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oneM2M;
MQTT Protocol Binding
(oneM2M TS-0010 version 2.4.1 Release 2)

Reference

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Foreword

This Technical Specification (TS) has been produced by ETSI Partnership Project oneM2M (oneM2M).

1 Scope

The present document specifies the binding of Mca and Mcc primitives (message flows) onto the MQTT protocol. It specifies:

1) How a CSE or AE connects to MQTT.

2) How an Originator (CSE or AE) formulates a Request as an MQTT message, and transmits it to its intended Receiver.

3) How a Receiver listens for incoming Requests.

4) How that Receiver can formulate and transmit a Response.

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.

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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] OASIS MQTT Version 3.1.1 (29 October 2014). OASIS Standard. Edited by Andrew Banks and Rahul Gupta.

NOTE: Available at http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html.

[2] ETSI TS 118 101: "oneM2M Functional Architecture (oneM2M TS-0001)".

[3] ETSI TS 118 104: "oneM2M; Service Layer Core Protocol Specification (oneM2M TS-0004)".

[4] IETF RFC 793 (September 1981): "Transmission Control Protocol - DARPA Internet Program - Protocol Specification", J. Postel.

NOTE: Available at http://www.ietf.org/rfc/rfc793.txt.

[5] IETF RFC 5246 (August 2008): "The Transport Layer Security (TLS) Protocol Version 1.2", T. Dierks.

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

[6] IETF RFC 6455 (December 2011): "The WebSocket Protocol", I. Fette.

NOTE: Available at http://tools.ietf.org/html/rfc6455.

[7] ETSI TS 118 103: "oneM2M; Security solutions (oneM2M TS-0003)".

[8] IETF RFC 3986 (January 2005): "Uniform Resource Identifier (URI): Generic Syntax", T. Berners-Lee.

NOTE: Available at https://tools.ietf.org/html/rfc3986.

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] oneM2M Drafting Rules.

NOTE: Available at http://www.onem2m.org/images/files/oneM2M-Drafting-Rules.pdf.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

originator [2]: actor that initiates a Request

NOTE: An Originator can either be an Application or a CSE.

receiver [2]: actor that receives the Request

NOTE: A Receiver can be a CSE or an Application.

resource [2]: uniquely addressable entity in oneM2M System such as by the use of a Uniform Resource Identifier (URI)

NOTE: A resource can be accessed and manipulated by using the specified procedures.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 118 101 [2] and the following apply:

ADN	Application Dedicated Node
ADN-AE	AE which resides in the Application Dedicated Node
AE	Application Entity
ASN	Application Service Node
CSE	Common Service Entity
IN	Infrastructure Node
IN-AE	Application Entity that is registered with the CSE in the Infrastructure Node
IN-CSE	CSE which resides in the Infrastructure Node
MN	Middle Node
MN-CSE	CSE which resides in the Middle Node
TLS	Transport Level Security

4 Conventions

The keywords "Shall", "Shall not", "May", "Need not", "Should", "Should not" in the present document are to be interpreted as described in the oneM2M Drafting Rules [i.1].

5 Introduction

5.1 Use of MQTT

This binding makes use of MQTT to provide reliable two-way communications between two parties (AEs and CSEs). It uses the following features of MQTT:

- Durable Sessions, providing Store and Forward in cases where network connectivity is not available.
- MQTT's "QoS 1" message reliability level. This provides reliability without incurring the overhead implied by QoS 2.
- NAT traversal (neither of the two parties is required to have prior knowledge of the other party's IP address).
- Dynamic topic creation and wild-carded subscription filters.

It does not use the following features:

- One-to-many publish/subscribe.
- Retained Messages.
- Will Messages.
- QoS 0 or QoS 2 message reliability levels.

5.2 Binding overview

5.2.1 Introduction

The MQTT protocol binding specifies how the Mca or Mcc request and response messages are transported across the MQTT protocol. Both communicating parties (AEs and CSEs) typically make use of an MQTT client library, and the communications are mediated via the MQTT server. There is no need for the client libraries or the server to be provided by the same supplier, since the protocol they use to talk to each other is defined by the MQTT specification [1].

Furthermore, the binding does not assume that the MQTT client libraries or server implementations are necessarily aware that they are being used to carry Mca, Mcc or any other oneM2M-defined primitives.

The binding is defined in terms of the MQTT protocol flows that take place between the client libraries and the MQTT server in order to effect the transport of an Mca or Mcc message.

There are two scenarios depending on the location of MQTT server: MQTT server co-located within a node, and MQTT server located independently from nodes.

