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Information technology — Open Connectivity Foundation (OCF) Specification —

Part 1: Core specification

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

Partie 1: Spécification du coeur



Reference number
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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.

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 or www.iec.ch/members_experts/refdocs).

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) or the IEC list of patent declarations received (see patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by the Open Connectivity Foundation (OCF) (as OCF Core Specification, version 2.2.0) 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*.

This second edition cancels and replaces the first edition (ISO/IEC 30118-1:2018), which has been technically revised.

The main changes compared to the previous edition are as follows:

— simplification of specification so that it only includes the core functionality;

— additional resusable infrastructure components are now in the core optional specification;

— addition of semantic tags, sleepy devices based on long latency;

— improvements made on CoAP bindings, Error diagnostic payloads, discovery, reset of device and usage of baseline interfaces;

— addition of clarifications throughout.

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

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 and www.iec.ch/national-committees.

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Introduction

This document, and all the other parts associated with this document, were developed in response to worldwide demand for smart home focused Internet of Things (IoT) devices, such as appliances, door locks, security cameras, sensors, and actuators; these to be modelled and securely controlled, locally and remotely, over an IP network.

While some inter-device communication existed, no universal language had been developed for the IoT. Device makers instead had to choose between disparate frameworks, limiting their market share, or developing across multiple ecosystems, increasing their costs. The burden then falls on end users to determine whether the products they want are compatible with the ecosystem they bought into, or find ways to integrate their devices into their network, and try to solve interoperability issues on their own.

In addition to the smart home, IoT deployments in commercial environments are hampered by a lack of security. This issue can be avoided by having a secure IoT communication framework, which this standard solves.

The goal of these documents is then to connect the next 25 billion devices for the IoT, providing secure and reliable device discovery and connectivity across multiple OSs and platforms. There are multiple proposals and forums driving different approaches, but no single solution addresses the majority of key requirements. This document and the associated parts enable industry consolidation around a common, secure, interoperable approach.

ISO/IEC 30118 consists of eighteen parts, under the general title Information technology — Open Connectivity Foundation (OCF) Specification. The parts fall into logical groupings as described herein:

- Core framework
  - Part 1: Core Specification
  - Part 2: Security Specification
  - Part 13: Onboarding Tool Specification
- Bridging framework and bridges
  - Part 3: Bridging Specification
  - Part 6: Resource to Alljoyn Interface Mapping Specification
  - Part 8: OCF Resource to oneM2M Resource Mapping Specification
  - Part 14: OCF Resource to BLE Mapping Specification
  - Part 15: OCF Resource to EnOcean Mapping Specification
  - Part 16: OCF Resource to UPlus Mapping Specification
  - Part 17: OCF Resource to Zigbee Cluster Mapping Specification
  - Part 18: OCF Resource to Z-Wave Mapping Specification
- Resource and Device models
  - Part 4: Resource Type Specification
  - Part 5: Device Specification

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- Core framework extensions
  - Part 7: Wi-Fi Easy Setup Specification
  - Part 9: Core Optional Specification
- OCF Cloud
  - Part 10: Cloud API for Cloud Services Specification
  - Part 11: Device to Cloud Services Specification
  - Part 12: Cloud Security Specification

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Information technology — Open Connectivity Foundation (OCF) Specification —

Part 1: Core specification

1 Scope

The OCF Core specifications are divided into a set of documents:

– Core specification (this document): The Core specification document specifies 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. This document is mandatory for all Devices to implement.

– Core optional specification: The Core optional specification document specifies 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 that can optionally be implemented by any Device.

– Core extension specification(s): The Core extension specification(s) document(s) specifies optional OCF Core functionality that are significant in scope (e.g., Wi-Fi easy setup, Cloud).

