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Multi-access Edge Computing (MEC); Radio Network Information API

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Reference

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Foreword

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document focuses on the Radio Network Information MEC service. It describes the message flows and the required information. The present document also specifies the RESTful API with the data model.

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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 necessary for the application of the present document.

[1] ETSI GS MEC 001: "Multi-access Edge Computing (MEC) Terminology".

[2] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

NOTE: Available at https://tools.ietf.org/html/rfc6749.

[3] IETF RFC 6750: "The OAuth 2.0 Authorization Framework: Bearer Token Usage".

NOTE: Available at https://tools.ietf.org/html/rfc6750.

[4] IETF RFC 5246: "The Transport Layer Security (TLS) Protocol Version 1.2".

NOTE: Available at https://tools.ietf.org/html/rfc5246.

[5] IETF RFC 2818: "HTTP Over TLS".

NOTE: Available at https://tools.ietf.org/html/rfc2818.

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.

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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 GS MEC 002: "Multi-access Edge Computing (MEC); Phase 2: Use Cases and Requirements".

[i.2] ETSI GS MEC 003: "Multi-access Edge Computing (MEC) Framework and reference architecture".

[i.3] ETSI TS 136 413:"LTE; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP) (3GPP TS 36 413)".

[i.4] ETSI TS 123 401: "LTE; General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (3GPP TS 23.401)".

[i.5] ETSI TS 136 214: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements (3GPP TS 36 214)".

[i.6] ETSI GS MEC 011: "Multi-access Edge Computing (MEC) MEC Platform Application Enablement".

[i.7] ETSI TS 136 331:"LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (3GPP TS 36.331)".

[i.8] ETSI GS MEC 009: "Multi-access Edge Computing (MEC) General principles for MEC Service APIs".

[i.9] OpenAPI Specification.

NOTE: Available at https://github.com/OAI/OpenAPI-Specification.

[i.10] Protocol Buffers Language Specification.

NOTE 1: Available at https://developers.google.com/protocol-buffers/.

NOTE 2: Protocol Buffers Version 3 Language Specification is recommended as it is the official release at the time of publication.

[i.11] ETSI TS 136 314: " Evolved Universal Terrestrial Radio Access (E-UTRA); Layer 2 - Measurements (3GPP TS 36.314)".

[i.12] ETSI TS 136 423: " Evolved Universal Terrestrial Radio Access (E-UTRA); X2 application protocol (X2AP) (3GPP TS 36.423)".

[i.13] ETSI TS 138 331: "5G; NR; Radio Resource Control (RRC); Protocol specification (3GPP TS 38.331)".

[i.14] ETSI TS 138 133: "5G; NR; Requirements for support of radio resource management (3GPP TS 38.133)".

[i.15] ETSI TS 138 101 (all parts): "5G; NR; User Equipment (UE) radio transmission and reception; (3GPP TS 38.101)".

[i.16] ETSI TS 136 133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management (3GPP TS 36.133)".

[i.17] ETSI TS 138 423: "5G; NG-RAN; Xn Application Protocol (XnAP) (3GPP TS 38.423)".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GS MEC 001 [1] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS MEC 001 [1] and the following apply:

3GPP	3rd Generation Partnership Project
API	Application Programming Interface
DL	DownLink
ECGI	E-UTRAN Cell Global Identifier
E-RAB	E-UTRAN Radio Access Bearer
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
GBR	Guaranteed Bit Rate
GTP	GPRS Tunnelling Protocol
GTP-U	GPRS Tunneling Protocol - User plane
GW	GateWay
HTTP	HyperText Transfer Protocol
HTTPS	HTTP over TLS
IE	Information Element
IP	Internet Protocol
JSON	JavaScript Object Notation
MCC	Mobile Country Code
MMEC	MME Code
MNC	Mobile Network Code
OAI	Open API Initiative
PLMN	Public Land Mobile Network
QCI	Quality Class Indicator
QoS	Quality of Service
PRB	Physical Resource Block
RAB	Radio Access Bearer
REST	REpresentational State Transfer
RFC	Request For Comments
RNI	Radio Network Information
RNIS	Radio Network Information Service
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
SGW	Serving Gateway
TEID	Tunnel End Point Identifier
TLS	Transport Layer Security
TMSI	Temporary Mobile Subscriber Entity
UE	User Equipment
UL	Uplink
URI	Uniform Resource Indicator
UTC	Coordinated Universal Time

4 Overview

The present document specifies the Radio Network Information API to support the requirements defined for Multi-access Edge Computing in ETSI GS MEC 002 [i.1].

