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Information technology — Open Connectivity Foundation (OCF) Specification —

Part 16: OCF resource to UPlus mapping specification

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

Partie 16: Spécification du mapping entre les ressources OCF et UPlus

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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 UPlus 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 16:
OCF resource to UPlus mapping specification

1 Scope

This document provides detailed mapping information between UPlus (U+) 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.

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

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

3 Terms, definitions symbols and abbreviations

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/

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 UPlus (U+) and OCF defined Resources is modelled using the derived model syntax described in Derived Models for Interoperability between IoT Ecosystems.

5.2 Mapping syntax

5.2.1 Introduction

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.

Within this document we apply the rules in defined in clause 5.2 to these blocks to ensure consistency and re-usability and extensibility of the mapping logic that is defined.

5.2.2 General

All statements are terminated with a carriage return.

5.2.3 Value assignment

The equals sign (=) is used to assign one value to another. The assignee is on the left of the operator; the value being assigned on the right.

5.2.4 Property naming

All Property names are identical to the name used by the original model; for example, from the OCF Temperature Resource the Property name "temperature" is used whereas when referred to the derived ecosystem then the semantically equivalent Property name is used.

The name of the OCF defined Property is prepended by the ecosystem designator "ocf" to avoid ambiguity (e.g. "ocf.step")

5.2.5 Range

The range on the OCF side is fixed.

5.2.6 Arrays

An array element is indicated by the use of square brackets "[]" with the index of the element contained therein, e.g. range [1]. All arrays start at an index of 0.

5.2.7 Default mapping

There are cases where the specified mapping is not possible as one or more of the Properties being mapped is optional in the source model. In all such instances a default mapping is provided. (e.g. "transitiontime = 1").

5.2.8 Conditional mapping

When a mapping is dependent on the meeting of other conditions then the syntax:

If "condition", then "mapping".

is applied.

E.g. if onoff = false, then ocf.value = false

5.2.9 Method invocation

The invocation of a command from the derived ecosystem as part of the mapping from an OCF Resource is indicated by the use if a double colon "::" delimiter between the applicable resource, service, interface or other construct identifier and the command name. The command name always includes trailing parentheses which would include any parameters should they be passed.

6 U+ translation

6.1 Operational scenarios

6.1.1 Introduction

The goal is to make Bridged U+ Servers appear to OCF Clients as if they were native OCF Servers. "Deep translation" between specific U+ properties and OCF resources is specified in clause 9.

Figure 1 shows an overview of OCF U+ Bridge Platform and its general topology. The U+ Translator supports asymmetric bridging. It exposes U+ Servers to OCF Clients. Each Bridged U+ Server is represented as a Virtual OCF Server.

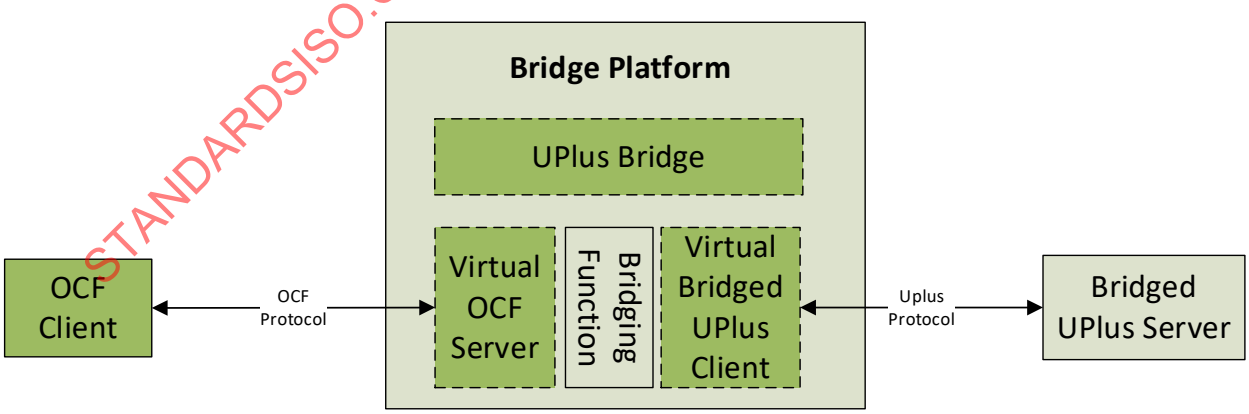

Figure 1 – OCF U+ Bridge Platform and Components

6.1.2 Use case for U+ bridging

Figure 2 shows a use case for U+ bridging. U+ washer air conditioner is installed in the user's house. The user uses OCF Client application on the smartphone to control the washer. OCF U+ Bridge Platform can reside in different physical platforms, for example, the smartphone, the washer or the gateway device.

