

# OCF Device Specification

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## 171 **Introduction**

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

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

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

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

190 The OCF specification suite is made up of nineteen discrete documents, the documents fall into  
191 logical groupings as described herein:

- 192 – Core framework
  - 193 – Core Specification
  - 194 – Security Specification
  - 195 – Onboarding Tool Specification
- 196 – Bridging framework and bridges
  - 197 – Bridging Specification
  - 198 – Resource to Alljoyn Interface Mapping Specification
  - 199 – OCF Resource to oneM2M Resource Mapping Specification
  - 200 – OCF Resource to BLE Mapping Specification
  - 201 – OCF Resource to EnOcean Mapping Specification
  - 202 – OCF Resource to LWM2M Mapping Specification
  - 203 – OCF Resource to UPlus Mapping Specification
  - 204 – OCF Resource to Zigbee Cluster Mapping Specification
  - 205 – OCF Resource to Z-Wave Mapping Specification
- 206 – Resource and Device models
  - 207 – Resource Type Specification
  - 208 – Device Specification
- 209 – Core framework extensions
  - 210 – Easy Setup Specification
  - 211 – Core Optional Specification
- 212 – OCF Cloud
  - 213 – Cloud API for Cloud Services Specification

214        – Device to Cloud Services Specification  
215        – Cloud Security Specification

# OCF Device Specification

## 1 Scope

The Device definitions use Resource definitions from ISO/IEC 30118-4.

This document is built on top of ISO/IEC 30118-1. ISO/IEC 30118-1 specifies the core architecture, interfaces protocols and services to enable the implementation of profiles for IoT usages and ecosystems. ISO/IEC 30118-1 also defines the main architectural components of network connectivity, discovery, data transmission, device & service management and ID & security. The core architecture is scalable to support simple devices (constrained devices) and more capable devices (smart devices).

## 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](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](https://openconnectivity.org/specs/OCF_Security_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](https://openconnectivity.org/specs/OCF_Resource_Type_Specification.pdf)

ISO/IEC 61850-7-1, Communication networks and systems for power utility automation --Part 7-1: Basic communication structure -- Principles and models

<https://webstore.iec.ch/publication/6014>

OpenAPI specification, fka *Swagger RESTful API Documentation Specification*, Version 2.0

<https://github.com/OAI/OpenAPI-Specification/blob/master/versions/2.0.md>

IETF RFC 4566, SDP: Session Description Protocol, July 2006

<https://tools.ietf.org/html/rfc4566>

Draft Report: A Basic Classification System for Energy-Using Products--Universal Device Classification, December 2013

<https://eta-intranet.lbl.gov/sites/default/files/lbln-classification-v1.pdf>

## 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

#### **Actuator**

Resource with support of the UPDATE operation.

### 3.1.2

#### **Sensor**

Resource without support of the UPDATE operation.

### 3.1.3

#### **Healthcare Device**

Device that is conformant to the normative requirements contained in Annex C of this document.

## 3.2 Symbols and abbreviated terms

|       |                                      |
|-------|--------------------------------------|
| CGM   | Continuous Glucose Monitor           |
| CRUDN | Create Retrieve Update Delete Notify |
| CSV   | Comma Separated Value                |
| NREM  | Non Rapid Eye Movement               |
| REM   | Rapid Eye Movement                   |
| REST  | Representational State Transfer      |
| SDP   | Session Description Protocol         |
| UDC   | Universal Device Classification      |

## 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, RETRIEVE, 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. 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).

These features add functionality supported by a Device and should be implemented. Recommended features take advantage of the capabilities a Device, 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 (or allowed).

These features are neither required nor recommended by a Device, 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*.

#### 4.3 Data types

See ISO/IEC 30118-1.

#### 4.4 Document structure

This document describes specific requirements governing the indication of Device Types on Devices and the requirements that are associated with specific Device Types themselves. The document makes use of functionality defined in the ISO/IEC 30118-1 and ISO/IEC 30118-4.

Annex A specifies the Device Types that shall be used by an OCF Device.

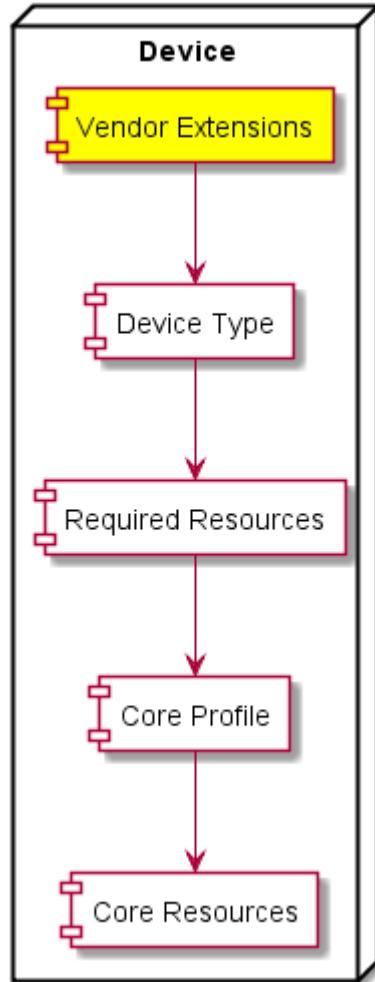
Annex B specifies the profiles that shall be used by an OCF Device that is part of the Smart Home vertical.

Annex C specifies the profiles that shall be used by an OCF Device that is part of the Healthcare vertical.

Annex D specifies the profiles that shall be used by an OCF Device that is part of the Industrial vertical.

Annex E specifies the profiles that shall be used by an OCF Device that is part of a Photovoltaic system.

This document further describes which constructs are used for a Device and which Resources are mandated to be implemented for each Device. A typical Device consisting of data elements defined in the referenced documents is depicted in Figure 1.



**Figure 1 – Device building blocks**

## 5 Operational scenarios

### 5.1 Document version

All Devices conformant to this document shall add the string "ocf.sh.1.3.0" to the dmv Property in oic.wk.d. This Property is for legacy Device support only and will no longer be revised in alignment with document versions.

## 6 Core resource model

### 6.1 Introduction

The Core Resource model is described in ISO/IEC 30118-1.

### 6.2 Device type

A Device Type is a specialisation of a Resource Type name, it is used to populate the "rt" Property of "/oic/d" and thus provide an indicator of the type of physical device that is being modelled by the

Server. All The Device Types defined by this document are have a Resource Type name ("rt") prefixed with "oic.d."

Examples of Device Types are:

- oic.d.fan
- oic.d.thermostat

The full list of defined Device names and types are in Table A.2, Annex B, Annex C, Annex D, and Annex E detail the minimal Resource(s) that a Device shall implement for a specific Device Type where required by a vertical. A Device may expose additional OCF and 3<sup>rd</sup> party defined Resources other than those indicated in these Annexes.

ISO/IEC 30118-1 defines a Device Resource with a URI of "/oic/d". A Device shall include in the "Resource Type" Property of "/oic/d" the Device Type (or Device Types) from Table A.2, or a Third party specified Device Type (see clause 6.4), of the physical device hosting the Server; the inclusion of the Device Type shall be done using one of the methods provided by clause 11.3.4 of ISO/IEC 30118-1 (i.e. add to the array of values).

ISO/IEC 30118-1 supports the inclusion of a Device Type as part of the Resource Type of a Collection (see also clause 7.4), in such cases the Collection shall include the Resource Types defined as mandatory for the Device Type by this document. For example, if a Collection Resource has an "rt" value of ["oic.d.light"], the Collection includes an instance of "oic.r.switch.binary" which is mandatory for an "oic.d.light" as per clause B.1.

Therefore a Device may be discovered by adding a query for the "rt" of the Device Type itself (e.g. "?rt=oic.d.fan") to the multicast OCF Endpoint discovery method (see clause 8.1).

### 6.3 Profile of ISO/IEC 30118-1

This clause describes the profiling of the Core Resources and transport mechanisms and functions that are defined in ISO/IEC 30118-1.

The required ISO/IEC 30118-1 Resources are also required for a profile implementation.

In addition to the required Resources the optional ISO/IEC 30118-1 Resources in Table 1 shall be required.

**Table 1 – Required Resources for Devices**

| Resource ("rt")          | Required in Profile      |
|--------------------------|--------------------------|
| Intentionally left blank | Intentionally left blank |

For each of the Resources listed in Table 1, Table 2 details the Properties within those Resources that shall be required.

**Table 2 – Required Properties in Resource**

| Resource ("rt")          | Property name            | Required in Profile      |
|--------------------------|--------------------------|--------------------------|
| Intentionally left blank | Intentionally left blank | Intentionally left blank |

A Device shall support CoAP based OCF Endpoint discovery as defined in clause 10.3 of ISO/IEC 30118-1.

The messaging protocol for a Device shall be CoAP (see ISO/IEC 30118-1).

A Device shall support a network layer as defined in clause 9 of ISO/IEC 30118-1 including any necessary defined bridging functions that ensure inter-operability with IPv6.

## 6.4 Third (3<sup>rd</sup>) party specified extensions

This clause describes how a 3<sup>rd</sup> party may add Device Types, Resource Types, 3<sup>rd</sup> party defined Properties to an existing or 3<sup>rd</sup> party defined Resource Type, 3<sup>rd</sup> party defined enumeration values to an existing enumeration and 3<sup>rd</sup> party defined Parameters to an existing defined Property.

A 3<sup>rd</sup> party may specify additional (non-OCF) Resources within an OCF Device. A 3<sup>rd</sup> party may also specify additional Properties within an existing OCF defined Resource Type. Further a 3<sup>rd</sup> party may extend an OCF defined enumeration with 3<sup>rd</sup> party defined values.

A 3<sup>rd</sup> party defined Device Type may expose both 3<sup>rd</sup> party and OCF defined Resource Types. A 3<sup>rd</sup> party defined Device Type must expose the mandatory Resources for all OCF Devices defined within this document.

A 3<sup>rd</sup> party defined Resource Type shall include any mandatory Properties defined in this document and also any vertically specified mandatory Properties. All Properties defined within a 3<sup>rd</sup> party defined Resource Type that are part of the OCF namespace that are not Common Properties as defined in this document shall follow the 3<sup>rd</sup> party defined Property rules in Table 3.

Table 3 defines the syntax rules for 3<sup>rd</sup> party defined Resource Type elements. Within the table the term "Domain\_Name" refers to a domain name that is owned by the 3<sup>rd</sup> party that is defining the new element.

**Table 3 – 3rd party defined Resource elements**

|   | Resource Element                | Vendor Definition Rules                     |
|---|---------------------------------|---|
| New 3 <sup>rd</sup> party defined Device Type                                   | "rt" Property Value of "/oic/d" | "x.<Domain_Name>.<Resource identification>" |
| New 3 <sup>rd</sup> party defined Resource Type                                 | "rt" Property Value             | "x.<Domain_Name>.<Resource identification>" |
| New 3 <sup>rd</sup> party defined Property within the OCF namespace             | Property Name                   | "x.<Domain_Name>.<Property>"                |
| Additional 3 <sup>rd</sup> party defined values in an OCF specified enumeration | Enumeration Property Value      | "x.<Domain_Name>.<enum value>"              |
| Additional 3 <sup>rd</sup> party defined Parameter in an OCF specified Property | Parameter key word              | x.<Domain_Name>.<parameter keyword>         |

With respect to the use of the Domain\_Name in this scheme the labels are reversed from how they appear in DNS or other resolution mechanisms. The 3<sup>rd</sup> party defined Device Type and Resource Type otherwise follow the rules defined in ISO/IEC 30118-1. 3<sup>rd</sup> party defined Resource Types should be registered in the IANA Constrained RESTful Environments (CoRE) Parameters registry.

For example:

```
x.com.samsung.galaxyphone.accelerator  
x.com.cisco.ciscorouterport  
x.com.hp.printerhead  
x.org.allseen.newinterface.newproperty
```

## 6.5 Semantic Tags

### 6.5.1 Introduction

Semantic Tags are meta-information associated with a specific Resource instance that are represented as both Link Parameters and Resource Properties that provide a mechanism whereby the Resource be annotated with additional contextual metadata that helps describe the Resource. The requirements are defined in ISO/IEC 30118-1, but clauses 6.5.2 and 6.5.3 define additional Device specific requirements.

### **6.5.2 "tag-pos-desc" or position description Semantic Tag**

In addition to the requirements defined in ISO/IEC 30118-1 the following requirements will apply:

- This Semantic Tag should not contain any 3<sup>rd</sup> party defined values (see clause 6.4).

### **6.5.3 "tag-func-desc" or function description Semantic Tag**

In addition to the requirements defined in ISO/IEC 30118-1 the following requirements will apply:

- This Semantic Tag when exposed shall be populated with a value from the currently supported set of standardized enumeration values defined in clause B.2.2.
- This Semantic Tag should not contain any 3<sup>rd</sup> party defined values (see clause 6.4).

## **7 Modelling of multiple logical Devices**

### **7.1 Introduction**

A physical Device may be modelled as a single Platform and Device, a single Platform with multiple Devices, multiple separately discoverable discrete Platforms and Devices, or as a single Platform and Device where the Device is represented as a composition of other Devices.

For example, a door that includes the functionality of a contact sensor, a lock and a camera may be modeled as a single-Platform, a multi-Platform, or a Composite Device. Each of these three options will be detailed in clauses 7.2, 7.3, and 7.4.

### **7.2 Single platform model**

The physical Device exposes one or more logical Devices that are independently discoverable (i.e. they separately respond to multicast discovery request messages as defined in clause 11.3 of ISO/IEC 30118-1). Given the door example there could be a single discovery response with an instance of "/oic/d" that exposes a single Device Type (such as "oic.d.door") or multiple discovery responses, each response having a single Device Type in the "rt" of "/oic/d" that represents the logical Device. The common denominator being that for all discovered logical Devices the Properties of "/oic/p" have the same values.

### **7.3 Multi-platform model**

Just like the single-Platform model, one or more logical Devices that make up a physical Device respond independently to multicast discovery request messages and expose their own Resources. Like the single-platform model, each logical Device exposes a single Device Type in the "rt" value of "/oic/d". The difference from the single-platform model is that each logical Device does not have the same values for the Properties of "oic/p".

### **7.4 Composite Device model**

When modelling a Server as a Composite Device there shall be a single Platform which represents the Composite Device. The Resource Type Property Value of "/oic/d" exposed should contain all of the Device Types of the Devices that compose the Composite Device. For each Device that is part of the Composite Device when using this approach there shall exist a Collection that represents one of the distinct Devices in the composition. Further each Collection shall have a Resource Type that at a minimum includes the Device Type that the Collection represents (e.g. ["oic.d.door"]).

Figure 2 illustrates the response to a discovery request using the baseline Interface on "/oic/res" for a Composite Device modeled as described in this clause. Figure 3 illustrates the response to a unicast RETRIEVE request using the baseline Interface to the Collection that represents the door Device.

```
[
  {
    "rt": ["oic.wk.res"],
    "if": ["oic.if.baseline", "oic.if.ll"],
    "links": [
      {
        "anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
        "href": "/oic/d",
        "rt": ["oic.wk.d", "oic.d.door", "oic.d.sensor", "oic.d.lock", "oic.d.camera"],
        "if": ["oic.if.r", "oic.if.baseline"],
        "p": {"bm": 3},
        "eps": [{"ep": "coap://[fe80::b1d6]:1111"}]
      },
      {
        "anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
        "href": "/mydevice/mydoor",
        "rt": ["oic.d.door"],
        "if": ["oic.if.ll", "oic.if.baseline", "oic.if.r"],
        "p": {"bm": 3},
        "eps": [{"ep": "coaps://[fe80::b1d6]:1111"}]
      },
      {
        "anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
        "href": "/mydevice/mysensor",
        "rt": ["oic.d.sensor"],
        "if": ["oic.if.ll", "oic.if.baseline", "oic.if.r"],
        "p": {"bm": 3},
        "eps": [{"ep": "coaps://[fe80::b1d6]:1111"}]
      },
      {
        "anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
        "href": "/mydevice/mylock",
        "rt": ["oic.d.lock"],
        "if": ["oic.if.ll", "oic.if.baseline", "oic.if.r"],
        "p": {"bm": 3},
        "eps": [{"ep": "coaps://[fe80::b1d6]:1111"}]
      },
      {
        "anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
        "href": "/mydevice/mycamera",
        "rt": ["oic.d.camera"],
        "if": ["oic.if.ll", "oic.if.baseline", "oic.if.r"],
        "p": {"bm": 3},
        "eps": [{"ep": "coaps://[fe80::b1d6]:1111"}]
      }
    ]
  }
]
```

**Figure 2 – Example composite Device model**

```
{
  "rt": ["oic.d.door"],
  "if": ["oic.if.ll1", "oic.if.r", "oic.if.baseline"],
  "id": "unique_example_id",
  "di": "dc70373c-1e8d-4fb3-962e-017eaa863989",
  "icv": "ocf.1.3.0",
  "dmv": "ocf.res.1.3.0, ocf.sh.1.3.0",
  "piid": "6F0AAC04-2BB0-468D-B57C-16570A26AE48",
  "links": [
    {
      "href": "/mydoor/openlevel",
      "rt": ["oic.r.openlevel"],
      "if": ["oic.if.a", "oic.if.baseline"],
      "p": {"bm": 2},
      "eps": [
        {"ep": "coaps://[fe80::b1d6]:1122"}
      ]
    }
  ]
}
```

**Figure 3 – RETRIEVE Response to example door from composite device model**

## 8 Discovery

### 8.1 OCF Endpoint discovery

Clients may discover Servers by using the mechanisms defined by ISO/IEC 30118-1 clause 10. A Client may populate an "rt" query parameter with the Device Types that the Client wants to discover, or if no "rt" query parameter is provided then the search is for all available Device Types irrespective.

Devices may be discovered by Device Type or implemented Resource Type. This difference is conveyed by the population of any "rt" query parameter included as part of discovery (see clause 11.3 of ISO/IEC 30118-1).

The values that may be used for discovering a specific Device Type are listed in Table A.2. The values that may be used to discover a specific Resource Type are listed in clause 6 of ISO/IEC 30118-4.

The discovery process provides the base URI of the Device that is acting as a Server to the Client. The structure of the detected Device can then be retrieved by Resource Discovery.

### 8.2 Resource discovery

Clause intentionally left blank

## 9 Security

A Device shall implement the mandated Security Virtual Resources specified in the ISO/IEC 30118-2. Additionally, all exposed ISO/IEC 30118-4 defined Resources shall be accessible via at least one secure OCF Endpoint. A Device shall not expose ISO/IEC 30118-4 defined Resources using unsecured OCF Endpoints. For the purposes of this document a secure OCF Endpoint is one that either uses a scheme locator of "coaps" or "coaps+tcp" in the "eps" Parameter exposed by "/oic/res", or one that provides a Simple Secure Multicast address in the "eps" Parameter exposed by "/oic/res" (see ISO/IEC 30118-2).

With the exception of those Resources related to Discovery that are explicitly identified by the ISO/IEC 30118-1 as not requiring secured access (see ISO/IEC 30118-1 clause 11.2.3), all other Resources defined in ISO/IEC 30118-1 implemented in the Device shall be accessible via at least one secure OCF Endpoint (i.e. use of a "coaps" or "coaps+tcp" scheme locator within the "eps" Parameter exposed by /oic/res). Similarly, any Resources defined in ISO/IEC 30118-1 that do not require unsecured access that are not listed in /oic/res shall also be accessible via "coaps" or "coaps+tcp".

## Annex A (normative)

### Device categories and Device Types

#### A.1 Device categories

Devices are grouped into Device Categories based on the Universal Device Classification (UDC) (see A Basic Classification System for Energy-Using Products--Universal Device Classification), all Device Categories are listed in Table A.1.