Clause 5 introduces how Radio Network Information Service (RNIS) may be used by the MEC applications and by the MEC platform. It describes the information flows used for RNI.

The information that can be exchanged over the RNI API is described in clause 6 which provides detailed description on all information elements that are used for RNI.

Clause 7 describes the actual RNI API providing detailed information how information elements are mapped into a RESTful API design.

5 Description of the service (informative)

5.1 RNIS service introduction

Multi-access Edge Computing allows running the MEC applications at the edge of the network where the environment is characterized by low latency, proximity, high bandwidth and exposure to location and up-to-date radio network information. The information on current radio conditions are shared via the MEC platform over Radio Network Information Service.

Radio Network Information Service (RNIS) is a service that provides radio network related information to MEC applications and to MEC platforms. The Radio Network Information Service is available for authorized MEC applications and is discovered over the Mp1 reference point [i.2]. The granularity of the radio network information may be adjusted based on parameters such as information per cell, per User Equipment, per QCI class or it may be requested over period of time. Typical information that may be provided is listed as follows:

- up-to-date radio network information regarding radio network conditions;
- measurement information related to the user plane based on 3GPP specifications;
- information about UEs connected to the radio node(s) associated with the MEC host, their UE context and the related radio access bearers;
- changes on information related to UEs connected to the radio node(s) associated with the MEC host, their UE context and the related radio access bearers.

The Radio Network Information may be used by the MEC applications and MEC platform to optimize the existing services and to provide new type of services that are based on up to date information on radio conditions. An example of MEC application that uses radio network information to optimize current services is video throughput guidance. Throughput guidance radio analytics MEC application uses services of Multi-access Edge Computing to provide the backend video server with a near real-time indication on the throughput estimated to be available at the radio downlink interface in the next time instant. The throughput guidance radio analytics MEC application computes throughput guidance based on the required radio network information it obtains from a MEC service running on the MEC host ETSI GS MEC 002 [i.1].

Radio Network Information may be also used by the MEC platform to optimize the mobility procedures required to support service continuity.

Radio Network Information may cater for a wide range of use cases, where certain MEC application requests a single piece of information using a simple request-response model while other MEC applications subscribe to multiple different notifications regarding information changes. It is reasonable to assume that for simple queries the RESTful methods are used. However there may be cases where the frequency of updates is so high and the amount of information is so large that RESTful methods do not scale anymore. In addition, there may be aspects of one-to-many communications, which cannot be efficiently addressed by RESTful interfaces. For those cases, the Radio Network Information may be provided over the message broker of the MEC platform. The present document does not specify the actual protocol for a message broker but rather addresses the interoperability aspects by defining stage 2 level definitions to different message types of RNI and by defining the message types in JSON and Protobuf format together with the present document. A MEC application queries information on a message broker via the transport information query procedure as defined in ETSI GS MEC 011 [i.6]. In addition, the transport information may be pre-provisioned to the MEC application via configuration.

The following clauses describe how the service consumers interact with the Radio Network Information Service over RNI API to obtain contextual information from the radio access network. The sequence diagrams that are relevant for Radio Network Information are presented.

5.2 Sequence diagrams

5.2.1 Introduction

The service consumers communicate with the Radio Network Information Service over RNI API to get contextual information from the radio access network. Both the MEC application and MEC platform may be service consumers. Radio Network Information may be provided by both the MEC platform and the MEC application.

The Radio Network Information API supports both queries and subscriptions (pub/sub mechanism) that are used over the RESTful API or over the message broker of the MEC platform. A message broker is not specified in detail in the present document, but the sequence diagrams and message types that are used over a message broker are defined. For RESTful architectural style, the present document defines the HTTP protocol bindings.