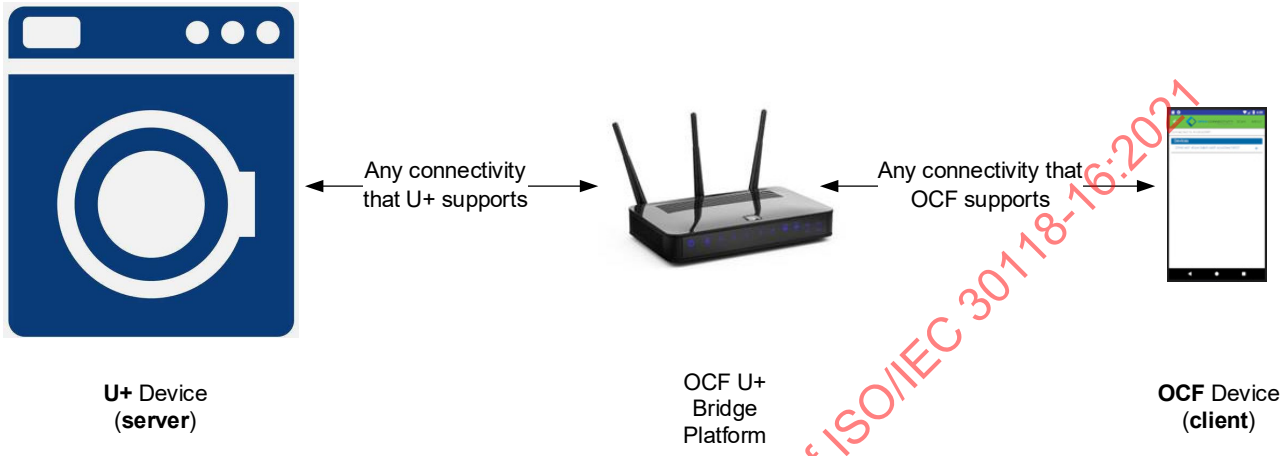

Figure 2 – U+ Bridging Use Case

6.2 Requirements specific to U+ translator

6.2.1 General

OCF U+ Bridge Platform shall satisfy the normative requirements from ISO/IEC 30118-3.

6.2.2 Requirements specific to U+

This document refers to version 5.0.0 or higher of U+ SDK.

6.2.3 Exposing U+ servers to OCF clients

6.2.3.1 General

Table 1 shows translation rule between U+ and OCF data model. One U+ Device Type is mapped to one OCF Device Type or one OCF Composite Device. One or more U+ Properties are mapped to one OCF Resource Type.

Table 1 – Translation Rule between U+ and OCF Data Model

From U+	mapping count	To OCF	mapping count
U+ Device Type	1	OCF Device Type	1
U+ Property	n	OCF Resource	1
		OCF Property	n

Table 2 shows an example of the translation rule, which maps U+ air conditioner to OCF air conditioner.

– U+ Property "onOffStatus" is mapped to OCF Resource Property "value" which belongs to OCF Resource "oic.r.switch.binary".

– U+ Property "targetTemperature" is mapped to OCF Resource Property "temperature" and "units" combined which both belong to OCF Resource "oic.r.temperature".

– U+ Property "indoorTemperature", "windDirectionVertical", "windDirectionHorizontal" and "windSpeed" together are mapped to OCF Resource Property "supportedDirections", "direction", "speed" and "automode" combined which all belong to OCF Resource "oic.r.airflow".

– U+ Property "operationMode" and "healthMode" together are mapped to OCF Resource Property "supportedModes" and "modes" combined which both belong to OCF Resource "oic.r.mode".

