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oneM2M;
CoAP Protocol Binding
(oneM2M TS-0008 version 1.3.2 Release 1)

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Foreword

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

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1 Scope

The present document will cover the protocol specific part of communication protocol used by oneM2M compliant systems as 'RESTful CoAP binding'.

The scope of the present document is (not limited to as shown below):

- Binding oneM2M primitives to CoAP messages
- Binding oneM2M Response Status Codes to CoAP Response Codes
- Defining behaviour of a CoAP Client and Server depending on oneM2M parameters

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.

The following referenced documents are necessary for the application of the present document.

[1] IETF RFC 7252: "The Constrained Application Protocol (CoAP)".

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

[3] IETF draft-ietf-core-block-15: "Blockwise transfers in CoAP".

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

[5] IETF RFC 6347: "Datagram Transport Layer Security Version 1.2".

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2.2 Informative references

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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 http://member.onem2m.org/Static_pages/Others/Rules_Pages/oneM2M-Drafting-Rules-V1_0.doc.

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AE	Application Entity
CSE	Common Service Entity
DTLS	Datagram Transport Layer Security
HTTP	Hyper Text Transfer Protocol
IP	Internet Protocol
RST	CoAP Reset message
TCP	Transport Control Protocol
TLS	Transport Layer Security
TLV	Tag - Length - Value (data structure)
UDP	User Datagram Protocol

URI Uniform Resource Identifier

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 Overview

5.0 Introduction

The clause describes which features need to be supported in CoAP layer and introduces a message format and several features of CoAP used in this procotol binding specification.

5.1 Required Features

This clause explicitely specifies the required features of the CoAP layer for oneM2M to properly bind oneM2M primitives into CoAP messages.

- The 4-byte binary CoAP message header is defined in Section 3 of [1].
- Confirmable (CON), Acknowledgement (ACK) and Reset (RST) messages shall be supported. The Reset message is used to send a error message in response to a malformed Confirmable message in CoAP layer.
- GET, PUT, POST and DELETE methods shall be supported. oneM2M primitives map to these methods.
- A subset of Response Code specified in clause 6.2.4 shall be supported for oneM2M ***Response Status Code*** parameter mapping.
- The Uri-Host, Uri-Port, Uri-Path, and Uri-Query shall be supported.
- The Content-Type Option shall be used to indicate the media types of the payload.
- The Token Option may be used.
- Block-wise transfers feature may be supported to carry large payloads.
- Caching feature may be supported.

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5.2 Introduction of CoAP

5.2.0 Introduction

This clause describes a message format, and caching and block-wise transfers features which may be used to map oneM2M primitives to CoAP messages.

5.2.1 Message Format

This clause specifies details about the CoAP [1] message format:

- CoAP message occupies the data section of one UDP datagram.
- CoAP message format supports a 4-byte fixed-size header.
- Fixed-size header is followed by a Token value of length 0 to 8 bytes.
- The Token value is followed by a sequence of zero or more CoAP Options in TLV format.
- CoAP Options are followed by the payload part.

For more details on the CoAP message format and the supported header fields, refer to [1].

5.2.2 Caching

5.2.2.0 Introduction

CoAP [1] supports caching of responses to fulfill future equivalent requests to the same resource. Caching is supported using freshness and validity information carried with CoAP [1] responses.

5.2.2.1 Freshness

- CoAP server shall use Max-Age CoAP Option to specify the explicit expiration time for the CoAP Response's resource representation. This indicates that the response is not fresh after its age is greater than the specified number of seconds.
- Max-Age Option defaults to a value of 60 (seconds). In case, Max-Age Option is not present in the cacheable response, the response shall not be considered fresh after its age is greater than 60 seconds.
- The CoAP server shall set the Max-Age Option value to 0 (zero) to prevent or disable caching.
- The CoAP client, having a fresh stored response, can make new request matching the request for that stored response. In this case, the new response shall invalidate the old response.