5.2.2 Sending a request for RAB information

Figure 5.2.2-1 shows a scenario where the service consumer (e.g. a MEC application or a MEC platform) sends a request to receive a cell level Radio Access Bearer information from the cells that are associated with the requested MEC application instance. The response contains information on users in the cells such as the identifiers of the cells, the identifiers associated to UEs in the cells and information on their E-RABs, consisting of the QCI and QoS information.

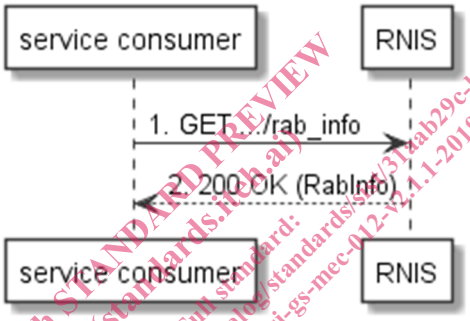

Figure 5.2.2-1: Flow of service consumer requesting Radio Access Bearer information

A service consumer requesting Radio Access Bearer information, as illustrated in figure 5.2.2-1, consists of the following steps:

1) Service consumer sends a GET request to the resource representing the RAB information. The request contains a MEC application instance identifier as an input parameter.

2) RNIS responds with "200 OK" with the message body containing the RabInfo.

5.2.3 Sending a request for PLMN information

Figure 5.2.3-1 shows a scenario where the service consumer (e.g. MEC application or MEC platform) sends a query to receive cell level PLMN information related to specific MEC application instance(s). The response contains information on cells that are associated with the requested MEC application instance(s).

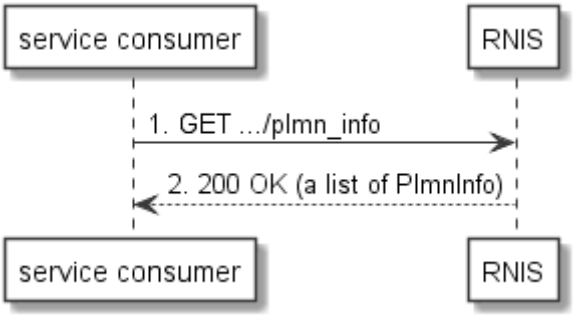

Figure 5.2.3-1: Flow of service consumer requesting PLMN information

A service consumer requesting PLMN information, as illustrated in figure 5.2.3-1, consists of the following steps:

1) Service consumer sends a GET request to the resource representing the PLMN information. The request contains MEC application instance identifier(s) as an input parameter.

2) RNIS responds with "200 OK" with the message body containing the list of PlmnInfo associated with the requested MEC application instance(s).

5.2.4 Sending a request for S1 bearer information

With the S1 bearer information acquired from the RNIS, the service consumer (e.g. the MEC application or the MEC platform) for example optimizes the relocation of MEC applications, or uses the acquired information for managing the traffic rules for the related application instances. Figure 5.2.4-1 shows a scenario where the MEC application or the MEC platform sends a query to receive the S1 bearer information.

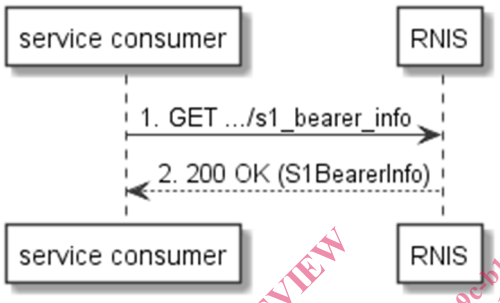

Figure 5.2.4-1: Flow of service consumer requesting S1 bearer information

Requesting S1 bearer information, as illustrated in figure 5.2.4-1, consists of the following steps:

1) Service consumer sends a GET request to the resource representing the S1 bearer information.

2) RNIS responds with "200 OK" with the message body containing the S1 bearer information.

5.2.4a Sending a request for Layer 2 measurements information

Figure 5.2.4a-1 shows a scenario where the service consumer (e.g. a MEC application or a MEC platform) sends a request to receive the Layer 2 measurements information from one or more eNBs that are associated with the requested MEC application instance. The response contains information of the Layer 2 measurements performed by the eNBs and/or the UEs as specified in ETSI TS 136 314 [i.11].