Table 2 – Example of Translation between U+ and OCF Data Model

From U+ Air Conditioner	To OCF Air Conditioner	
U+ Property	**OCF Resource**	**OCF Resource Property**
"onOffStatus"	"oic.r.switch.binary"	"value"
"targetTemperature"	"oic.r.temperature"	"temperature"
		"units"
"indoorTemperature"	"oic.r.airflow"	"supportedDirections"
"windDirectionVertical"		"direction"
"windDirectionHorizontal"		"speed"
"windSpeed"		"automode"
"operationMode"	"oic.r.mode"	"supportedModes"
"healthMode"		"modes"

6.2.3.2 Deep translation for U+ property

All U+ devices are well defined. Table 3 is the mapping between U+ devices and their properties and OCF Devices and Resources. Table 3 includes a full list of U+ devices to be mapped to OCF. Table 4, Table 5, and Table 6 define the mapping between OCF core Resources and U+ properties.

Table 3 – Mapping between U+ device and property and OCF device and resource

U+ Device	U+ Property	OCF Resource Type	OCF Device Name	OCF Device Type ("rt")
Air Conditioner	"onOffStatus"	"oic.r.switch.binary"	Air Conditioner	"oic.d.airconditioner"
	"targetTemperature"	"oic.r.temperature"		
	"windSpeed"	"oic.r.selectablelevels"		
	"operationMode"	"oic.r.mode"		
Water Heater	"onOffStatus"	oic.r.switch.binary	Water Heater	"oic.d.waterheater"
	"targetTemperature"	"oic.r.temperature"		
Air Purifier	"onOffStatus"	"oic.r.switch.binary"	Air Purifier	"oic.d.airpurifier"
	"mode"	"oic.r.operational.state"		
	"windSpeed"	"oic.r.selectablelevels"		

Table 4 shows the mapping between the properties of "oic.wk.d" Resource Type (see ISO/IEC 30118-1) and the properties of U+ device.

Table 4 – "oic.wk.d" Resource Type definition

To OCF Property title	OCF Property name	OCF Description	OCF Mandatory	From U+ Property value	U+ Description	U+ Mandatory
(Device) Name	"n"	Human friendly name defined by the vendor. In the presence of "n" Property of "/oic/con", both have the same Property Value. When "n" Property Value of "/oic/con" is modified, it shall be reflected to "n" Property Value of "/oic/d".	Yes	"deviceId"	An unique ID of the Device	Yes
Spec Version	"icv"	Spec version of the core specification to which this Device is implemented. The syntax is "ocf.<major>.<minor>.<sub-version>" where <major>, <minor, and <sub-version> are the major, minor and sub-version numbers of the specification respectively. The string value shall be set to the version of the Core Specification on which the implementation is built (e.g. "ocf.2.0.6).	Yes	(none)	Translator returns its own value.	No
Device UUID	"di"	Unique identifier for Device. This value shall be the same value (i.e. mirror) as the doxm.deviceuuid Property as defined in ISO/IEC 30118-2.	Yes	(none)	As defined in ISO/IEC 30118-2	No
Data Model Version	"dmv"	Spec version of the Resource Specification to which this Device data model is implemented; if implemented against a Vertical specific Device specification(s), then the Spec version of the vertical specification this Device model is implemented to.	Yes	"specVersion"	Data model version of the Device	Yes
Permanent Immutable ID	"piid"	A unique and immutable Device identifier. A Client can detect that a single Device supports multiple communication protocols if it discovers that the Device uses a single Permanent Immutable ID value for all the protocols it supports. Handling privacy-sensitivity for the "piid" Property, refer to ISO/IEC 30118-2	Yes	(none)	Translator returns its own value.	No

To OCF Property title	OCF Property name	OCF Description	OCF Mandatory	From U+ Property value	U+ Description	U+ Mandatory
Localized Descriptions	"ld"	Detailed description of the Device, in one or more languages. This property is an array of objects where each object has a "language" field (containing an IETF RFC 5646 language tag) and a "value" field containing the Device description in the indicated language.	No	(none)	(none)	No
Software Version	"sv"	Version of the Device software.	No	"swver"	Software version of the Device	Yes
Manufacturer Name	"dmn"	Name of manufacturer of the Device, in one or more languages. This property is an array of objects where each object has a "language" field (containing an IETF RFC 5646 language tag) and a "value" field containing the manufacturer name in the indicated language.	No	"manufacturerName"	The value of property "manufacturerName" indicates the name of manufacturer.	Yes
Model Number	"dmno"	Model number as designated by manufacturer.	No	"modelNumber"	The value of property "modelNumber" indicates the model number of the Device.	Yes

Table 5 shows the mapping between the properties of "oic.wk.p" Resource Type (see ISO/IEC 30118-1) and the properties of U+ device.

