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Multi-access Edge Computing (MEC); WLAN Access Information API

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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

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1 Scope

The present document focuses on the WLAN Access 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] Void.

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

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

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

NOTE 1: Available at https://tools.ietf.org/html/rfc5246.

NOTE 2: Obsoleted by IETF RFC 8446.

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

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

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

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

[6] IETF RFC 6225: "Dynamic Host Configuration Protocol Options for Coordinate-Based Location Configuration Information".

NOTE: Available at https://tools.ietf.org/html/rfc6225.

[7] IETF RFC 4776: "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information".

NOTE: Available at https://tools.ietf.org/html/rfc4776.

[8] IEEE 802.11-2016™: "IEEE Standard for Information technology -- Telecommunications and information exchange between systems Local and metropolitan area networks -- Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[9] Void.

[10] ETSI GS MEC 009: "Multi-access Edge Computing (MEC); General principles, patterns and common aspects of MEC Service APIs".

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 011: "Multi-access Edge Computing (MEC); Edge Platform Application Enablement".

[i.2] OpenAPI™ Specification.

NOTE 1: Available at https://github.com/OAI/OpenAPI-Specification.

NOTE 2: OpenAPI Specification and OpenAPI Initiative and their respective logos, are trademarks of the Linux Foundation.

[i.3] Wi-Fi® Alliance 2014: "Hot Spot 2.0 (Release 2) Technical Specification V1.0.0".

[i.4] ETSI GS MEC 002: "Multi-access Edge Computing (MEC); Phase 2: Use Cases and Requirements".

[i.5] ETSI GS MEC 003: "Multi-access Edge Computing (MEC); Framework and Reference Architecture".

[i.6] ETSI GS MEC 012: "Multi-access Edge Computing (MEC); Radio Network Information API".

[i.7] ETSI GS MEC 029: "Multi-access Edge Computing (MEC); Fixed Access Information API".

[i.8] WiFi Alliance 2019: "Data Elements Specification v1.0".

[i.9] ISO 3166: "Codes for the representation of names of countries and their subdivisions".

[i.10] IEEE P802.11ax™: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications - Amendment 1: Enhancement for High Efficiency WLAN".

[i.11] IEEE P802.11ay™: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications - Amendment 1: Enhancement for High Efficiency WLAN - Amendment 2: Enhanced throughput for operation in license-exempt bands above 45 GHz".

[i.12] ETSI GS MEC 001: "Multi-access Edge Computing (MEC); Terminology".

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 [i.12] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS MEC 001 [i.12] and the following apply:

3GPP	3rd Generation Partnership Project
AID	Association Identifier
A-MPDU	Aggregate MAC Protocol Data Unit
A-MSDU	Aggregate MAC Service Data Unit
AP	Access Point
API	Application Programming Interface
APSD	Automatic Power Save Delivery
ASEL	Antenna Selection
BSS	Basic Service Set
BSSID	Basic Service Set Identifier
DMG	Directional Multi-Gigabit

NOTE: As in Directional Multi-Gigabit WLAN.

DSSS	Direct Sequence Spread Spectrum
EDMG	Enhanced Directional Multi-Gigabit

NOTE: As in Enhanced Directional Multi-Gigabit WLAN.

ERP	Extended Rate PHY
ESS	Extended Service Set
FCS	Frame Check Sequence
FTM	Fine Timing Measurement
HE	High Efficiency

NOTE: As in High Efficiency WLAN.

HT	High Throughput

NOTE: As in High Throughput WLAN.

HTTP	Hyper Text Transport Protocol
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
LMD	Load Measurement Duration
MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MDE	Mobility Domain Element
MPDU	MAC Protocol Data Unit
NSS	Number of Spatial Streams
OBSS	Overlapping Basic Service Set
OFDM	Orthogonal Frequency Division Multiplexing
PBSS	Personal Basic Service Set
PCP	PBSS Control Point
PHY	Physical layer
PPDU	PHY Protocol Data Unit
QoS	Quality of Service
RCPI	Received Channel Power Indicator
RSNI	Received Signal-to-Noise Indicator
RSSI	Receive Signal Strength Indicator
RTS	Request To Send
SC	Single Carrier
SSID	Service Set Identifier
STA	Station
TSF	Timing Synchronization Function
TU	Time Unit
URI	Uniform Resource Identifier

VHT Very High Throughput

NOTE: As in Very High Throughput WLAN.

WAI WLAN Access Information
WAIS WLAN Access Information Service
WLAN Wireless Local Area Network

4 Overview

The present document specifies the WLAN Access Information (WAI) API to support the requirements defined for Multi-access Edge Computing in ETSI GS MEC 002 [i.4].