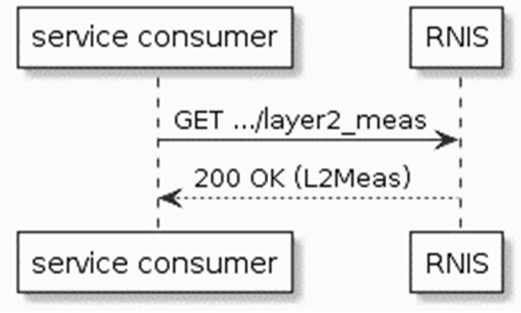

Figure 5.2.4a-1: Flow of service consumer requesting Layer 2 measurements information

A service consumer requesting Layer 2 measurements information, as illustrated in figure 5.2.4a-1, consists of the following steps:

1) Service consumer sends a GET request to the resource representing the Layer 2 measurements information.

2) RNIS responds with "200 OK" with the message body containing the Layer 2 measurement information.

5.2.5 REST based subscribe-notify model

5.2.5.1 Subscribing to RNI event notifications

To receive notifications on selected RNI events, the service consumer creates a subscription to certain specific RNI event that is available at RNIS. Figure 5.2.5.1-1 shows a scenario where the service consumer uses REST based procedures to create a subscription for RNI event notifications.

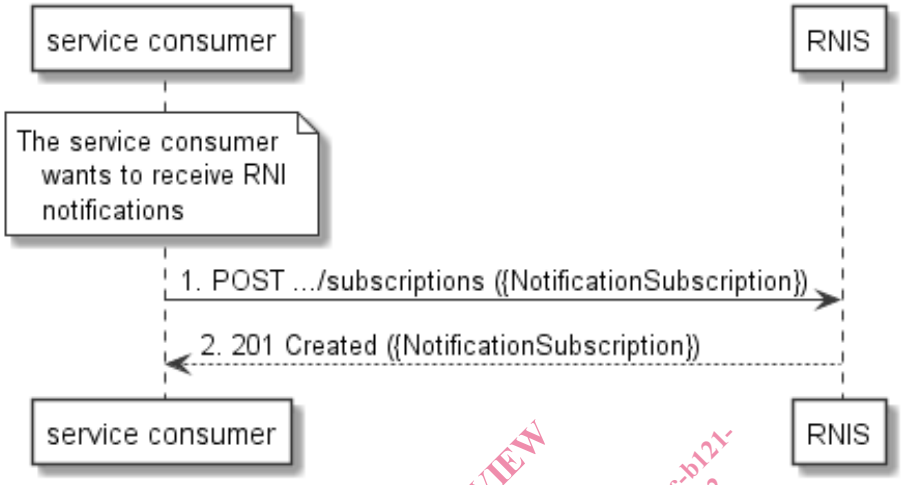

Figure 5.2.5.1-1: Flow of subscribing to the RNI event notifications

Subscribing to the RNI event notifications, as illustrated in figure 5.2.5.1-1, consists of the following steps.

When the service consumer wants to receive notifications about the RNI events, it creates a subscription to the RNI event notifications:

1) The service consumer sends a POST request with the message body containing the {NotificationSubscription} data structure to the resource representing RNI subscription. The variable {NotificationSubscription} is replaced with the data type specified for different RNI event subscriptions as specified in clauses 6.3.2 through 6.3.9 and in 6.3.11 , and it defines the subscribed event, the filtering criteria and the address where the service consumer wishes to receive the RNI event notifications.

2) RNIS sends "201 Created" response with the message body containing the data structure specific to that RNI event subscription. The data structure contains the address of the resource created and the subscribed RNI event type.

5.2.5.2 Receiving notification on expiry of RNI event subscription

RNIS may define an expiry time for the RNI event subscription. In case expiry time is used, the time will be included in the {NotificationSubscription} data structure that is included in the response message to the subscription. Prior the expiry, RNIS will also send a notification to the service consumer that owns the subscription.

Figure 5.2.5.2-1 shows a scenario where the service consumer receives a subscription expiry notification for the existing subscription.