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Information technology — Open Connectivity Foundation (OCF) Specification —

Part 14: OCF resource to BLE mapping specification

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

Partie 14: Spécification du mapping entre ressources OCF et BLE

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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).

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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 Resource to BLE Mapping, 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) Specification —

Part 14: OCF resource to BLE mapping specification

1 Scope

This document provides detailed mapping information between BLE (Bluetooth Low Energy) and OCF defined Resources.

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.

Adopted Bluetooth Profiles, Services, Protocols and Transports
https://www.bluetooth.com/specifications/adopted-specifications

Bluetooth Core Specification 4.0
https://www.bluetooth.com/specifications/bluetooth-core-specification

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 30118-3 Information technology – Open Connectivity Foundation (OCF) Specification – Part 3: Bridging specification
https://www.iso.org/standard/74240.html
Latest version available at: https://openconnectivity.org/specs/OCF_Bridging_Specification.pdf

ISO/IEC 30118-4 Information technology – Open Connectivity Foundation (OCF) Specification – Part 4: Resource Type specification
https://www.iso.org/standard/74241.html
Latest version available at: https://openconnectivity.org/specs/OCF_Resource_Type_Specification.pdf

ISO/IEC 30118-5 Information technology – Open Connectivity Foundation (OCF) Specification – Part 5: Device specification
https://www.iso.org/standard/79389.html
Latest version available at: https://openconnectivity.org/specs/OCF_Device_Specification.pdf

Derived Models for Interoperability between IoT Ecosystems, Stevens & Merriam, March 2016
https://www.iab.org/wp-content/IAB-uploads/2016/03/OCF-Derived-Models-for-Interoperability-Between-IoT-Ecosystems_v2-examples.pdf

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

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 30118-1, ISO/IEC 30118-2, and ISO/IEC 30118-3 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
GATT-based profile
BLE profile using procedures and operating models provided by GATT profile

3.2 Symbols and abbreviated terms

ATT	Attribute protocol
GAP	Generic Access Profile
GATT	Generic Attribute profile

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).

> These basic features shall be implemented to comply with the Mapping Specification. The phrases "shall not", and "PROHIBITED" indicate behavior that is prohibited, i.e. that if performed means the implementation is not in compliance.

Recommended (or should).

These features add functionality supported by the Mapping Specification and should be implemented. Recommended features take advantage of the capabilities the Mapping Specification, 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 behavior that is permitted but not recommended.

Allowed (or allowed).

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

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.

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.

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

Words that are emphasized are printed in *italic*.

5 Theory of operation

5.1 Interworking approach

The interworking between the BLE defined services/characteristics model and OCF defined Resources is modelled using the derived model syntax described in Derived Models for Interoperability between IoT Ecosystems.

5.2 Mapping syntax

Within the defined syntax for derived modelling used by this document there are two blocks that define the actual Property-Property equivalence or mapping. These blocks are identified by the keywords "x-to-ocf" and "x-from-ocf". Derived Models for Interoperability between IoT Ecosystems does not define a rigid syntax for these blocks; they are free form string arrays that contain pseudo-coded mapping logic.

In this document, Python (version >= 3.0) syntax is used to describe translation rules.

The JSON skeleton shows typical translation block used in the derived models.

```
"<BLE Service Name>" : {
        "type": "object",
        "properties": {
                "<a value field in BLE Characteristic value>" : {
                        "x-ocf-conversion" : {
                                "x-ocf-alias": "<corresponding OCF Resource type>",
                                "x-to-ocf": [
                                        ...
                                        ...
                                ],
                                "x-from-ocf": [
                                        "N/A"
                                ]
                        }
                }
        }
}
```

– <BLE Service Name>: this is fully qualified name of a BLE Service (e.g. "org.bluetooth.characteristic.blood_pressure_measurement")

– <a value field in BLE Characteristic value>: a Characteristic value is byte stream which is composed of multiple value fields. “A value field in BLE Characteristic value” is a description for one of them.

– <corresponding OCF Resource type>: an OCF Resource type which is corresponding to this BLE Service.

– “N/A”: in BLE Bridging, most of the BLE devices are read only. So there is no specific value to be written to the BLE devices from OCF Devices. Therefore, nothing is described in “x-from-ocf” translation clause. “N/A” is used to describe this case.

6 BLE translation

6.1 Operational scenarios

6.1.1 Introduction

The overall goal is to make Bridged BLE GATT Servers appear to OCF Clients as if they were native OCF Servers in the local network or cloud environment.