5.2.2 Scenarios

5.2.2.1 MQTT server co-located within a node

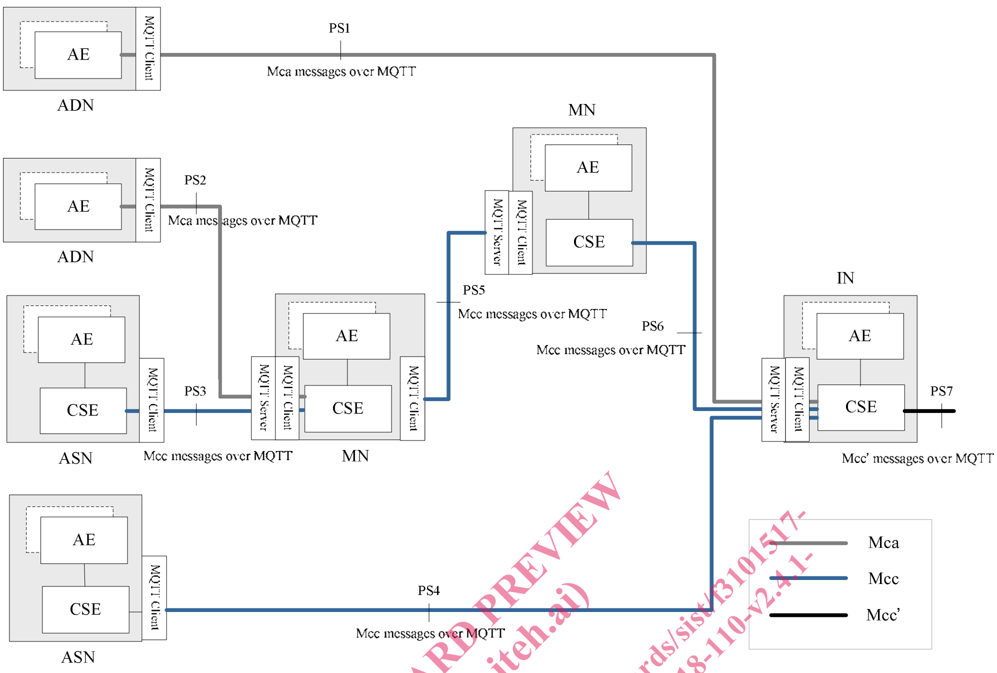

Figure 5.2.2.1-1: MQTT server co-located scenario

Figure 5.2.2.1-1 shows a protocol segment view of the MQTT server co-located scenario. In this scenario, all oneM2M nodes (ADN, ASN, MN, IN) include one or more MQTT clients. MQTT servers are provided within MN and IN.

In this scenario, the protocol segments are illustrated as follows.

Table 5.2.2.1-1: Protocol segment for MQTT server co-located scenario

Protocol Segment	oneM2M Message Transported	MQTT Interaction
PS1	Mca (AE of ADN to CSE of IN)	Client in ADN to Server in IN
PS2	Mca (AE of ADN to CSE of MN)	Client in ADN to Server in MN
PS3	Mcc (CSE of ASN to CSE of MN)	Client in ASN to Server in MN
PS4	Mcc (CSE of ASN to CSE of IN)	Client in ASN to Server in IN
PS5	Mcc (CSE of MN to CSE of MN)	Client in MN to Server in MN
PS6	Mcc (CSE of MN to CSE of IN)	Client in MN to Server in IN
PS7	Mcc' (CSE of IN to CSE of IN)	Client in IN to Server in IN