Table 5 – "oic.wk.p" Resource Type definition

To OCF Property title	OCF Property name	OCF Description	OCF Mandatory	From U+ Property value	U+ Description	U+ Mandatory
Platform ID	"pi"	Unique identifier for the physical platform (UIUID); this shall be a UUID in accordance with IETF RFC 4122. It is recommended that the UUID be created using the random generation scheme (version 4 UUID) specific in the RFC. Handling privacy-sensitivity for the "pi" Property, refer to ISO/IEC 30118-2	Yes	(none)	Translator generates a UUID as "pi" value.	No
Manufacturer Name	"mnmn"	Name of manufacturer	Yes	"manufacturerName"	The value of property "manufacturerName" indicates the name of manufacturer.	Yes
Model Number	"mnmo"	Model number as designated by manufacturer	No	"modelNumber"	The value of property "modelNumber" indicates the model number of the Device.	Yes

Table 6 shows the mapping between the properties of "oic.wk.con" Resource Type (see ISO/IEC 30118-1) and the properties of U+ device.

Table 6 – oic.wk.con Resource Type definition

To OCF Property title	OCF Property name	OCF Description	OCF Mandatory	From U+ Property value	U+ Description	U+ Mandatory
(Device) Name	"n"	Human friendly name configurable by the end user (e.g. Bob's thermostat). The "n" Common Property of the oic.wk.con Core Resource and the "n" Common Property of the "/oic/d" Core Resource shall have the same Value. When the "n" Common Property Value of the oic.wk.con Core Resource is modified, it shall be reflected to the "n" Common Property of "/oic/d" Core Resource.	Yes	"deviceId"	An unique ID of the device	Yes

6.2.3.3 On-the-fly translation

If a U+ device is not in the well-defined set, the U+ Translator does not translate it.

6.2.3.4 Protocol translation between U+ and OCF

U+ framework is based on the CoAP protocol. There are three operations defined for handling the properties on U+ device. Table 7 shows the mapping between U+ operations and OCF CRUDN operations.

If a U+ translator receives CREATE or DELETE Request from OCF Client, it shall return an error response indicating "Method Not Allowed" due to no corresponding operation in U+ framework.

Table 7 – Mapping of operations between U+ and OCF

U+ operation	OCF CRUDN
Not applicable	CREATE
GET	RETRIEVE
PUT	UPDATE
Not applicable	DELETE
GET (Option: COAP_OPTION_OBSERVE)	NOTIFY

The U+ translator shall translate RETRIEVE Request from OCF Client into GET Request to U+ server, and translate corresponding Response from U+ server into RETRIEVE Response back to OCF Client, as in Figure 3.