“Deep translation” between specific BLE Profile and OCF Device is specified in clause 9. Figure 1 shows an overview of the BLE Bridge Platform and its general topology. The BLE Bridging Function supports Asymmetric bridging. It exposes BLE GATT Servers to OCF Clients. Each Bridged BLE GATT Server shall be represented as a Virtual OCF Server.

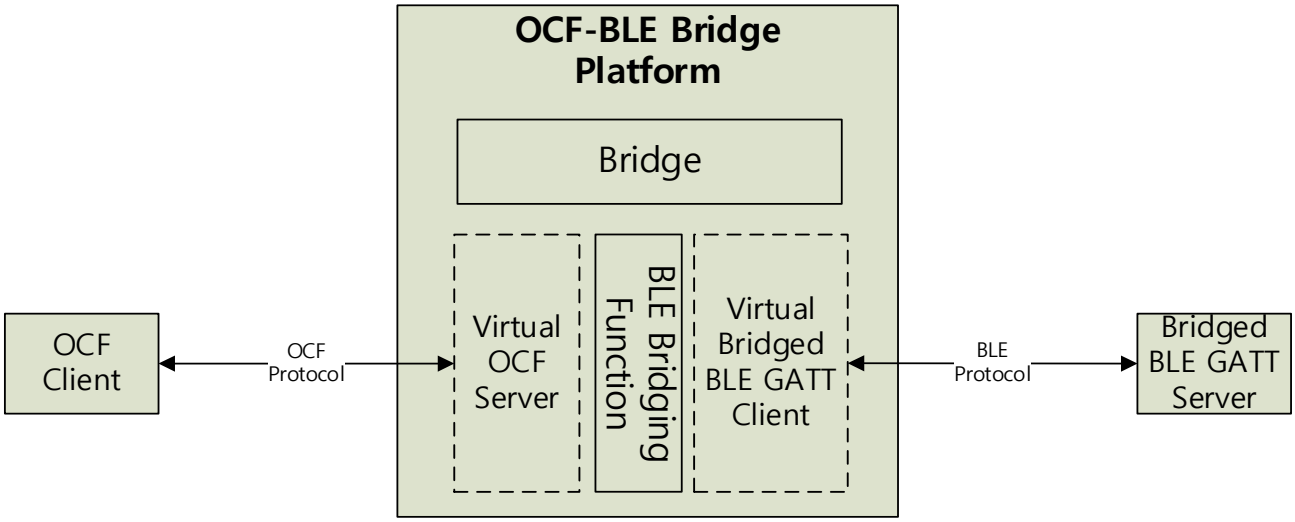

Figure 1 – OCF-BLE Bridge Platform Components

6.1.2 Use case for BLE bridging

Figure 2 shows a use case for an OCF Client and BLE GATT Server. An OCF Client on a smartphone reads a BLE thermometer device through an OCF-BLE Bridge Platform. Any connectivity that OCF supports is used for communications between the OCF Client and the OCF-BLE Bridge Platform. The OCF Client can communicate with OCF-BLE Bridge Platform through OCF Cloud.

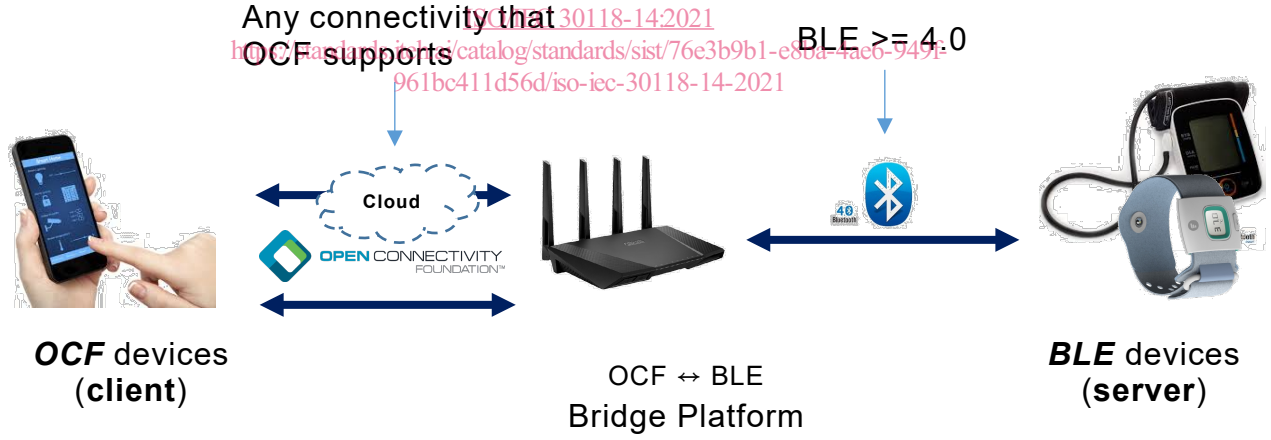

Figure 2 – BLE Bridging use case in real life

6.2 Requirements specific to BLE bridging function

6.2.1 General

OCF-BLE Bridge Platform shall satisfy clause 5.2 General Requirements of ISO/IEC 30118-3.