5.2.2.2 MQTT server located independently from nodes

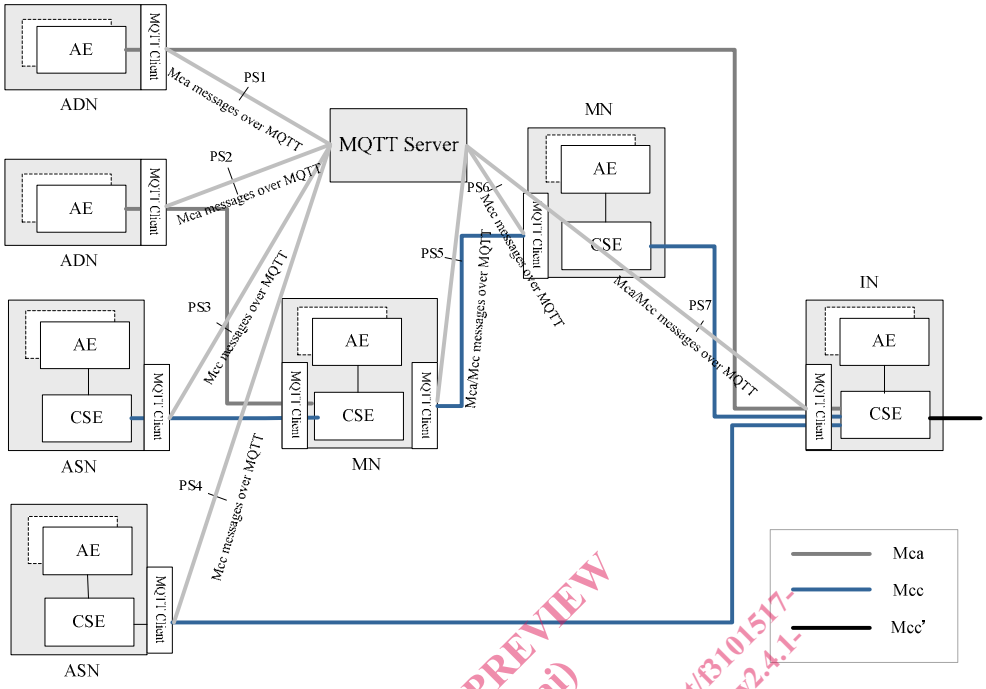

Figure 5.2.2.2-1: MQTT server independently located scenario

Figure 5.2.2.2-1 shows a protocol segment view in which the MQTT server is located independently from the oneM2M nodes. In this scenario, all oneM2M nodes (ADN, ASN, MN, IN) include one or more MQTT clients. MQTT servers exist independently, which means the servers are located outside of the nodes.

In this scenario, the protocol segments are illustrated as follows.

Table 5.2.2.2-1: Protocol segment for MQTT server independently located scenario

Protocol Segment	oneM2M Message Transported	MQTT Interaction
PS1	Mca (AE of ADN to CSE of IN)	Client in ADN to Server
PS2	Mca (AE of ADN to CSE of MN)	Client in ADN to Server
PS3	Mcc (CSE of ASN to CSE of MN)	Client in ASN to Server
PS4	Mcc (CSE of ASN to CSE of IN)	Client in ASN to Server
PS5	Mcc (CSE of MN to CSE of MN) Mcc (CSE of MN to CSE of ASN) Mca (CSE of MN to AE of ADN)	Client in MN to Server
PS6	Mcc (CSE of MN to CSE of MN) Mcc (CSE of MN to CSE of IN)	Client in MN to Server
PS7	Mcc (CSE of IN to CSE of MN) Mcc (CSE of IN to CSE of ASN) Mca (CSE of IN to AE of ADN)	Client in IN to Server

The next four clauses show the four configurations in which the MQTT binding can be used in the co-located scenario, followed by similar configurations in the independently-located scenario.

NOTE: Other configurations are possible, but they are currently out of scope.

5.2.3 Configurations

5.2.3.1 AE to IN

This configuration, illustrated in figure 5.2.3.1-1, allows an AE to connect to an IN via MQTT.

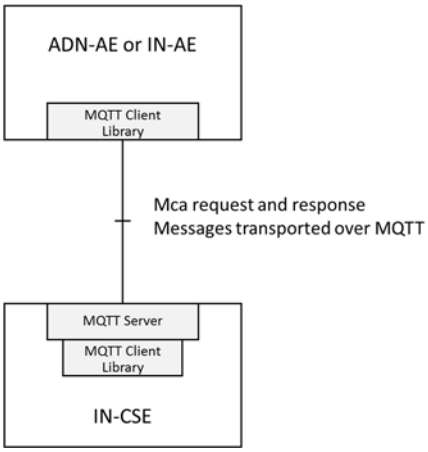

Figure 5.2.3.1-1: Using MQTT between AE and IN-CSE

The MQTT server is co-located with the IN-CSE and allows connection of the ADN-AEs (typically devices) and/or IN-AEs. It can store and forward messages if there is a gap in the connectivity with the devices. Note that the AEs each establish their own separate TCP/IP connection with the MQTT server. Thus the server shall have an accessible IP address, but AEs need not have.

5.2.3.2 AE to MN

This configuration, illustrated in figure 5.2.3.2-1, allows an ADN-AE to connect to an IN via MQTT.

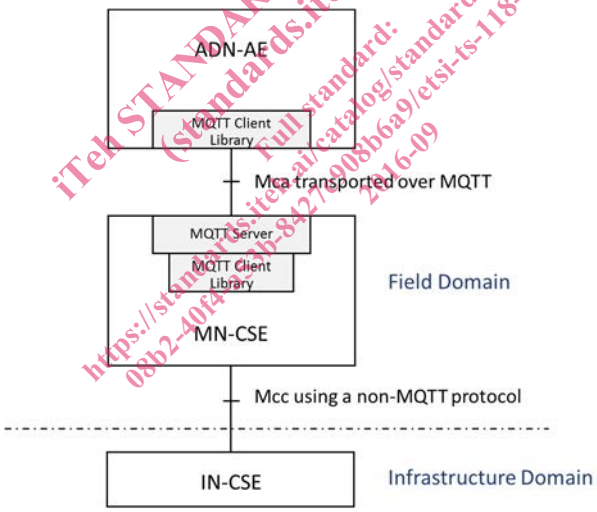

Figure 5.2.3.2-1: Using MQTT between AE and MN-CSE

This configuration is very similar to the AE-IN configuration shown in clause 5.2.3.1, except that the MQTT server is hosted on the MN rather than the IN. Onwards connection to the IN-CSE is via a different transport protocol.