**Table A.1 – List of device categories**

| Device Category Name | Description   |
|----------------------|---|
| Space Conditioning   | Heating and cooling systems                                     |
| Lighting             |   |
| Appliance            | Also known as "white goods"; covers major appliances only.      |
| Electronics          | Personal electronics  |
| Miscellaneous        | Small appliances, other   |
| Infrastructure       | Physical building and infrastructure                            |
| Transportation       | Vehicles, fixed devices that provide movement (e.g. Escalators) |
| Fitness              | Includes lifestyle  |
| Medical              |   |
| Personal Health      |   |
| Other                |   |

#### A.2 Device Types

The complete Universal Device Classification with Device Types per Device Category is provided in Table A.2. Note that not all Devices within the UDC classification have equivalent OCF defined Device Types. All defined Device Types are of the form "oic.d.<thing>" where <thing> is a single alphanumeric string (lower case [a..z],[0..9] only) no more than 24 characters in length giving a total maximum length of the Device Type of 32 characters. Where an abbreviated form of the Device Type is required (applicable only to population of a Wi-Fi beacon IE) then the "oic.d." portion of the Device Type may be omitted.

Table A.2 does not specify the mandatory Resources that are implemented by an instance of such a Device Type; the set of applicable mandatory Resources is dependent on the application domain. In this document the following domains are specified: Smart Home, Healthcare. The "Reference" column in the table references vertical specific annexes where the Device Type is further refined (e.g. mandatory Resources).

**Table A.2 – Per category list of Device Types**

| Device Category Name | UDC Device Name | Device Name     | Device Type (Normative) | Reference |
|----------------------|-----------------|-----------------|-------------------------|-----------|
| Space Conditioning   | Unitary System  | Air Conditioner | oic.d.airconditioner    | B.1       |
|                      | Boiler          | Water Heater    | oic.d.waterheater       | B.1       |
|                      | Furnace         | Furnace         | oic.d.furnace           |           |

|           |                           |                             |  |     |
|-----------|---------------------------|-----------------------------|--|-----|
|           | Pump                      | Pump                        | oic.d.pump                                 |     |
|           | Fan                       | Fan                         | oic.d.fan                                  | B.1 |
|           | Condensing Unit           | Condensing Unit             | oic.d.condensingunit                       |     |
|           | Condenser                 | Condenser                   | oic.d.condenser                            |     |
|           | Humidifier                | Humidifier                  | oic.d.humidifier                           | B.1 |
|           | Dehumidifier              | Dehumidifier                | oic.d.dehumidifier                         | B.1 |
|           | HVAC – Control            | Thermostat                  | oic.d.thermostat                           | B.1 |
|           | HVAC - Other              | HVAC                        | oic.d.hvac                                 |     |
|           |                           | Air Purifier                | oic.d.airpurifier                          | B.1 |
|           |                           | Air Quality Monitor         | oic.d.airqualitymonitor                    | B.1 |
|           |                           |                             |  |     |
| Lighting  | Lighting - Controls       | Lighting Controls           | oic.d.lightingcontrol                      |     |
|           | Lighting - Other          | Light                       | oic.d.light                                | B.1 |
|           |                           | DALI Application Controller | oic.d.dali.ac                              | B.1 |
|           |                           | DALI Bus                    | oic.d.dali.bus                             | B.1 |
|           |                           | DALI Device                 | oic.d.dali                                 | B.1 |
|           |                           | Smart Light                 | oic.d.light.smart,oic.d.light <sup>1</sup> | B.1 |
|           |                           |                             |  |     |
| Appliance | Airer                     | Airer                       | oic.d.airer                                | B.1 |
|           | Air Conditioner Assistant | Air Conditioner Assistant   | oic.d.acassistant                          | B.1 |
|           | Clothes Dryer             | Dryer (Laundry)             | oic.d.dryer                                | B.1 |
|           | Clothes Washer            | Washer (Laundry)            | oic.d.washer                               | B.1 |
|           |                           | Clothes Washer Dryer        | oic.d.washerdryer                          | B.1 |
|           | Dishwasher                | Dishwasher                  | oic.d.dishwasher                           | B.1 |
|           | Freezer                   | Freezer                     | oic.d.freezer                              | B.1 |
|           | Ice Machine               | Ice Machine                 | oic.d.icemachine                           |     |
|           | Indoor Garden             | Indoor Garden               | oic.d.indoorgarden                         | B.1 |
|           | Mattress                  | Mattress                    | oic.d.mattress                             | B.1 |
|           | Oven                      | Oven                        | oic.d.oven                                 | B.1 |
|           | Range                     | Range                       | oic.d.range                                |     |
|           | Refrigerator              | Refrigerator                | oic.d.refrigerator                         | B.1 |
|           | Water Heater              | Water Heater                | oic.d.waterheater                          | B.1 |
|           | Water Purifier            | Water Purifier              | oic.d.waterpurifier                        | B.1 |

<sup>1</sup> Any Device that exposes a Device Type of "oic.d.light.smart" shall also expose a Device Type of "oic.d.light". In essence a Smart Light is also a Light, and will be treated as such by any Client that only understands "oic.d.light".

|               |                        |                        |                            |            |
|---------------|------------------------|------------------------|----------------------------|------------|
|               | Appliance – Other      | Cooker Hood            | oic.d.cookerhood           | B.1        |
|               |                        | Cooktop                | oic.d.cooktop              | B.1        |
|               |                        | Steam Closet           | oic.d.steamcloset          | B.1        |
|               |                        |                        |                            |            |
| Electronics   | Audio System           | Audio System           | oic.d.audiosystem          |            |
|               | A/V Player             | AV Player              | oic.d.avplayer             |            |
|               | Camera                 | Camera                 | oic.d.camera               | B.1        |
|               | Computer – Desktop     | Desktop PC             | oic.d.desktoppc            |            |
|               | Computer - Notebook    | Notebook PC            | oic.d.notebookpc           |            |
|               | Computer - Server      | Server                 | oic.d.server               |            |
|               | Computer – Other       | Computer               | oic.d.pc                   |            |
|               | Data Storage           | Data Storage Unit      | oic.d.datastorageunit      |            |
|               | Display                | Display                | oic.d.display              |            |
|               | Electronics - Portable | Portable Electronics   | oic.d.portableelectronics  |            |
|               | Game Console           | Game Console           | oic.d.gameconsole          |            |
|               | Imaging Equipment      | 3D Printer             | oic.d.3dprinter            | B.1        |
|               |                        | Printer                | oic.d.printer              | B.1        |
|               |                        | Printer Multi-Function | oic.d.multifunctionprinter | B.1        |
|               |                        | Scanner                | oic.d.scanner              | B.1        |
|               | Musical Instrument     | Musical Instrument     | oic.d.musicalinstrument    |            |
|               | Networking Equipment   | Networking Equipment   | oic.d.networking           |            |
|               | Phone Handset          | Handset                | oic.d.handset              |            |
|               | Receiver               | Receiver               | oic.d.receiver             | B.1        |
|               | Set Top Box            | Set Top Box            | oic.d.stb                  | B.1        |
|               | Telephony              | Telephony              | oic.d.telephonydevice      |            |
|               | Television             | Television             | oic.d.tv                   | B.1, B.4.1 |
|               | A/V - Other            | Active Speaker         | oic.d.speaker              |            |
|               | Electronics – Other    | Electronics            | oic.d.smallelectrical      |            |
|               |                        |                        |                            |            |
| Miscellaneous | Air Compressors        | Air Compressor         | oic.d.aircompressor        |            |
|               | Bathroom Device        | Bathroom General       | oic.d.bathroomdevice       |            |
|               | Battery Charger        | Battery Charger        | oic.d.batterycharger       |            |

|                |                       |                               |                         |          |
|----------------|-----------------------|-------------------------------|-------------------------|----------|
|                | Business Equipment    | Business Equipment            | oic.d.businessequipment |          |
|                | Cleaning Equipment    | Robot Cleaner                 | oic.d.robotcleaner      | B.1      |
|                | Cooking – Portable    | Portable Stove                | oic.d.portablestove     |          |
|                | Exercise Machine      | Exercise Machine              | oic.d.exercisemachine   |          |
|                | HVAC – Portable       | Portable HVAC                 | oic.d.hvacportable      |          |
|                | Industrial            | Optical augmented RFID Reader | oic.d.orfid             | D.1      |
|                | Kitchen               | Coffee Machine                | oic.d.coffeemachine     | B.1      |
|                |                       | Food Probe                    | oic.d.foodprobe         | B.1      |
|                |                       | Grinder                       | oic.d.grinder           | B.1      |
|                |                       | Kettle                        | oic.d.kettle            | B.1      |
|                | Lighting – Decorative | Decorative Lighting           | oic.d.lightdecorative   |          |
|                | Lighting – Emergency  | Emergency Lighting            | oic.d.lightemergency    |          |
|                | Microwave Oven        | Microwave Oven                | oic.d.microwave         | B.1      |
|                | Vending Machine       | Vending Machine               | oic.d.vendingmachine    |          |
|                | Water Dispenser       | Water Dispenser               | oic.d.waterdispenser    |          |
|                | Miscellaneous - Other | Battery                       | oic.d.battery           | B.1, E.3 |
|                |                       |                               |                         |          |
|                |                       |                               |                         |          |
| Infrastructure | Breakers              | Water Valve                   | oic.d.watervalve        | B.1      |
|                | Control               | Wallpad                       | oic.d.wallpad           | B.1      |
|                | Doors/Windows         | Blind                         | oic.d.blind             | B.1      |
|                |                       | Door                          | oic.d.door              | B.1      |
|                |                       | Garage Door                   | oic.d.garagedoor        | B.1      |
|                |                       | Smart Lock                    | oic.d.smartlock         | B.1      |
|                |                       | Window                        | oic.d.window            | B.1      |
|                | Fireplace             | Fireplace                     | oic.d.fireplace         |          |
|                | Pump                  | Pump                          | oic.d.pump              |          |
|                | Power - Portable      | Energy Generator              | oic.d.energygenerator   | B.1      |
|                |                       | Smart Plug                    | oic.d.smartplug         | B.1      |
|                | Power - Fixed         | Arc Fault Circuit Interrupter | oic.d.afci              | B.1      |
|                |                       | Circuit Breaker               | oic.d.circuitbreaker    | E.3      |

|                 |                   |                                  |                              |     |
|-----------------|-------------------|----------------------------------|------------------------------|-----|
|                 |                   | Ground Fault Circuit Interrupter | oic.d.gfci                   | B.1 |
|                 |                   | Inverter                         | oic.d.inverter               | E.3 |
|                 |                   | PV Array System                  | oic.d.pvarraysystem          | E.3 |
|                 |                   | Switch                           | oic.d.switch                 | B.1 |
|                 | Security          | Security Panel                   | oic.d.securitypanel          | B.1 |
|                 | Sensors           | Generic Sensor                   | oic.d.sensor                 | B.1 |
|                 | Meter             | Electric Meter                   | oic.d.electricmeter          | B.1 |
|                 |                   | Energy Monitor                   | oic.d.energymonitor          | B.1 |
|                 |                   |                                  |                              |     |
| Transportation  | Transport - Other | Electric Vehicle Charger         | oic.d.electricvehiclecharger | B.1 |
|                 |                   |                                  |                              |     |
| Fitness         |                   | Fitness Device                   | oic.d.fitnessdevice          |     |
|                 |                   | Activity Tracker                 | oic.d.activitytracker        | C.4 |
|                 |                   | Blood Pressure Monitor           | oic.d.bloodpressuremonitor   | C.4 |
|                 |                   | Body Thermometer                 | oic.d.bodythermometer        | C.4 |
|                 |                   | Cycling Power Meter              | oic.d.cyclingpowermeter      | C.4 |
|                 |                   | Cycling Speed Sensor             | oic.d.cyclingspeedsensor     | C.4 |
|                 |                   | Cycling Cadence Sensor           | oic.d.cyclingcadencesensor   | C.4 |
|                 |                   | Heart Rate Monitor               | oic.d.heartratemonitor       | C.4 |
|                 |                   | Muscle Oxygen Monitor            | oic.d.muscleoxygenmonitor    | C.4 |
|                 |                   |                                  |                              |     |
| Medical         |                   | Blood Pressure Monitor           | oic.d.bloodpressuremonitor   | C.4 |
|                 |                   | Body Scale                       | oic.d.bodyscale              | C.4 |
|                 |                   | Body Thermometer                 | oic.d.bodythermometer        | C.4 |
|                 |                   | CGM                              | oic.d.cgm                    | C.4 |
|                 |                   | Glucose Meter                    | oic.d.glucosemeter           | C.4 |
|                 |                   | Heart Rate Monitor               | oic.d.heartratemonitor       | C.4 |
|                 |                   | Medical Device                   | oic.d.medicaldevice          |     |
|                 |                   | Pulse Oximeter                   | oic.d.pulseoximeter          | C.4 |
|                 |                   | Sleep Monitor                    | oic.d.sleepmonitor           | C.4 |
|                 |                   | Medication Monitor               | oic.d.medicationmonitor      | C.4 |
|                 |                   |                                  |                              |     |
| Personal Health |                   | Activity Tracker                 | oic.d.activitytracker        | C.4 |

|       |       |                                   |                               |     |
|-------|-------|-----------------------------------|-------------------------------|-----|
|       |       | Blood Pressure Monitor            | oic.d.bloodpressuremonitor    | C.4 |
|       |       | Body Composition Analyser         | oic.d.bodycompositionanalyser | C.4 |
|       |       | Body Scale                        | oic.d.bodyscale               | C.4 |
|       |       | Body Thermometer                  | oic.d.bodythermometer         | C.4 |
|       |       | CGM                               | oic.d.cgm                     | C.4 |
|       |       | Glucose Meter                     | oic.d.glucosemeter            | C.4 |
|       |       | Heart Rate Monitor                | oic.d.heartratemonitor        | C.4 |
|       |       | Personal Health Device            | oic.d.personalhealthdevice    |     |
|       |       | Pulse Oximeter                    | oic.d.pulseoximeter           | C.4 |
|       |       | Sleep Monitor                     | oic.d.sleepmonitor            | C.4 |
|       |       |                                   |                               |     |
|       |       |                                   |                               |     |
|       |       |                                   |                               |     |
| Other | Other |                                   | oic.d.unknown                 |     |
|       |       | Access Management Service         | oic.d.ams                     |     |
|       |       | Credential Management Service     | oic.d.cms                     |     |
|       |       | Device Ownership Transfer Service | oic.d.dots                    |     |

## Annex B (normative)

### Smart home Device Types

#### B.1 Smart home required Resources per Device Type

Device Types may mandate that specific Resources be implemented. The required Resource per Device Type where mandated is listed in Table B.1. Additionally, specific Resources that use enumeration values to indicate supported states or modes may mandate usage of standardized enumeration values. The mandated allowed values are indicated for each applicable Resource Type, the Property of interest on that Resource Type and to which Device Type it applies.

Per Table B.1, some Device types support two instances of the same Resource Type. When this is the case, the Resources shall support different CRUDN actions, e.g. one Resource acts as a Sensor (CRUDN action write not supported) and the other Resource acts as an Actuator (CRUDN actions read and write supported at a minimum) unless otherwise specified.

**Table B.1 – Alphabetical list of Device Types ("rt"), including required Resources for smart home**

| Device Name<br>(informative)     | Device Type ("rt")<br>(Normative) | Required Resource<br>name   | Required Resource Type     |
|----------------------------------|-----------------------------------|-----------------------------|----------------------------|
| 3D Printer                       | oic.d.3dprinter                   | Binary Switch               | oic.r.switch.binary        |
|                                  |                                   | 3D Printer                  | oic.r.printer.3d           |
|                                  |                                   | Operational State           | oic.r.operational.state    |
|                                  |                                   | Temperature                 | oic.r.temperature          |
|                                  |                                   | Print Queue                 | oic.r.printer.queue        |
| Active Speaker                   | oic.d.speaker                     | Binary Switch               | oic.r.switch.binary        |
|                                  |                                   | Audio Controls              | oic.r.audio                |
| Airer                            | oic.d.airer                       | Binary Switch               | oic.r.switch.binary        |
|                                  |                                   | Linear Movement<br>Controls | oic.r.movement.linear      |
| Air Conditioner                  | oic.d.airconditioner              | Binary Switch               | oic.r.switch.binary        |
|                                  |                                   | Temperature                 | oic.r.temperature          |
| Air Conditioner<br>Assistant     | oic.d.acassistant                 | Binary Switch               | oic.r.switch.binary        |
|                                  |                                   | Vendor List                 | oic.r.vendorlist           |
| Air Purifier                     | oic.d.airpurifier                 | Binary Switch               | oic.r.switch.binary        |
| Air Quality<br>Monitor           | oic.d.airqualitymonitor           | Air Quality<br>Collection   | oic.r.airqualitycollection |
| Arc Fault Circuit<br>Interrupter | oic.d.afci                        | Fault Interrupter<br>Switch | oic.r.switch.fault         |
| Battery                          | oic.d.battery                     | Battery                     | oic.r.battery              |
| Blind                            | oic.d.blind                       | Open Level                  | oic.r.openlevel            |
| Camera                           | oic.d.camera                      | Media                       | oic.r.media                |
| Clothes Washer<br>Dryer          | oic.d.washeddryer                 | Binary Switch               | oic.r.switch.binary        |
|                                  |                                   | Operational State           | oic.r.operational.state    |
| Coffee Machine                   | oic.d.coffeemachine               | Binary Switch               | oic.r.switch.binary        |

|                                     |                              |   |   |
|-------------------------------------|------------------------------|---|---|
|                                     |                              | Operational State   | oic.r.operational.state   |
| Cooker Hood                         | oic.d.cookerhood             | Airflow Control   | oic.r.airflowcontrol  |
|                                     |                              | Binary Switch   | oic.r.switch.binary   |
|                                     |                              | Mode  | oic.r.mode  |
| Cooktop                             | oic.d.cooktop                | Heating Zone Collection   | oic.r.heatingzonecollection   |
| Dehumidifier                        | oic.d.dehumidifier           | Binary Switch   | oic.r.switch.binary   |
|                                     |                              | Humidity  | oic.r.humidity  |
| Dishwasher                          | oic.d.dishwasher             | Binary Switch   | oic.r.switch.binary   |
|                                     |                              | Mode  | oic.r.mode  |
| Door                                | oic.d.door                   | Open Level  | oic.r.openlevel   |
| Dryer (Laundry)                     | oic.d.dryer                  | Binary switch   | oic.r.switch.binary   |
|                                     |                              | Operational State   | oic.r.operational.state   |
| Electric Vehicle Charger            | oic.d.electricvehiclecharger | Binary Switch   | oic.r.switch.binary   |
|                                     |                              | Operational State   | oic.r.operational.state   |
|                                     |                              | Battery   | oic.r.battery   |
|                                     |                              | Vehicle Connector   | oic.r.vehicleconnector  |
| Electric Meter                      | oic.d.electricmeter          | Energy Consumption  | oic.r.energy.consumption  |
| Energy Generator                    | oic.d.energygenerator        | Energy Generation   | oic.r.energy.generation   |
| Energy Monitor                      | oic.d.energymonitor          | One of: Energy Consumption, Gas Consumption                                       | oic.r.energy.consumption or oic.r.gas.consumption   |
| Fan                                 | oic.d.fan                    | Binary Switch   | oic.r.switch.binary   |
| Food Probe                          | oic.d.foodprobe              | Temperature (Sensor)  | oic.r.temperature   |
| Freezer                             | oic.d.freezer                | Temperature(2)(1 Sensor and 1 Actuator)   | oic.r.temperature   |
| Garage Door                         | oic.d.garagedoor             | Door  | oic.r.door  |
| Generic Sensor                      | oic.d.sensor                 | Any Resource Type that supports and exposes in "/oic/res" the oic.if.s interface. | oic.r. <x><br>Where this equates to any Resource Type that supports the oic.if.s Interface. |
| Grinder                             | oic.d.grinder                | Operational State   | oic.r.operational.state   |
|                                     |                              | Grinder Settings  | oic.r.grinder   |
| Ground Fault Circuit Interrupter    | oic.d.gfci                   | Fault Interrupter Switch  | oic.r.switch.fault  |
| Humidifier                          | oic.d.humidifier             | Binary Switch   | oic.r.switch.binary   |
| Kettle                              | oic.d.kettle                 | Binary Switch   | oic.r.switch.binary   |
| Light                               | oic.d.light                  | Binary Switch   | oic.r.switch.binary   |
| Light (DALI) Application Controller | oic.d.dali.ac                | Dali  | oic.r.dali  |
| Light (DALI) Bus                    | oic.d.dali.bus               | Dali  | oic.r.dali  |