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

ISO/IEC DIS 20924, *Information Technology – Internet of Things – Vocabulary*, June 2018
https://www.iso.org/standard/69470.html

ISO/IEC 30118-2, *Information technology – Open Connectivity Foundation (OCF) Specification – Part 2: Security specification*
https://www.iso.org/standard/74239.html
Latest version available at: https://openconnectivity.org/specs/OCF_Security_Specification.pdf

IETF RFC 768, *User Datagram Protocol*, August 1980
https://www.rfc-editor.org/info/rfc768

IETF RFC 3339, *Date and Time on the Internet: Timestamps*, July 2002
https://www.rfc-editor.org/info/rfc3339

IETF RFC 3986, *Uniform Resource Identifier (URI): General Syntax, January 2005*.
https://www.rfc-editor.org/info/rfc3986

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IETF RFC 4122, *A Universally Unique IDentifier (UUID) URN Namespace*, July 2005
https://www.rfc-editor.org/info/rfc4122

IETF RFC 4287, *The Atom Syndication Format*, December 2005,
https://www.rfc-editor.org/info/rfc4287

IETF RFC 4941, *Privacy Extensions for Stateless Address Autoconfiguration in IPv6*, September 2007
https://www.rfc-editor.org/info/rfc4941

IETF RFC 5646, *Tags for Identifying Languages*, September 2009
https://www.rfc-editor.org/info/rfc5646

IETF RFC 6347, *Datagram Transport Layer Security Version 1.2*, January 2012
https://www.rfc-editor.org/info/rfc6347

IETF RFC 6434, *IPv6 Node Requirements*, December 2011
https://www.rfc-editor.org/info/rfc6434

IETF RFC 6573, *The Item and Collection Link Relations*, April 2012
https://www.rfc-editor.org/info/rfc6573

IETF RFC 6690, *Constrained RESTful Environments (CoRE) Link Format*, August 2012
https://www.rfc-editor.org/info/rfc6690

IETF RFC 7049, *Concise Binary Object Representation (CBOR)*, October 2013
https://www.rfc-editor.org/info/rfc7049

IETF RFC 7084, *Basic Requirements for IPv6 Customer Edge Routers*, November 2013
https://www.rfc-editor.org/info/rfc7084

IETF RFC 7159, *The JavaScript Object Notation (JSON) Data Interchange Format*, March 2014
https://www.rfc-editor.org/info/rfc7159

IETF RFC 7252, *The Constrained Application Protocol (CoAP)*, June 2014
https://www.rfc-editor.org/info/rfc7252

IETF RFC 7301, *Transport Layer Security (TLS) Application-Layer Protocol Negotiation Extension*, July 2014
https://www.rfc-editor.org/info/rfc7301

IETF RFC 7346, *IPv6 Multicast Address Scopes*, August 2014
https://www.rfc-editor.org/info/rfc7346

IETF RFC 7595, *Guidelines and Registration Procedures for URI Schemes*, June 2015
https://www.rfc-editor.org/info/rfc7595

IETF RFC 7641, *Observing Resources in the Constrained Application Protocol (CoAP)*, September 2015
https://www.rfc-editor.org/info/rfc7641

IETF RFC 7721, *Security and Privacy Considerations for IPv6 Address Generation Mechanisms*, March 20016
https://www.rfc-editor.org/info/rfc7721

IETF RFC 7959, *Block-Wise Transfers in the Constrained Application Protocol (CoAP)*, August 2016
https://www.rfc-editor.org/info/rfc7959

IETF RFC 8075, *Guidelines for Mapping Implementations: HTTP to the Constrained Application Protocol (CoAP)*, February 2017
https://www.rfc-editor.org/info/rfc8075

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IETF RFC 8085, *UDP Usage Guidelines*, March 2017
https://www.rfc-editor.org/info/rfc8085

IETF RFC 8288, *Web Linking*, October 2017
https://www.rfc-editor.org/info/rfc8288

IETF RFC 8323, *CoAP (Constrained Application Protocol) over TCP, TLS, and WebSockets*, February 2018
https://www.rfc-editor.org/info/rfc8323

IANA ifType-MIB Definitions
https://www.iana.org/assignments/ianaiftype-mib/ianaiftype-mib

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

IANA Link Relations, October 2017
http://www.iana.org/assignments/link-relations/link-relations.xhtml

JSON Schema Validation, *JSON Schema: interactive and non-interactive validation*, January 2013
http://json-schema.org/draft-04/json-schema-validation.html

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

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

– ISO Online browsing platform: available at https://www.iso.org/obp.

