

INTERNATIONAL STANDARD

ISO/IEC 30118-1

First edition
2018-11

Information technology — Open Connectivity Foundation (OCF) Specification —

Part 1: Core specification

*Technologies de l'information — Spécification de la Fondation pour la
connectivité ouverte (Fondation OCF) —*

Partie 1: Spécification du cœur



Reference number
ISO/IEC 30118-1:2018(E)

© ISO/IEC 2018



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement. © ISO/IEC 2018 – All rights reserved

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the Open Connectivity Foundation (OCF) (as the OCF Core Specification v1.0.0) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

A list of all parts in the ISO/IEC 30118 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

[This is a preview - click here to buy the full publication](#)

CONTENTS

1	Scope	15
2	Normative references	15
3	Terms, definitions, symbols and abbreviations	18
3.1	Terms and definitions.....	18
3.2	Symbols and abbreviations	21
3.3	Conventions	22
3.4	Data types	22
4	Document conventions and organization	23
5	Architecture	24
5.1	Overview	24
5.2	Principle	25
5.3	Functional block diagram	26
5.4	Framework	27
5.5	Example Scenario with roles	27
5.6	Example Scenario: Bridging to Non- OCF ecosystem	28
6	Identification and addressing	29
6.1	Introduction	29
6.2	Identification.....	30
6.2.1	Resource identification and addressing	30
6.3	Namespace:	31
6.4	Network addressing	31
7	Resource model	31
7.1	Introduction	31
7.2	Resource.....	32
7.3	Property	33
7.3.1	Introduction	33
7.3.2	Common Properties	34
7.4	Resource Type	35
7.4.1	Introduction	35
7.4.2	Resource Type Property	36
7.4.3	Resource Type definition	36
7.4.4	Multi-value "rt" Resource	38
7.5	Device Type	38
7.6	Interface	39
7.6.1	Introduction	39
7.6.2	Interface Property	39
7.6.3	Interface methods	40
7.7	Resource representation	52
7.8	Structure	52
7.8.1	Introduction	52
7.8.2	Resource Relationships	52

7.8.3	Collections	57
7.9	Third (3 rd) party specified extensions	60
8	CRUDN	61
8.1	Overview	61
8.2	CREATE	62
8.2.1	CREATE request	63
8.2.2	Processing by the Server	63
8.2.3	CREATE response	63
8.3	RETRIEVE	63
8.3.1	RETRIEVE request	64
8.3.2	Processing by the Server	64
8.3.3	RETRIEVE response	64
8.4	UPDATE	64
8.4.1	UPDATE request	65
8.4.2	Processing by the Server	65
8.4.3	UPDATE response	65
8.5	DELETE	65
8.5.1	DELETE request	66
8.5.2	Processing by the Server	66
8.5.3	DELETE response	66
8.6	NOTIFY	66
9	Network and connectivity	67
9.1	Introduction	67
9.2	Architecture	67
9.3	IPv6 network layer requirements	68
9.3.1	Introduction	68
9.3.2	IPv6 node requirements	69
10	Endpoint	69
10.1	Endpoint definition	69
10.2	Endpoint information	70
10.2.1	Introduction	70
10.2.2	“ep”	70
10.2.3	“pri”	70
10.2.4	Endpoint information in “eps” Parameter	71
10.3	Endpoint discovery	71
10.3.1	Introduction	71
10.3.2	Implicit discovery	71
10.3.3	Explicit discovery with “/oic/res” response	71
10.4	CoAP based Endpoint discovery	75
11	Functional interactions	76
11.1	Introduction	76
11.2	Onboarding, Provisioning and Configuration	76
11.3	Resource discovery	78
11.3.1	Introduction	78