|                        |                               |   |  |
|------------------------|-------------------------------|---|--|
|                        |                               | Dali Config                               | oic.r.dali.config                          |
| Light (DALI) Device    | oic.d.dali                    | Dali                                      | oic.r.dali                                 |
|                        |                               | Dali Config                               | oic.r.dali.config                          |
| Indoor Garden          | oic.d.indoorgarden            | Binary Switch                             | oic.r.switch.binary                        |
| Mattress               | oic.d.mattress                | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Mode                                      | oic.r.mode                                 |
| Oven                   | oic.d.oven                    | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Temperature (2) (1 Sensor and 1 Actuator) | oic.r.temperature                          |
| Printer                | oic.d.printer                 | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Operational State                         | oic.r.operational.state                    |
| Printer Multi-Function | oic.d.multifunctionprinter    | Binary switch                             | oic.r.switch.binary                        |
|                        |                               | Operational State (2) <sup>a</sup>        | oic.r.operational.state                    |
|                        |                               | Automatic Document Feeder                 | oic.r.automaticdocumentfeeder <sup>b</sup> |
| Receiver               | oic.d.receiver                | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Audio Controls                            | oic.r.audio                                |
|                        |                               | Media Source List (2)                     | oic.r.media.input, oic.r.media.output      |
| Refrigerator           | oic.d.refrigerator            | Temperature (2) (1 Sensor and 1 Actuator) | oic.r.temperature                          |
| Robot Cleaner          | oic.d.robotcleaner            | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Mode                                      | oic.r.mode                                 |
| Scanner                | oic.d.scanner                 | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Operational State                         | oic.r.operational.state                    |
|                        |                               | Automatic Document Feeder                 | oic.r.automaticdocumentfeeder              |
| Security Panel         | oic.d.securitypanel           | Mode                                      | oic.r.mode                                 |
| Set Top Box            | oic.d.stb                     | Binary Switch                             | oic.r.switch.binary                        |
| Smart Light            | oic.d.light.smart,oic.d.light | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Dimming                                   | oic.r.light.dimming                        |
| Smart Lock             | oic.d.smartlock               | Lock Status                               | oic.r.lock.status                          |
| Smart Plug             | oic.d.smartplug               | Binary Switch                             | oic.r.switch.binary                        |
| Steam Closet           | oic.d.steamcloset             | Operational State                         | oic.r.operational.state                    |
|                        |                               | Time Period                               | oic.r.time.period                          |
| Switch                 | oic.d.switch                  | Binary Switch                             | oic.r.switch.binary                        |
| Television             | oic.d.tv                      | Binary Switch                             | oic.r.switch.binary                        |
|                        |                               | Audio Controls                            | oic.r.audio                                |
|                        |                               | Media Source List                         | oic.r.media.input                          |
| Thermostat             | oic.d.thermostat              | Temperature (2) (1 Sensor and 1 Actuator) | oic.r.temperature                          |

|   |                     |  |                         |
|---|---------------------|--|-------------------------|
| Wallpad   | oic.d.wallpad       | Binary Switch                            | oic.r.switch.binary     |
|   |                     | Temperature(2) (1 Sensor and 1 Actuator) | oic.r.temperature       |
| Washer (Laundry)  | oic.d.washer        | Binary Switch                            | oic.r.switch.binary     |
|   |                     | Operational State                        | oic.r.operational.state |
| Water Heater  | oic.d.waterheater   | Binary Switch                            | oic.r.switch.binary     |
|   |                     | Temperature(2) (1 Sensor and 1 Actuator) | oic.r.temperature       |
| Water Purifier  | oic.d.waterpurifier | Operational State                        | oic.r.operational.state |
|   |                     | Water Info                               | oic.r.waterinfo         |
| Water Valve   | oic.d.watervalve    | Open Level                               | oic.r.openlevel         |
| Window  | oic.d.window        | Open Level                               | oic.r.openlevel         |
| <p><b>a</b> A Multi-Function Printer shall expose two instances of an Operational State Resource; each in discrete Collections, one for the Printer specific operational state information and one for the Scanner specific operational state information. The friendly name for the Collections should indicate the device modality (printer or scanner).</p> <p><b>b</b> A Multi-Function Printer shall only expose an Automatic Document Feeder Resource if the device has the Automatic Document Feeder capability.</p> |                     |  |                         |

## B.2 Standardized enumeration values

### B.2.1 Introduction

Resource Types may have a list of supported enumeration values. The supported enumeration values may differ when applied in different devices. In this clause the affected Resource Types are described by:

- list of supported values
- list of recommended values when applied to a specific Device Type

### B.2.2 Alphabetical list of standardized enumeration types

Table B.2 lists the standardized enumeration types that may be present within Resource Properties where the Property is defined as containing values from this clause. The enumerations also apply to Semantic Tags (see ISO/IEC 30118-1) where the tag is defined as containing values from this clause.

**Table B.2 – The defined set of standardized enumerations**

| Enumeration         | Description   |
|---------------------|---|
| aborted             | An internal device, communication or security error   |
| active              | Unit is active  |
| after               | unit is in a mode that is waiting for another trigger (after which)   |
| airClean            | unit is in air clean mode or state  |
| airDry              | unit is air drying  |
| airfilterconsumable | identifies the main air filter consumable ("oic.r.consumable") Resource of the Device                       |
| airflow             | Identifies the main airflow ("oic.r.airflow") Resource of the Device  |
| airpurifierswitch   | identifies that the switch ("oic.r.switch.binary") can turn on/off the air purifying function of the Device |

|                        |  |
|------------------------|--|
| airqualityairpollution | identifies the air quality ("oic.r.airquality") Resource measuring (total) AirPollution                                    |
| airqualitych20         | identifies the air quality ("oic.r.airquality") Resource measuring measuring Methanol (also known as Formaldehyde): (CH2O) |
| airqualityco           | identifies the air quality ("oic.r.airquality") Resource measuring carbon monoxide (CO)                                    |
| airqualityco2          | identifies the air quality ("oic.r.airquality") Resource measuring carbon dioxide (CO2)                                    |
| airqualityno2          | identifies the air quality ("oic.r.airquality") Resource measuring nitrogen dioxide (NO2)                                  |
| airqualityo3           | identifies the air quality ("oic.r.airquality") Resource measuring ozone (O3)  |
| airqualityodor         | identifies the air quality ("oic.r.airquality") Resource measuring Odor  |
| airqualityso2          | identifies the air quality ("oic.r.airquality") Resource measuring sulphur dioxide (SO2)                                   |
| airqualitypm1          | identifies the air quality ("oic.r.airquality") Resource measuring particulate matter (pm1)                                |
| airqualitypm10         | identifies the air quality ("oic.r.airquality") Resource measuring particulate matter (pm10)                               |
| airqualitypm2.5        | identifies the air quality ("oic.r.airquality") Resource measuring particulate matter (pm2.5)                              |
| airqualitysmoke        | identifies the air quality ("oic.r.airquality") Resource measuring smoke   |
| airqualityvoc          | identifies the air quality ("oic.r.airquality") Resource measuring volatile organic compounds (VOC)                        |
| alarm                  | unit is in an alarm mode or state  |
| alarmtimeperiod        | identifies the duration time for an alarm ("oic.r.time.period")  |
| ambient                | unit is in ambient mode or state   |
| armedAway              | unit is armed for away   |
| armedInstant           | unit is armed instantly  |
| armedMaximum           | unit is armed at maximum level   |
| armedNightStay         | unit is armed in night stay  |
| armedStay              | unit is armed in stay mode   |
| aroma                  | unit is armed in aroma mode  |
| artificialintelligence | unit is in artificial intelligence mode  |
| auto                   | unit is in auto mode or state  |
| awning                 | identifies that the instance of "oic.r.windowcovering" represents an awning  |
| babyCare               | unit is in baby care mode or state   |
| baking                 | unit is in baking mode or state  |
| battery                | identifies the main battery ("oic.r.battery") Resource of the Device   |
| boiling                | unit is in boiling state or mode   |
| brewing                | unit is in brewing state or mode   |
| cancelled              | the job was cancelled either by the remote client or by the user   |

|                           |  |
|---------------------------|--|
| changeCondition           | the unit has experienced a change in condition, mode or state  |
| charging                  | the unit is in charging mode or state  |
| checkingTurbidity         | unit is in checking turbidity state  |
| circulating               | unit is in circulating mode or state   |
| cleaning                  | unit is in cleaning mode or state  |
| clearVoice                | type is in sound mode  |
| clothes                   | unit is in clothes mode  |
| completed                 | job finished successfully  |
| contactsensor             | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of contact sensor   |
| convenientroomdoor        | identifies the convenient room door ("oic.r.door") of the refrigerator ("oic.d.refrigerator")  |
| convertible               | unit is for a convertible part (among compartments of a refrigerator). User can configure the parts as desired                               |
| convBake                  | unit is in convection bake mode  |
| convRoast                 | unit is in convection roast mode   |
| cool                      | unit is in cooling mode or state   |
| coolClean                 | unit is in cool-clean mode or state  |
| coolingtargettemperature  | identifies the target cooling temperature ("oic.r.temperature") Resource of the air conditioner ("oic.d.airconditioner")                     |
| coolerdoor                | identifies the cooler door ("oic.r.door") of the Device  |
| coolermeasuredtemperature | identifies the measured cooler temperature ("oic.r.temperature") Resource of the Device  |
| coolertargettemperature   | identifies the target cooler temperature ("oic.r.temperature") Resource of the Device  |
| cosensor                  | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of carbon monoxide sensor   |
| currenttemperature        | identifies the current measured temperature ("oic.r.temperature") Resource of the Device   |
| custom                    | type is in sound mode  |
| delicate                  | unit is in delicate mode or state  |
| deodorization             | identifies the main deodorization ("oic.r.deodorization") Resource of the Device   |
| diagnosis                 | unit is in diagnosis mode or state; when an error occurs, a Device is in diagnosis mode (state) for identifying causes and finding solutions |
| disabled                  | unit's current operational mode is disabled  |
| dishwasherdoor            | identifies the main door ("oic.r.door") Resource of the Dish Washer ("oic.d.dishwasher")   |
| down                      | unit is unavailable  |
| downWard                  | identifies that the instance of "oic.r.movement.linear" represents downward  |
| drapery                   | identifies that the instance of "oic.r.windowcovering" represents drapery  |
| dry                       | unit is dry mode   |
| dryClean                  | unit is in dry-clean mode or state   |

|                            |   |
|----------------------------|---|
| dual                       | unit is in dual mode  |
| dynamic                    | type is in picture mode   |
| ecomode                    | identifies the main (overall) ecomode ("oic.r.ecemode") Resource of the Device                                  |
| edge                       | unit is edge mode or state  |
| enabled                    | unit's current operational mode is enabled  |
| express                    | unit is in express mode or state  |
| extended                   | unit is in extended mode or state   |
| fan                        | unit is in fan mode or state  |
| fast                       | unit is in fast mode or state   |
| filterMaterial             | filter material that is used by a Device  |
| firesensor                 | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of fire sensor                                   |
| focused                    | unit is in focused mode or state  |
| foot                       | unit is in foot mode or state, typically seen as a mode on a Smart Mattress                                     |
| freezePrevent              | unit is in freeze prevent mode or state   |
| freezePreventPending       | unit is pending freeze prevent mode   |
| freezePreventPause         | unit is in the paused state while in freeze prevent mode  |
| freezer                    | unit is for a freezer part (among compartments of a refrigerator)   |
| freezerdoor                | identifies the freezer room door ("oic.r.door") Resource of the Device  |
| freezermeasuredtemperature | identifies the measured freezer temperature ("oic.r.temperature") of the Device                                 |
| freezertargettemperature   | identifies the target freezer temperature ("oic.r.temperature") of the Device                                   |
| fridge                     | unit is for a fridge part (among compartments of a refrigerator)  |
| glassbreaksensor           | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of glass break sensor                            |
| grinding                   | unit is in grinding state or mode   |
| healing                    | unit is in healing mode or state  |
| heating                    | unit is in heating mode or state  |
| heatingtargettemperature   | identifies the target heating temperature ("oic.r.temperature") of the Device                                   |
| heavy                      | unit is in heavy mode or state  |
| homing                     | unit is in homing state, Device produces a special signal so that it can be found using electronic equipment    |
| hot                        | unit is in hot mode or state  |
| humidify                   | unit is in humidify mode or state   |
| humidity                   | identifies the main humidity ("oic.r.humidity") Resource of the Device  |
| ice                        | unit is in ice mode or state  |
| idle                       | new jobs can start processing without waiting   |
| initializing               | unit is in initializing state, a Device resets its values set by a Client to initial values set by manufacturer |

|                        |   |
|------------------------|---|
| ink                    | generic ink cartridge for a Device  |
| inkBlack               | black ink cartridge for a Device  |
| inkCyan                | cyan ink cartridge for a Device   |
| inkMagenta             | magenta ink cartridge for a Device  |
| inkTricolour           | tricolour ink cartridge for a Device  |
| inkYellow              | yellow ink cartridge for a Device   |
| invalid                | unit is in an invalid mode, state, or setting   |
| keepwarm               | unit is in keep warm state or mode  |
| keyfob                 | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of key fob   |
| keypad                 | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of keypad  |
| localtime              | identifies the clock ("oic.r.clock") time representing the local time zone  |
| macro                  | unit is in macro mode or state, Client manually inputs a rule or pattern of operation   |
| main                   | unit is part of the main device or is the main device   |
| manual                 | unit is in manual mode or state   |
| map                    | unit is in mapping mode or state  |
| mineral                | unit is in mineral mode   |
| monitoring             | unit is in monitoring mode or state; such as security functions detecting unusual movements in an empty place for a camera-mounted Device |
| monitoringInitializing | unit is in initializing state in monitoring mode; a Device resets its values of monitoring mode to initial values set by manufacturer     |
| monitoringMoving       | unit is in moving state in monitoring mode; following a specific target that client select while the Device is in monitoring mode         |
| monitoringPreparation  | unit is in preparation state in monitoring mode; a Device is getting ready for its monitoring operation                                   |
| morning                | unit is in morning mode or state  |
| motionsensor           | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of motion sensor   |
| movie                  | type is in picture mode   |
| moving                 | unit is in moving state; the action of going to a different place   |
| music                  | type is in sound mode   |
| natural                | type is in picture mode   |
| night                  | unit is in night-time mode or state   |
| nightDry               | unit is in night-time drying mode or state  |
| none                   | unit is in an undefined mode or state   |
| normal                 | unit is in a normal operational state   |
| notsupported           | ability to set a specific operational mode by a Client is not supported   |
| onedoorfridgedoor      | identifies the single door ("oic.r.door") of the Device   |
| operationalstate       | identifies the main (overall) operational state ("oic.r.operational.state") of the Device   |

|                             |   |
|-----------------------------|---|
| operationalmode             | identifies the main (overall) mode ("oic.r.mode") of the Device   |
| part                        | unit is in part mode or state, typically seen on a robot cleaner, analogous to spot cleaning                        |
| pause                       | unit is paused (by user)  |
| ped                         | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of personal emergency device                         |
| pending                     | job initiated, engine is preparing  |
| pendingHeld                 | job is not a candidate for processing for any number of reasons, will return to pending state if reasons are solved |
| permashift                  | unit is in permanent shift mode or state  |
| point                       | unit is at a defined or specific point (with respect to movement)   |
| powerOff                    | unit is powered off (standby)   |
| powerswitch                 | identifies the Resource that is the main power switch ("oic.r.switch.binary"), e.g. on/off of the Device            |
| preHeat                     | unit is in pre-heat mode or state   |
| preparation                 | unit is in preparation mode or state; a Device is getting ready for its operation                                   |
| preSteam                    | unit is in pre-steam mode or state  |
| preWash                     | unit is pre wash mode   |
| processing                  | processing the job  |
| projectorscreen             | identifies that the instance of "oic.r.windowcovering" represents a projector screen                                |
| pure                        | unit is in pure mode or state   |
| quick                       | unit is in quick mode or state  |
| quiet                       | unit is in quiet mode   |
| refresh                     | unit is in refresh mode or state  |
| refrigeration               | identifies the main ("oic.r.refrigeration") Resource of the Device  |
| relativeremainingtimeperiod | identifies the Resource as (overall) relative remaining time period ("oic.r.time.period")                           |
| relax                       | unit is in relax mode or state  |
| remainingtimeperiod         | identifies the Resource as (overall) absolute remaining time period ("oic.r.time.period")                           |
| remotecontrol               | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of remote control                                    |
| remotecontrolenable         | identifies the Resource for remote control enable ("oic.r.switch.binary"), e.g. remote enablement of the Device     |
| repeat                      | unit is in repeat mode or state   |
| reserve                     | unit is in reserve mode or state  |
| reserving                   | unit is in reserving state  |
| restart                     | unit is in re-start mode or state   |
| ringing                     | unit is in ringing state to indicate alarm, emergency, caution, and so on   |
| rinse                       | unit is in rinse mode or state  |

|                            |  |
|----------------------------|--|
| rollershade                | identifies that the instance of "oic.r.windowcovering" represents a roller shade                                     |
| rollershade2               | identifies that the instance of "oic.r.windowcovering" represents a two motor roller shade                           |
| rollershadeext             | identifies that the instance of "oic.r.windowcovering" represents an exterior roller shade                           |
| rollershadeext2            | identifies that the instance of "oic.r.windowcovering" represents an exterior two motor roller shade                 |
| sectored                   | unit is in sectored mode or state  |
| select                     | unit is in select mode or state  |
| securityrepeater           | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of security repeater                                  |
| setOption                  | unit is in a state whereby device options may be set   |
| shake                      | unit is in shake mode or state   |
| shoesDry                   | unit is in shoes dry mode or state   |
| shutter                    | identifies that the instance of "oic.r.windowcovering" represents a shutter  |
| silent                     | unit is in silent mode or state  |
| sleep                      | unit is in sleep mode or state   |
| sleepreservationtimeperiod | identifies the Resource ("oic.r.time.period") as sleep reservation time  |
| smart                      | unit is in smart mode or state   |
| soaking                    | unit is in soaking mode or state   |
| soda                       | unit is in soda mode   |
| spin                       | unit is in spin mode or state  |
| spot                       | unit is in spot mode or state  |
| spray                      | unit is in spray mode or state   |
| standard                   | type is in picture or sound mode   |
| standardcie                | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of standard control and indicator equipment           |
| start                      | unit is in start mode or state   |
| startreservationtimeperiod | identifies the Resource ("oic.r.time.period") as start of reservation time   |
| steam                      | unit is in steam mode or state   |
| steamSoftening             | unit is in steam softening mode or state, whereby the fabric is softened using only water and no softening additives |
| sterilize                  | unit is in sterilize mode or state   |
| stop                       | identifies that the instance of "oic.r.movement.linear" represents stop  |
| stopreservationtimeperiod  | identifies the Resource ("oic.r.time.period") as stop of reservation time  |
| stopped                    | error condition occurred   |
| stretching                 | unit is in stretching mode or state  |
| subDevice                  | unit is for a sub-device that makes up part of a main device   |
| swd                        | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of standard warning device                            |

|                       |   |
|-----------------------|---|
| targettemperature     | identifies the target (setpoint) temperature ("oic.r.temperature") of the Device                    |
| testing               | calibrating, preparing the unit   |
| tiltblind             | identifies that the instance of "oic.r.windowcovering" represents a tilt only tilt blind            |
| tiltblind2mode        | identifies that the instance of "oic.r.windowcovering" represents a tilt and lift tilt blind        |
| toner                 | generic toner cartridge for a Device  |
| tonerBlack            | black toner cartridge for a Device  |
| tonerCyan             | cyan toner cartridge for a Device   |
| tonerMagenta          | magenta toner cartridge for a Device  |
| tonerYellow           | yellow toner cartridge for a Device   |
| turbo                 | unit is in turbo mode or state  |
| update                | unit is in update mode or state   |
| upWard                | identifies that the instance of "oic.r.movement.linear" represents upward                           |
| vendorspecific        | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type that is specific to the manufacturer |
| vibrationsensor       | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of vibration sensor                  |
| waiting               | unit is in waiting mode or state  |
| wakeup                | unit is in wakeup state just after sleep mode   |
| warm                  | unit is in warm mode or state   |
| wash                  | unit is in wash mode or state   |
| waterinfo             | identifies the main water information ("oic.r.waterinfo") of the Device                             |
| waterfilterconsumable | identifies the main water filter consumable ("oic.r.consumable") of the Device                      |
| waterproofing         | unit is in waterproofing mode or state  |
| watersensor           | identifies an "Intruder Alert Zone" ("oic.r.iaszoneinfo") type of water sensor                      |
| wet                   | unit is in wet mode or state  |
| wind                  | unit is in wind mode  |
| wrinklePrevent        | unit is in winkle prevent mode  |
| zigzag                | unit is in zigzag mode or state   |

### B.2.3 Standardized list of supported values for mode Resource Type (oic.r.mode)

Table B.3 lists per Device Type the enumeration values that should be exposed by the "supportedModes" Property and by extension allowed within the "modes" Property of the "oic.r.mode" Resource Type. A Device shall not expose any value not defined in Table B.3 unless that value follows the requirements in clause 6.4.