5.2.2.2 Validity

- A CoAP endpoint with stored responses but not able to satisfy subsequent requests (for example, the response is not fresh), shall use the ETag Option to perform a conditional request to the CoAP server where the resource is hosted.
- If the cached response with the CoAP client is still valid, the server shall include the Max-Age Option in the response along with a code of 2.03 - Valid. This shall update the freshness of the cached response at the CoAP client.
- If the cached response with the CoAP client is not valid, the server shall respond with an updated representation of the resource with response code 2.05 - Content. The CoAP client shall use the updated response to satisfy request and may also replace/update the stored or cached response.

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5.2.3 Blockwise Transfers

CoAP Block [3] Options may be used when CoAP endpoints need to transfer large payloads e.g. firmware, software updates. Instead of relying on IP fragmentation, CoAP Block Option should be used for transferring multiple blocks of information in multiple request-response pairs.

6 CoAP Message Mapping

6.1 Introduction

When AE or CSE binds oneM2M primitives to CoAP messages, or binds CoAP messages to oneM2M primitives, it is required that:

- AE shall host a CoAP client and should host a CoAP server; or
- CSE shall host both a CoAP client and a CoAP server.

Basically single oneM2M request primitive is mapped to single CoAP request message, and single oneM2M response primitive is mapped to single CoAP response message. However, single oneM2M request/response primitive is mapped to multiple CoAP request/response messages respectively when CoAP block-wise transfers feature is used.

Mapping between CoAP message and oneM2M primitive shall be applied in the following cases:

- when the Originator sends a request primitive;
- when the Receiver receives a CoAP message(s);

- when the Receiver sends a response primitive;
- when the Originator receives a CoAP message(s).

The following sub-clauses specify how to map each oneM2M primitive parameter defined in [2] to a corresponding CoAP message field to compose a CoAP request/response message.

6.2 Primitive Mapping to CoAP Message

6.2.0 Introduction

This clause describes where to map oneM2M parameters in a primitive to header, Option and payload fields in a CoAP message.

6.2.1 Header

This clause specifies how to configure CoAP header information.

- The Version field shall be configured as 1.
- The Type field shall be configured according to clause 6.3. The Reset message is used to send a error message in response to a malformed Confirmable message in CoAP layer.
- In case of a request, the Code field indicates CoAP Method. The oneM2M ***Operation*** parameter shall be mapped to a CoAP Method according to the table 6.2.1-1.
- In case of a response, the Code field indicates CoAP Response Code. The oneM2M ***Response Status Code*** parameter shall be mapped to CoAP Response Code as specified in clause 6.2.4.

The configurations of Token Length and Message ID are left to implementation.

Table 6.2.1-1: oneM2M Operation Parameter Mapping

oneM2M Operation Parameter	CoAP Method
CREATE	POST
RETRIEVE	GET
UPDATE	PUT
DELETE	DELETE
NOTIFY	POST

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At the Receiver, CoAP request message with POST method shall be mapped to oneM2M CREATE or NOTIFY ***Operation*** parameter in accordance with the existence of ***Resource Type*** parameter. If ***Resource Type*** parameter exists then value of the ***Operation*** parameter is CREATE and if ***Resource Type*** parameter does not exist, the value of ***Operation*** parameter is NOTIFY.

6.2.2 Configuration of Token and Options

6.2.2.0 Introduction

This clause describes configuration of Token and Options based on oneM2M parameters.

6.2.2.1 Token

Due to size limitation, Request Identifier is not mapped to Token option. However, Token may be used in CoAP layer to match a CoAP request and response.

6.2.2.2 Content Format Negotiation Options

The CoAP Accept Option may be used to indicate which Content-Format is acceptable to an Originator. If a Hosting CSE supports the Content-Format specified in Accept Option of the request, the Hosting CSE shall respond with that Content-Format. If the Hosting CSE does not support the Content-Format specified in Accept Option of the request, 4.06 "Not Acceptable" shall be sent as a response, unless another error code takes precedence for this response.