– IEC Electropedia: available at http://www.electropedia.org/.

3.1.1
Atomic Measurement
design pattern that ensures that the *Client* (3.1.6) can only access the *Properties* (3.1.33) of linked *Resources* (3.1.31) atomically, that is as a single group

3.1.2
Bridged Client
logical entity that accesses data via a *Bridged Protocol* (3.1.4)

Note 1 to entry: For example, an AllJoyn Consumer application is a *Bridged Client* (3.1.2).

3.1.3
Bridged Device
Bridged Client (3.1.2) or *Bridged Server* (3.1.5)

3.1.4
Bridged Protocol
another protocol (e.g., AllJoyn) that is being translated to or from OCF protocols

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3.1.5
Bridged Server
logical entity that provides data via a *Bridged Protocol* (3.1.4)

Note 1 to entry: For example an AllJoyn Producer is a *Bridged Server* (3.1.5).

Note 2 to entry: More than one *Bridged Server* (3.1.5) can exist on the same physical platform.

3.1.6
Client
logical entity that accesses a *Resource* (3.1.31) on a *Server* (3.1.36)

3.1.7
Collection
Resource (3.1.31) that contains zero or more *Links* (3.1.21)

3.1.8
Common Properties
Properties (3.1.33) specified for all *Resources* (3.1.31)

3.1.9
Composite Device
Device (3.1.13) that is modelled as multiple *Device Types* (3.1.14); with each component *Device Type* (3.1.14) being exposed as a *Collection* (3.1.7)

3.1.10
Configuration Source
cloud or service network or a local read-only file which contains and provides configuration related information to the *Devices* (3.1.13)

3.1.11
Core Resources
those *Resources* (3.1.31) that are defined in this document

3.1.12
Default OCF Interface
OCF Interface (3.1.18) used to generate the response when an *OCF Interface* (3.1.18) is omitted in a request

3.1.13
Device
logical entity that assumes one or more roles, e.g., *Client* (3.1.6), *Server* (3.1.36)

Note 1 to entry: More than one *Device* (3.1.13) can exist on a *Platform* (3.1.30).

3.1.14
Device Type
uniquely named definition indicating a minimum set of *Resource Types* (3.1.34) that a *Device* (3.1.13) supports

Note 1 to entry: A *Device Type* (3.1.14) provides a hint about what the *Device* (3.1.13) is, such as a light or a fan, for use during *Resource* (3.1.31) discovery.

3.1.15
Device UUID
stack instance identifier

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3.1.16
Discoverable Resource
Resource (3.1.31) that is listed in "/oic/res"

3.1.17
OCF Endpoint
entity participating in the OCF protocol, further identified as the source or destination of a request and response messages for a given Transport Protocol Suite

Note 1 to entry: Example of a Transport Protocol Suite would be CoAP over UDP over IPv6.

3.1.18
Framework
set of related functionalities and interactions defined in this document, which enable interoperability across a wide range of networked devices, including IoT

3.1.19
OCF Interface
interface description extended by OCF that provides a view to and permissible responses from a *Resource* (3.1.31)

[SOURCE: IETF RFC 6690]

3.1.20
Introspection
mechanism to determine the capabilities of the hosted *Resources* (3.1.31) of a *Device* (3.1.13)

3.1.21
Introspection Device Data (IDD)
data that describes the payloads per implemented method of the *Resources* (3.1.31) that make up the *Device* (3.1.13)

Note 1 to entry: See 11.4 for all requirements and exceptions.