Clause 5 provides overview how WLAN Access Information Service (WAIS) may be used by the MEC applications and by the MEC platform. It describes the information flows used for WLAN Access Information Service.

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

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

5 Description of the service (informative)

5.1 WLAN Access Information 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 information from the underlying access networks. The information on current conditions from the WLAN access is shared via WLAN Access Information Service.

WLAN Access Information Service (WAIS) is a service that provides WLAN access related information to service consumers within MEC System. The WLAN Access Information Service is available for authorized MEC applications and is discovered over the Mp1 reference point as specified in ETSI GS MEC 003 [i.5]. The granularity of the WLAN Access Information may be adjusted based on parameters such as information per station (STA), per Access Point (AP) or per Multiple Access Points (Multi-AP).

The WLAN Access 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 from WLAN access possibly combined with the information such as Radio Network Information as specified in ETSI GS MEC 012 [i.6] or Fixed Access Network Information as specified in ETSI GS MEC 029 [i.7] from the other access technologies.

The present document defines the protocol, data model and interface in the form of RESTful Application Programming Interface (APIs) specifications. Information about the Access Points and client stations can be requested either by querying or by subscribing to notifications.

The procedures defined for queries are flexible and cater wide set of use cases from simple queries to queries requesting wide set of information on targets. This flexibility is enabled with concepts of attribute-based filtering and attribute selectors, as specified in ETSI GS MEC 009 [10], and those are described in more detail in clauses 6.18 and 6.19 of ETSI GS MEC 009 [10].

5.2 Sequence diagrams

5.2.1 Introduction

The service consumers communicate with WLAN Access Information Service over WAI API to get contextual information from the WLAN access network. Both the MEC application and MEC platform may be service consumers and both the MEC platform and MEC application may be providers of WLAN Access Information.

The WAI API supports both queries and subscriptions (pub/sub mechanism) over the RESTful API or over alternative transports such as message bus. Alternative transports are not specified in detail in the present document. When queries are used, the attribute-based filter expression can be used to limit the number of objects returned by query operation and attribute-selectors can be used to limit the number of attributes included in the response.

For RESTful architectural style, the present document defines the HTTP protocol bindings.

5.2.2 Sending a query for Access Point information

5.2.2.1 General query procedure

Figure 5.2.2.1-1 shows a scenario where the service consumer (e.g. a MEC application or a MEC platform) sends a query to receive information about Access Points (AP). The response may contain information on one or more access points. The number of queried objects and desired contents can be controlled with an attribute-based filter expression and attribute-selectors as defined in ETSI GS MEC 009 [10].

Figure 5.2.2.1-1: Flow of service consumer querying Access Point information

A service consumer requesting Access Point information, as illustrated in Figure 5.2.2.1-1, consists of the following steps:

1) Service consumer sends a GET request to the resource representing the Access Point(s) information. The request may contain attribute-filter to limit the number of Access Points whose information is received and attribute-selector to limit the number of attributes included in the response.

2) WAIS responds with "200 OK" with the message body containing the requested Access Point information.

5.2.2.2 Sending a query for a list of Access Points

A list of Access Points available in the system can be queried with the flow as in Figure 5.2.2.1-1 by using the attribute selector as follows:

GET …/queries/ap?fields=apId

5.2.2.3 Sending a query for WLAN capabilities

The WLAN Capabilities of Access Points can be queried with the flow of Figure 5.2.2.1-1 by using the attribute selector as follows:

GET …/queries/ap?fields=apId,wlanCap

The above query, if successful, would return the identifiers of Access Points available together with their WLAN Capabilities.

As an example, the WLAN Capabilities of the Access Point with an apId equal to "admiralsclub" can be queried using the attribute selector and filter attribute as follows:

GET …/queries/ap?filter=(eq,apId,admiralsclub)&fields=apId,wlanCap

5.2.2.4 Sending a query for BSS Load

The BSS Load of an Access Point can be queried with the flow of Figure 5.2.2.1-1 by using the attribute selector and filter attribute (in this instance the Access Point with apId equal to "admiralsclub") as follows:

GET …/queries/ap?filter=(eq,apId,admiralsclub)&fields=apId,bssLoad

More accurate information about BSS Load, for the same Access Point, can be obtained by adding the attribute "extBssLoad" in the list of requested fields as follows:

GET …/queries/ap?filter=(eq,apId,admiralsclub)&fields=apId,bssLoad,extBssLoad

5.2.2.5 Sending a query for WAN metrics

The WAN metrics of an Access Point can be queried with the flow of Figure 5.2.2.1-1 by using the attribute selector and filter attribute (in this instance the Access Point with apId equal to "admiralsclub") as follows:

GET …/queries/ap?filter=(eq,apId,admiralsclub)&fields=apId,wanMetrics

5.2.2.6 Sending a query for AP Location

The location of an Access Point can be queried with the flow of Figure 5.2.2.1-1 by using the attribute selector and filter attribute (in this instance the Access Point with apId equal to "admiralsclub") as follows:

GET …/queries/ap?filter=(eq,apId,admiralsclub)&fields=apId,apLocation

5.2.2.7 Void

5.2.2.8 Sending a query for OBSS Load

The Overlapping BSS (OBSS) Load of an Access Point can be queried with the flow of Figure 5.2.2.1-1 by using the attribute selector and filter attribute (in this instance the Access Point with apId equal to "admiralsclub") as follows:

GET …/queries/ap?filter=(eq,apId,admiralsclub)&fields=apId,obssLoad

5.2.3 Sending a query for Station information

5.2.3.1 General query procedure

Figure 5.2.3.1-1 shows a scenario where the service consumer (e.g. a MEC application or a MEC platform) sends a request to receive information about client station(s). The response may contain information on one or more stations and the number of queried objects and desired contents can be controlled with attribute-based filtering and attribute-selectors as defined in ETSI GS MEC 009 [10].

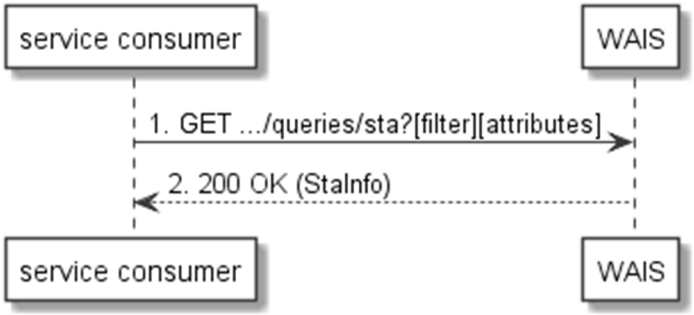

Figure 5.2.3.1-1: Flow of service consumer querying station Info

A service consumer requesting client station information, as illustrated in Figure 5.2.3.1-1, consists of the following steps:

1) Service consumer sends a GET request to the resource representing the station(s) information. The request may contain attribute-filters to limit the number of client stations whose information is received and attribute-selectors to limit the number of attributes included in the response.

2) WAIS responds with "200 OK" with the message body containing the requested WLAN station information.

5.2.3.2 Sending a query for a list of stations

A list of stations available in the system can be queried with the flow as in Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId

The above query, if successful, would return the identities of all the stations that are known to be associated in the system. Information about the Access Points that the stations are associated to can be queried as follows:

GET …/queries/sta?fields=staId,apAssociated

Further, to get the stations associated to a particular Access Point, the following query can be used including the attribute selector and filter attribute (in this instance the stations associated to Access Point with apAssociated equal to "mec123"):

GET …/queries/sta?filter=(eq,apAssociated,mec123)&fields=staId,apAssociated

5.2.3.3 Sending a query for channel used by station(s)

The channel used by stations can be queried with the flow of Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId,channel

5.2.3.4 Sending a query for RSSI of station(s)

The RSSI value of stations can be queried with the flow of Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId,rssi

The results can be narrowed down to stations under specific Access Point by adding filter attribute (in this instance the Access Point with apId equal to "mec123") to the query as follows:

GET …/queries/sta?filter=(eq,apAssociated,mec123)&fields=staId,rssi

5.2.3.5 Sending a query for station data rates

The physical layer data rate of stations can be queried with the flow of Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId,staDataRate

As there may be great number of stations in the system, it may be practical to limit the query to consider either stations under specific Access Point or certain specific station by including the attribute filter:

GET …/queries/sta?filter=(eq,apAssociated,mec404)&fields=staId,staDataRate

GET …/queries/sta?filter=(eq,staId,C8:D0:66:08:B6:0F)&fields=staId,staDataRate

5.2.3.6 Sending a query for station statistics

The statistics of stations can be queried with the flow of Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId,staStatistics

As there may be great number of stations in the system, it may be practical to limit the query to consider either stations under specific Access Point or certain specific station by including the attribute filter:

GET …/queries/sta?filter=(eq,apAssociated,mec404)&fields=staId,staStatistics

GET …/queries/sta?filter=(eq,staId,C8:D0:66:08:B6:0F)&fields=staId,staStatistics

5.2.3.7 Sending a query for Neighbor Report

The neighbor report of stations can be queried with the flow of Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId,neighborReport

As there may be great number of stations in the system, it may be practical to limit the query to consider either stations under specific Access Point or certain specific station by including the attribute filter:

GET …/queries/sta?filter=(eq,apAssociated,mec404)&fields=staId,neighborReport

GET …/queries/sta?filter=(eq,staId,C8:D0:66:08:B6:0F)&fields=staId,neighborReport

