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Information technology — Open Connectivity Foundation (OCF) —

Part 11: Device to cloud services specification

PROOF/ÉPREUVE

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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 Device to Cloud Services 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*.

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) —

Part 11:
Device to cloud services specification

1 Scope

This document defines functional extensions to the capabilities defined in ISO/IEC 30118-1 to meet the requirements of the OCF Cloud. This document specifies new Resource Types to enable the functionality and any extensions to the existing capabilities defined in ISO/IEC 30118-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 30118-1 *Information technology -- Open Connectivity Foundation (OCF) Specification -- Part 1: Core specification*
https://www.iso.org/standard/53238.html
Latest version available at: https://openconnectivity.org/specs/OCF_Core_Specification.pdf

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

ISO/IEC 17788 *Information technology – Cloud computing – Overview and vocabulary*
https://www.iso.org/standard/60544.html

ISO/IEC 17789 *Information technology – Cloud computing – Reference architecture*
https://www.iso.org/standard/60545.html

OCF Core Optional Framework, *Open Connectivity Foundation Core – Optional Specification, Version 2.2.0*
Available at: https://openconnectivity.org/specs/OCF_Core_Optional_Specification_v2.2.0.pdf
Latest version available at: https://openconnectivity.org/specs/OCF_Core_Optional_Specification.pdf

OCF Wi-Fi Easy Setup, *Open Connectivity Foundation Wi-Fi Easy Setup, Version 2.2.0*
Available at: https://openconnectivity.org/specs/OCF_Wi-Fi_Easy_Setup_Specification_v2.2.0.pdf
Latest version available at:
https://openconnectivity.org/specs/OCF_Wi-Fi_Easy_Setup_Specification.pdf

OCF Cloud Security, *Open Connectivity Foundation Cloud Security, Version 2.2.0*
Available at: https://openconnectivity.org/specs/ OCF_Cloud_Security_Specification_v2.2.0.pdf
Latest version available at:
https://openconnectivity.org/specs/OCF_Cloud_Security_Specification.pdf

OCF Cloud API for Cloud Services, *Open Connectivity Foundation Cloud API for Cloud Services, Version 2.2.0*
Available at:
https://openconnectivity.org/specs/OCF_Cloud_API_For_Cloud_Services_Specification_v2.2.0.pdf
Latest version available at:
https://openconnectivity.org/specs/OCF_Cloud_API_For_Cloud_Services_Specification.pdf

IETF RFC 6749, *The OAuth 2.0 Authorization Framework*, October 2012
https://tools.ietf.org/html/rfc6749

IETF RFC 6750, *The OAuth 2.0 Authorization Framework: Bearer Token Usage*, October 2012
https://tools.ietf.org/html/rfc6750

IETF RFC 8323, *CoAP (Constrained Application Protocol) over TCP, TLS, and WebSockets*, February 2018
https://tools.ietf.org/html/rfc8323

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 ISO/IEC 30118-1 and ISO/IEC 30118-2 and 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
Cloud Provider
entity or organization that hosts an *OCF Cloud* (3.1.2).

3.1.2
OCF Cloud
logical entity that is owned by the *Cloud Provider* (3.1.1) that authorised to communicate with a Device on behalf of the *OCF Cloud User* (3.1.3).

3.1.3
OCF Cloud User
Client that has permissions to interact with the Devices that are exposed by the *OCF Cloud* (3.1.2).

3.1.4
Resource Directory
set of descriptions of Resources where the actual Resources are held on Servers external to the entity hosting the *Resource Directory* (3.1.4), allowing lookups to be performed for those Resources

3.2 Symbols and abbreviated terms

UX User Experience

4 Document conventions and organization

4.1 Conventions

In this document a number of terms, conditions, mechanisms, sequences, parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., Network Architecture). Any lowercase uses of these words have the normal technical English meaning.

In this document, to be consistent with the IETF usages for RESTful operations, the RESTful operation words CRUDN, CREATE, RETRIVE, UPDATE, DELETE, and NOTIFY will have all letters capitalized. Any lowercase uses of these words have the normal technical English meaning.