**Table B.3 – List of supported "oic.r.mode" values per Device Type ("rt")**

| Device Name<br>(informative) | Device Type (rt)<br>(Normative) | Supported<br>enumeration<br>value | Description  |
|------------------------------|---------------------------------|-----------------------------------|--|
| Air Conditioner              | oic.r.airconditioner            | airClean                          | This removes contaminants from the indoor air.   |
|                              |                                 | airDry                            | This removes moisture from the inside of the device to prevent mould after cooling air.  |
|                              |                                 | aroma                             | This adds a deodorizing scent to make the air fresher.   |
|                              |                                 | auto                              | This automatically selects and operates cooling and/or heating based on the current temperature condition.   |
|                              |                                 | cool                              | This cools the indoor air.   |
|                              |                                 | coolClean                         | This removes contaminants while also cooling   |
|                              |                                 | dry                               | This reduces indoor humidity   |
|                              |                                 | dryClean                          | This removes contaminants while also reducing humidity   |
|                              |                                 | energySaving                      | This saves energy (electricity) by restricting some functions.   |
|                              |                                 | fan                               | This circulates the inside air without cool and inflow of outside air.   |
|                              |                                 | wind                              | This circulates the air with a stronger current or flow  |
| Air Purifier                 | oic.d.airpurifier               | auto                              | This is continuously checking the air quality and operating as needed to maintain good air quality.  |
|                              |                                 | babyCare                          | This removes contaminants from indoor air and discharges clean air in a downward flow for babies and children.   |
|                              |                                 | circulating                       | This circulates the inside air by using the fan inside the device.   |
|                              |                                 | cleaning                          | This removes contaminants from the indoor air. In the case where the device consists of lower and upper sections, this function is operated only in the lower section. |
|                              |                                 | dual                              | This removes contaminants from the indoor air. In the case where the device consists of lower and upper sections, this function operates in both of sections.          |
|                              |                                 | humidity                          | This increases moisture in the indoor air.   |
|                              |                                 | silent                            | This reduces noise during the operation.   |
|                              |                                 | sleep                             | This is a low power mode for the device to lower electrical consumption on standby.  |
| Arier                        | oic.d.ailer                     | airDry                            | This dries wet materials by using forced air (no heat).  |
|                              |                                 | Dry                               | This dries wet materials by using hot air.   |
|                              |                                 | none                              | This is an undefined mode.   |
| Dishwasher                   | oic.d.dishwasher                | auto                              | This senses the soiled amount and soiled toughness and is optimized to achieve the best cleaning.  |
|                              |                                 | cleaning                          | This means cleaning the inside of the device when there are no dishes.   |

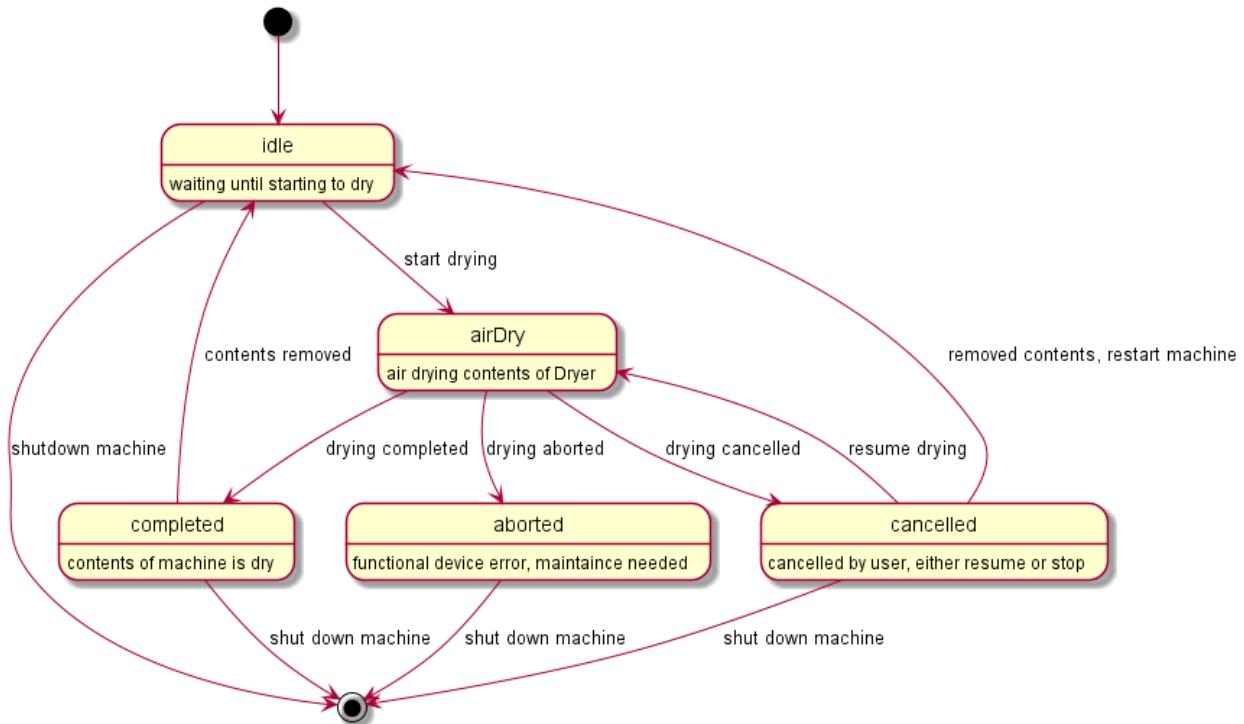
|               |                    |              |  |
|---------------|--------------------|--------------|--|
|               |                    | delicate     | This is to clean delicate items (e.g., fine china, small plates, long cutlery, cups, glasses, and so on).          |
|               |                    | energySaving | This saves energy by reducing the wash and rinsing temperature.  |
|               |                    | express      | This cleans lightly soiled dishes faster than "quick" mode.  |
|               |                    | fast         | This focuses on cleaning soiled dishes quickly.  |
|               |                    | heavy        | This cleans heavily soiled dishes with the strongest spray intensity.  |
|               |                    | normal       | This cleans soiled dishes for everyday use based on basic setting from manufacturers.                              |
|               |                    | quick        | This quickly cleans the lightly soiled dishes used that were used recently.  |
|               |                    | refresh      | This is to freshen up and warm dishes that have been unused for a long time.                                       |
|               |                    | rinse        | This rinses dishes with water.   |
|               |                    | spray        | This provides selectable options for spray intensity. (For example, the options could be soft, medium, and strong) |
|               |                    | steam        | This adds steam at the beginning of the cycle to improve the wash performance.                                     |
|               |                    | turbo        | This cleans heavily soiled dishes by using slightly more energy and water.   |
|               |                    | update       | This downloads a dedicated cycle via Wi-Fi, NFC, and so on.  |
| Oven          | oic.d.oven         | baking       | This cooks by dry heat in an oven  |
|               |                    | convBake     | This is a baking mode of a convection oven   |
|               |                    | convRoast    | This is a roasting mode of a convection oven   |
| Robot Cleaner | oic.d.robotcleaner | after        | unit is in a mode that is waiting for another trigger (after which)  |
|               |                    | alarm        | The unit is in an alarm mode   |
|               |                    | auto         | This is in automatic cleaning mode   |
|               |                    | charging     | This is when the Device is charging at the home station  |
|               |                    | cleaning     | This is standard cleaning mode   |
|               |                    | edge         | This is cleaning the outside perimeter of the area.  |
|               |                    | homing       | The Device is returning to its charging station, or producing a special signal so it can be found                  |
|               |                    | idle         | This is when the unit is idle  |
|               |                    | macro        | This is cleaning specific areas manually selected by a client.   |
|               |                    | manual       | The unit is under direct manual control  |
|               |                    | map          | The unit is performing its mapping function (creating a 2D map of the space)                                       |
|               |                    | part         | This is handling a portion of the cleaning cycle   |
|               |                    | point        | The unit is at a defined or specific point (with respect to movement)  |
|               |                    | powerOff     | The unit is in a power off or standby mode   |

|                |                     |                |  |
|----------------|---------------------|----------------|--|
|                |                     | repeat         | This is repeating the previous set cycle   |
|                |                     | reserve        | The unit is in a reserve mode that can be user defined                             |
|                |                     | sectored       | This is cleaning complex areas by dividing the cleaning area into sections.        |
|                |                     | select         | This is cleaning areas selected by a client among divided sections of the indoor.  |
|                |                     | spot           | This is cleaning a small area within the radius of the manufacturer's default set. |
|                |                     | stop           | The Device has encountered an error or is otherwise stationary                     |
|                |                     | zigzag         | This is cleaning each spot of indoor by moving zigzag.                             |
| Security Panel | oic.d.securityPanel | active         |  |
|                |                     | armedAway      |  |
|                |                     | armedInstant   |  |
|                |                     | armedMaximum   |  |
|                |                     | armedNightStay |  |
|                |                     | armedStay      |  |

The modes can be viewed upon as mode changes of the device. However, this document does not impose any relationship between the different modes of a Device. Hence all mode changes are expected to occur from a Client point of view.

Figure B.1 provides an illustrative example of a possible set of modes and the transitions between them for a Dryer Device Type (oic.d.dryer).

An example mode transition diagram of a Dryer, not all mode transitions are listed.



**Figure B.1 – Example of mode transitions of a dryer**

**B.2.4 Standardized list of supported values for operational state Resource Type (oic.r.operational.state)**

Table B.4 lists the supported enumeration values per Device Type for the Property "machineStates" of the operational state Resource Type.

**Table B.4 – List of supported "oic.r.operational.state" values per Device Type ("rt")**

| Device Name<br>(informative) | Device Type (rt)<br>(Normative) | Supported enumeration value<br>machineStates |
|------------------------------|---------------------------------|--|
| Dishwasher                   | oic.d.dishwasher                | start  |
|                              |                                 | stop   |
| Dryer                        | oic.d.dryer                     | start  |
|                              |                                 | stop   |
| Oven                         | oic.d.oven                      | completed                                    |
|                              |                                 | preHeat                                      |
|                              |                                 | start  |
| Printer                      | oic.d.printer                   | idle   |
|                              |                                 | processing                                   |
|                              |                                 | stopped                                      |
| Printer Multi-Function       | oic.d.multifunctionPrinter      | See Printer                                  |
|                              |                                 | See Scanner                                  |
| Robot Cleaner                | oic.d.robotcleaner              | homing                                       |
|                              |                                 | pause  |
|                              |                                 | restart                                      |
|                              |                                 | start  |
|                              |                                 | wakeUp                                       |
| Scanner                      | oic.d.scanner                   | down   |
|                              |                                 | idle   |
|                              |                                 | processing                                   |
|                              |                                 | stopped                                      |
|                              |                                 | testing                                      |
| Steam Closet                 | oic.d.steamcloset               | start  |
|                              |                                 | stop   |
|                              |                                 | wakeUp                                       |
| Washer                       | oic.d.washer                    | start  |
|                              |                                 | stop   |
|                              |                                 | wakeUp                                       |

Table B.5 lists the supported enumeration values per Device Type for the Property “jobStates” of the operational state Resource Type.

**Table B.5 – List of supported values per Device Type (“rt”) for jobStates of operational state Resource Type**

| Device Name<br>(informative) | Device Type (rt)<br>(Normative) | Supported<br>enumeration value<br>jobStates | Description  |
|------------------------------|---------------------------------|---|--|
| Dishwasher                   | oic.d.dishwasher                | aborted                                     | This is an internal device, communication, or security error. (e.g. power_fail)  |
|                              |                                 | airDry                                      | This dries wet materials by using forced air (no heat).  |
|                              |                                 | cancelled                                   | This state is cancelled by (remote) user.  |
|                              |                                 | completed                                   | This state is a job completed without any error.   |
|                              |                                 | down  | This state is unavailable to operate a job due to some issues. (e.g. power_off)  |
|                              |                                 | nightDry                                    | This runs the ventilation fan periodically to vent the stream from the tub. Because the dishes are often left in the dishwasher overnight after the cycle ends, this can result in the steam inside the tub condensing on the dishes, leaving them wet. To prevent the above state, the device can provide this state. |
|                              |                                 | pause                                       | This state is paused by user.  |
|                              |                                 | pending                                     | This state is waiting that the device prepares to initiate a job.  |
|                              |                                 | reserve                                     | This state means that a client has finished setting the system for future use.   |
|                              |                                 | rinse                                       | This is to rinse the dishes with water   |
|                              |                                 | wash  | This is to clean the soiled dishes   |
| Dryer                        | oic.d.dryer                     | aborted                                     | This is an internal device, communication, or security error.  |
|                              |                                 | airDry                                      | This dries the materials by using forced air (no heat).  |
|                              |                                 | completed                                   | This state is a job completed without any error.   |
|                              |                                 | coolDown                                    | This state is for the temperature cool down to reduce clothes temperature' by spinning the interior drum without heat.   |
|                              |                                 | diagnosis                                   | When an error occurs, the device enters this state to identify causes and find solutions.  |
|                              |                                 | down  | This state is device unavailable to operate a job due issues. (e.g. power_off)   |
|                              |                                 | pause                                       | This state is paused by user.  |
|                              |                                 | pending                                     | This state is waiting that the device prepares to initiate a job.  |
|                              |                                 | processing                                  | This is working on a job executed by a client.   |
|                              |                                 | reserve                                     | This state means that a client has finished setting the system for future use.   |
|                              |                                 | wrinklePrevent                              | This state runs the dryer periodically to help prevent wrinkles from forming.  |

|                        |                                |              |   |
|------------------------|--------------------------------|--------------|---|
| Oven                   | oic.d.oven                     | cleaning     | This is cleaning to remove the soiled inside and outside of the device.   |
|                        |                                | completed    | This state is job completed without any error.  |
|                        |                                | cool         | This is cooling the temperature inside and outside of the device after finishing cooking.   |
|                        |                                | down         | This state is unavailable to operate a job due to issues. (e.g. power_off)  |
|                        |                                | idle         | This means that new jobs can start processing without waiting. (e.g., preheating is done)   |
|                        |                                | pause        | This state is paused by user.   |
|                        |                                | pending      | This state is waiting that the engine prepares to initiate a job.   |
|                        |                                | preHeat      | This is pre-heating the inside of the device prior to cooking.  |
|                        |                                | processing   | This is working on a job executed by a user.  |
|                        |                                | setOption    | This is in status while being set for the device's options.   |
| Printer                | oic.d.printer                  | aborted      | This is in internal device, communication, or security error.   |
|                        |                                | cancelled    | This state is cancelled by (remote) user.   |
|                        |                                | completed    | This state is job completed without any error.  |
|                        |                                | pending      | This state is waiting that the device prepares to initiate a job.   |
|                        |                                | pendingHeld  | This state halts pending from processing for any number of reasons. This will return to pending state if the issues are resolved. |
|                        |                                | processing   | This is working on a job executed by a client.  |
| Printer Multi-Function | oic.d.multifunction<br>Printer | See printer  | Refer to the supported enumeration values of a Printer (oic.d.printer).   |
|                        |                                | See scanner  | Refer to the supported enumeration values of a Scanner (oic.d.scanner).   |
| Robot Cleaner          | oic.d.robotcleaner             | charging     | This means that the device is charging. In the case of robot cleaner, it can be charged by connecting with its home station.      |
|                        |                                | cleaning     | This is cleaning indoor floor with selected mode by a client.   |
|                        |                                | diagnosis    | When an error occurs, a device enters this state to identify causes and find solutions.   |
|                        |                                | homing       | This state means that the device is moving to its home station after finishing work or to charging its battery                    |
|                        |                                | idle         | This means that new jobs can start processing without waiting.  |
|                        |                                | initializing | This is resetting device to initial values set by manufacturer.   |
|                        |                                | macro        | This is controlled and cleaned by the client based on a remote controller.  |
|                        |                                | mapping      | At first use of the device, it scans the indoor area by moving to make a map.   |

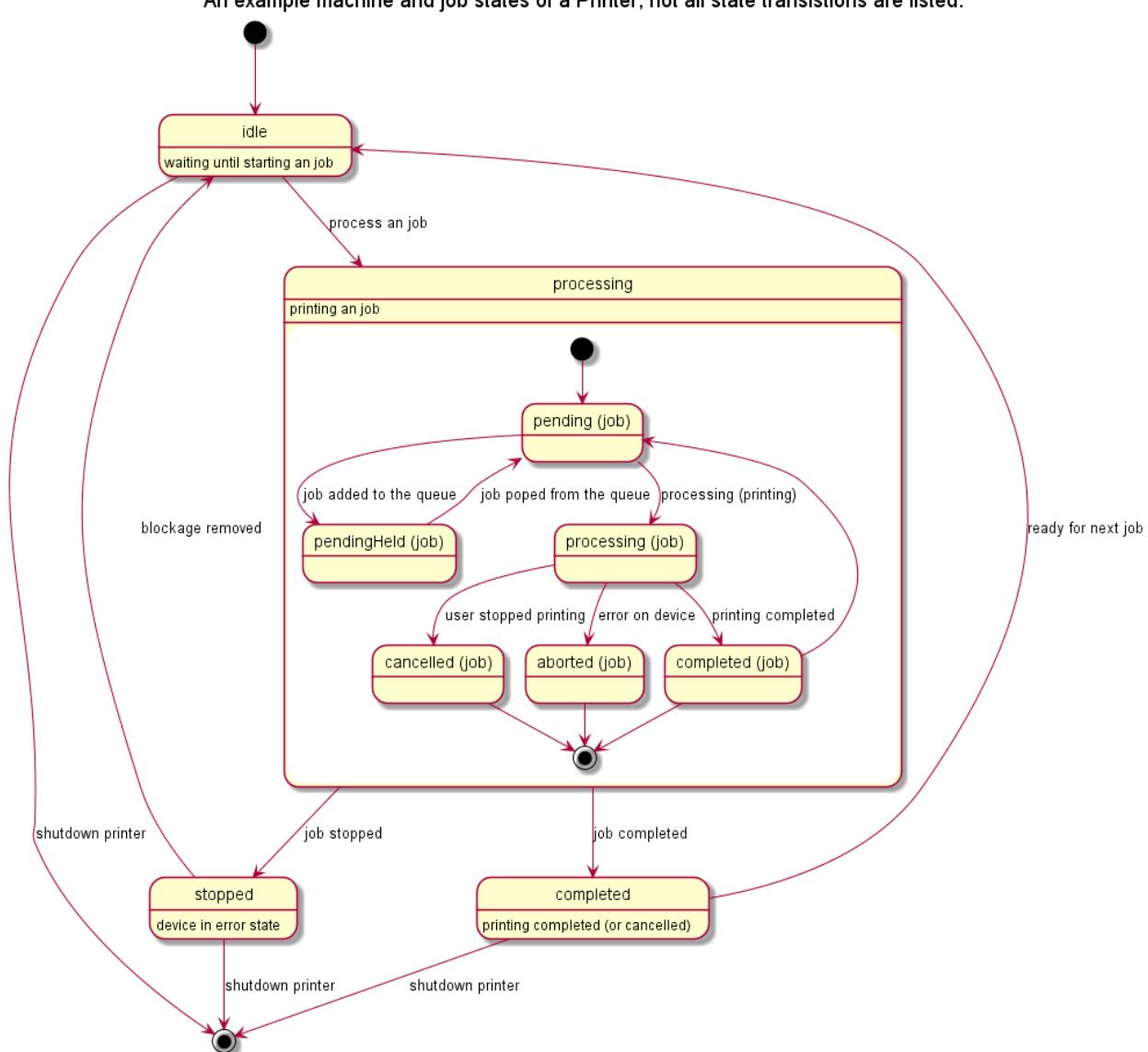
|              |                   |                        |  |
|--------------|-------------------|------------------------|--|
|              |                   | monitoring             | This is a security functions detecting strange movements in an empty place by using mounted cameras.   |
|              |                   | monitoringInitializing | This is resetting device to initial values set by the manufacturer.  |
|              |                   | monitoringMoving       | This is moving to follow a specific target that a user selects while the device is in monitoring mode.   |
|              |                   | monitoringPreparation  | This is in a state where a device is getting ready for its monitoring operation.   |
|              |                   | moving                 | This is moving to go to a different place.   |
|              |                   | pause                  | This state is paused by user.  |
|              |                   | preparation            | This means that the device is getting ready for its operation.   |
|              |                   | reserving              | This state means that a client is setting systems for future use.  |
|              |                   | setOption              | This is the status while being set for the device's options.   |
| Scanner      | oic.d.scanner     | aborted                | This is in internal device, communication, or security error.  |
|              |                   | cancelled              | This state is cancelled by (remote) user.  |
|              |                   | completed              | This state is completely finished the job without any error.   |
|              |                   | pending                | This state is waiting that the device prepares to initiate a job.  |
|              |                   | processing             | This is working on a job executed by a client.   |
| Steam Closet | oic.d.steamcloset | aborted                | This is an internal device, communication, or security error.  |
|              |                   | airDry                 | This is in drying the materials by using wind.   |
|              |                   | completed              | This state is job completed without any error.   |
|              |                   | diagnosis              | When an error occurs, a device enters this state to identify causes and find solutions.  |
|              |                   | down                   | This state is unavailable to operate a job due to issues (e.g. power_off)  |
|              |                   | idle                   | This means that new jobs can start processing without waiting (e.g. washing is done).  |
|              |                   | initializing           | This is resetting device to initial values set by manufacturer.  |
|              |                   | nightDry               | This is a special sanitary care during the night, which runs heavy sanitary care and then dries periodically every hour for an additional eight hours. |
|              |                   | pause                  | This state is paused by user.  |
|              |                   | pending                | This state is waiting that the device prepares to initiate a job.  |
|              |                   | preHeat                | This is preheating the inside of the device.   |
|              |                   | preSteam               | This is steaming the inside of the device to remove residual material at the beginning of the cleaning sequence.                                       |
|              |                   | processing             | This is working on a job executed by a client.   |