A BLE Bridging Function supports asymmetric bridging. It exposes BLE GATT server to OCF Clients only. Therefore, it shall play a BLE GATT client role. (This is a requirement so that users can expect that a certified OCF Bridge Platform will be able to talk to any BLE GATT server device, without the user having to buy some other device.).

6.2.2 Requirements specific to BLE

The version of Bluetooth SIG core specification that this document refers to is 4.0 or higher (see Bluetooth Core Specification 4.0). Bluetooth BR/EDR is not included in the scope of this document.

6.2.3 Exposing BLE GATT servers to OCF clients

6.2.3.1 General

The requirements in this clause apply when using algorithmic translation, and by default apply to deep translation unless the relevant requirements for such deep translation specifies otherwise.

Basic translation rule between BLE Service/Characteristic model and OCF Resource model is described in Table 1.

Table 1 – Translation rule between BLE and OCF data model

From BLE	mapping count	To OCF	mapping count
GATT-based profile	n	OCF Device	1
Service	1	OCF Resource	n
Characteristic	1	OCF Resource Property	n
Characteristic Descriptor	1	OCF Notification on/off option	1

One or more BLE GATT-based profiles should be mapped to one Virtual OCF Server (e.g. Health Thermometer profile (HTP) is mapped to Body Thermometer Device ("oic.d.body.thermometer")). A BLE Service should be mapped to one or more OCF Resources (e.g. Health Thermometer Service is mapped to Temperature ("oic.r.body.temperature") and Body Location for temperature ("oic.r.body.location.temperature")). Each Characteristic of BLE Service should be mapped to one or more Properties of OCF Resource (if there is no BLE Characteristic corresponding to an OCF Property, default value should be used). Table 2 is a translation example of this rule. Figure 3 provides an illustration of this rule.

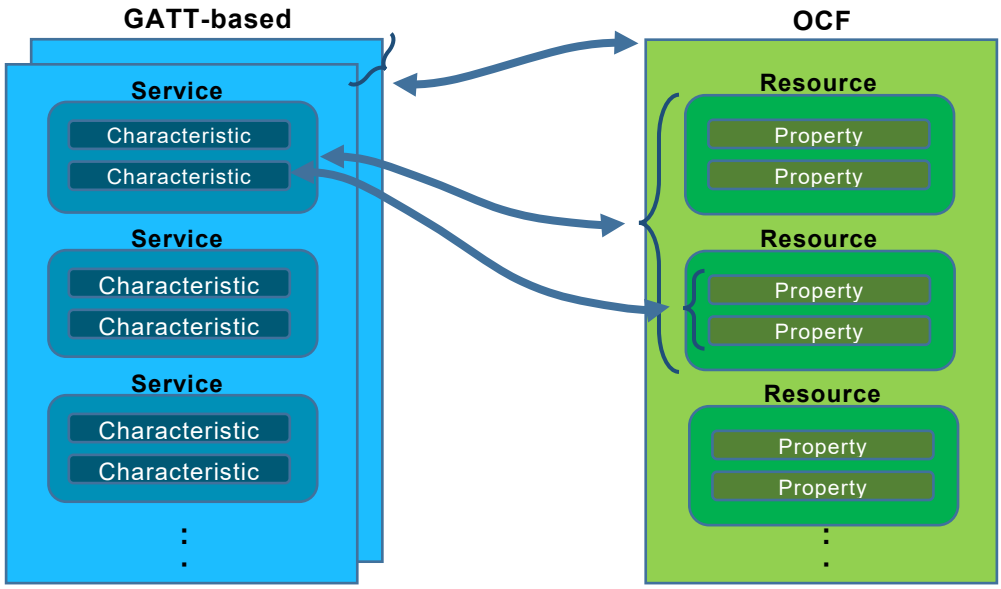

Figure 3 – Translation mapping rule illustration

Table 2 – BLE to OCF translation example (Blood Pressure Device)