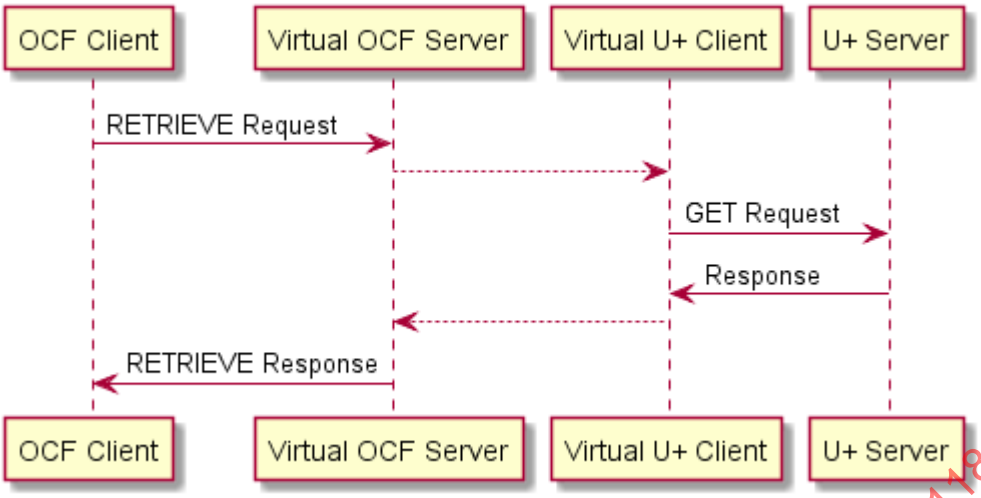

Figure 3 – Mapping of RETRIEVE operation

The U+ translator shall translate UPDATE Request from OCF Client into PUT Request to U+ server, and translate corresponding Response from U+ server into UPDATE Response back to OCF Client, as in Figure 4. The PUT Request shall update all properties needed in the payload, i.e. a full replacement.

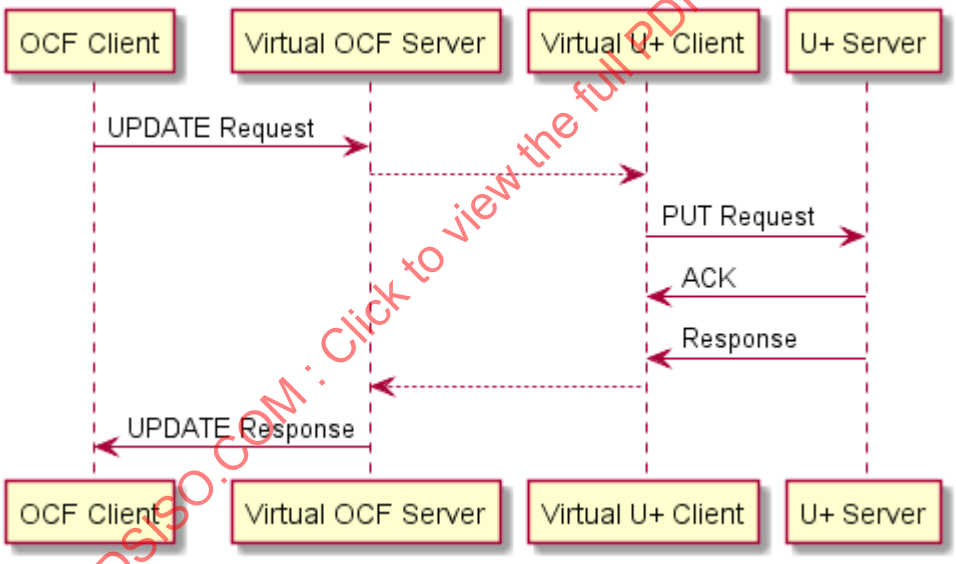

Figure 4 – Mapping of UPDATE operation

The U+ translator shall translate RETRIEVE Request (Observe), i.e. Notification, from OCF Client into GET Request (Option: COAP_OPTION_OBSERVE) to U+ server, and translate corresponding Response from U+ server into RETRIEVE Response (Observe) back to OCF Client, as in Figure 5.

