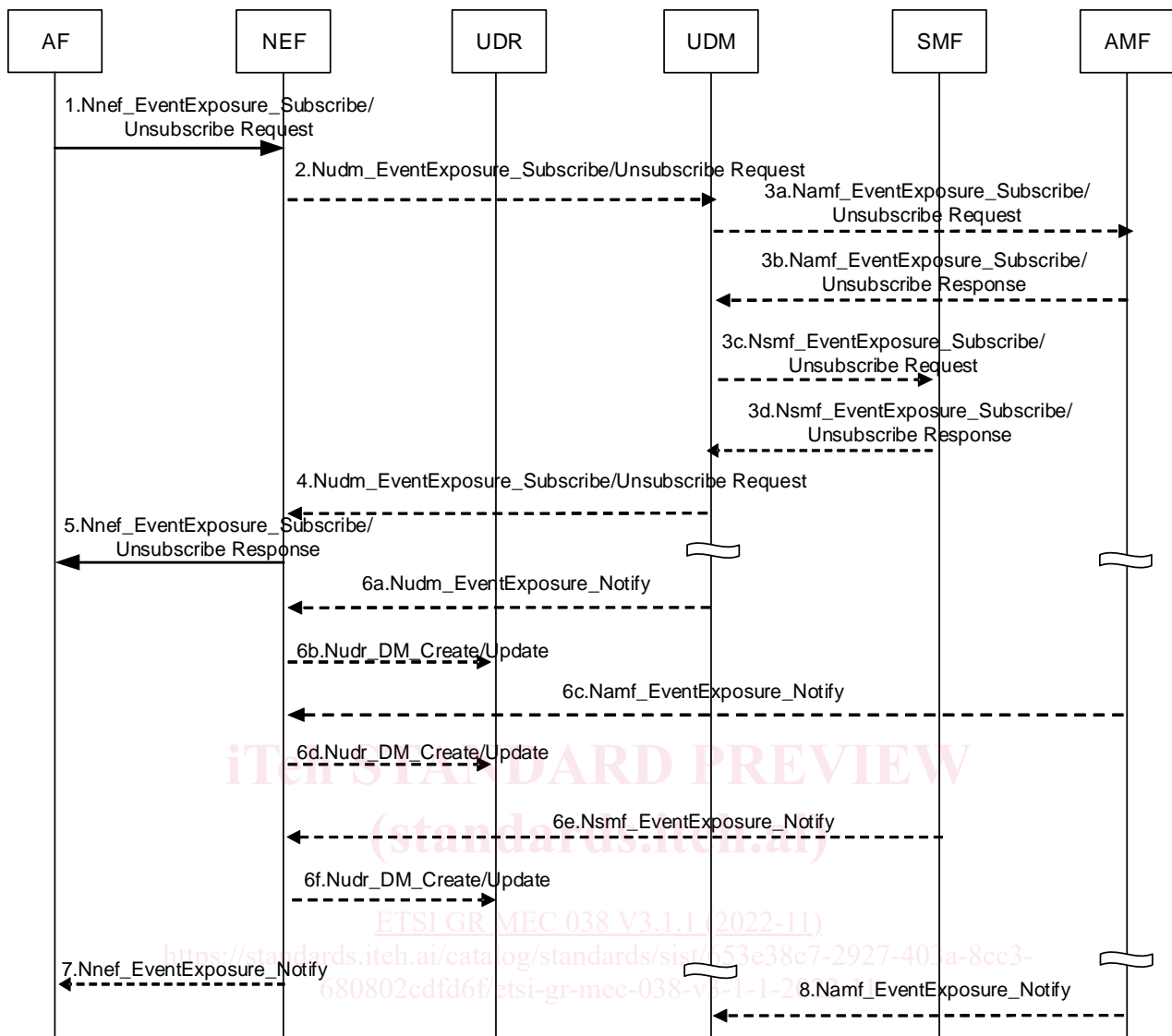


Figure 5.1.2.2.1-1: Nnef_EventExposure_Subscribe, Unsubscribe and Notify operations

NOTE 1: The procedure is referenced from ETSI TS 123 502 [i.2], with the details described specifically for this solution.

1. The AF subscribes to Location Reporting (identified by Event ID) and provides the associated notification endpoint of the AF (IP address) by sending Nnef_EventExposure_Subscribe request.

