
**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





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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 reusable 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.

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

- 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

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>

ISO/IEC 30118-1:2021(E)

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 2016
<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>

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>