4.2 Notation

In this document, features are described as required, recommended, allowed or DEPRECATED as follows:

Required (or shall or mandatory)(M).

– These basic features shall be implemented to comply with Core Architecture. The phrases "shall not", and "PROHIBITED" indicate behaviour that is prohibited, i.e. that if performed means the implementation is not in compliance.

Recommended (or should)(S).

– These features add functionality supported by Core Architecture and should be implemented. Recommended features take advantage of the capabilities Core Architecture, usually without imposing major increase of complexity. Notice that for compliance testing, if a recommended feature is implemented, it shall meet the specified requirements to be in compliance with these guidelines. Some recommended features could become requirements in the future. The phrase "should not" indicates behaviour that is permitted but not recommended.

Allowed (may or allowed)(O).

– These features are neither required nor recommended by Core Architecture, but if the feature is implemented, it shall meet the specified requirements to be in compliance with these guidelines.

DEPRECATED.

– Although these features are still described in this document, they should not be implemented except for backward compatibility. The occurrence of a deprecated feature during operation of an implementation compliant with the current document has no effect on the implementation's operation and does not produce any error conditions. Backward compatibility may require that a feature is implemented and functions as specified but it shall never be used by implementations compliant with this document.

Conditionally allowed (CA)

– The definition or behaviour depends on a condition. If the specified condition is met, then the definition or behaviour is allowed, otherwise it is not allowed.

Conditionally required (CR)

– The definition or behaviour depends on a condition. If the specified condition is met, then the definition or behaviour is required. Otherwise the definition or behaviour is allowed as default unless specifically defined as not allowed.

Strings that are to be taken literally are enclosed in "double quotes".

Words that are emphasized are printed in italic.

5 Overview

5.1 Introduction

An OCF Cloud extends the use of CoAP to enable a Device to interact with a cloud by utilizing following features

– CoAP over TCP protocol defined in ISO/IEC 30118-1

– The requirements within this document including those for a Resource Directory

– Security requirements and SVRs defined within the ISO/IEC 30118-2

Devices which are not within a single local network may interact with each other using CoAP over TCP (see ISO/IEC 30118-1) via an OCF Cloud. At any point in time, a Device is configured to use at most one OCF Cloud. The OCF Cloud groups Devices that belong to same OCF Cloud User under an OCF Cloud created User ID. All the Devices registered to the OCF Cloud and belonging to the same User ID can communicate with each other subject to the Device(s) authorising the OCF Cloud in the ACE2 policies.

Annex A specifies the Resource Type definitions using the schema defined in the OpenAPI specification as the API definition language that shall be followed by an OCF Device realizing the Resources specified in this document.

Note that an OCF Cloud is not an OCF Device, but a logical entity that is owned by the Cloud Provider. An OCF Cloud is authorized to communicate with a Device by the OCF Cloud User

5.2 OCF Cloud architecture alignment with ISO IEC 17789

Reference ISO/IEC 17789 defines a cloud computing reference architecture (CCRA) which can be described in terms of one of four architectural viewpoints; user, functional, implementation, and deployment. Of the four viewpoints, implementation and deployment are explicitly out of scope of ISO/IEC 17789.

OCF defines an application capabilities type cloud service, providing Communication as a Service (CaaS) (reference ISO/IEC 17788). This cloud service is provided by a cloud service provider, the mechanisms used by the cloud service provider in managing their overall cloud infrastructure are outside the scope of the OCF defined cloud service. The OCF definition is specific to the interface offered by the cloud service to the cloud service customer, specifically the cloud service user.