3.1.22
Links
extends typed web links

[SOURCE: IETF RFC 8288]

3.1.23
Non-Discoverable Resource
Resource (3.1.31) that is not listed in "/oic/res"

Note 1 to entry: The *Resource* (3.1.31) can be reached by a *Link* (3.1.21) which is conveyed by another *Resource* (3.1.31). For example a Resource (3.1.31) linked in a Collection (3.1.7) does not have to be listed in "/oic/res", since traversing the *Collection* (3.1.7) would discover the *Resource* (3.1.31) implemented on the *Device* (3.1.13).

3.1.24
Notification
mechanism to make a *Client* (3.1.6) aware of state changes in a *Resource* (3.1.31)

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3.1.25
Observe
act of monitoring a *Resource* (3.1.31) by sending a RETRIEVE operation which is cached by the *Server* (3.1.36) hosting the *Resource* (3.1.31) and reprocessed on every change to that *Resource* (3.1.31)

3.1.26
OpenAPI 2.0
Resource (3.1.31) and *Intropection Device Data* (3.1.20) definitions used in this document

[SOURCE: OpenAPI specification]

3.1.27
Parameter
element that provides metadata about a *Resource* (3.1.31) referenced by the target URI of a *Link* (3.1.21)

3.1.28
Partial UPDATE
UPDATE operation to a *Resource* (3.1.31) that includes a subset of the *Properties* (3.1.33) that are visible via the *OCF Interface* (3.1.18) being applied for the *Resource Type* (3.1.34)

3.1.29
Permanent Immutable ID
identity for a *Device* (3.1.13) that cannot be altered

3.1.30
Physical Device
physical thing on which a *Device(s)* (3.1.13) is exposed

3.1.31
Platform
Physical Device (3.1.29) containing one or more *Devices* (3.1.13)

3.1.32
Resource
represents an entity modelled and exposed by the *Framework* (3.1.17)

3.1.33
Resource Interface
qualification of the permitted requests on a *Resource* (3.1.31)

3.1.34
Property
significant aspect or *Parameter* (3.1.26) of a *Resource* (3.1.31), including metadata, that is exposed through the *Resource* (3.1.31)

3.1.35
Resource Type
uniquely named definition of a class of *Properties* (3.1.33) and the interactions that are supported by that class

Note 1 to entry: Each *Resource* (3.1.31) has a *Property* (3.1.33) "rt" whose value is the unique name of the *Resource Type* (3.1.34).

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3.1.36
Secure OCF Endpoint
OCF Endpoint (3.1.16) with a secure connection (e.g., CoAPS)

3.1.37
Semantic Tag
meta-information that provides additional contextual information with regard to the *Resource* (3.1.31) that is the target of a *Link* (3.1.21)

3.1.38
Server
Device (3.1.13) with the role of providing *Resource* (3.1.31) state information and facilitating remote interaction with its *Resources* (3.1.31)

3.1.39
Sleepy Server
Server (3.1.37) that will have latency in responding to requests

3.1.40
Unsecure OCF Endpoint
OCF Endpoint (3.1.16) with an unsecure connection (e.g., CoAP)

3.1.41
Vertical Resource Type
Resource Type (3.1.34) in a vertical domain specification

Note 1 to entry: An example of a Vertical *Resource Type* (3.1.40) would be "oic.r.switch.binary".

3.2 Symbols and abbreviated terms

ACL	Access Control List
BLE	Bluetooth Low Energy
CBOR	Concise Binary Object Representation
CoAP	Constrained Application Protocol
CoAPs	Secure Constrained Application Protocol
DTLS	Datagram Transport Layer Security
IP	Internet Protocol
ISP	Internet Service Provider
JSON	JavaScript Object Notation
MTU	Maximum Transmission Unit
OCF	Open Connectivity Foundation
REST	Representational State Transfer
RESTful	REST-compliant Web services
UDP	User Datagram Protocol

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