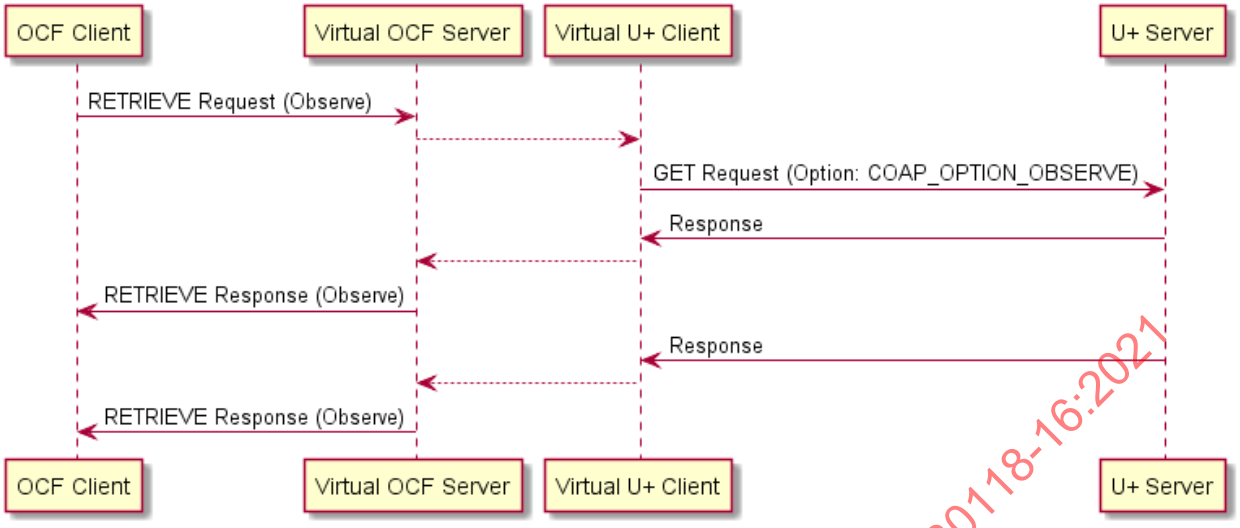

Figure 5 – Mapping of NOTIFICATION operation

6.2.3.5 Error handling

If a U+ operation fails, the translator sends an appropriate OCF error response to the OCF Client.

7 Device type mapping

7.1 Introduction

This clause contains the mappings from U+ Device Types to OCF Device Types.

7.2 U+ device types to OCF device types

Table 8 captures the equivalency mapping between U+ Device Types and OCF Device Types.

Table 8 – U+ to OCF Device Type Mapping

U+ Device Type	OCF Device Type
Air Conditioner	"oic.d.airconditioner"
Air Purifier	"oic.d.airpurifier"
Water Heater	"oic.d.waterheater"

8 Resource to U+ property equivalence

8.1 Introduction

This clause lists the U+ Properties and provides the equivalent OCF Resource Type(s) to which the Properties map.

8.2 U+ property to OCF resources

Table 9 captures the equivalency mapping between U+ Properties and OCF Resource Types. U+ properties are device type-dependent. The properties with same name may be different within different device types.

Table 9 – U+ Property to OCF Resource Type Mapping

U+ Device Type	U+ Property	OCF Resource Type Name	OCF Resource Type ID	OCF Interface(s)
Air Conditioner	"onOffStatus"	Binary Switch	"oic.r.switch.binary"	"oic.if.a"
	"targetTemperature"	Temperature	"oic.r.temperature"	"oic.if.s", "oic.if.a"
	"windSpeed"	Selectable Levels	"oic.r.selectablelevels"	"oic.if.a"
	"operationMode"	Mode	"oic.r.mode"	"oic.if.a"
Air Purifier	"onOffStatus"	Binary Switch	"oic.r.switch.binary"	"oic.if.a"
	"windSpeed"	Selectable Levels	"oic.r.selectablelevels"	"oic.if.a"
	"operationMode"	Mode	"oic.r.mode"	"oic.if.a"
Water Heater	"onOffStatus"	Binary Switch	"oic.r.switch.binary"	"oic.if.a"
	"targetTemperature"	Temperature	oic.r.temperature	"oic.if.s", "oic.if.a"

9 Detailed mapping APIs

9.1 Introduction

This clause provides a Device Type mapping description (using JSON that aligns with the Derived Modelling syntax described in Derived Models for Interoperability between IoT Ecosystems) for all U+ Properties and OCF Resources that are within scope.

9.2 Air conditioner mapping

9.2.1 Derived model

The derived model: "uplus.device.airconditioner".

9.2.2 Property definition

Table 10 provides the detailed per Property mapping for "uplus.device.airconditioner".

Table 10 – The Property mapping for "uplus.device.airconditioner"

UPlus Property name	OCF Resource	To OCF	From OCF
onOffStatus	oic.r.switch.binary.value	oic.r.switch.value = onOffStatus	onOffStatus=oic.r.switch.value
targetTemperature	oic.r.temperature.temperature	oic.r.temperature.temperature=targetTemperature	targetTemperature=oic.r.temperature.temperature
windSpeed	oic.r.selectablelevels	availablelevels=[1,2,3,4,5]targetlevel=windSpeed	windSpeed=targetlevel
operationMode	oic.r.mode	supportedModes=["Auto","Cool","Dry","Warm","Wind"]modes=supportedModes[operationMode]	operationMode=supportedModes.indexof(modes)

Table 11 provides the details of the Properties that are part of "uplus.device.airconditioner".