	BLE	OCF
BLE Profile → OCF Device	Blood Pressure Profile (BLP)	Blood Pressure Monitor Device ("oic.d.bloodpressuremonitor")
BLE Service → OCF Resource	Blood Pressure Measurement Service ("org.bluetooth.service.blood_pressure")	Blood Pressure ("oic.r.blood.pressure")
		Pulse Rate ("oic.r.pulserate")
	Device Information Service ("org.bluetooth.service.device_information")	Device ("oic.wk.d") Platform ("oic.wk.p")
BLE Characteristic → OCF Resource Property	Blood Pressure Measurement ("org.bluetooth.characteristic.blood_pressure_measurement")	"oic.r.blood.pressure.systolic" "oic.r.blood.pressure.diastolic" "oic.r.blood.pressure.map" "oic.r.blood.pressure.units"
		"oic.r.pulserate.pulserate"

Figure 4 shows an example for 1:N mapping between BLE Characteristic and OCF Properties. In this case, multiple fields in "Blood Pressure Measurement Service" are mapped into the Properties of OCF Resources ("oic.r.pulserate", "oic.r.blood.pressure").

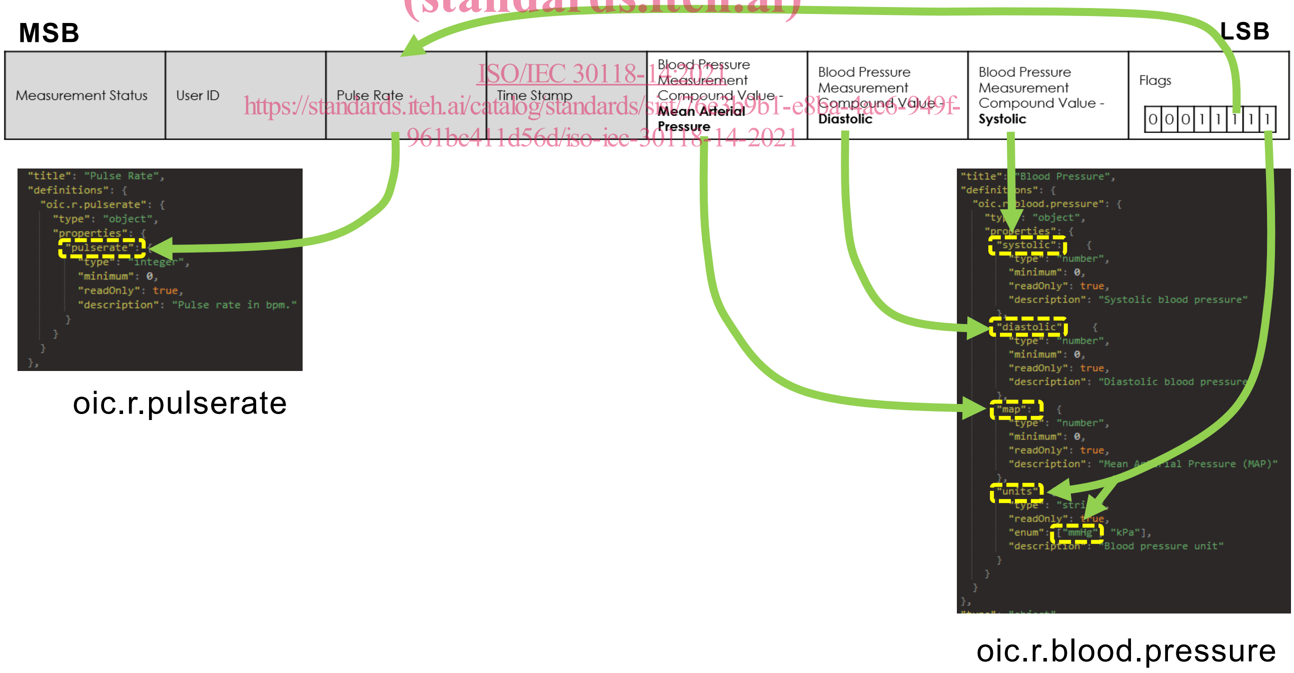

Figure 4 – An example for 1:N mapping between BLE Characteristic and OCF Properties

6.2.3.2 Translation for well-defined set

6.2.3.2.1 General

If a BLE Profile is in a well-defined set, translation should be done as follows. Table 3 is the list of BLE GATT-based Profiles which have corresponding OCF Resources as of now.