11.3.2	Resource based discovery: mechanisms	78
11.3.3	Resource based discovery: Information publication process.....	80
11.3.4	Resource based discovery: Finding information	81
11.3.5	Resource discovery using “/oic/res”	87
11.3.6	Resource directory (RD) based discovery.....	89
11.4	Notification	103
11.4.1	Overview	103
11.4.2	Observe	103
11.5	Device management	105
11.5.1	Overview	105
11.5.2	Diagnostics and maintenance	105
11.6	Scenes	106
11.6.1	Introduction	106
11.6.2	Scenes	106
11.6.3	Security considerations.....	110
11.7	Icons	110
11.7.1	Overview	110
11.7.2	Resource.....	111
11.8	Introspection.....	111
11.8.1	Overview	111
11.8.2	Usage of introspection	113
12	Messaging	114
12.1	Introduction	114
12.2	Mapping of CRUDN to CoAP	115
12.2.1	Overview	115
12.2.2	URIs.....	115
12.2.3	CoAP method with request and response	115
12.2.4	Content-Format negotiation.....	117
12.2.5	OCF-Content-Format-Version information.....	118
12.2.6	Content-Format policy.....	118
12.2.7	CRUDN to CoAP response codes.....	119
12.2.8	CoAP block transfer.....	119
12.3	CoAP serialization over TCP	120
12.4	Payload Encoding in CBOR.....	121
13	Security	121
Annex A	(informative) Operation Examples	123
A.1	Introduction	123
A.2	When at home: From smartphone turn on a single light.....	123
A.3	GroupAction execution.....	124
A.4	When garage door opens, turn on lights in hall; also notify smartphone.....	124
A.5	Device management	124
Annex B	(informative) OCF interaction scenarios and deployment models	126
B.1	OCF interaction scenarios.....	126
B.2	Deployment model	127

Annex C (informative) Other Resource Models and OCF Mapping	129
C.1 Multiple resource models	129
C.2 OCF approach for support of multiple resource models	129
C.3 Resource model indication	130
C.4 An Example Profile (IPSO profile)	130
C.4.1 Conceptual equivalence	130
Annex D (normative) Resource Type definitions	133
D.1 List of Resource Type definitions	133
D.2 OCF Collection	134
D.2.1 Introduction	134
D.2.2 Example URI	134
D.2.3 Resource Type	134
D.2.4 RAML Definition	134
D.2.5 Property Definition	139
D.2.6 CRUDN behavior	140
D.2.7 Referenced JSON schemas	140
D.2.8 oic.oic-link-schema.json	140
D.3 Device Configuration	142
D.3.1 Introduction	142
D.3.2 Example URI	142
D.3.3 Resource Type	142
D.3.4 RAML Definition	142
D.3.5 Property Definition	147
D.3.6 CRUDN behavior	147
D.4 Platform Configuration	147
D.4.1 Introduction	147
D.4.2 Example URI	147
D.4.3 Resource Type	147
D.4.4 RAML Definition	147
D.4.5 Property Definition	150
D.4.6 CRUDN behavior	150
D.5 Device	150
D.5.1 Introduction	150
D.5.2 Wellknown URI	150
D.5.3 Resource Type	150
D.5.4 RAML Definition	151
D.5.5 Property Definition	153
D.5.6 CRUDN behavior	153
D.6 Maintenance	154
D.6.1 Introduction	154
D.6.2 Wellknown URI	154
D.6.3 Resource Type	154
D.6.4 RAML Definition	154
D.6.5 Property Definition	156

D.6.6	CRUDN behavior	156
D.7	Platform.....	157
D.7.1	Introduction	157
D.7.2	Wellknown URI	157
D.7.3	Resource Type	157
D.7.4	RAML Definition.....	157
D.7.5	Property Definition.....	159
D.7.6	CRUDN behavior	160
D.8	Ping	160
D.8.1	Introduction	160
D.8.2	Wellknown URI	160
D.8.3	Resource Type	160
D.8.4	RAML Definition.....	160
D.8.5	Property Definition.....	162
D.8.6	CRUDN behavior	162
D.9	Discoverable Resources Baseline Interface	162
D.9.1	Introduction	162
D.9.2	Wellknown URI	162
D.9.3	Resource Type	162
D.9.4	RAML Definition.....	162
D.9.5	Property Definition.....	164
D.9.6	CRUDN behavior	165
D.10	Discoverable Resources Link List interface.....	165
D.10.1	Introduction	165
D.10.2	Wellknown URI	165
D.10.3	Resource Type	165
D.10.4	RAML Definition.....	165
D.10.5	Property Definition.....	166
D.10.6	CRUDN behavior	167
D.10.7	Referenced JSON schemas	168
D.10.8	oic.oic-link-schema.json.....	168
D.11	Scenes (Top level).....	170
D.11.1	Introduction	170
D.11.2	Example URI	170
D.11.3	Resource Type	170
D.11.4	RAML Definition.....	170
D.11.5	Property Definition.....	172
D.11.6	CRUDN behavior	172
D.12	Scene Collections	172
D.12.1	Introduction	172
D.12.2	Example URI	173
D.12.3	Resource Type	173
D.12.4	RAML Definition.....	173
D.12.5	Property Definition.....	176