Event Reporting Information defines the type of reporting requested (e.g. one-time reporting, periodic reporting or event based reporting, for Monitoring Events). For this solution, Location Reporting is using event based reporting.

AF is authenticated and authorized by the NEF if requested. The NEF records the association of the event trigger and the requester identity. The subscription may also include maximum number of reports and/or maximum duration of reporting IE.

2. [Conditional - depending on authorization in step 1] The NEF subscribes to received Event(s) (identified by Event ID) and provides the associated notification endpoint of the NEF to UDM by sending Nudm_EventExposure_Subscribe request. The NEF maps the AF-Identifier into DNN and S-NSSAI combination based on local configuration, and include DNN, S-NSSAI in the request.

If the reporting event subscription is authorized by the UDM, the UDM records the association of the event trigger and the requester identity. Otherwise, the UDM continues in step 4 indicating failure.

- 3a. [Conditional] If the requested event (e.g. Location Reporting, monitoring of Loss of Connectivity) requires AMF assistance, then the UDM sends the Namf_EventExposure_Subscribe to the AMF serving the requested user. The UDM sends the Namf_EventExposure_Subscribe request to all serving AMF(s) (if subscription applies to a UE or a group of UE(s)), or all the AMF(s) in the same PLMN as the UDM (if subscription applies to any UE).

As the UDM itself is not the Event Receiving NF, the UDM should additionally provide the notification endpoint of itself besides the notification endpoint of NEF. Each notification endpoint is associated with the related (set of) Event ID(s). This is to assure the UDM can receive the notification of subscription change related event.

If the subscription applies to a group of UE(s), the UDM should include the same notification endpoint of itself, i.e. Notification Target Address (+ Notification Correlation Id), in the subscriptions to all UE's serving AMF(s).

NOTE 2: Using the same notification endpoint of UDM is to help the AMF identify whether the subscription for the requested group event is the same or not when a new group member UE is registered.

- 3b. [Conditional] AMF acknowledges the execution of Namf_EventExposure_Subscribe.
- 3c. [Conditional] If the requested event (e.g. PDU Session Status) requires SMF assistance, then the UDM sends the Nsmf_EventExposure_Subscribe request message to each SMF where at least one UE identified in step 2 has a PDU session established. The NEF notification endpoint received in step 2 is included in the message.

NOTE 3: In the home routed case, the UDM sends the subscription to the V-SMF via the H-SMF.

- 3d. [Conditional] The SMF acknowledges the execution of Nsmf_EventExposure_Subscribe.

3c-3d are not needed for this solution.

4. [Conditional] UDM acknowledges the execution of Nudm_EventExposure_Subscribe.

If the subscription is applicable to a group of UE(s) and the maximum number of reports is included in the Event Report information in step 1, the number of UEs is included in the acknowledgement.

5. NEF acknowledges the execution of Nnef_EventExposure_Subscribe to the requester that initiated the request.

- 6a - 6b. [Conditional - depending on the Event] The UDM (depending on the Event) detects the event occurs and sends the event report, by means of Nudm_EventExposure_Notify message to the associated notification endpoint of the NEF along with the time stamp. NEF may store the information in the UDR along with the time stamp using either Nudr_DM_Create or Nudr_DM_Update service operation as appropriate.

6a - 6b are not needed for this solution.

- 6c - 6d. [Conditional - depending on the Event] The AMF detects that the event occurs and sends the event report, by means of Namf_EventExposure_Notify message to associated notification endpoint of the NEF along with the time stamp. NEF may store the information in the UDR along with the time stamp using either Nudr_DM_Create or Nudr_DM_Update service operation as appropriate.

If the AMF has a maximum number of reports stored for the UE or the individual member UE, the AMF should decrease its value by one for the reported event.

For both step 6a and step 6b, when the maximum number of reports is reached and if the subscription is applied to a UE, The NEF unsubscribes the monitoring event(s) to the UDM and the UDM unsubscribes the monitoring event(s) to AMF serving for that UE.

For both step 6a and step 6b, when the maximum number of reports is reached for an individual group member UE, the NEF uses the number of UEs received in step 4 to determine if reporting for the group is complete. If the NEF determines that reporting for the group is complete, the NEF unsubscribes the monitoring event(s) to the UDM and the UDM unsubscribes the monitoring event(s) to all AMF(s) serving the UEs belonging to that group.

When the maximum duration of reporting expires in the NEF, the UDM and the AMF, then each of these nodes should locally unsubscribe the monitoring event.