5.2.3.8 Sending a query for Channel Load

The channel load as measured via stations can be queried with the flow of Figure 5.2.3.1-1 by using the attribute selector as follows:

GET …/queries/sta?fields=staId,channelLoad

As there may be great number of stations in the system, it may be practical to limit the query to consider either stations under specific Access Point or certain specific station by including the attribute filter:

GET …/queries/sta?filter=(eq,apAssociated,mec404)&fields=staId,channelLoad

GET …/queries/sta?filter=(eq,staId,C8:D0:66:08:B6:0F)&fields=staId,channelLoad

5.2.4 REST based subscribe-notify model

5.2.4.1 Subscribing to WLAN event notifications

To receive notifications on selected WLAN events, the service consumer creates a subscription to certain specific event that is available at WAIS. Figure 5.2.4.1-1 shows a scenario where the service consumer uses REST based procedures to create a subscription for WLAN event notifications.

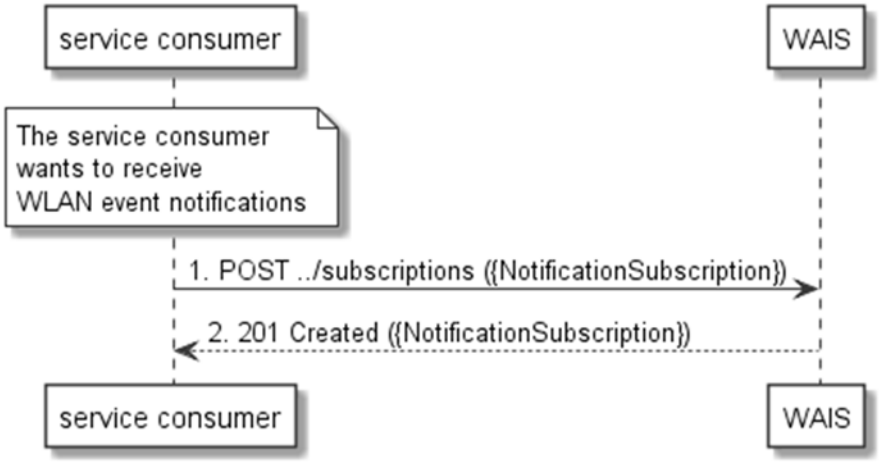

Figure 5.2.4.1-1: Flow of subscribing to WLAN event notifications

Subscribing to the WLAN event notifications, as illustrated in Figure 5.2.4.1-1, consists of the following steps.

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

1) The service consumer sends a POST request with the message body containing the {NotificationSubscription} data structure The variable {NotificationSubscription} is replaced with the data type specified for different WLAN event subscriptions as specified in clauses 6.3.2 and 6.3.3, and it defines the subscribed event, the filtering criteria and the address where the service consumer wishes to receive the WLAN event notifications.
2) WAIS sends "201 Created" response with the message body containing the data structure specific to that WLAN event subscription. The data structure contains the address of the resource created and the subscribed WLAN event type.

5.2.4.2 Receiving notification on expiry of WLAN event subscription

WAIS may define an expiry time for the WLAN 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, WAIS will also send a notification to the service consumer that owns the subscription.

Figure 5.2.4.2-1 shows a scenario where the service consumer receives a subscription expiry notification for the existing subscription.

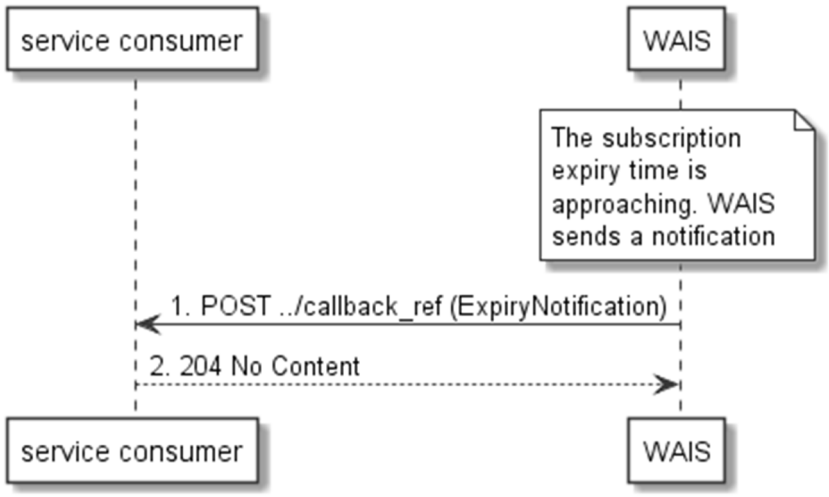

Figure 5.2.4.2-1: Flow of WAIS sending a notification on expiry of the subscription