D.12.6	CRUDN behavior	177
D.13	Scene Member	177
D.13.1	Introduction	177
D.13.2	Example URI	177
D.13.3	Resource Type	177
D.13.4	RAML Definition.....	177
D.13.5	Property Definition.....	179
D.13.6	CRUDN behavior	179
D.14	Resource directory resource	179
D.14.1	Introduction	179
D.14.2	Wellknown URI	180
D.14.3	Resource Type	180
D.14.4	RAML Definition.....	180
D.14.5	Property Definition.....	185
D.14.6	CRUDN behavior	186
D.15	Icon.....	186
D.15.1	Introduction	186
D.15.2	Example URI	186
D.15.3	Resource Type	186
D.15.4	RAML Definition.....	186
D.15.5	Property Definition.....	187
D.15.6	CRUDN behavior	187
D.16	Introspection Resource	188
D.16.1	Introduction	188
D.16.2	Example URI	188
D.16.3	Resource Type	188
D.16.4	RAML Definition.....	188
D.16.5	Property Definition.....	189
D.16.6	CRUDN behavior	190
Annex E (informative)	Swagger2.0 definitions	191
E.1	Icon.....	191
E.1.1	Introduction	191
E.1.2	Example URI	191
E.1.3	Resource Type	191
E.1.4	Swagger2.0 Definition.....	191
E.1.5	Property Definition.....	193
E.1.6	CRUDN behavior	193
E.2	Introspection Resource	194
E.2.1	Introduction	194
E.2.2	Example URI	194
E.2.3	Resource Type	194
E.2.4	Swagger2.0 Definition.....	194
E.2.5	Property Definition.....	196
E.2.6	CRUDN behavior	197

E.3	OCF Collection	197
E.3.1	Introduction	197
E.3.2	Example URI	197
E.3.3	Resource Type	197
E.3.4	Swagger2.0 Definition	197
E.3.5	Property Definition	210
E.3.6	CRUDN behavior	213
E.4	Platform Configuration	213
E.4.1	Introduction	213
E.4.2	Example URI	213
E.4.3	Resource Type	213
E.4.4	Swagger2.0 Definition	213
E.4.5	Property Definition	217
E.4.6	CRUDN behavior	217
E.5	Device Configuration	217
E.5.1	Introduction	217
E.5.2	Example URI	217
E.5.3	Resource Type	217
E.5.4	Swagger2.0 Definition	217
E.5.5	Property Definition	223
E.5.6	CRUDN behavior	224
E.6	Device	224
E.6.1	Introduction	224
E.6.2	Wellknown URI	224
E.6.3	Resource Type	224
E.6.4	Swagger2.0 Definition	224
E.6.5	Property Definition	227
E.6.6	CRUDN behavior	228
E.7	Maintenance	228
E.7.1	Introduction	228
E.7.2	Wellknown URI	228
E.7.3	Resource Type	229
E.7.4	Swagger2.0 Definition	229
E.7.5	Property Definition	231
E.7.6	CRUDN behavior	231
E.8	Platform	231
E.8.1	Introduction	231
E.8.2	Wellknown URI	231
E.8.3	Resource Type	231
E.8.4	Swagger2.0 Definition	232
E.8.5	Property Definition	235
E.8.6	CRUDN behavior	236
E.9	Ping	236
E.9.1	Introduction	236