|        |              |                      |  |
|--------|--------------|----------------------|--|
|        |              | reserve              | This state means that a client has finished setting the system for future use.   |
|        |              | shake                | This is to quickly shake the hanger inside of the device to remove drops of water on clothes after a steam cycle.  |
|        |              | sleep                | This is in low power state for the device to lower electrical consumption on standby.  |
|        |              | steam                | This sprays steam on the washable items to remove odors and wrinkles after preheat the inside of the device.   |
|        |              | sterilize            | This removes germs on items through high temperature and steam.  |
|        |              | update               | This downloads a dedicated cycle via Wi-Fi, NFC, and so on.  |
| Washer | oic.d.washer | aborted              | This is an internal device, communication, or security error.  |
|        |              | changeCondition      | After the washer checked the turbidity, the device could change condition progressing state. For example, the washer can rinse the clothes one more time or finish washing it. |
|        |              | checkingTurbidity    | The device automatically checks turbidity during rinsing the clothes to check if the detergent remains.  |
|        |              | completed            | This state is completely finished the job without any error.   |
|        |              | coolDown             | This state is temperature cool down to reduce clothes temperature' by spinning the interior drum without heat only in case the washer supports a dry function.                 |
|        |              | diagnosis            | When an error occurs, a device enters this state to identify causes and find solutions.  |
|        |              | down                 | This state is unavailable to operate a job due to issues. (e.g. power_off)   |
|        |              | dry                  | This is to dry the washed clothes with heat.   |
|        |              | freezePrevent        | To prevent developing ice inside of the device and pipe, the device takes special care of the device condition in the winter.  |
|        |              | freezePreventPause   | This is paused state in freeze prevent mode.   |
|        |              | freezePreventPending | This is pending state in freeze prevent mode.  |
|        |              | grinding             | This is to grind debris to prevent drain pipes being clogged.  |
|        |              | idle                 | This means that new jobs can start processing without waiting. (e.g. rinsing clothes is done)  |
|        |              | pause                | This state is paused by user.  |
|        |              | pending              | This state is waiting that the device prepares to initiate a job.  |
|        |              | preparation          | This means that the device is getting ready for its operation This state includes checking the amount of detergent, softener, water and so on.                                 |
|        |              | preWash              | This is to wash heavily soiled clothes in advance before starting the washing process.   |

|  |                |   |
|--|----------------|---|
|  | processing     | This is working on a job executed by a client.  |
|  | refresh        | This removes wrinkles from slightly wrinkled clothes by using steam if the washer supports steam function       |
|  | reserve        | This state means that a client has finished setting the system for future use.                                  |
|  | rinse          | This is to rinse the dishes with water.   |
|  | shoesDry       | This is a special cycle for drying shoes.   |
|  | sleep          | This is in low power state for the device to lower electrical consumption on standby.                           |
|  | soaking        | This makes clothes thoroughly wet by immersing them in liquid so dust and stains can easily be removed.         |
|  | spin           | This is spinning fast to remove the water after completely rinsing the clothes.                                 |
|  | steam          | This sprays steam on clothes to remove odors and wrinkles.  |
|  | steamSoftening | This softens the fabric using 100% pure water and no chemicals with steam instead of chemical fabric softeners. |
|  | testing        | This checks the amount of clothes inside the washer and displays the results.                                   |
|  | update         | This downloads a dedicated cycle via Wi-Fi, NFC, and so on.   |
|  | wash           | This is washing the clothes with selected cycle set by a client   |
|  | waterproofing  | This washes (sports) clothes with a dedicated liquid for waterproofing.   |
|  | wrinklePrevent | This state can help prevent wrinkles from forming.  |

The operational state can be viewed as state changes of the device that includes separate handling of jobs within the overall machine state. However, this document does not impose any relationship between the different machine or job states of a device. Hence all "machinestate" and or "jobStates" changes are expected to occur from a Client point of view.

Figure B.2 provides an illustrative example of a possible set of job states and the transitions between them for a Printer Device Type ("oic.d.printer").



**Figure B.2 – Example of job state transitions of a printer**

**B.2.5 Standardized list of supported values for consumable and consumable collection Resource Types (oic.r.consumable, oic.r.consumablecollection)**

Table B.6 lists the enumeration values that may be populated in both the supportedconsumables (in oic.r.consumablecollection) and typeofconsumable (in oic.r.consumable) Properties within the Consumable and Consumable Collection Resource Types. The typeofconsumable Property shall only be populated with a value exposed within the supportedconsumables Property in a specific instance of the Consumable Collection Resource Type.

This constitutes the known set of possible values for these Properties in the Consumable and Consumable Collection Resources. A vendor may extend this set by providing vendor defined enumerations following the convention defined in ISO/IEC 30118-4.

**Table B.6 – List of defined enumeration values for oic.r.consumable, oic.r.consumablecollection**

| Friendly Name<br>(informative) | Enumeration Value<br>(Normative) | Description<br>(Informative)   |
|--------------------------------|----------------------------------|--|
| Toner Cartridge                | toner                            | Generic toner cartridge.   |
| Black Toner Cartridge          | tonerBlack                       | Black toner cartridge  |
| Cyan Toner Cartridge           | tonerCyan                        | Cyan toner cartridge   |
| Magenta Toner Cartridge        | tonerMagenta                     | Magenta toner cartridge  |
| Yellow Toner Cartridge         | tonerYellow                      | Yellow toner cartridge   |
| Filter Material                | filterMaterial                   | Any replaceable or reusable filter material; such as water filters, air filters, dust filters etc. |
| Ink Cartridge                  | ink                              | Generic ink cartridge  |
| Black Ink Cartridge            | inkBlack                         | Black ink cartridge  |
| Cyan Ink Cartridge             | inkCyan                          | Cyan ink cartridge   |
| Magenta Ink Cartridge          | inkMagenta                       | Magenta ink cartridge  |
| Yellow Ink Cartridge           | inkYellow                        | Yellow ink cartridge   |
| Tricolour Ink Cartridge        | inkTricolour                     | Tri-colour ink cartridge; typically Cyan plus Magenta plus Yellow.                                 |

### B.3 Camera media format (oic.r.media)

The supported camera media formats can be discovered by looking at the SDP (see IETF RFC 4566) list of the media Resource Type. The recommended list of supported media formats are listed in Table B.7.

**Table B.7 – Recommended media profiles**

| Mediatype   | codec     | Content container format | transport | Additional information                                   |
|-------------|-----------|--------------------------|-----------|--|
| Audio       | AAC       |                          | RTP       |  |
| Video       | H.264     |                          | RTP       | Recommended minimal resolution 1920x1080 (width, height) |
| Video       | H.264/AAC | MPEG-2 TS                | RTP       | Recommended minimal resolution 1920x1080 (width, height) |
| Still image | JPEG      | JPEG                     | RTP       | Recommended minimal resolution 1920x1080 (width, height) |

## B.4 Additional requirements per Device Type

### B.4.1 Additional requirements for Television Devices ("oic.d.tv")

A set of Resource Types have been defined that are applicable should a Device of type "oic.d.tv" need to expose behaviours typically found in "settings" menus or functions. A Device should expose one or more of these Resource Types:

- accessibility settings ("oic.r.settings.accessibility")
- broadcast settings ("oic.r.settings.broadcast")
- picture settings ("oic.r.settings.picture")
- sound settings ("oic.r.settings.sound")
- support settings ("oic.r.settings.support")
- general system settings ("oic.r.settings.system")
- ecomode ("oic.r.ecomode")

A Device may additionally expose the following Resource Types:

- software update ("oic.r.softwareupdate")
- Wi-Fi configuration ("oic.r.wificonf")

Thus enabling a complete set of Client accessible information typically found within a television system settings user interface.

## Annex C (normative)

### Healthcare Device Types

#### C.1 Scope

This Annex defines Device Types for use in the healthcare and fitness vertical, and describes general use cases to which OCF Healthcare Devices apply, along with common functional requirements.

Although some common requirements are defined in this document, implementation is responsible for checking appropriate security, safety, environmental, and health practices, and applicable regulatory requirements from national health authorities.

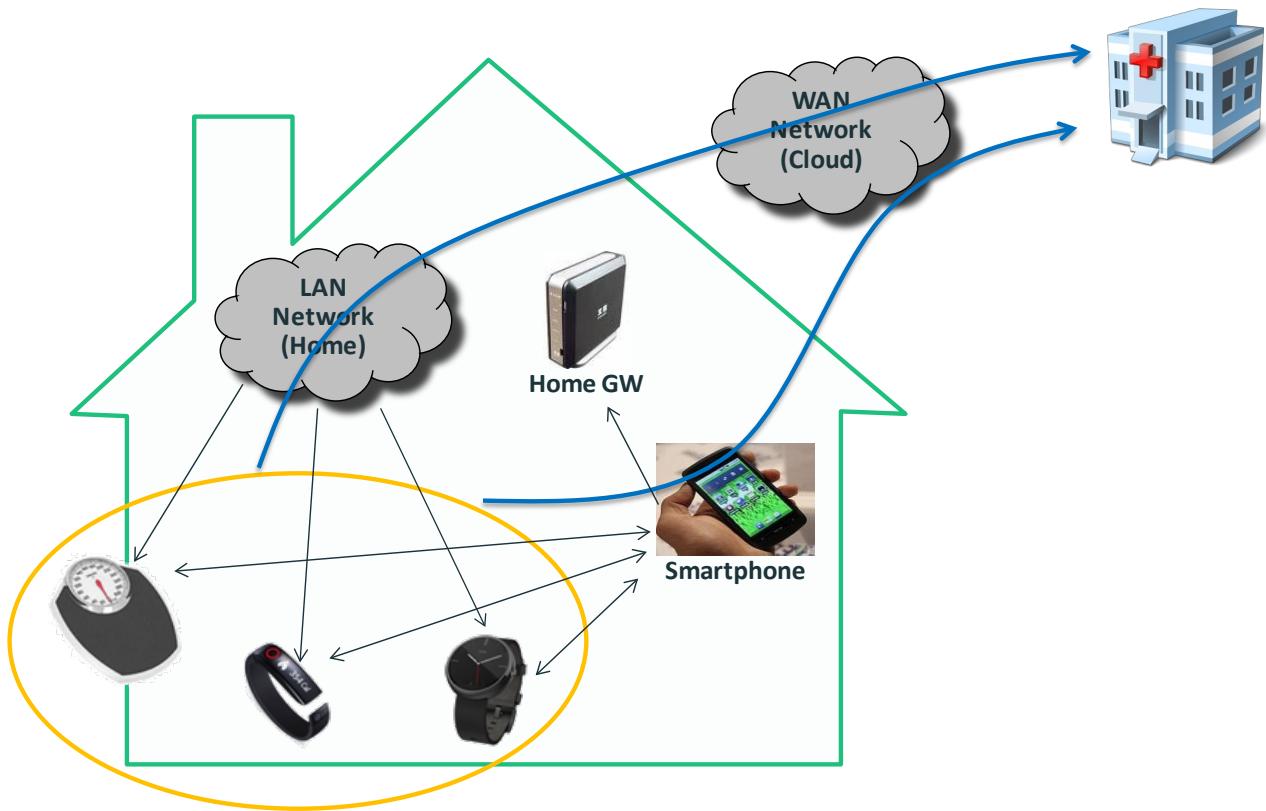
#### C.2 Introduction to OCF healthcare Devices

This Annex references and inherits data models defined in the ISO/IEC 30118-4, to define OCF Healthcare Device Types in clause C.4.

#### C.3 Operational scenarios

Personal fitness and/or medical data are read by a monitoring Device (OCF Client role) from Healthcare Devices (OCF Server role), and the monitoring Device triggers appropriate actions based on the data collected. Many of the target usages are for personal health or fitness, although clinical use cases can be realized with similar modelling.

As shown in Figure C.1, data from various fitness and healthcare devices can be gathered on a smart phone for monitoring and can be transmitted to the healthcare services through a gateway or through the smartphone. The protocol to be used for transmission is defined in ISO/IEC 30118-1. Collected personal fitness and/or medical data are used for condition monitoring or medical research, receiving advice from a trainer/doctor, or triggering an emergency notification.



**Figure C.1 – Schematic diagram of healthcare usages**

## C.4 Standardized Device Types

### C.4.1 Introduction

OCF Healthcare Device Types specify Devices in the healthcare and fitness domains of the OCF ecosystem. The Device Type exposed by the "rt" value of /oic/d of all Healthcare Devices shall have a Resource Type value ("rt") prefixed with "oic.d." The Healthcare Device Types are listed in Table C.1.

**Table C.1 – Alphabetical list of healthcare Device Types**

| Clause | Device Name                     | Device Type ("rt")            |
|--------|---------------------------------|-------------------------------|
| C.4.9  | Activity Tracker                | oic.d.activitytracker         |
| C.4.2  | Blood Pressure Monitor          | oic.d.bloodpressuremonitor    |
| C.4.15 | Body Composition Analyser       | oic.d.bodycompositionanalyser |
| C.4.4  | Body Scale                      | oic.d.bodyscale               |
| C.4.5  | Body Thermometer                | oic.d.bodythermometer         |
| C.4.10 | CGM(Continuous Glucose Monitor) | oic.d.cgm                     |
| C.4.11 | Cycling Power Meter             | oic.d.cyclingpowermeter       |
| C.4.12 | Cycling Speed Sensor            | oic.d.cyclingspeedsensor      |
| C.4.13 | Cycling Cadence Sensor          | oic.d.cyclingcadencesensor    |
| C.4.3  | Glucose Meter                   | oic.d.glucosemeter            |
| C.4.6  | Heart Rate Monitor              | oic.d.heartratemonitor        |

|        |                       |                           |
|--------|-----------------------|---------------------------|
| C.4.16 | Medication Monitor    | oic.d.medicationmonitor   |
| C.4.14 | Muscle Oxygen Monitor | oic.d.muscleoxygenmonitor |
| C.4.7  | Pulse Oximeter        | oic.d.pulseoximeter       |
| C.4.8  | Sleep Monitor         | oic.d.sleepmonitor        |

The remainder of this Annex defines Resource Types for each Device Type, but for full definitions of Resource Types, see ISO/IEC 30118-4.

Each Device Type defines a minimal set of Resource Types that are implemented by that Device Type as required Resource Types. A Healthcare Device may expose additional OCF-defined optional Resource Types. It should be noted that all Resource Types are commonly available for all Device Types, but if a Device Type aims to implement optional Resource Types related to healthcare, it shall expose such Resource Types using the definitions provided in this annex.

When a Resource Type is listed as Mandatory (M) in this Annex, the Device shall:

- expose that Atomic Measurement Resource Type in /oic/res
- expose that Resource Type as a Link in the Atomic Measurement

The mandatory Resource Types for an Atomic Measurement shall be listed in the "rts-m" Property Value.

When a Resource Type is listed as Optional (O) in this Annex, a Device may expose that Resource Type as a Link in the Atomic Measurement, or may also expose that Resource Type as a discretely discoverable Resource outside of the Atomic Measurement. For example, if a blood pressure monitor (i.e. "oic.d.bloodpressuremonitor") measures pulse rate and chooses to expose that feature over OCF, it exposes the "oic.r.pulserate" Resource Type as a Link in the blood pressure monitor Atomic Measurement ("oic.r.bloodpressuremonitor-am"). The allowed Resource Types for an instance of an Atomic Measurement (which includes both the M and O Resource Types that are implemented) shall be listed in the "rts" Property Value.

Some Resource Types are commonly used for all Healthcare Device Types; these are provided in Table C.2. Users may want to associate timestamps to the measurements when they access their healthcare information (in RFC3339 date and time format, oic.r.time.stamp). A Healthcare Device may be used by different users, so identifying a specific user with an ID may be appropriate ("oic.r.userid"). These Resource Types are exposed as Conditionally Required Resource Types of an Atomic Measurement (as defined per clause 7.8.4 of ISO/IEC 30118-1) of a specific Healthcare Device. The "rt" value of Resource Types that use Atomic Measurements are suffixed by -am (Atomic Measurements). When present in an Atomic Measurement, "oic.r.time.stamp" and "oic.r.userid" indicate the time when a sample of data is measured by a certain user.

**Table C.2 – Commonly used Resource Types of healthcare Device Types**

| Resource Type Name | Resource Type Value | Requirement (M, S, O, CA, CR) |
|--------------------|---------------------|-------------------------------|
| Observed Time      | oic.r.time.stamp    | O                             |
| User ID            | oic.r.userid        | O                             |

It should also be noted that Resource-level and Property-level requirements can be different. All OCF Resource Types are specified using OpenAPI 2.0 and the Properties which are defined in a specific schema can either be mandatory or optional. In other words, even if a Resource Type is mandatory for a Device Type, some of its Properties may not be mandatory.

## C.4.2 Blood pressure monitor

### C.4.2.1 Introduction

A blood pressure monitor measures blood pressure [i.e., systolic, diastolic, and mean arterial pressure (MAP)]. Blood pressure is most frequently measured using the units of millimetres of mercury (mmHg). Blood pressure is often denoted as 120/80 mmHg, which means systolic blood pressure of 120 and diastolic blood pressure of 80.

Table C.3 describes the Device Type for a blood pressure monitor. Table C.4 describes the Atomic Measurement that is present in all instances of a blood pressure monitor.