There are three different user views defined. In the case where the cloud service customer is an OCF Device as specified in this document then the views provided are:

- Interface for the OCF Device to provide information to the cloud service

- Interface for the OCF Device to retrieve information that has been provided to the cloud service

In the case where the cloud service customer is another instance of a cloud service as specified in OCF Cloud API for Cloud Services then the view provided is:

- Interface for the other cloud service instance to retrieve and update the information that is provided via the cloud service

The OCF cloud service pertains specifically to a cloud service user, there is a single applicable cloud service activity, that of "Use cloud service" defined in clause 8.2.21 of ISO/IEC 17789.

Credentials for the user of the cloud service are provided using OAUTH2.0 as defined by IETF RFC 6749. The cloud service, either itself, or leveraging an external authorization server, provides a bearer token that is required in all requests from all cloud users. Please see clause 8.1 and OCF Cloud Security.

All connectivity between a cloud user and the cloud service is via mutually authenticated TLS; see clause 7.1 of OCF Cloud Security.

5.3 Architecture

The OCF Cloud is a logical entity to which an OCF Device communicates via a persistent TLS connection. It encapsulates two functions:

– an account server function which is a logical entity that handles Device registration, Access Token validation and handles sign-in and token-refresh requests from the Device. An OCF Cloud User creates offline an account on the account server (by means of the mediator). The account server is then also used to register the Devices (Clients and Servers) per account. Note that all accounts are fully separated, e.g. logging into account A does not give access to Devices registered to account B.

– a Resource Directory as defined by this document. The Resource Directory exposes Resource information published by Devices. A Client, when discovering Devices, receives a response from the Resource Directory on behalf of the Device. With information included in the response from the Resource Directory, the Client may connect to the Device via the OCF Cloud.

This is illustrated in Figure 1.

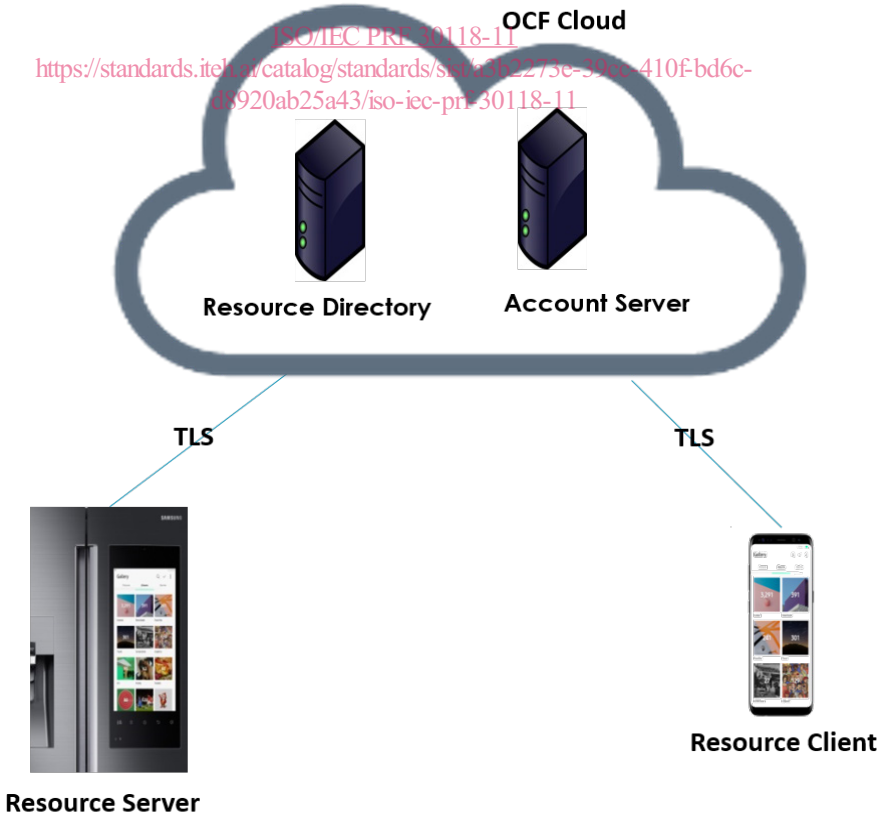

Figure 1 – OCF Cloud Architecture