E.9.2	Wellknown URI	236
E.9.3	Resource Type	236
E.9.4	Swagger2.0 Definition	236
E.9.5	Property Definition	238
E.9.6	CRUDN behavior	239
E.10	Resource directory resource	239
E.10.1	Introduction	239
E.10.2	Wellknown URI	239
E.10.3	Resource Type	239
E.10.4	Swagger2.0 Definition	239
E.10.5	Property Definition	248
E.10.6	CRUDN behavior	249
E.11	Discoverable Resources	249
E.11.1	Introduction	249
E.11.2	Wellknown URI	249
E.11.3	Resource Type	249
E.11.4	Swagger2.0 Definition	249
E.11.5	Property Definition	256
E.11.6	CRUDN behavior	258
E.12	Scenes	258
E.12.1	Introduction	258
E.12.2	Example URI	258
E.12.3	Resource Type	258
E.12.4	Swagger2.0 Definition	258
E.12.5	Property Definition	272
E.12.6	CRUDN behavior	275

Figures

Figure 1: Architecture - concepts	25
Figure 2: Functional block diagram	26
Figure 3: Communication layering model.....	27
Figure 4: Example illustrating the Roles	28
Figure 5: Framework - Architecture Detail	28
Figure 6: Server bridging to Non- OCF device	29
Figure 7: Example of a Resource	33
Figure 8: Example - "Heater" Resource (for illustration only).....	50
Figure 9: Example - Actuator Interface	50
Figure 10: Example of a Link	52
Figure 11: Example of distinct Links.....	52
Figure 12: Example of use of anchor in Link.....	53
Figure 13: Example of "eps Parameter	56
Figure 14: List of Links in a Resource	57
Figure 15: Example showing Collection and Links	59
Figure 16. CREATE operation.....	63
Figure 17. RETRIEVE operation	64
Figure 18. UPDATE operation.....	65
Figure 19. DELETE operation	66
Figure 20. High Level Network & Connectivity Architecture.....	68
Figure 21: Example of "ep"	70
Figure 22: Example of Link with "eps" Parameter	71
Figure 23: Example of "/oic/res" with Endpoint information.....	75
Figure 24. Resource based discovery: Information publication process.....	81
Figure 25. Resource based discovery: Finding information	81
Figure 26. Indirect discovery of resource by resource directory.....	90
Figure 27. RD discovery and RD supported query of resources support	92
Figure 28. Resource Direction Deployment Scenarios	93
Figure 29. Example of POST request payload	97
Figure 30. Example of POST response payload.....	98
Figure 31. Example of DELETE request with "di" or "ins" query	99
Figure 32. Observe Mechanism	104
Figure 33 Generic scene resource structure	107
Figure 34 Interactions to check Scene support and setup of specific scenes	108
Figure 35 Client interactions on a specific scene	109
Figure 36 Interaction overview due to a Scene change	110

Figure 37 Interactions to check Introspection support and download the Introspection Device Data. 114

Figure 38 Content-Format Policy..... 119

Figure 39. When at home: from smartphone turn on a single light 124

Figure 40. Device management (maintenance)..... 125

Figure 41. Direct interaction between Server and Client 126

Figure 42. Interaction between Client and Server using another Server 126

Figure 43. Interaction between Client and Server using Intermediary 126

Figure 44. Interaction between Client and Server using support from multiple Servers and Intermediary 127

Figure 45. Example of Devices 127

Tables

Table 1. Additional OCF Types	22
Table 2. Name Property Definition	35
Table 3. Resource Identity Property Definition.....	35
Table 4. Resource Type Common Property definition	36
Table 5. Example foobar Resource Type.....	37
Table 6. Example foobar properties	37
Table 7. Resource Interface Property definition	39
Table 8. OCF standard Interfaces	40
Table 9. Common Properties for Collections (in addition to Common Properties defined in section 7.3.2)	60
Table 10. 3rd party defined Resource elements.....	61
Table 11. Parameters of CRUDN messages	62
Table 12. “ep” value for Transport Protocol Suite	70
Table 13. List of Core Resources	76
Table 14. Configuration Resource.....	76
Table 15. “oic.wk.con” Resource Type definition.....	77
Table 16. “oic.wk.con.p” Resource Type definition.....	78
Table 17. Mandatory discovery Core Resources.....	82
Table 18. “oic.wk.res” Resource Type definition	83
Table 19. Protocol scheme registry	83
Table 20. “oic.wk.d” Resource Type definition	84
Table 21. “oic.wk.p” Resource Type definition	86
Table 22. “oic.wk.rd” Resource Type definition	90
Table 23. “oic.wk.rd” Properties	91
Table 24: Selection parameters	94
Table 25. Optional diagnostics and maintenance device management Core Resources	105
Table 26. “oic.wk.mnt” Resource Type definition	106
Table 27 list of Resource Types for Scenes	110
Table 28. Optional Icon Core Resource.....	111
Table 29. “oic.r.icon” Resource Type definition.....	111
Table 30. Introspection Resource.....	113
Table 31. “oic.wk.introspection” Resource Type definition.....	113
Table 32. CoAP request and response	115
Table 33. OCF Content-Formats	117
Table 34. OCF-Content-Format-Version and OCF-Accept-Content-Format-Version Option Numbers	118
Table 35. OCF-Accept-Content-Format-Version and the OCF-Content-Format-Version Representation	118