**Table C.3 – Healthcare Device Type of blood pressure monitor**

| Device Type (rt)               | Resource Type Name                           | Resource Type Value               | Requirement level |
|--------------------------------|--|-----------------------------------|-------------------|
| oic.d.<br>bloodpressuremonitor | Blood pressure monitor<br>Atomic Measurement | oic.r.bloodpressuremonitor-<br>am | M                 |

**Table C.4 – Atomic measurement of blood pressure monitor**

| Atomic Measurement<br>Resource Type Value | Resource Type Name | Resource Type Value  | Requirement level |
|---|--------------------|----------------------|-------------------|
| oic.r.<br>bloodpressuremonitor-am         | Blood pressure     | oic.r.blood.pressure | M                 |
|   | Pulse rate         | oic.r.pulserate      | O                 |

### C.4.2.2 Required resource types

A blood pressure monitor shall expose "oic.r.blood.pressure" to report the blood pressure (systolic and diastolic) and optionally MAP.

### C.4.2.3 OCF-defined optional resource types

A blood pressure monitor measures pulse rate using the "oic.r.pulserate" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

## C.4.3 Glucose meter

### C.4.3.1 Introduction

A glucose meter measures the concentration of glucose in the blood. Glucose, or blood sugar, is the human body's primary source of energy. The blood glucose level is a key parameter that diabetics measure multiple times per day.

Table C.5 describes the Device Type for a glucose meter. Table C.6 describes the Atomic Measurement that is present in all instances of a glucose meter.

**Table C.5 – Healthcare Device Type of glucose meter**

| Device Type (rt)   | Resource Type Name                  | Resource Type Value   | Requirement level |
|--------------------|-------------------------------------|-----------------------|-------------------|
| oic.d.glucosemeter | Glucose meter Atomic<br>Measurement | oic.r.glucosemeter-am | M                 |

**Table C.6 – Atomic measurement of glucose meter**

| Atomic Measurement<br>Resource Type Value | Resource Type Name    | Resource Type Value | Requirement level |
|---|-----------------------|---------------------|-------------------|
| oic.r.glucosemeter-am                     | Glucose               | oic.r.glucose       | M                 |
|   | Context Carbohydrates | oic.r.glucose.carb  | O                 |

|  |  |                              |   |
|--|--|------------------------------|---|
|  | Context Exercise                             | oic.r.glucose.exercise       | O |
|  | Hemoglobin Bound to Glucose A1c Form (HbA1c) | oic.r.glucose.hba1c          | O |
|  | Context Health                               | oic.r.glucose.health         | O |
|  | Context Meal                                 | oic.r.glucose.meal           | O |
|  | Context Medication                           | oic.r.glucose.medication     | O |
|  | Context Sample Location                      | oic.r.glucose.samplelocation | O |
|  | Context Tester                               | oic.r.glucose.tester         | O |

#### C.4.3.2 Required Resource Types

A glucose meter shall expose "oic.r.glucose" to report the blood glucose level in mg/dL or mmol/L.

#### C.4.3.3 OCF-defined optional Resource Types

A glucose meter measures context carbohydrates, then it shall expose the context carbohydrates using "oic.r.glucose.carb" Resource Type.

A glucose meter measures context exercise using the "oic.r.glucose.exercise" Resource Type.

A glucose meter measures Hemoglobin Bound to Glucose A1c Form (HbA1c) using the "oic.r.glucose.hba1c" Resource Type.

A glucose meter measures context health using the "oic.r.glucose.health" Resource Type.

A glucose meter measures context meal using the "oic.r.glucose.meal" Resource Type.

A glucose meter measures context medication using the "oic.r.glucose.medication" Resource Type.

A glucose meter measures context sample location using the "oic.r.glucose.samplelocation" Resource Type.

A glucose meter measures context tester using the "oic.r.glucose.tester" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.4 Body scale

#### C.4.4.1 Introduction

A body scale measures the weight. The weight is most frequently measured using the units of kilograms (kg) or pounds (lb).

Table C.7 describes the Device Type for a body scale. Table C.8 describes the Atomic Measurement that is present in all instances of a body scale.

**Table C.7 – Healthcare Device Type of body scale**

| Device Type (rt) | Resource Type Name            | Resource Type Value | Requirement level |
|------------------|-------------------------------|---------------------|-------------------|
| oic.d.bodyscale  | Body scale Atomic Measurement | oic.r.bodyscale-am  | M                 |

**Table C.8 – Atomic measurement type of body scale**

| Atomic Measurement Resource Type Value | Resource Type Name    | Resource Type Value | Requirement level |
|--|-----------------------|---------------------|-------------------|
| oic.r.bodyscale-am                     | Weight                | oic.r.weight        | M                 |
|  | Body Mass Index (BMI) | oic.r.bmi           | O                 |
|  | Height                | oic.r.height        | O                 |
|  | Body Fat              | oic.r.body.fat      | O                 |
|  | Body Water            | oic.r.body.water    | O                 |
|  | Body Soft Lean Mass   | oic.r.body.slm      | O                 |
|  | Body Fat Free Mass    | oic.r.body.ffm      | O                 |

#### C.4.4.2 Required Resource Types

A body scale shall expose "oic.r.weight" to report the body weight of a person.

#### C.4.4.3 OCF-defined optional Resource Types

A body scale measures height using the "oic.r.height" Resource Type. Especially, a body scale measures the height if BMI is also reported because the height is used when a body scale measures BMI.

A body scale measures Body Mass Index (BMI) using the "oic.r.bmi" Resource Type.

A body scale measures body fat using the "oic.r.body.fat" Resource Type.

A body scale measures body water using the "oic.r.body.water" Resource Type.

A body scale measures body soft lean mass using the "oic.r.body.slm" Resource Type.

A body scale measures body fat free mass using the "oic.r.body.ffm" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.5 Body thermometer

#### C.4.5.1 Introduction

A body thermometer measures the temperature at some point. In general, the body thermometer is placed at the measurement site for sufficient time for the measuring probe to reach the same temperature as the body site, and when stable, a direct digital reading of the probe temperature is taken.

Table C.9 describes the Device Type for a body thermometer. Table C.10 describes the Atomic Measurement that is present in all instances of a body thermometer.

**Table C.9 – Healthcare Device Type of body thermometer**

| Device Type (rt)      | Resource Type Name                  | Resource Type Value      | Requirement level |
|-----------------------|-------------------------------------|--------------------------|-------------------|
| oic.d.bodythermometer | Body thermometer Atomic Measurement | oic.r.bodythermometer-am | M                 |

**Table C.10 – Atomic measurement type of body thermometer**

| Atomic Measurement Resource Type Value | Resource Type Name | Resource Type Value | Requirement level |
|--|--------------------|---------------------|-------------------|
| oic.r.bodythermometer-am               | Temperature        | oic.r.temperature   | M                 |

|  |                               |                                 |   |
|--|-------------------------------|---------------------------------|---|
|  | Body Location for temperature | oic.r.body.location.temperature | O |
|--|-------------------------------|---------------------------------|---|

#### C.4.5.2 Required Resource Types

A body thermometer shall expose "oic.r.body.temperature" to report the temperature level and the unit of a measured temperature is reported either in C, F or K.

#### C.4.5.3 OCF-defined optional Resource Types

A body thermometer measures temperature site using the "oic.r.body.location.temperature" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.6 Heart rate monitor

#### C.4.6.1 Introduction

A heart rate monitor measures heart rate. Heart rate is most frequently measured using the units of beats per minute (bpm). While normal heart rate varies from person to person depending on the individual, age, body size, heart conditions, posture, medication use, etc., normal resting heart rate range for adults is from 60 to 100 according to the American Heart Association.

Table C.11 describes the Device Type for a heart rate monitor. Table C.12 describes the Atomic Measurement that is present in all instances of a heart rate monitor.

**Table C.11 – Healthcare Device Type of heart rate monitor**

| Device Type (rt)       | Resource Type Name                    | Resource Type Value        | Requirement level |
|------------------------|---------------------------------------|----------------------------|-------------------|
| oic.d.heartratemonitor | Heart Rate Monitor Atomic Measurement | oic.r.heartratemonitor -am | M                 |

**Table C.12 – Atomic measurement of heart rate monitor**

| Atomic Measurement Resource Type Value | Resource Type Name | Resource Type Value | Requirement level |
|--|--------------------|---------------------|-------------------|
| oic.r.heartratemonitor -am             | Heart Rate         | oic.r.heartrate     | M                 |

#### C.4.6.2 Required Resource Types

A heart rate monitor shall expose "oic.r.heartrate" to report the heart rate of a person.

#### C.4.6.3 OCF-defined Optional Resource Types

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.7 Pulse oximeter

#### C.4.7.1 Introduction

A pulse oximeter measures peripheral capillary oxygen saturation (SpO<sub>2</sub>), an estimate of the amount of oxygen in the blood. Oxygen saturation is most frequently measured using percentage (%). Normal oxygen saturation is 95% or above according to the World Health Organization (WHO).

Table C.13 describes the Device Type for a pulse oximeter. Table C.14 describes the Atomic Measurement that is present in all instances of a pulse oximeter.

**Table C.13 – Healthcare Device Type of pulse oximeter**

| Device Type (rt)    | Resource Type Name                | Resource Type Value    | Requirement level |
|---------------------|-----------------------------------|------------------------|-------------------|
| oic.d.pulseoximeter | Pulse Oximeter Atomic Measurement | oic.r.pulseoximeter-am | M                 |

**Table C.14 – Atomic measurement of pulse oximeter**

| Atomic Measurement Resource Type Value | Resource Type Name       | Resource Type Value           | Requirement level |
|--|--------------------------|-------------------------------|-------------------|
| oic.r.pulseoximeter-am                 | SpO2                     | oic.r.spo2                    | M                 |
|  | Pulse Rate               | oic.r.pulserate               | M                 |
|  | Pulsatile Occurrence     | oic.r.pulsatileoccurrence     | O                 |
|  | Pulsatile Characteristic | oic.r.pulsatilecharacteristic | O                 |

#### C.4.7.2 Required Resource Types

A pulse oximeter shall expose "oic.r.spo2" to report the oxygen saturation of a person.

A pulse oximeter shall expose "oic.r.pulserate" to report the pulse rate of a person.

#### C.4.7.3 OCF-defined Optional Resource Types

A pulse oximeter measures pulsatile occurrence using the "oic.r.pulsatileoccurrence" Resource Type.

A pulse oximeter measures pulsatile characteristic using the "oic.r.pulsatilecharacteristic" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.8 Sleep monitor

#### C.4.8.1 Introduction

A sleep monitor measures the duration of each one of the sleep stages, and can also compute a "Sleep Score" from these data. The stages of sleep are: NREM stage 1 (Light Sleep stage 1), NREM stage 2 (Light Sleep stage 2), NREM stage 3 (Deep Sleep stage 1), NREM stage 4 (Deep Sleep stage 2), REM.

A night of sleep is composed of several sleep cycles, with each sleep cycle progressing from Light Sleep to Deep Sleep, before reversing back from Deep Sleep to Light Sleep, ending with REM.

The first cycle takes about 90 minutes. After that, the cycles average between 100 minutes and 120 minutes. Typically, an individual will go through 4 to 5 sleep cycles per night. Dreams occur during REM stages.

NREM stage 4 is not recognized in every country: in 2007, the USA merged NREM stages 3 and 4 into only one stage, NREM stage 3, thus effectively removing NREM stage 4.

Light Sleep consists of NREM stages 1 and 2. Deep Sleep consists of NREM stages 3 and 4.

Table C.15 describes the Device Type for a sleep monitor. Table C.16 describes the Atomic Measurement that is present in all instances of a sleep monitor.

**Table C.15 – Healthcare Device Type of sleep monitor**

| Device Type (rt)   | Resource Type Name               | Resource Type Value   | Requirement level |
|--------------------|----------------------------------|-----------------------|-------------------|
| oic.d.sleepmonitor | Sleep Monitor Atomic Measurement | oic.r.sleepmonitor-am | M                 |

**Table C.16 – Atomic measurement of sleep monitor**

| Atomic Measurement Resource Type Value | Resource Type Name | Resource Type Value | Requirement level |
|--|--------------------|---------------------|-------------------|
| oic.r.sleepmonitor-am                  | Sleep              | oic.r.sleep         | M                 |
|  | Heart Rate         | oic.r.heartrate     | O                 |

#### C.4.8.2 Required Resource Types

A sleep monitor shall expose "oic.r.sleep" to report the time spent in the Awake, NREM1, NREM2, NREM3 and REM stages, and optionally the time spent in the NREM4, Light Sleep, Deep Sleep stages, and the sleep score.

#### C.4.8.3 OCF-defined Optional Resource Types

A sleep monitor measures the heartrate using the "oic.r.heartrate" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.9 Activity tracker

#### C.4.9.1 Introduction

An Activity Tracker measures a user's activities. An Activity Tracker shows a user's current activity type, accumulated step counts per day since the beginning of the day (or last reset), consumed calories per day since the beginning of the day (or last reset), and alarm status.

Table C.17 describes the Device Type for an activity tracker. Table C.18 describes the Atomic Measurement that is present in all instances of an activity tracker.

**Table C.17 – Healthcare Device Type of activity tracker**

| Device Type (rt)      | Resource Type Name                  | Resource Type Value      | Requirement level |
|-----------------------|-------------------------------------|--------------------------|-------------------|
| oic.d.activitytracker | Activity Tracker Atomic Measurement | oic.r.activitytracker-am | M                 |
|                       | Clock                               | oic.r.clock              | O                 |
|                       | Battery                             | oic.r.energy.battery     | O                 |
|                       | Alarm                               | oic.r.alarm              | O                 |

**Table C.18 – Atomic measurement of activity tracker**

| Atomic Measurement Resource Type Value | Resource Type Name | Resource Type Value | Requirement level |
|--|--------------------|---------------------|-------------------|
| oic.r.activitytracker-am               | Activity           | oic.r.activity      | M                 |
|  | Heartrate          | oic.r.heartrate     | O                 |

#### C.4.9.2 Required Resource Types

An activity tracker shall expose "oic.r.activity" to report the activity of a person, and optionally the number of steps per day or since last reset, plus the consumed calories per day or since last reset.

### C.4.9.3 OCF-defined Optional Resource Types

An activity tracker manages the alarm status using the "oic.r.alarm" Resource Type.

An activity tracker measures heart rate using the "oic.r.heartrate" Resource Type.

An activity tracker measures time using the "oic.r.clock" Resource Type.

An activity tracker measures battery status using the "oic.r.energy.battery" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### C.4.10 CGM (Continuous Glucose Meter)

#### C.4.10.1 Introduction

A CGM is a device that measures the concentration of glucose in the blood, typically measured from interstitial fluid (ISF). The glucose concentration is available on a continual basis at a periodic interval from a sensor. Glucose, or blood sugar, is the human body's primary source of energy. Frequent measurements provided by a CGM give a patient greater insight as to the fluctuations in blood glucose levels throughout the day, and in turn, can reduce the risk of developing diabetic complications.

Table C.19 describes the Device Type for a CGM. Table C.20 describes the Atomic Measurement that is present in all instances of a CGM.

**Table C.19 – Healthcare Device Type of CGM**

| Device Type (rt) | Resource Type Name     | Resource Type Value        | Requirement level |
|------------------|------------------------|----------------------------|-------------------|
| oic.d.cgm        | CGM Atomic Measurement | oic.r.cgm-am               | M                 |
|                  | CGM Sampling Interval  | oic.r.cgm.samplinginterval | M                 |
|                  | CGM Calibration        | oic.r.cgm.calibrate        | M                 |
|                  | CGM Threshold          | oic.r.cgm.threshold        | M                 |
|                  | CGM Status             | oic.r.cgm.status           | O                 |
|                  | Battery                | oic.r.energy.battery       | O                 |

**Table C.20 – Atomic measurement of CGM**

| Atomic Measurement Resource Type Value | Resource Type Name | Resource Type Value | Requirement level |
|--|--------------------|---------------------|-------------------|
| oic.r.cgm-am                           | Glucose            | oic.r.glucose       | M                 |
|  | CGM Sensor         | oic.r.cgm.sensor    | O                 |

#### C.4.10.2 Required Resource Types

A CGM shall expose "oic.r.glucose" to report the blood glucose level in mg/dL or mmol/L.

A CGM shall manage (RETRIEVE and UPDATE) the CGM Sampling Interval using the "oic.r.cgm.samplinginterval" Resource Type.

A CGM shall manage (RETRIEVE and UPDATE) CGM Calibration using the "oic.r.cgm.calibrate" Resource Type.

A CGM shall manage (RETRIEVE and UPDATE) CGM Threshold using the "oic.r.cgm.threshold" Resource Type.

#### **C.4.10.3 OCF-defined Optional Resource Types**

A CGM measures CGM sensor information using the "oic.r.cgm.sensor" Resource Type.

A CGM measures CGM Status using the "oic.r.cgm.status" Resource Type.

A CGM measures Battery using the "oic.r.energy.battery" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### **C.4.11 Cycling power meter**

#### **C.4.11.1 Introduction**

A cycling power meter is a sensor that is mounted on a bicycle and that allows the cyclist to measure his or her power output, which is used to move the bike forward and is measured in Watts. The meter transmits the information to OCF Clients. A cycling power meter uses different measurements to determine power:

- measure power directly
- measure torque and rotational velocity at the crank
- measure torque and rotational velocity at the wheel

Possible methods used by a cycling power meter for information updates include:

- Event-Synchronous Update e.g. the power information is updated each time the power sensor detects a new crank rotation.
- Time-Synchronous Update e.g. the power information is updated at 1Hz.

Table C.21 describes the Device Type for a cycling power meter.

**Table C.21 – Healthcare Device Type of cycling power meter**

| Device Type (rt)        | Resource Type Name | Resource Type Value | Requirement level |
|-------------------------|--------------------|---------------------|-------------------|
| oic.d.cyclingpowermeter | Cycling power      | oic.r.cyclingpower  | M                 |
|                         | Torque             | oic.r.torque        | O                 |
|                         | Cadence            | oic.r.cadence       | O                 |

#### **C.4.11.2 Required Resource Types**

A cycling power meter shall expose "oic.r.cyclingpower" to report the measured power output (which is the power used to move the bike forward).

#### **C.4.11.3 OCF-defined Optional Resource Types**

A cycling power meter measures the torque at the crank or the wheel using the "oic.r.torque" Resource Type.

A cycling power meter measures the cadence, which is the number of revolutions of crank per minute when cyclists pedal the pedals, at the crank or the wheel using the "oic.r.cadence" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### **C.4.12 Cycling speed sensor**

#### **C.4.12.1 Introduction**

Cycling speed sensors are devices mounted on a bicycle that measure the speed the bicycle is travelling. This is typically done using a magnet mounted on the wheel spokes and a sensor on the bicycle frame that senses the magnet passing.

Table C.22 describes the Device Type for a cycling speed sensor.

Note: The notion 'Sensor' of the Device Name (Cycling Speed Sensor) is not associated with 'sensor', which is an OCF standard OCF Interfaces defined in ISO/IEC 30118-1.

**Table C.22 – Healthcare Device Type of cycling speed sensor**

| Device Type (rt)          | Resource Type Name | Resource Type Value | Requirement level |
|---------------------------|--------------------|---------------------|-------------------|
| oic.d. cyclingspeedsensor | Speed              | oic.r.speed         | M                 |

#### **C.4.12.2 Required Resource Types**

A cycling speed sensor shall expose "oic.r.speed" to report the speed the bicycle is travelling.

#### **C.4.12.3 OCF-defined Optional Resource Types**

See Table C.2 for additional commonly used Resource Types that could be used here

### **C.4.13 Cycling cadence sensor**

#### **C.4.13.1 Introduction**

Cycling cadence sensors measure the speed at which the user is pedaling, typically using a magnet attached to the pedal shaft and a sensor mounted on the frame.

Table C.23 describes the Device Type for a cycling speed sensor.

Note: The notion 'Sensor' of the Device Name (Cycling Cadence Sensor) is not associated with 'sensor', which is an OCF standard OCF Interfaces defined in ISO/IEC 30118-1.

**Table C.23 – Healthcare Device Type of cycling cadence sensor**

| Device Type (rt)            | Resource Type Name | Resource Type Value | Requirement level |
|-----------------------------|--------------------|---------------------|-------------------|
| oic.d. cyclingcadencesensor | Cadence            | oic.r.cadence       | M                 |

#### **C.4.13.2 Required Resource Types**

A cycling cadence sensor shall expose "oic.r.cadence" to report the cadence, which is the number of revolutions of crank per minute when cyclists pedal the pedals.

#### **C.4.13.3 OCF-defined Optional Resource Types**

See Table C.2 for additional commonly used Resource Types that could be used here

### **C.4.14 Muscle oxygen monitor**

#### **C.4.14.1 Introduction**

A muscle oxygen monitor provides an indication of the muscle oxygen saturation (SmO<sub>2</sub>) and is used by athletes to monitor the intensity of their training, and by coaches and physiotherapists to identify which and when muscles are being used.

SmO<sub>2</sub> is a measure of the percentage of hemoglobin that is saturated with oxygen in the capillaries of a muscle. SmO<sub>2</sub> decreases as a muscle does work, for example, when a person is exercising. SmO<sub>2</sub> increases when blood circulation brings new oxygen to the muscle. SmO<sub>2</sub> varies from muscle to muscle depending on which muscle is used to perform a particular action.

Table C.24 describes the Device Type for a muscle oxygen monitor.

**Table C.24 – Healthcare Device Type of muscle oxygen monitor**

| Device Type (rt)          | Resource Type Name       | Resource Type Value          | Requirement level |
|---------------------------|--------------------------|------------------------------|-------------------|
| oic.d.muscleoxygenmonitor | Muscle Oxygen Saturation | oic.r.muscleoxygensaturation | M                 |

#### **C.4.14.2 Required Resource Types**

A muscle oxygen monitor shall expose "oic.r.muscleoxygensaturation" to report the muscle oxygen saturation (SmO<sub>2</sub>).

#### **C.4.14.3 OCF-defined Optional Resource Types**

See Table C.2 for additional commonly used Resource Types that could be used here.

### **C.4.15 Body composition analyser**

#### **C.4.15.1 Introduction**

A body composition analyser is a device that analyzes the composition of a human body including body fat, body height, body weight, etc. A body composition analyser uses various techniques for measuring the composition of a human body. For example, body impedance analysis measures the bioelectrical impedance with electrical signals sent from pairs of probes (typically metal electrodes) applied at the feet and/or hands and evaluates the body composition from these impedances.

Table C.25 describes the Device Type for a body composition analyser. Table C.26 describes the Atomic Measurement that is present in all instances of a body composition analyser.

**Table C.25 – Healthcare Device Type of body composition analyser**

| Device Type (rt)              | Resource Type Name                           | Resource Type Value              | Requirement level |
|-------------------------------|--|----------------------------------|-------------------|
| oic.d.bodycompositionanalyser | Body composition analyser Atomic Measurement | oic.r.bodycompositionanalyser-am | M                 |

**Table C.26 – Atomic measurement type of body composition analyser**

| Device Type (rt)                 | Resource Type Name    | Resource Type Value | Requirement level |
|----------------------------------|-----------------------|---------------------|-------------------|
| oic.r.bodycompositionanalyser-am | Body fat              | oic.r.body.fat      | M                 |
|                                  | Height                | oic.r.height        | M                 |
|                                  | Weight                | oic.r.weight        | M                 |
|                                  | Body Fat Free Mass    | oic.r.body.ffm      | O                 |
|                                  | Body Soft Lean Mass   | oic.r.body.slm      | O                 |
|                                  | Body Water            | oic.r.body.water    | O                 |
|                                  | Body Mass Index (BMI) | oic.r.bmi           | O                 |

#### **C.4.15.2 Required Resource Types**

A body composition analyser shall expose "oic.r.body.fat" to report the body fat of a person.

A body composition analyser shall expose "oic.r.height" to report the height of a person.

A body composition analyser shall expose "oic.r.weight" to report the weight of a person.

### **C.4.15.3 OCF-defined Optional Resource Types**

A body composition analyser measures body fat free mass using the "oic.r.body.ffm" Resource Type.

A body composition analyser measures body soft lean free mass using the "oic.r.body.slm" Resource Type.

A body composition analyser measures body water using the "oic.r.body.water" Resource Type.

A body composition analyser measures Body Mass Index (BMI) using the "oic.r.bmi" Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

### **C.4.16 Medication monitor**

#### **C.4.16.1 Introduction**

A medication monitor is expected to improve a person's compliance with taking prescribed medicines as well as supplements taken by their own decision. A medication monitor reports the medication dispensing status either fixed or variable manner. The optionality of both fixed and variable should be determined depending on the Medication monitor type resource. Therefore, the requirement level of both resources should be CR.

Exactly one of the fixed-dosage medication dispensed Resource or the variable-dosage medication dispensed resource shall be supported by a medication monitor device.

In case of "fixed", it reports which "relative location" of medicine was taken within the package using the number.

In case of "variable", it reports how much medicine was taken or injected using the "unit" property presented in "oic.r.med.dispensed.variable".

A medication monitor optionally supports the device status report.

Table C.27 describes the Device Type for a Medication monitor.

**Table C.27 – Healthcare Device Type of medication monitor**

| <b>Device Type (rt)</b> | <b>Resource Type Name</b>     | <b>Resource Type Value</b>   | <b>Requirement level</b> |
|-------------------------|-------------------------------|------------------------------|--------------------------|
| oic.d.medicationmonitor | Medication Monitor Type       | oic.r.med.type               | M                        |
|                         | Medication information        | oic.r.med.medication.info    | M                        |
|                         | Fixed Medication Dispensed    | oic.r.med.dispensed.fixed    | CR                       |
|                         | Variable Medication Dispensed | oic.r.med.dispensed.variable | CR                       |
|                         | Status Reporter               | oic.r.med.status.rep         | O                        |

#### **C.4.16.2 Required Resource Types**

A medication monitor shall expose "oic.r.med.type" to report the medication monitor type which can determine optionality of Fixed Medication Dispensed or Variable Medication Dispensed.

A medication monitor shall expose "oic.r.med.medication.info" to report the information of a medication.

#### **C.4.16.3 Conditionally required resource types**

A medication monitor shall expose either “oic.r.med.dispensed.fixed” or “oic.r.med.dispensed.variable” to report user’s medication status. The optionality of these resources shall be determined by “oic.r.med.type”. “oic.r.med.dispensed.fixed” should be required if “oic.r.med.type” value is “fixed” and “oic.r.med.dispensed.variable” should be required if “oic.r.med.type” value is “variable”.

#### **C.4.16.4 CF-defined Optional Resource Types**

A medication monitor reports status of the medication monitor using the “oic.r.med.status.rep” Resource Type.

See Table C.2 for additional commonly used Resource Types that could be used here.

## Annex D (normative)

### Industrial Device Types

#### D.1 Operational scenarios

The Optical RFID Tag and Optical RFID Station Resource Types describe the attributes associated with an optical augmented RFID system of a smart factory environment for integrating the observation and the actuation in production lines of plants.

Commercial observation is the real-time monitoring to collect broad series of data from each product on the production line and machineries from the plant floor. This collected big data can be sent to OCF cloud and/or manufacturer's internal OCF network where it is analysed and used to estimate overall production flow, productivity and identify failure parts.

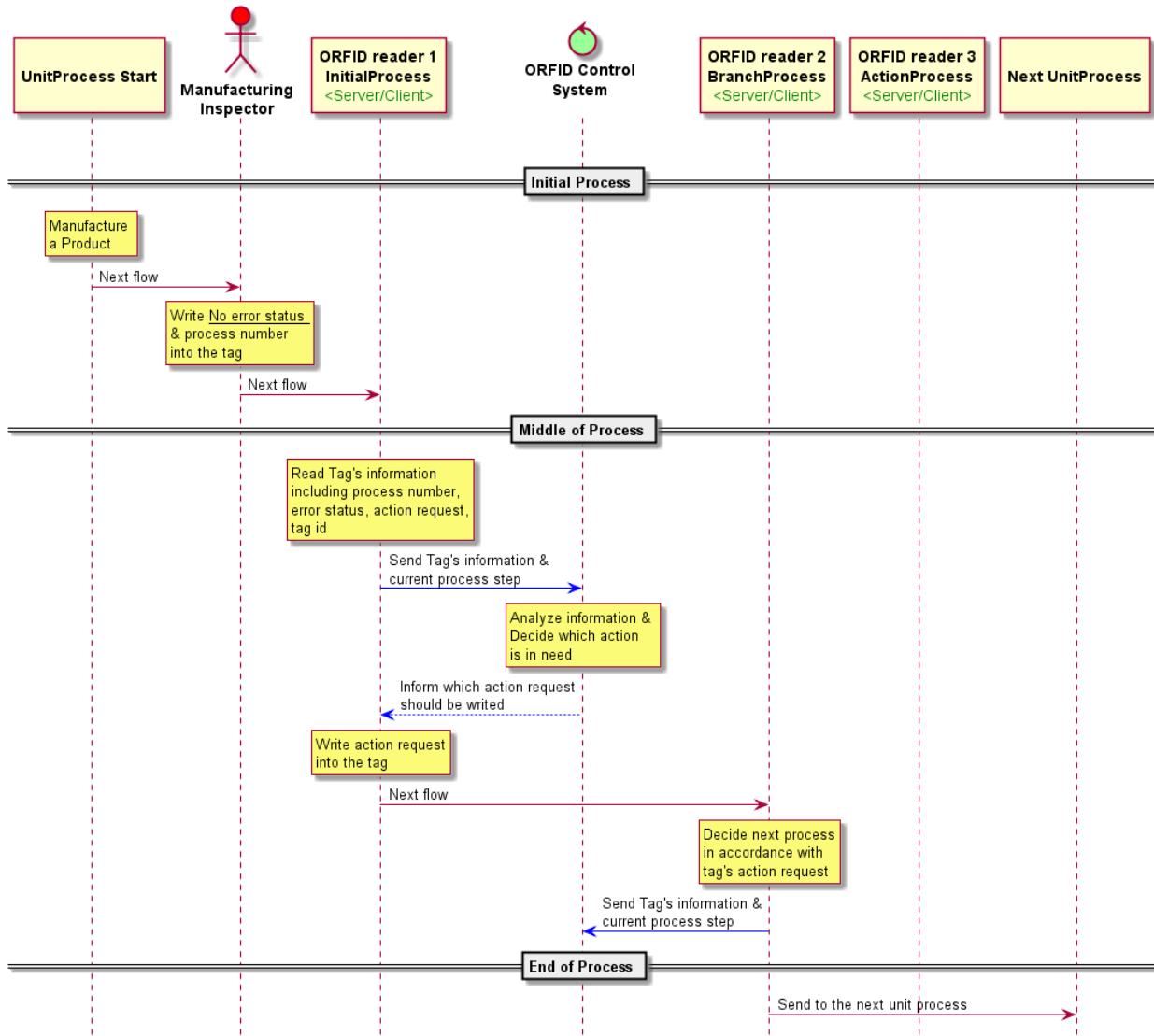
Commercial actuation is the real-time interaction to take actions on system failures such as defected product's isolation, possibly sending the product into a repair line, alarming, such as production line status, display panels and hazard issues such as fire and flood of the Commercial environment by sending actuation requests to actuators directly and/or to client(s).

Optical augmented RFID reader and tag assist in production line control utilizing the OCF ecosystem for smart factory environment. The optical augmented RFID reader is represented by the RFID Station Resource Type, the tag by the RFID Tag Resource Type.

In the RFID Tag Resource Type, the tagid is an integer showing the currently read optical augmented RFID tag's identity information.

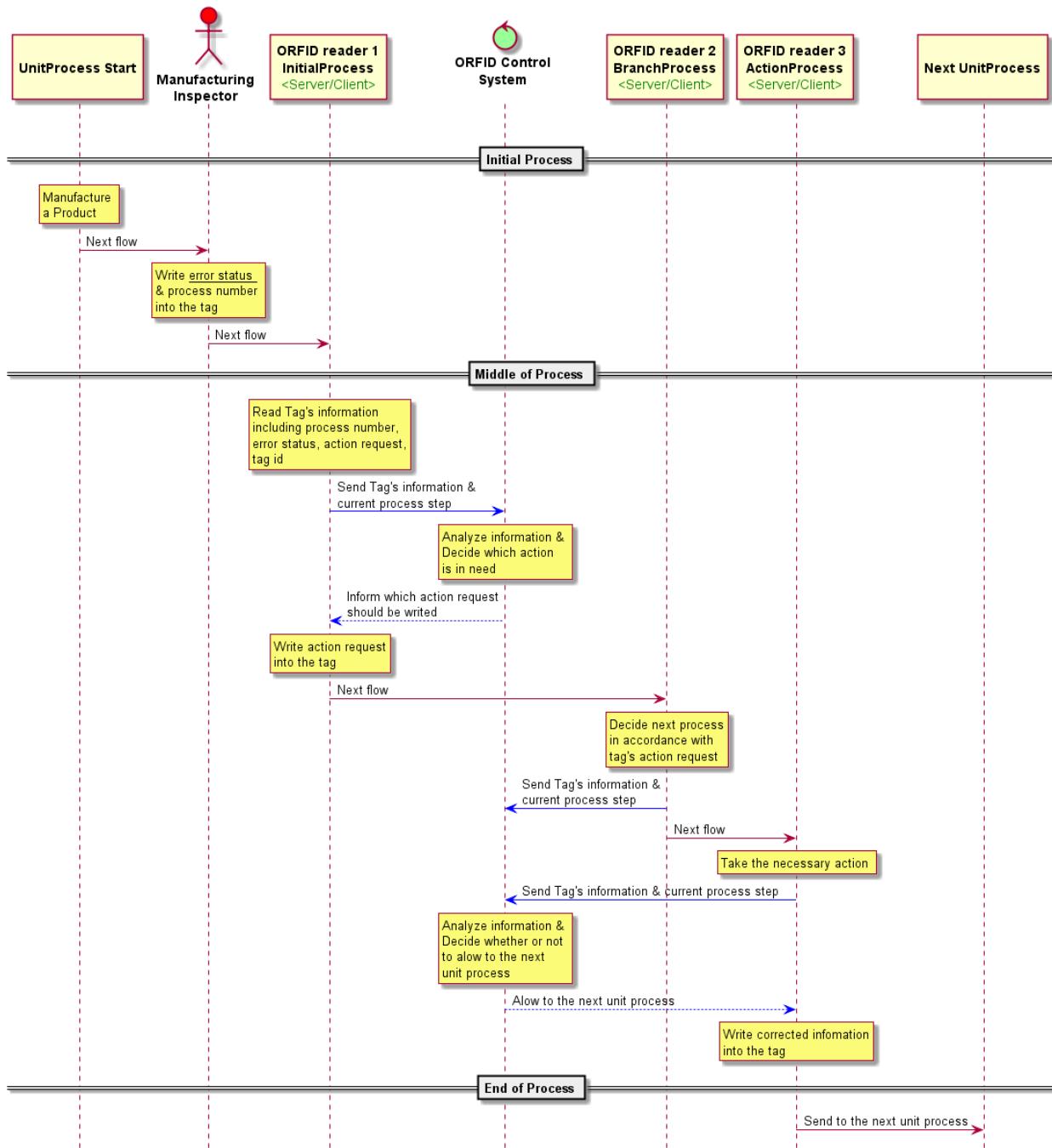
In the RFID Station Resource Type, the process represents the stage of the product in the product line which has an optical RFID tag on its body. Event is represented by a Boolean value set to "True" or "False" alarming the issue when additional action is requested for the tagged product. actionrequest represents necessary actions like the isolation of the product, to send the product back to another specific line to modify or fix an issue.

Figure D.1 shows a normal, non-error case process flow in the smart factory. Blue arrow lines are where OCF communication exists. ORFID tag ID is only readable to maintain consistent identity.



**Figure D.1 – Normal process scheme of optical augmented RFID in smart factory environment**

Figure D.2 shows product error control scheme in the smart factory. Blue arrow lines are where OCF communication exists. RFID tag ID is only readable to maintain consistent identity.



**Figure D.2 – Abnormal process scheme of optical augmented RFID in smart factory environment**

Manufacturing Inspector writes "error status" and "process number" into the tag after manufacturing a product. RFID reader1 reads Tag's information and sends the information including current process step to RFID Control System. Then RFID reader1 waits until RFID Control System replies. When RFID reader1 receives "action request" from RFID Control System. RFID reader1 writes "action request" into the tag.

RFID reader2 located at the "BranchProcess" line decides next flow in accordance with tag's "action request" information then it sends Tag's information and current process step to RFID Control System, and sends the product to the right flow.

If the product has an error, the product gets necessary action at "ActionProcess" line. Then ORFID reader3 sends repaired product's information. Then ORFID reader3 waits until ORFID Control System replies. When ORFID reader3 receives instruction from ORFID Control System for the next flow, ORFID reader3 sends the product according to instruction.

## D.2 Industrial required resources per Device Type

Device Types may mandate that specific Resources be implemented. The required Resource per Device Type where mandated by the Industrial vertical is listed in Table B.1.

**Table D.1 – Alphabetical list of Device Types ("rt"), including required resources for Industrial**

| Device Name<br>(informative)  | Device Type ("rt")<br>(Normative) | Required Resource name | Required Resource Type |
|-------------------------------|-----------------------------------|------------------------|------------------------|
| Optical augmented RFID Reader | oic.d.rfid                        | Optical RFID Tag       | oic.r.rfid.tag         |
|                               |                                   | Optical RFID Station   | oic.r.rfid.station     |

## Annex E (normative)

### PV (Photovoltaic) system Device Types

#### E.1 Scope

This Annex defines Device Types for use in PV (Photovoltaic) systems and describes general use cases to which OCF PV system Devices apply, along with common functional requirements. This Annex considers one of the typical PV system configurations, which is composed of one or more PV array systems, battery systems, inverters, and circuit breakers.

#### E.2 Operational scenarios

An electrical grid facility can be classified into utility side and customer sides. The utility side facility includes electricity generation, transmission, and distribution. The customer side facility includes high and low voltage equipment, distributed renewable energy equipment, and so on. Figure E.1 shows the overall classification of an electrical grid facility. The utility side facility is generally managed by using IEC 61850 (Communication networks and systems for power utility automation) series standards. Especially, ISO/IEC 61850-7-1 defines the data models for electrical equipment for the utility side. OCF defines the data models for devices in the residential environment, so electrical equipment in the customer side of the electrical grid facility also needs to be defined. Since electrical equipment in the utility side uses data models defined in IEC 61850 standards, customer side equipment also needs to be defined with consideration to IEC 61850 data models.