Table 36. Examples of OCF-Content-Format-Version and OCF-Accept-Content-Format-Version Representation	118
Table 37. Ping resource.....	120
Table 38. “oic.wk.ping” Resource Type definition.....	121
Table 39. oic.example.light Resource Type definition	123
Table 40. oic.example.garagedoor Resource Type definition	123
Table 41. Light control Resource Type definition	131
Table 42. Light control Resource Type definition	131
Table 43. Alphabetized list of core resources	133

1 Scope

The OCF specifications are divided into two sets of documents:

- Core Specification documents: The Core Specification documents specify the Framework, i.e., the OCF core architecture, interfaces, protocols and services to enable OCF profiles implementation for Internet of Things (IoT) usages and ecosystems.
- Vertical Profiles Specification documents: The Vertical Profiles Specification documents specify the OCF profiles to enable IoT usages for different market segments such as smart home, industrial, healthcare, and automotive. The Application Profiles Specification is built upon the interfaces and network security of the OCF core architecture defined in the Core Specification.

This document is the OCF Core specification which specifies the Framework and core architecture.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8601, *Data elements and interchange formats – Information interchange –Representation of dates and times*, International Standards Organization, December 3, 2004

IEEE 754, *IEEE Standard for Floating-Point Arithmetic*, August 2008

IETF RFC 1981, *Path MTU Discovery for IP version 6*, August 1996
<https://tools.ietf.org/rfc/rfc1981.txt>

IETF RFC 2460, *Internet Protocol, version 6 (IPv6), December, 1998*
<https://tools.ietf.org/rfc/rfc2460.txt>

IETF RFC 2616, *Hypertext Transfer Protocol – HTTP/1.1*, June 1999.
<http://www.ietf.org/rfc/rfc2616.txt>

IETF RFC 3810, *Multicast Listener Discovery Version 2 (MLDv2) for IPv6*, June 2004
<http://www.ietf.org/rfc/rfc3810.txt>

IETF RFC 3986, *Uniform Resource Identifier (URI): General Syntax*, January 2005.
<http://www.ietf.org/rfc/rfc3986.txt>

IETF RFC 4122, *A Universally Unique Identifier (UUID) URN Namespace*, July 2005
<http://www.ietf.org/rfc/rfc4122.txt>

IETF RFC 4287, *The Atom Syndication Format*, December 2005,
<http://www.ietf.org/rfc/rfc4287.txt>

IETF RFC 4193, *Unique Local IPv6 Unicast Addresses*, October 2005
<http://www.ietf.org/rfc/rfc4193.txt>

IETF RFC 4291, *IP Version 6 Addressing Architecture*, February 2006
<http://www.ietf.org/rfc/rfc4291.txt>

IETF RFC 4443, *Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*, March 2006
<http://www.ietf.org/rfc/rfc4443.txt>

IETF RFC 4861, *Neighbor Discovery for IP version 6 (IPv6)*, September 2007
<http://www.ietf.org/rfc/rfc4861.txt>

IETF RFC 4862, *IPv6 Stateless Address Autoconfiguration*, September 2007
<http://www.ietf.org/rfc/rfc4862.txt>

IETF RFC 4941, *Privacy Extensions for Stateless Address Autoconfiguration in IPv6*, September 2007
<http://www.ietf.org/rfc/rfc4941.txt>