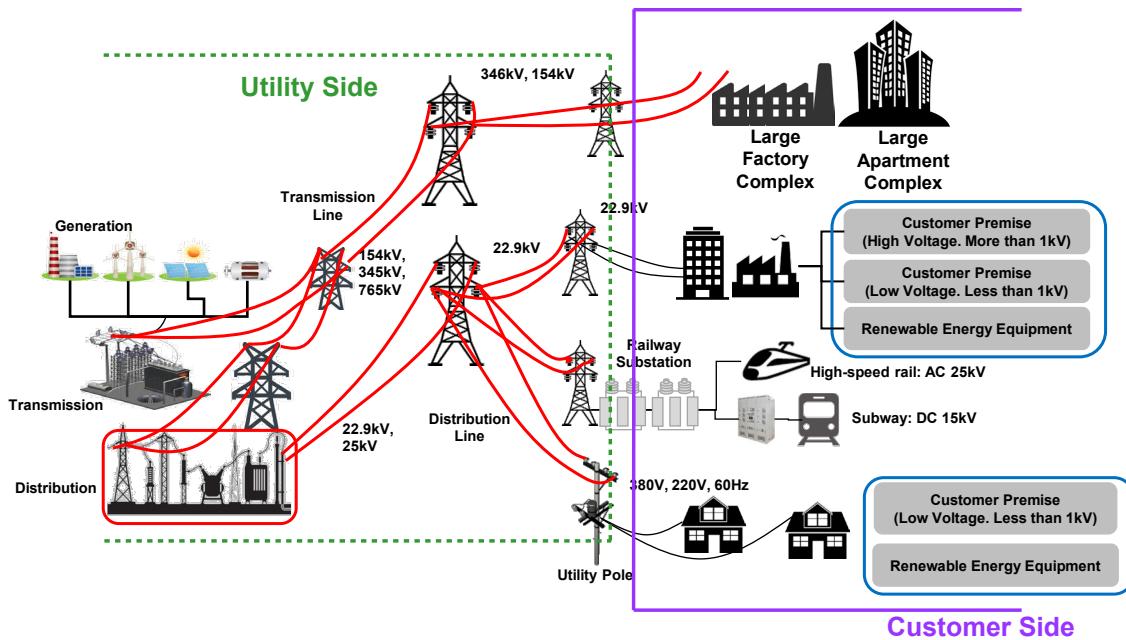
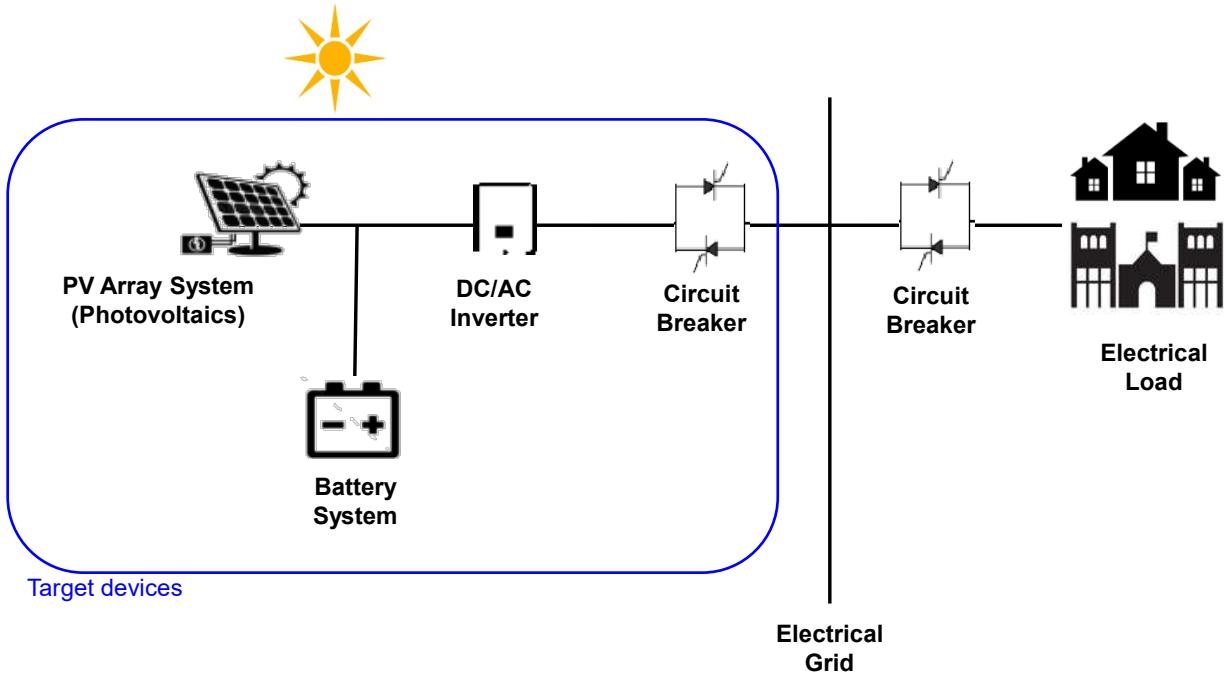


Figure E.1 – Classification of electrical grid facility

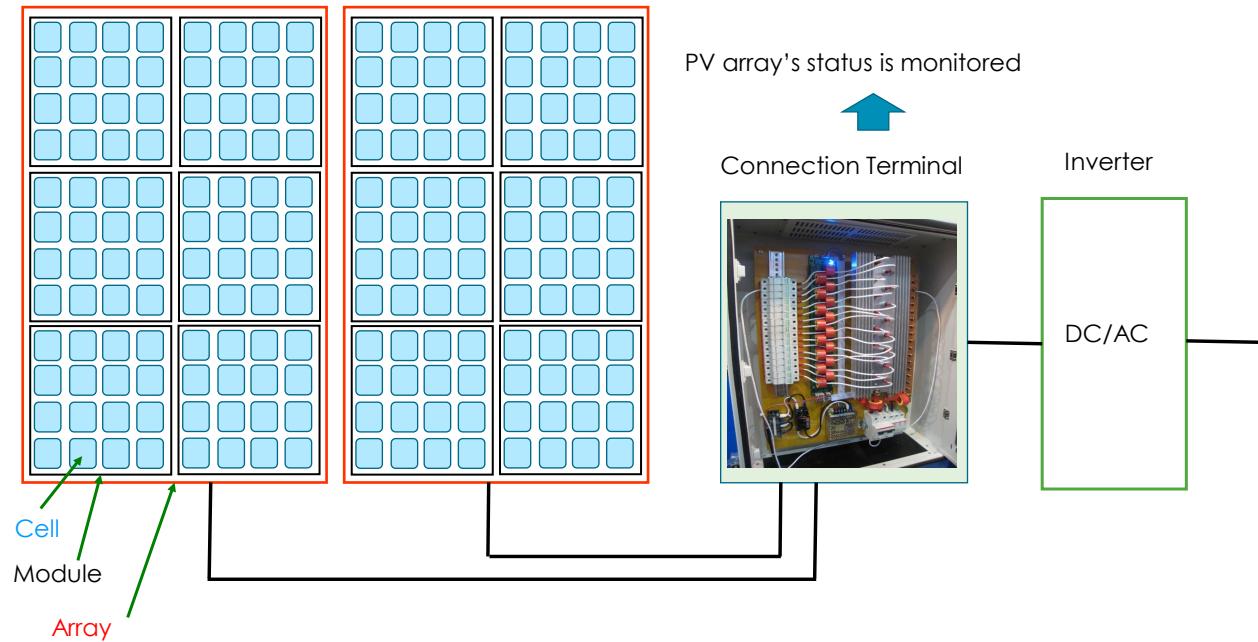
Figure E.2 depicts a typical PV system configuration. As shown in the figure, a PV system consists of one or more PV array systems, DC (Direct Current)/AC (Alternating Current) inverters, battery systems, and circuit breakers. A PV array system converts the sun's rays into electricity and the generated DC current is converted into AC current by a DC/AC inverter. A battery system may be used to store generated electricity and discharge it to the electrical grid later. A circuit breaker is

installed in order to disconnect the circuit between the PV system and the internal distribution grid. In this use case, the PV array system, battery system, DC/AC inverter, and circuit breaker are considered.



**Figure E.2 – Typical PV system configuration**

Figure E.3 shows the detailed configuration of the PV array system. The PV panel is composed of a durable glass panel (array) and a rigid frame made up of durable units (modules) after the unit cells are integrated and electrically connected. The PV array is connected through the connection terminal and the connection terminal monitors the status of each PV array. The connection terminal passes through the inverter before passing AC current to the electrical grid.



**Figure E.3 – Detailed configuration of PV array system**

### E.3 Standard Device Types

Table E.1 lists the brief explanation of the function and required resources of PV system Devices. Table E.2 lists PV system Device Types. The Device Type exposed by the "rt" value of /oic/d of all PV system Devices shall have a Resource Type value ("rt") prefixed with "oic.d.".

**Table E.1 – Function and required resources for PV system Device Types**

| Device Name     | Roles of Device  | Required Resource and Function  |
|-----------------|--|---|
| Circuit Breaker | Functions for the control and monitoring of circuit breakers   | Circuit breaker: describes circuit breakers used in the protection of the PV system |
| Battery System  | Functions required to store excess energy produced by the PV system. Energy storage in PV systems is usually done with batteries | Battery: battery if needed for energy storage                                       |
| Inverter        | Functions for the control and monitoring of the DC/AC inverter   | Inverter: converts DC to AC   |
| PV Array System | Functions to maximize the power output of the PV array   | PV Connection Terminal: PV array(s) is connected and status is monitored            |

**Table E.2 – List of PV system Device Types**

| Device Name     | Device Type (rt)     | Required Resource Name | Required Resource Type |
|-----------------|----------------------|------------------------|------------------------|
| Circuit Breaker | oic.d.circuitbreaker | circuit breaker        | oic.r.circuitbreaker   |
| Battery System  | oic.d.battery        | battery                | oic.r.energy.battery   |
| Inverter        | oic.d.inverter       | inverter               | oic.r.inverter         |

|                 |                     |                        |                            |
|-----------------|---------------------|------------------------|----------------------------|
| PV Array System | oic.d.pvarraysystem | PV connection terminal | oic.r.pvconnectionterminal |
|-----------------|---------------------|------------------------|----------------------------|

## Annex F (normative)

### Fire Alarm system Device Types

#### F.1 Scope

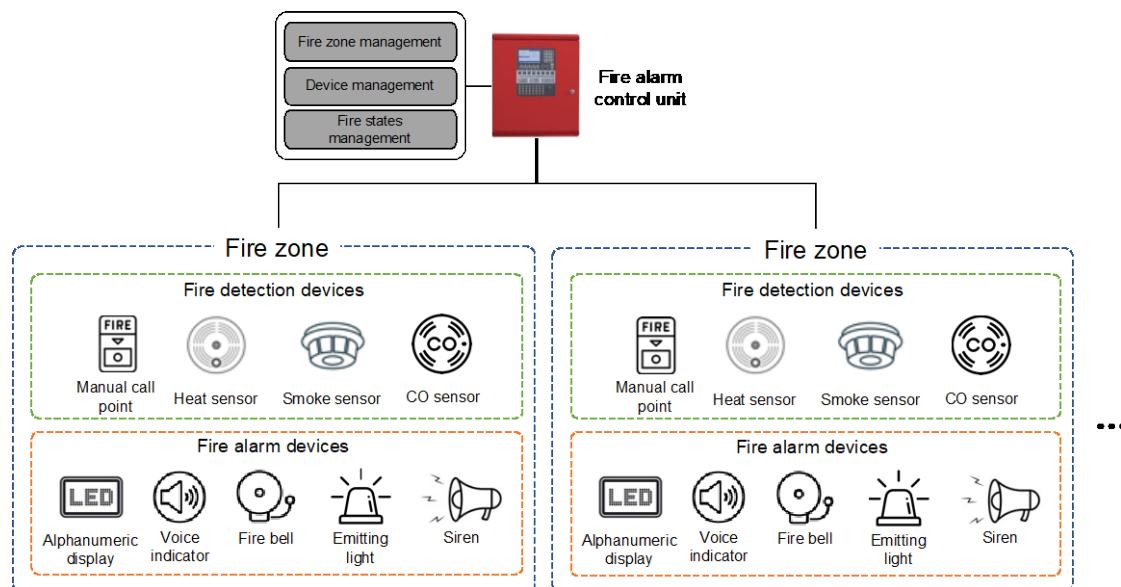
This Annex defines Device Types for use in fire alarm systems and describes use cases to which fire alarm system devices apply to the smart home and building. The fire alarm system considered in this Annex is composed of a fire alarm control unit, fire detection devices, and fire alarm devices.

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#### F.2 Operational scenarios

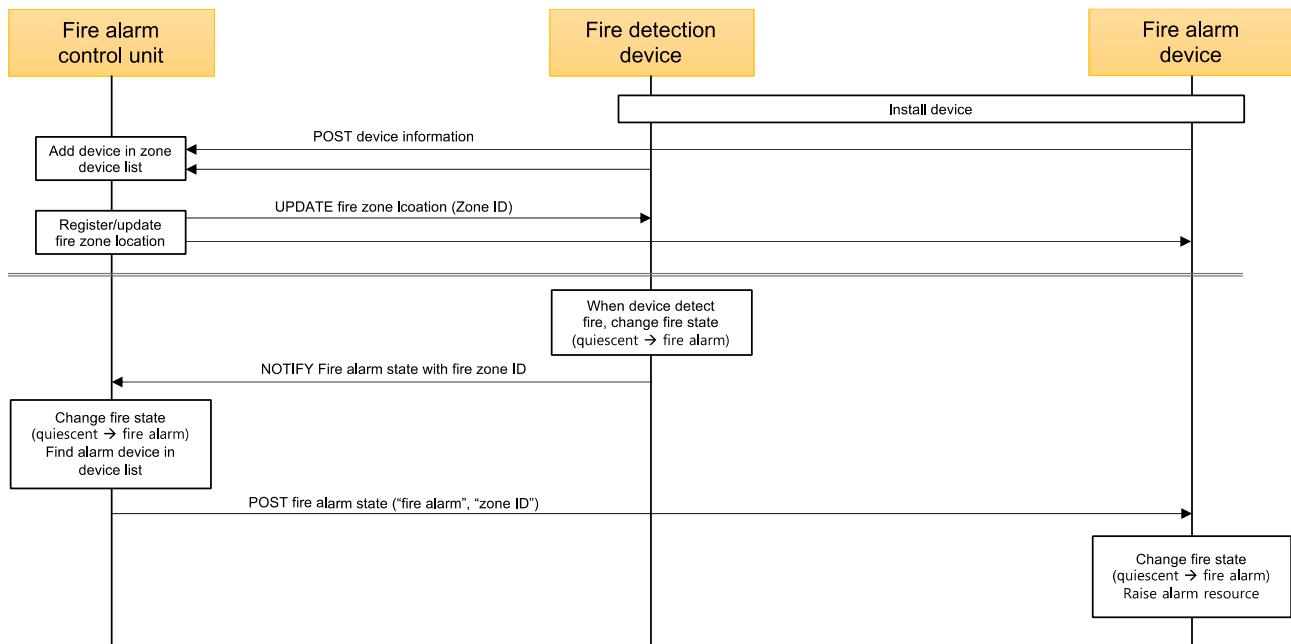
Generally, the residential house is classified into two types; single-family house and apartment house. In the case of a single-family house, there is a single owner who is fully responsible for managing and controlling the fire alarm systems and devices. Otherwise, the apartment house is shared by different owners who are responsible for their own rooms so the manager is required to manage and control the fire alarm system of the entire building including sharing facilities such as the elevator, lobby, etc. The fire alarm system is deployed in a centralized manner, in which all devices are connected to a control unit called the fire alarm control unit. Fire alarm systems for apartment houses also can adapt to the commercial building scenario. The entire fire alarm system includes fire detectors, indicators, and protection devices. In this Annex, our initial scope is limited to the centralized control unit, detectors, and indicators.

Figure F. 1 shows the deployment scenario of a fire alarm system in smart home/building. Design, operation, and management of fire alarm systems and devices should be following ISO 7240(Fire detection and alarm systems) series standards. To design a system, ISO 7240-1 defines fire zones which are sub-division of premises distinguishable areas separately from other subdivisions. Each fire zone has fire detection devices and alarm devices. For monitoring and control of these devices with separating zone, ISO 7240-2 defines fire indication and alarm control functions for a centralized fire management system called a fire alarm control unit. The fire alarm control unit also manages fire alarm states by six conditions and routing fire detection signals from fire detection devices to fire alarm devices and external (i.e., manager, fire station).



**Figure F. 1 – Deployment scenario of the fire alarm system in smart home/building**

Figure F. 2 shows example message flows for setting the fire alarm system and operating it when a fire is detected. When a fire detection device and fire alarm device (OCF Server role) install in the system, they use OCF to POST their device information to the fire alarm control unit (OCF Client role) for adding device information in the system. In the fire alarm control unit, the resource is required to identify the fire zone ID and allocate it to each device. After mapping the device to the corresponding fire zone ID, the fire alarm control unit sends an OCF message to devices including the allocated fire zone ID. This ID is used by fire detection devices to send detection messages to notice the location of a fire, by the fire alarm control unit to determine the appropriate alarm devices for indicating residence in the building, and by the fire alarm devices to indicate information using sound or display.



**Figure F. 2 – Message call flow example for the fire alarm system**

### F.3 Standardized Device Types

OCF device types for the fire alarm system categorized into three Device Types; Fire alarm control unit, Fire detection and Fire alarm. The Device Type exposed by the “rt” value of /oic/d of all Fire alarm system Devices shall have a Resource Type value (“rt”) prefixed with “oic.d.”. Table F. 1 lists Device Type for the fire alarm control unit.

**Table F. 1 – Fire alarm control unit device types**

| Device Name             | Device Type (rt)           | Required Resource Name | Required Resource Type  |
|-------------------------|----------------------------|------------------------|-------------------------|
| Fire Alarm Control Unit | oic.d.firealarmcontrolunit | Fire Zone location     | oic.r.location.firezone |
|                         |                            | Fire state             | oic.r.fire.state        |
|                         |                            | Zone Device List       | oic.r.zonedevicelist    |

Table F. 2 lists Fire detection Device Types. For fire detection, four types of devices are defined. Manual Call Point is used to initiate a fire signal by pressing simple switch or button with human intervention. Other devices use existing sensor resources to detect fire by monitoring heat, smoke and carbon monoxide.

**Table F. 2 – List of Fire detection Device Types**

| Device Name              | Device Type (rt)             | Required Resource Name | Required Resource Type      |
|--------------------------|------------------------------|------------------------|-----------------------------|
| Heat Detector            | oic.d.heatdetector           | Fire Zone location     | oic.r.location.firezone     |
|                          |                              | Fire state             | oic.r.fire.state            |
|                          |                              | Temperature            | oic.r.temperature           |
|                          |                              | Value Conditional      | oic.r.value.conditional     |
| Smoke Detector           | oic.d.smokedetector          | Fire Zone location     | oic.r.location.firezone     |
|                          |                              | Fire state             | oic.r.fire.state            |
|                          |                              | Smoke sensor           | oic.r.sensor.smoke          |
|                          |                              | Value Conditional      | oic.r.value.conditional     |
| Carbon Monoxide Detector | oic.d.carbonmonoxidedetector | Fire Zone location     | oic.r.location.firezone     |
|                          |                              | Fire state             | oic.r.fire.state            |
|                          |                              | Carbon monoxide sensor | oic.r.sensor.carbonmonoxide |
|                          |                              | Value Conditional      | oic.r.value.conditional     |
| Manual Call Point        | oic.d.manualcallpoint        | Fire Zone location     | oic.r.location.firezone     |
|                          |                              | Fire state             | oic.r.fire.state            |
|                          |                              | Binary switch          | oic.r.switch.binary         |

Table F. 3 lists Fire alarm Device Types. For fire alarm, five devices are defined. For fire alarm, devices use resource to play sound or light.

**Table F. 3 – List of Fire alarm Device Types**

| <b>Device Name</b>     | <b>Device Type (rt)</b>     | <b>Required Resource Name</b> | <b>Required Resource Type</b> |
|------------------------|-----------------------------|-------------------------------|-------------------------------|
| Fire Bell              | oic.d.firebell              | Fire Zone location            | oic.r.location.firezone       |
|                        |                             | Fire state                    | oic.r.fire.state              |
|                        |                             | Binary switch                 | oic.r.swtich.binary           |
| Siren                  | oic.d.siren                 | Fire Zone location            | oic.r.location.firezone       |
|                        |                             | Fire state                    | oic.r.fire.state              |
|                        |                             | Audio controls                | oic.r.audio                   |
| Voice Indicator        | oic.d.voiceindicator        | Fire Zone location            | oic.r.location.firezone       |
|                        |                             | Fire state                    | oic.r.fire.state              |
|                        |                             | Audio controls                | oic.r.audio                   |
|                        |                             | Media source list             | oic.r.mediasourcelist         |
| Emitting Light         | oic.d.emittinglight         | Fire Zone location            | oic.r.location.firezone       |
|                        |                             | Fire state                    | oic.r.fire.state              |
|                        |                             | Emitting                      | oic.r.light.emitting          |
| Alphanumeric Indicator | oic.r.alphanumericindicator | Fire Zone location            | oic.r.location.firezone       |
|                        |                             | Fire state                    | oic.r.fire.state              |
|                        |                             | Media source list             | oic.r.mediasourcelist         |