IETF RFC 4944, *Transmission of IPv6 Packets over IEEE 802.15.4 Networks*, September 2007
<http://www.ietf.org/rfc/rfc4944.txt>

IETF RFC 5646, *Tags for Identifying Languages*, September 2009
<http://www.ietf.org/rfc/rfc5646.txt>

IETF RFC 5988, *Web Linking: General Syntax*, October 2010
<http://www.ietf.org/rfc/rfc5988.txt>

IETF RFC 6434, *IPv6 Node Requirements*, December 2011
<http://www.ietf.org/rfc/rfc6434.txt>

IETF RFC 6455, *The WebSocket Protocol*, December 2011
<https://www.ietf.org/rfc/rfc6455.txt>

IETF RFC 6573, *The Item and Collection Link Relations*, April 2012
<http://www.ietf.org/rfc/rfc6573.txt>

IETF RFC 6690, *Constrained RESTful Environments (CoRE) Link Format*, August 2012
<http://www.ietf.org/rfc/rfc6690.txt>

IETF RFC 6762, *Multicast DNS* February 2013
<http://www.ietf.org/rfc/rfc6762.txt>

IETF RFC 6763, *DNS-Based Service Discovery*, February 2013
<http://www.ietf.org/rfc/rfc6763.txt>

IETF RFC 6775, *Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs)*, November 2012
<http://www.ietf.org/rfc/rfc6775.txt>

IETF RFC 7049, *Concise Binary Object Representation (CBOR)*, October 2013
<http://www.ietf.org/rfc/rfc7049.txt>

IETF RFC 7084, *Basic Requirements for IPv6 Customer Edge Routers*, November 2013
<http://www.ietf.org/rfc/rfc7084.txt>

IETF RFC 7159, *The JavaScript Object Notation (JSON) Data Interchange Format*, March 2014
<http://tools.ietf.org/rfc/rfc7159.txt>

IETF RFC 7252, *The Constrained Application Protocol (CoAP)*, June 2014
<http://tools.ietf.org/rfc/rfc7252.txt>

IETF RFC 7301, *Transport Layer Security (TLS) Application-Layer Protocol Negotiation Extension*, July 2014
<https://tools.ietf.org/html/rfc7301>

IETF RFC 7428, *Transmission of IPv6 Packets over ITU-T G.9959 Networks*, February 2015
<http://www.ietf.org/rfc/rfc7428.txt>

IETF RFC 7641, *Observing Resources in the Constrained Application Protocol (CoAP)*, September 2015
<https://tools.ietf.org/html/rfc7641>

IETF RFC 7668, *IPv6 over BLUETOOTH(r) Low Energy*, October 2015
<https://tools.ietf.org/html/rfc7668>

IETF RFC 7721, *Security and Privacy Considerations for IPv6 Address Generation Mechanisms*, March 2016
<https://tools.ietf.org/html/rfc7721>

IETF RFC 7959, *Block-Wise Transfers in the Constrained Application Protocol (CoAP)*, August 2016
<https://tools.ietf.org/html/rfc7959>

IETF draft-ietf-core-coap-tcp-tls-07, *CoAP over TCP, TLS, and WebSockets*, June 10 2015
<https://datatracker.ietf.org/doc/draft-ietf-core-coap-tcp-tls/>

ECMA-4-4, *The JSON Data Interchange Format*, October 2013.
<http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-404.pdf>

OCF Security, *Open Connectivity Foundation Security Capabilities*, Version 1.0,

IANA IPv6 Multicast Address Space Registry
<http://www.iana.org/assignments/ipv6-multicast-addresses/ipv6-multicast-addresses.xhtml>

IANA Media Types Assignment, March 2017
<http://www.iana.org/assignments/media-types/media-types.xhtml>

OpenAPI specification, *fka Swagger RESTful API Documentation Specification*
<https://github.com/OAI/OpenAPI-Specification/blob/master/versions/2.0.md>

OCF Resource Type Definitions, *API Definition Language for OCF Resource Type Definitions*,
Release OCF-v1.0.0
<https://github.com/openconnectivityfoundation/core>

W3C XML character escaping, *Extensible Markup Language (XML) 1.0*, November 2008
<http://www.w3.org/TR/2008/REC-xml-20081126/#syntax>